An experimental investigation of a gas pipeline merger on retail gas prices:

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Bridging thought and practice

CONTENTS

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ABSTRACT

The purpose of this project is to examine the impact on consumer gas prices when two competing pipelines supplying gas merge, under cases with or without a dominant retailer buying gas from either of the two pipelines and selling gas to end use consumers. The inspiration for this investigation was the merger the two energy utilities AGL and Alinta, who respectively control the two gas pipelines into the Sydney basin. In preparing the model we used data that is broadly based on the real situation of these companies, however we have not investigated their individual circumstances closely enough to consider this study to be of “real world significance”. This project should rather be viewed as an example of how such a question can be investigated in an experimental manner.

We find that under conditions of a single owner of both pipelines, or when a dominant retailer at the end of the supply chain is present, there is potential for retail prices to rise above the competitive level.

We use experimental economics to test the implications of market power, both wholesale and retail, in the gas industry. Human participants are employed, acting as pipeline owners and retailers in a controlled environment, constructed using parameters broadly based on the actual Sydney gas market. In the laboratory we can modify the institutions and market parameters to examine what would happen under an array of scenarios.

EXPERIMENTAL ECONOMICS AND ITS USES

AGL and Alinta are two large diversified energy utilities in Australia, which have recently been seeking to merge. The Australian Competition and Consumer Commission (ACCC) is the Australian competition policy regulator, and have been considering if the merger should be allowed to proceed. The proposed merger is relatively complex, with a number of different options on how assets could be distributed in the merged entity. The ACCC has released an issues paper, which discusses the merger in detail. One of the concerns that has arisen is the potential impact on natural gas prices for consumers in Sydney.

Natural gas used by Sydney is supplied by two gas fields, each over 1,000 km away from Sydney and almost diametrically opposed geographically. Gas from Moomba in South West Queensland travels through the Moomba to Sydney Pipeline (MSP), and gas from offshore rigs in the Bass Strait between Victoria and Tasmania passes through the Eastern Gas Pipeline (EGP). Although the exact commercial ownership is complicated (ACCC 2006), AGL may be considered as potentially controlling the EGP, while Alinta has a similar arrangement with the MSP. When the gas arrives in Sydney it is sold to residential and commercial consumers by gas retailers – companies that buy wholesale gas, and undertake the marketing and contracting of gas sales to consumers. As well as having a significant ownership in one pipe, AGL is also the largest gas retailer in the Sydney market.

It is the above situation that has inspired this study of market power in the gas industry. The potential merger between AGL and Alinta gives a relevant backdrop for studying how wholesale and retail prices are affected by an industry merging from two to one suppliers. The research methods employed in this analysis enable analysis of the profit and behaviour of all parties can be analysed, and lessons drawn about future mergers and major market shifts. Other markets, and other market constructs, can be similarly tested with the same level of accuracy and predictive power. This gives interested parties the ability to predict what might happen under several different markets or market rules, without actually having to implement them.

Under the scenario explained above, with no one singular agent having monopoly control of any link in the chain, and multiple buyers, it is generally presumed that gas prices are not impacted a great deal by market power issues in either wholesale or retail markets. However, if in one of the links a single or dominant player were to emerge, the balance of an efficient market may be disturbed. It is this balance of an efficient market that this research studies. Put another way, how will market power in one sector of the gas supply chain affect the ability of the market to provide enough gas at an efficient price to the consumer? This experiment aims to emulate the potential market power gained by a merger of two pipelines into one, and its effect on the retail price of gas. Furthermore, how does the distribution of retail market share among retailers affect retail price?

PRIOR EXPERIMENTAL MERGER AND COMPETITION STUDIES

Experimental economics is a tool in which the researcher can emulate an existing or possible economic environment and institution in a controlled setting to observe behaviour of participants and outcomes of prescribed treatments (Kagel and Roth 1995, Davis and Holt 1993). The experimenter can then modify the environment and/or institution in a specific parameter and observe the results. Experiments are done for a number of reasons, one of which is to compare environments and/or institutions (Smith 1994, Friedman and Cassar 2004). With experimental economics, a variable change in an existing market can be tested relatively inexpensively compared to testing the same change in a real market. This is especially true if the experimenter is testing a number of different variables, gaining a large array of outcomes.

Experiments have been conducted attempting to understand, in fine detail, what the underlying motivations and underpinnings are of different market and strategic situations. Experimentation in a lab environment has contributed largely to understanding and building robust markets for Electricity (Rassenti and Smith, 1986), payloads on the space shuttle (Banks, Ledyard and Porter 1989), US FCC spectrum bandwidth, airport time slots (Rassenti et al. 1982), delivery routes, real estate auctions, environmental rights to pollute, and difference in investment decisions of college students and professional executives, of which there is little difference (Smith et al. 1988). Additional studies have been conducted on negotiations under market power. Any permutation one can think of could potentially be tested. One can analyse market power under a monopoly, monopsony, market power gained through price or quantity, patents, or copyrights.

Analysing markets from past data to gain insights of how markets operate is nothing new. That is, simply taking past experiences, forming theories as to why the market operated as it did, and testing the significance of these theories to “predict the past” has frequently been done. The power of the experimental economics laboratory, however, lies in the ability to glimpse into the future and scientifically investigate the performance of markets that may not even yet exist. An experimenter can establish a market in the laboratory, modify one aspect of the market, and evaluate the outcome of the modification.

For example, a market can be simulated with a dominant player and without a dominant player. Because every aspect of the market, besides the decisions that real participants make, is kept constant by the experimenter the resulting differences paint a picture of how the market could have been, or can be, compared to its current state. Additionally, a new, innovative market that does not yet exist can be experimented with to understand the market incentives and how they affect the outcomes. The exactness of the experimental outcome is subject to the information available, but a test of a new market rule can be conducted before a costly implementation is attempted.

AN AUSTRALIAN APPLICATION

A number of experimental studies on mergers and acquisitions have been conducted. The results, however, of mergers is dependent on the situation. Gotte and Schmutzler (2005) offer a comprehensive review of experimental and other studies investigating merger policy. The majority of the studies were conducted with initially 5 firms, where two firms would merge leaving 4 firms. The overarching results indicated that increasing capacity within a firm had a larger impact on a market than the number of firms. If all firms were equal in there ability to produce goods, reducing the number of firms would increase the profit of the non-merged firms, reduce the profit of the merged firm, and increase the price for the consumer.

However, if under the same setting one firm's productive capacity is increased, profit for the firm increases, prices tend to be lower after the firms have merged, and the remainder of the firms in the market tend to be worse off. Productive capacity can be increased in number of ways. The most obvious one is where both firms entering the merger join their productive capacity. Others include a lesser efficient firm merging and using the technology of a more efficient firm, and synergies that are created when the more efficient bits of both firms are combined in the merged firm.

The above merger studies all deal with horizontal integration. Very few studies have investigated vertical integration. Vertical integration is often thought of as being efficiency enhancing, due to logistics and transactions costs being reduced. A study by Martin et. al. (2001), however, indicates what most sceptical observers would predict: higher profits for firms that have upstream market power, and lower profit for firms that are further down stream in the production chain.

Again it will be stated that each merger or potential merger has the possibility of affecting total market output, prices, and profit for the merged and the remaining firms. The setting, productive capacity of each firm, production costs of each firm and vertical integration each play a role in the outcome of the market. This leads us to our current study, and the backdrop that is of interest.

In this study we analyse a potential merger using experimental economics. AGL and Alinta are two diversified energy utilities operating in Australia. A proposed merger arrangement raises a significant number of competition policy issues. One of those issues involves the supply of natural gas to the Sydney basin, given that AGL and Alinta are each owners of the two natural gas pipelines serving Sydney.

It is this backdrop that we will use to analyse the effects of market power where two pipelines merging under one owner, and separately where one retailer has market power. The potential AGL and Alinta merger gives us a real life example of experimental economics can be employed to predict the futures of all parties involved, without the merger actually taking place. The market is fairly well organized and documented, allowing for a high degree of reflecting what will actually take place in the market. Below is the basic constructs of the market, based on real data, that we will use to run our study.

EXPERIMENTAL DESIGN

The supply chain for gas operates with four different agents: gas field suppliers, pipeline operators, retailers and consumers. There are two main conduits in which gas is extracted and transferred to the retailers. The first gas field from which gas is obtained is located in Moomba in South West Queensland. The gas is hauled through the Moomba Sydney Pipeline (MSP). AGL owns 30% of Australian Pipeline Trust (APT) which owns the MSP. Additionally, AGL provides management services to MSP through its Agility subsidiary.

The second gas field is the Bass Strait between Victoria and Tasmania. The gas is hauled through the Eastern Gas Pipeline (EGP). Alinta owns 20% of Alinta Infrastructure Holdings (AIH) which owns the EGP. Alinta provides management services to EGP through Alinta Asset Management.

MSP and EGP compete to supply pipeline services to the wholesale gas market in eastern New South Wales (NSW). ESP is not covered by the gas code and MSP is only partially covered. Previous decisions about whether to include the pipelines under the gas code have weighted the fact that separate ownership provides a degree of competition between the two pipelines.

The next agents are the retailers, of which there are five that constitute the bulk of retail sales. Retailers enter the wholesale market for gas from the gas-well operators (Moomba and Bass Strait) to purchase gas wholesale, then approach the pipeline operators (MSP and EGP) to get haulage for the gas from the gas-field to the Sydney basin. Finally, the consumers of gas in the Sydney basin purchase gas from a gas retailer, who signs a contract to supply gas at a fixed dollar per GigaJoule (GJ) of gas for some period of time, typically 6 to 12 months.

It is interesting to note that AGL is vertically integrated here as the largest gas retailer in Sydney. This is not examined experimentally in this paper, although it is a natural extension to run a treatment where one participant is both a pipeline operator and a retailer.

The concern of anti-competitive behaviour and market power lies in two main areas. First, if two pipelines were to merge, the one remaining pipeline could have power over the price and output haulage of gas. Also, the vertical integration of one of the pipelines as a retailer has the potential to drive other retailers out of the market. This could happen if this pipeline set retail prices equal to the end of pipe price (the price of gas plus haulage). The margin for the retail sector would dry up, while the pipeline would still make a profit through haulage. Other concerns are potential new gas fired generators could face barriers to entry by making it less likely they will receive competitive gas supplies. New retailers, therefore, would be less likely to enter the market if haulage prices are above the competitive level.

The questions answered in this experimental investigation are:

- What is the effect on retail gas price of the two pipeline owners merging?
- Is this effect altered by having a incumbent retailer?

EXPERIMENTAL STRUCTURE

There are 2 sessions that will be conducted, a control group and a treatment group. Retail price of each session are statistically compared to one another. The statistical treatment is discussed later in this document. The control group will act as our baseline, mimicking a market where there are two pipeline owners, one incumbent retailer, and two new retailers. The incumbent retailer will start the experiment supplying all consumers, while the new retailers will have no market share. We investigate what the market might look like if there is only one retailer, and three incumbent retailers, each starting the experiment supply a third of the consumers each. By comparing the control session to the treatment session, we can attribute differences in retail price paid by end consumers, differences in price paid by retailers to pipeline owners, and quantity of gas consumed to the differences in the market structure. That is, if there are differences in prices or gas consumed, it can be inferred that these differences are due to one pipeline verses two, and one retailer being the incumbent compared to three incumbents starting the session.

An experimental session lasts approximately one hour, taking participants through 4 experimental years (from 1st Jan 2001 to 31st Dec 2004) as a single continuous period. Thus each year lasts about 12 minutes, and each experimental day lasts about 2 seconds. The institution comprises two simultaneous market places, being the "end-of-pipe" wholesale gas market, and the retail market.

Five human participants are employed to act as agents in the market. Two participants noted as X and Y, or one participant noted as Z, act as pipeline operators. Pipelines see bids for price and quantity of gas from gas retailers, and choose which bids to accept. This is then considered a "posted-bid" market. The other three participants noted as A, B, and C act as gas retailers. The retailers post bids to purchase gas in the wholesale market, and post offer prices at which they will sell gas to consumers in the retail market.

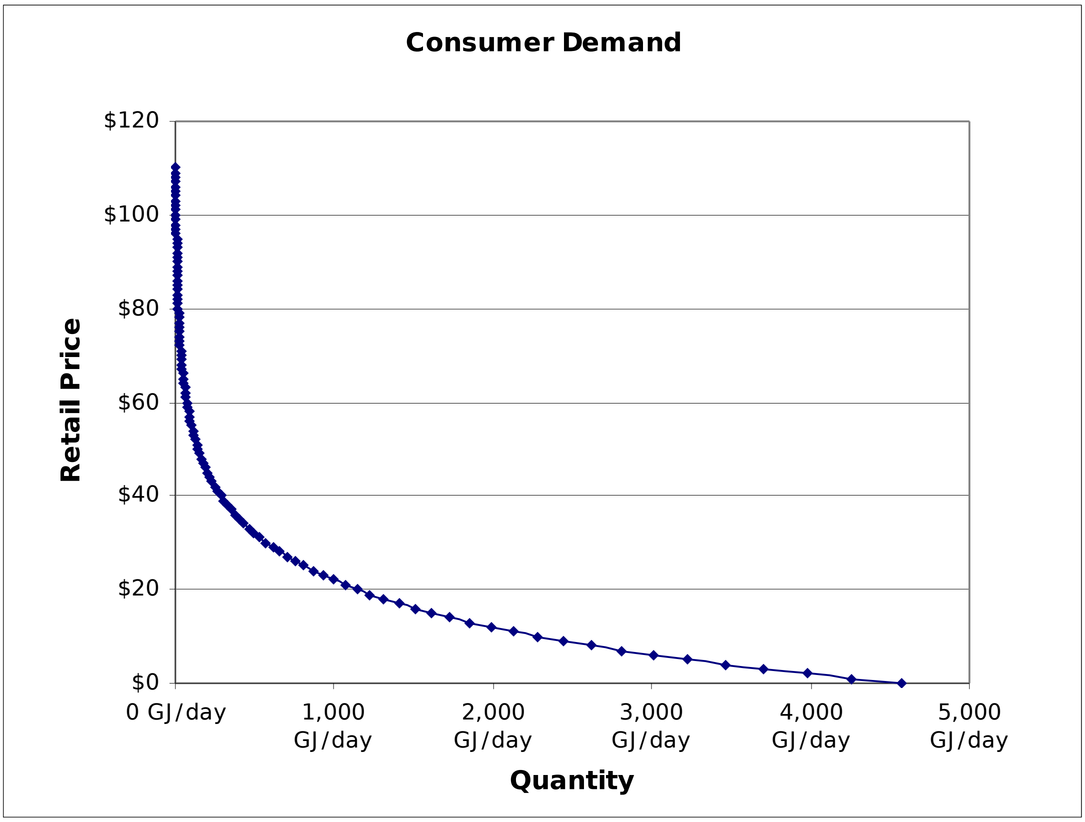
The retail market comprises the three retailers and 180 robotic gas consumers. Retailers post offers to sell gas at a particular price.. Simply, retailers purchase gas from a pipeline, and sell this gas to consumers. The difference in the price paid for gas, and the price received from the consumer is the retailers profit (or loss). Each consumer enters the retail market once every 6 experimental months. With 180 robotic consumers, that is one consumer entering the market each experimental day, or one each 2 seconds in real time. The retailers have a book of consumer accounts at any point in time. The book grows or shrinks as consumers sign on or leave throughout the experiment.

When arriving, the robotic consumer examines the prices currently posted by the 3 retailers, and selects the retailer with the lowest price. This part of the market is then considered a "posed-offer" market. The consumer enters a 6 month fixed-price contract with that retailer, at the price posted by the retailer. The consumer will then demand a certain quantity of gas from that retailer each day for the duration of their contract, at the contracted price. Consumers have a demand function where the quantity demanded on a daily basis increases as the price declines. The quantity demanded each day is determined by the price at which the contract was struck. This demand function is represented by equation 1, and the demand curve is represented by Figure 1 below.

Equation 1, Consumer Demand:

$$Ln(Quantity) = 8.426 + (-0.069 \times price)$$

Figure 1 – Consumer Demand Curve



Each day consumers demand gas from their retailer, taken from the retailers storage tank, and pay the retailer money at the contracted rate. Retailers must enter the wholesale market to obtain gas to meet their consumers' demand. As gas is purchased from the pipeline operators it is put in the retailer's local gas storage tank. The gas tank is sized to store enough gas for 20 experimental days. This is represented by a gas tank on their trading screen, which empties as consumers take their gas, and fills as the retailers purchase gas from the pipelines.

If the tank gets too close to empty a warning light begins to flash indicating to the retailer they will shortly enter a default situation. In the event that a retailer does not have enough gas in reserve for their customers, default gas will be provided where the pipeline operator earns no profit on those parcels of gas, and the retailer must pay $50 for each GJ of gas, an extremely high price.

Retailers make bids to the pipeline operators for their supply of gas. Bids are for the supply of the purchased parcel of gas over a 20 day period. Pipeline participants choose which bids from retailers to accept. The pipeline participant screen shows the open bids from retailers, their own utilisation of their pipe, and the utilisation in the other pipe. A pipeline operator may only accept a bid when they have sufficient flow capacity in their pipeline to deliver the gas.

The pipeline participant faces a hauling cost for each GigaJoule of gas supplied. The hauling cost equation comprises a fixed cost and a variable cost, and differs depending on the pipeline. Equation 2 and 3 below represent the costs of pipelines X and Y, while equation 4 represents the case where X and Y merge to form pipeline Z.

Equation 2, Haulage Cost of Pipeline X:

$$HaulageCost_{Pipeline-X} = \$209{,}415 + \$0.047 \times Flow(GJ)$$

Equation 3, Haulage Cost of Pipeline Y:

$$HaulageCost_{Pipeline-Y} = \$77{,}218 + \$0.065 \times Flow(GJ)$$

Equation 4, Haulage Cost of Combined Pipeline Z:

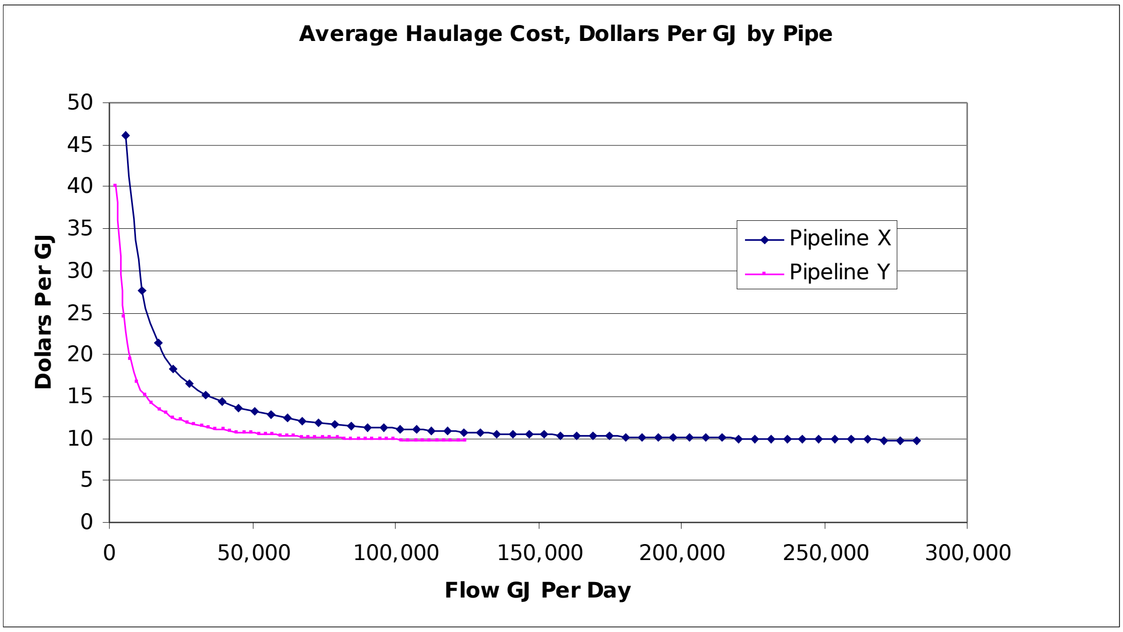
$$HaulageCost_{Pipeline-X} = \$209{,}415 + \$0.047 \times Flow(GJ)$$

For to capacity of 282,000 of GJ per day, then

$$HaulageCost_{Pipeline-Y} = \$77{,}218 + \$0.065 \times Flow(GJ)$$

The average cost is decreasing with output, and is represented in Figure 2 below. Note that pipeline Z (not shown) is simply the summing of pipelines X and Y, where the pipeline with the lower cost, X, is used to capacity before pipeline Y is utilized. This graph indicates that pipelines are eager to supply more gas than less, as their average cost is decreasing to the maximum capacity of the pipe. It should also be noted that the physical upper limits on gas flow are 282,000 GigaJoules per day for pipe X, 124,600 GigaJoules per day for pipe Y, and 406,600 GigaJoules per day for the combined pipeline Z.

Figure 2 – Average Haulage Cost



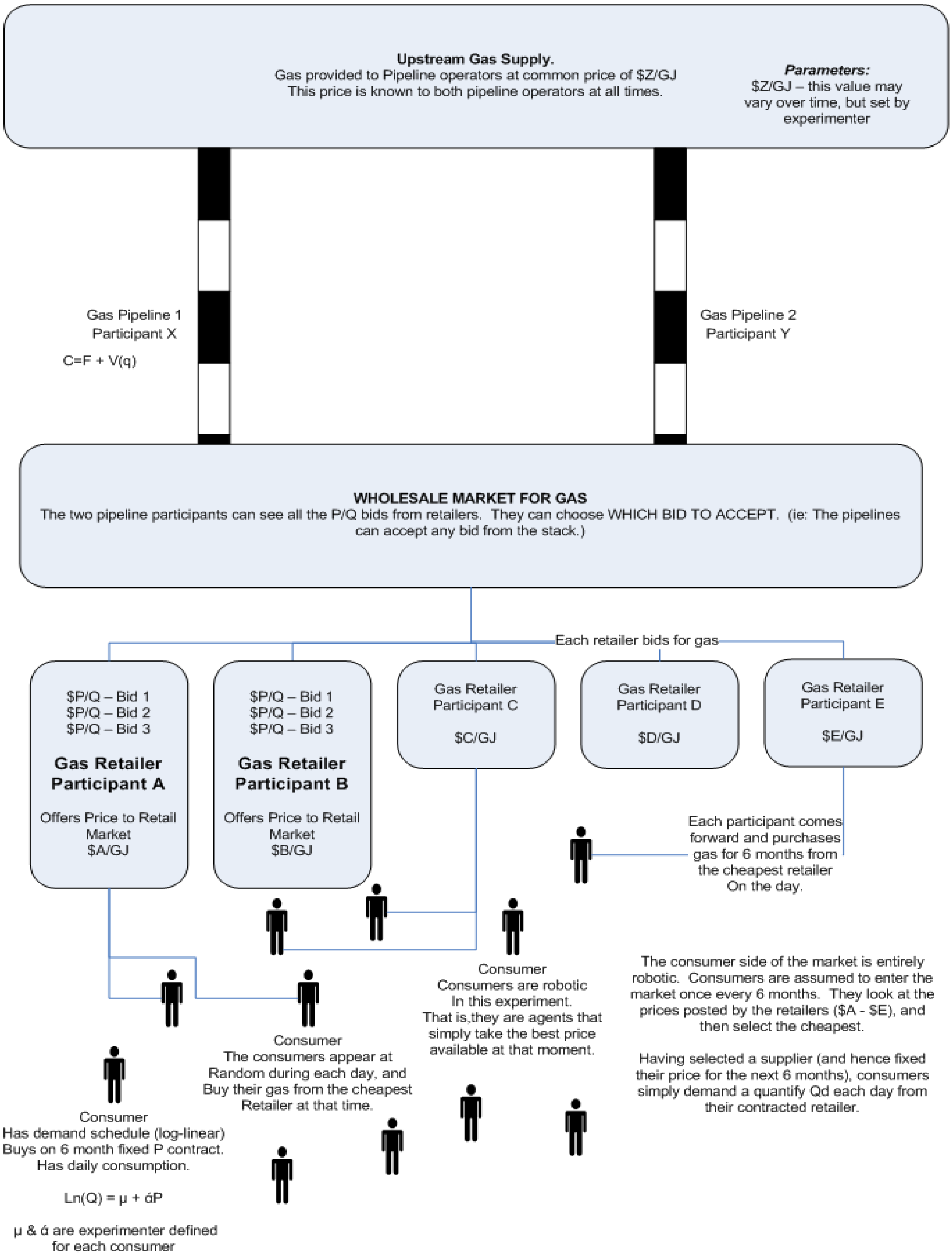
The cost of hauling a parcel of gas is shown on the pipeline's screen. The cost is calculated and charged daily. Pipeline operators also know that gas from the gas field has a set price of $3.00 per GJ. Additionally, there is a set $6.00 charge for distribution of the gas after the gas leaves the wholesale pipeline, which the supplier incurs. Pipeline operators see an end-of-pipe price that is the daily gas field price plus the distribution charge, plus the per GigaJoule haulage price, which they use to determine if a retailer's bid is acceptable[1].

In treatments α and γ, participant A is initialised with 70% of the retail consumers. Our hypothesis is that commencing with a large fraction of the demand, participant A will be able to bid for large parcels of gas at lower prices from the pipelines, since the pipeline participants will be willing to accept a discount in order to secure large sales. This will potentially give participant A some market power. In treatments δ and β, the retailers are initialised with 20% of retail consumers each, reducing the potential for retailer market power.

The overall experimental environment can be summarised in figure 3 on the next page.

[1] It is assumed there is a single upstream gas price at which upstream gas is available to all participants, and that transportation charges are invariant regardless of the amount of gas supplied.

Figure 3 - Experiment structure



Experimental parameters

At this point it is worth noting that gas volumes are measured by their energy content which can be converted to a volumetric measure. For our purposes of mimicking the actual market, all gas is measured in terms of Joules. A Joule is a relatively small energy unit[2], and hence gas volumes are more typically measured in larger units. In this experiment we have phrased flows, quantities, and parameters in the most appropriate units, outlined in Table 1 below.

Table 1 - Units for measuring gas

MegaJoules (MJ)	$1x10^6$ J	Retail tariffs are typically published priced in c/MJ
GigaJoules (GJ)	$1x10^9$ J	A typical residential house with gas cooking and heating in Sydney would consume around 22 GJ of gas annually.
TeraJoules (TJ)	$1x10^{12}$ J	The daily gas flow into Sydney would be around 400 TJ per day.
PetaJoules (PJ)	$1x10^{15}$ J	Total gas consumption for Sydney would be in the order of 120 PJ per annum.

In choosing experimental parameters we have attempted to provide a realistic parameterisation of the actual Sydney basin gas market. Using published prices for retail supply of gas (available from the websites of the Sydney based gas retailers) and using the published regulated “fallback” plan tariff rates, we concluded that the average end-use price of gas in Sydney is in the order of $10/GJ delivered. To calculate the haulage function we conducted our own market research. We believe that wholesale gas price averages around $3.00/GJ. Also the current average pipeline cost of haulage is around $1.00/GJ, both key values in determining hauling costs.

In respect of the pipes, we have set the parameters in Table 3 to create a robust experiment, based in part on discussions held with active market participants.

Table 2 - Estimates of key parameters for the pipelines

Flow Capacity (TJ of gas per day)	282 TJ/Day	124 TJ/Day	406 TJ/Day
Spare Capacity (TJ of gas per day)	22 TJ/Day	30 TJ/Day	52 TJ/Day
Spare Capacity %	8%	24%	130%
Utilisation %	92%	76%	87%
Average Daily flow (TJ)	260 TJ/Day	94 TJ/Day	354 TJ/Day

[2] An apple falling through a distance of 1m would have approximately 1J of kinetic energy.

PREDICTED OUTCOMES

As discussed in the Experimental Structure above, we have implemented the retail market with 180 robotic consumers. From considering the above information, we know that at a price of $10/GJ, an approximate total demand of 255 TeraJoules per day consumed by 180 customers equates to about 1,416 GigaJoules per consumer per day. Additionally we assume that even if gas is free that demand will not go above 4,566 GigaJoules per day.

Economic theory gives clear predictions as to what should happen in a market populated perfectly rational, forward thinking people. Clearly the aim of the firm is to maximise profits. Profit in these experiments is determined by the revenue gained from the consumer minus the cost of supplying the gas. The cost of gas, as noted earlier, is $9.00. Economic theory suggests that this cost will be passed through the retailer to the end consumer. The predicted outcomes can be seen in table 4 below. This table lists the outcomes of both the one pipeline owner, and the two pipeline owner. The second column is the predicted price paid by the consumer, with the daily flow of gas in each pipeline, followed by total flow of gas into the experimental market.

Table 3 – Predicted Outcomes

2 Owners	$12.07/GJ	282,000 GJ/Day	74,096 GJ/Day	356,096 GJ/Day
1 Owner	$23.47/GJ	161,503 GJ/Day	0 GJ/Day	161,503 GJ/Day

As can be seen, when there are two owners, economic theory will predict that competition will ensue, but only to a point. The predictions under the two pipeline case is where pipeline X is supplying their maximum amount, and allowing pipeline Y to set the price by choosing the amount of gas they will supply, and retailers will earn no profit (as discussed later). The more gas pipeline Y supplies, the lower the price must be. Because Pipeline X is already at capacity, they can do little to change the price. If pipeline X reduces their flow, pipeline Y will increase their flow to match the reduction, maintaining price, and increasing their own profit. Therefore, the price that maximizes pipeline Y's profit is $12.07, with X supplying 282 TJ/Day, and Y supplying 74TJ/Day. Profit for X will be $642,193, while Y will get $145,213

When only on owner is present, they control both pipelines. The owner will use the lesser expensive pipeline, X, first. Only after X is fully utilized will the owner use pipeline Y. It is true that the fixed costs of both pipelines will be incurred by the owner, using both pipes may not be the best option.

In fact, as shown above in table 4, the owner would restrict output to about 161 TJ/Day, to increase price to $23.47, nearly double the two pipe competitive price. In this manner their profit is maximized without using the Y pipe at all. This is because the X pipe can accommodate that 161 TJ/Day flow, and the Y pipe is always more expensive to operate on the margin[3]. The profit obtained in this case will be $2,043,360.

Having discussed the non-competitive, one owner, case, an alternate to the competitive prediction can be discussed. What would happen if the two pipelines colluded, maximising profit? In this case equating the marginal cost and the marginal revenue will ensure profit maximisation for both firms combined. If this were the case, the price close to $23.47 would be observed, with a total output of about 161 TJ/Day. This could only happen if pipeline X were to give some of it's market share up to pipeline Y. X may be willing to do this to get more than just $642,193 in profit, as they received when competing with Y[4].

Thus far we have ignored the retailers. The retailers do not incur a specific cost for servicing their clients in this experiment. Therefore, the profit gained per GJ by the retailers is simply the price per GJ obtained from the consumer minus the price paid to the pipeline per GJ. The per GJ profit gained by the pipelines is the price obtained from the retailers, per GJ, minus the haulage charge and the $9.00 base charge.

Economic theory predicts that the retailers will accept next to nothing to provide service to their customers under perfect competition with no dominant retailer. The reason for this is that if retailer A is charging a $1.00 per GJ mark-up on their gas, retailer B can steal retailer A's consumers away by charging a $0.99 mark-up. Retailer A retaliates by charging a mark-up of only $0.98, and so on. Finally, $0.01 per GJ is better than nothing. This means that their price mark-up will be next to zero dollars. It should be remember though, that if a retailer does sell gas at a slim margin, they must still supply the gas to the consumers, or face a $50 per GJ charge enforced by the government.

Additionally, as noted in the experimental design, under the control group one retailer will be start the experiment supplying the whole market, with the other two retailers having no market share. It is expected that the incumbent retailer should be able to hold onto their market share easier as they are able to purchase gas in larger lots. However, again, there is no way of knowing how much competition will take place among the retailers and between the retailers and wholesalers.

Experimentally it is predicted that all participants will fight to gain some positive profit, increasing their price mark-up to some positive number. If there is some positive mark-up obtained by the retailer, the price faced by the consumer will increase, reducing their quantity demanded. This directly affects the potential revenue the pipelines can expect. The exact amount of retailer mark-up will be revealed in the experimental outcome.

The main data gathered includes price and quantity of each bid, ask, and completed transaction by the pipelines and retailers, and profit gained by each participant. From this data we can test a number of phenomena. Tests will be t-tests, testing means of

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[3] Note that the cost of supplying one extra GJ of gas for X is $0.047, and it is $0.065 for Y to supply an extra GJ

[4] It is interesting to note that if X were to let Y to use it's full capacity, and supply just enough to reach the $23.47 price, X would still make more money than if it were to compete.

two distributions, or one distribution against a theoretical competitive or monopolistic solution. The tests will mainly be applied to prices. The main tests of interest include:

1. Does initialising one retailer with only one incumbent increase the incumbent's ability to raise retail prices above a market with three incumbents?

-Prices of the control session will be tested against the treatment

2. Does a monopoly pipeline increase wholesale prices paid by retailers to wholesalers compared to a duopoly?

-Prices of the control session will be tested against the treatment

3. Does a monopoly increase retail prices seen by consumers compared to a duopoly?

-Prices of the control session will be tested against the treatment

4. Does a monopoly pipeline exhibit curtailed consumption of gas compared to a duopoly?

-Quantity of gas consumed of the control session will be compared with the treatment

The results of this study are as expected and quite clear. The retail price paid by consumers is consistently higher, and statistically different, when there is only one pipeline as compared to a two pipeline market structure. Furthermore, the price paid by retailers to pipeline owners is also higher in a monopoly pipeline market structure versus the more competitive duopoly pipeline market. As a result the amount of gas purchased by the retailers from the pipeline, and therefore the amount of gas consumed by the end user is lower under a monopoly pipeline as compared to the duopoly pipeline. These assertions are proven in the graphs and tables below.

The most striking result is shown in figure 4 The Consumer Gas Price Comparison. As can be seen, prices paid by consumers to retailers is higher under the one pipeline case, when compared to the two pipeline case. During much of the first year the price paths are entangled, which is expected and is attributed to the market finding its equilibrium. The remaining three years shows quite well how prices are inflated in the monopoly market over the more competitive duopoly market.

The average (mean) price paid by consumers in the monopoly market structure was \$27.29, while the duopoly market consumers paid \$22.09, as can be seen in table 4. Consumers in the less competitive market paid a 23% premium over prices in the more competitive market. The averages were tested against each other to determine if they statistically came from the same distribution. As can be seen in the t-test they are not. Therefore it can be summarized that the consumers in the competitive market paid less for their gas than under a monopoly pipeline market.

Figure 4 Consumer Gas Price Comparison

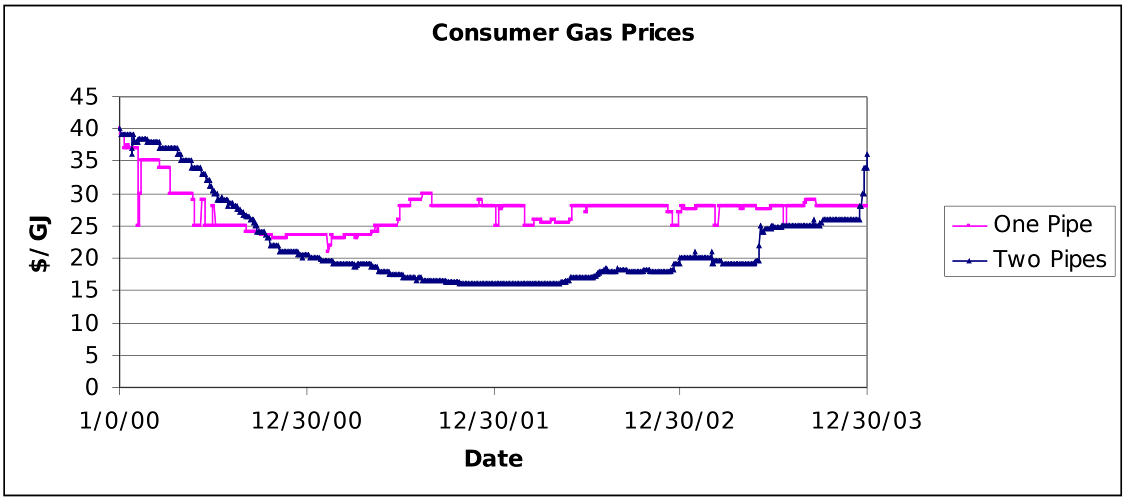
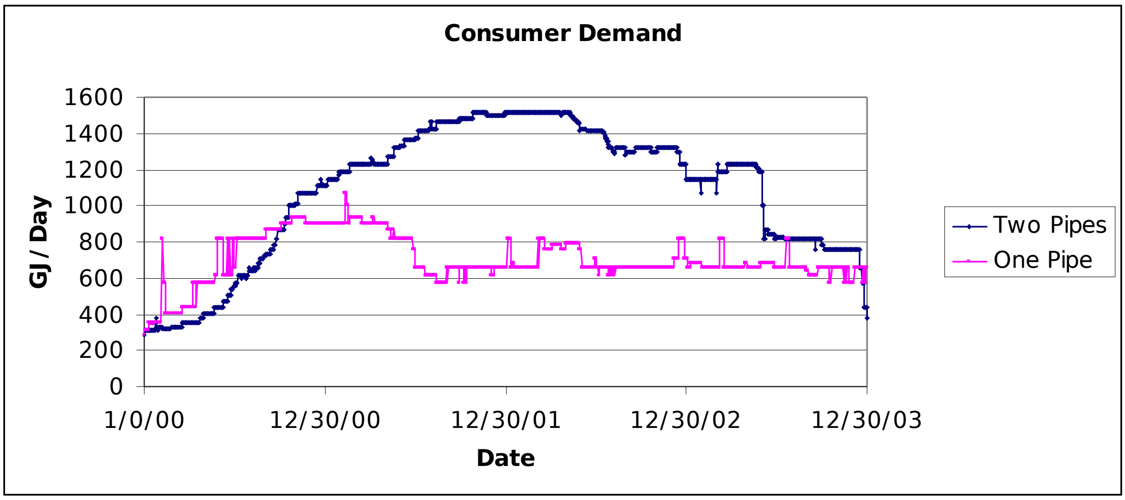


Table 4 Consumer Gas Price Statistics

Statistic	One Pipeline	Two Pipelines
Mean	$27.29	$22.09
Standard Deviation	2.96	6.58
T-Test		9.1481E-142

As further evidence that the monopoly pipeline market fostered a less competitive outcome, Consumer Gas Demand is plotted in figure 5 below. As can be seen, consumer demand, and therefore consumption, is lower under the less competitive model. Quite simply, consumers purchased less gas due to higher prices in the monopoly pipeline case.

Figure 5 Consumer Gas Demand Comparison



It is clear that end use consumers are less happy with a monopoly pipeline market structure. However, we have not discovered if it is due to the monopoly pipeline, or the differences in retailer market structure. Let us first observe the differences in prices paid by retailers to pipelines between the two sessions. In figure 6, pipeline gas prices under one pipeline and three retailers, prices rise from $15 to $25 per GJ. In contrast, figure 7, pipeline gas prices under two pipeline and three retailers, the price is consistently around $15. The averages, as seen in table 5, pipeline gas price supply statistics, are $15.43 for the two pipe case, and $19.95 for the one pipe case. Again the t-test shows that these two sessions were statistically different.

This price disparity can be ascribed to the differences in the number of pipelines. Again, remember, these sessions were identical except in market structure. In both the control and treatment sessions retailers were passing the costs they were paying onto the consumers. So at least part, if not most, of the consumer price disparity is due to the differences in number of pipelines.

Figure 6 Pipeline Gas Prices Under One Pipeline and Three Retailers

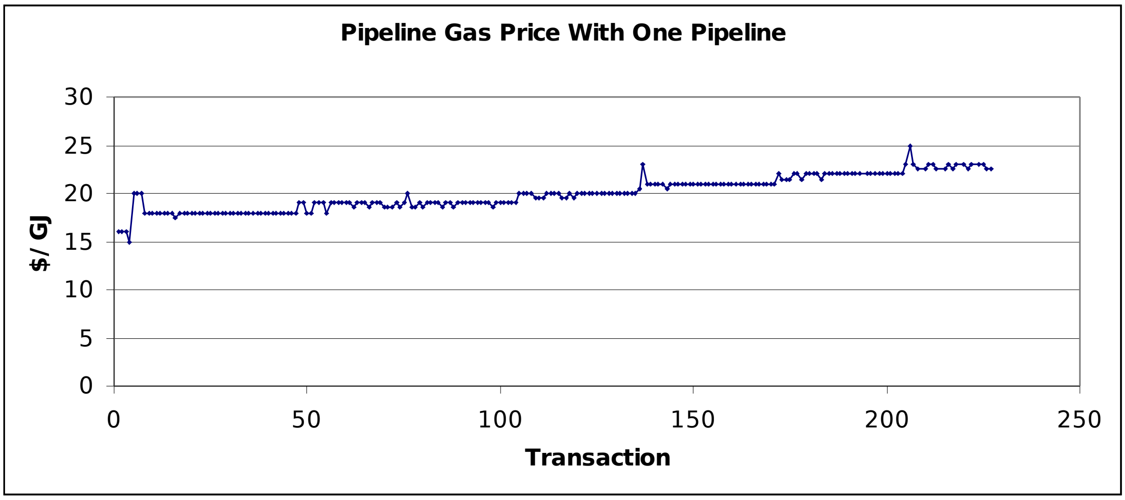


Figure 7 Pipeline Gas Prices Under Two Pipelines and Three Retailers

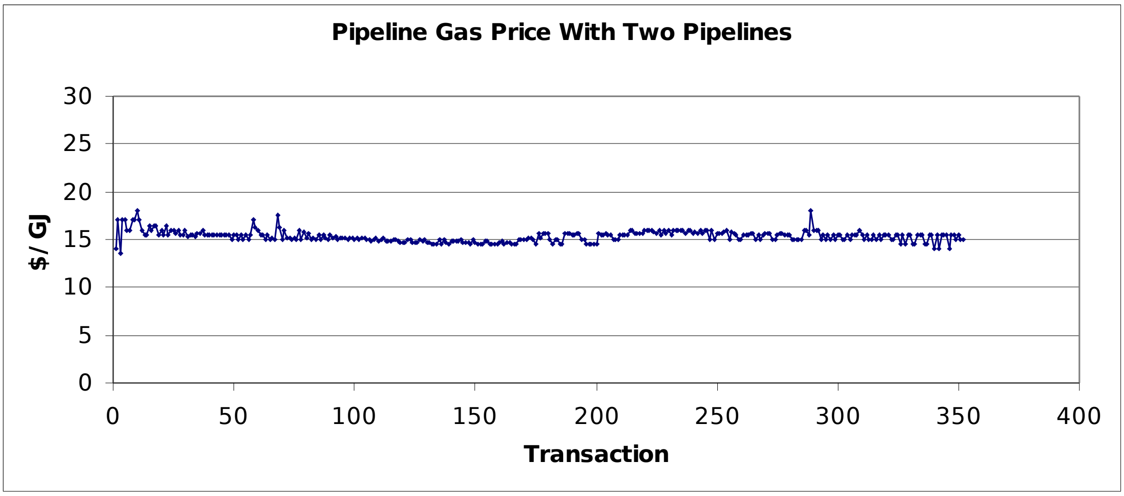


Table 5 Pipeline Gas Price Supply Statistics

Statistic	One Pipeline	Two Pipelines
Mean	$19.95	$15.33
Standard Deviation	1.70	0.586
T-Test		1.1137E-111

When looking at the number of transactions, and the quantity of each transaction made, it can be seen that the two pipeline market was more robust, an indication of a competitive market. This can be seen in figures 8, pipeline gas supply under one pipeline and three retailers, and 9, pipeline gas supply under two pipelines and three retailers. The number of transactions made between the retailers and one pipeline numbered 222, while 352 transactions were completed with two pipelines. In both cases 50,000 to 100,000 GJ were purchased with each transaction. However, the lot size was higher than 100,000 GJ in a number of cases under the one pipeline market, while lot size was less than 50,000 GJ for several transactions in the two pipeline market, and no transactions over 100,000 GJ. In general there were many, small, transactions, showing little market power. Conversely there were comparatively few, large, transactions. This would indicate that the one pipeline has more market power, thus increasing prices for retailers and consumers, when measured against a duopoly.

Figure 8 Pipeline Gas Supply Under One Pipeline and Three Retailers

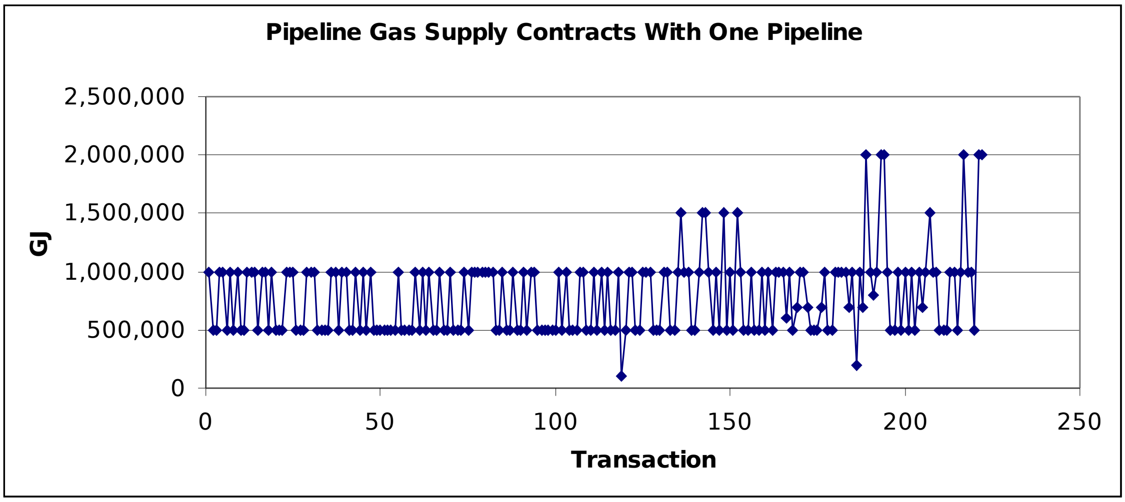
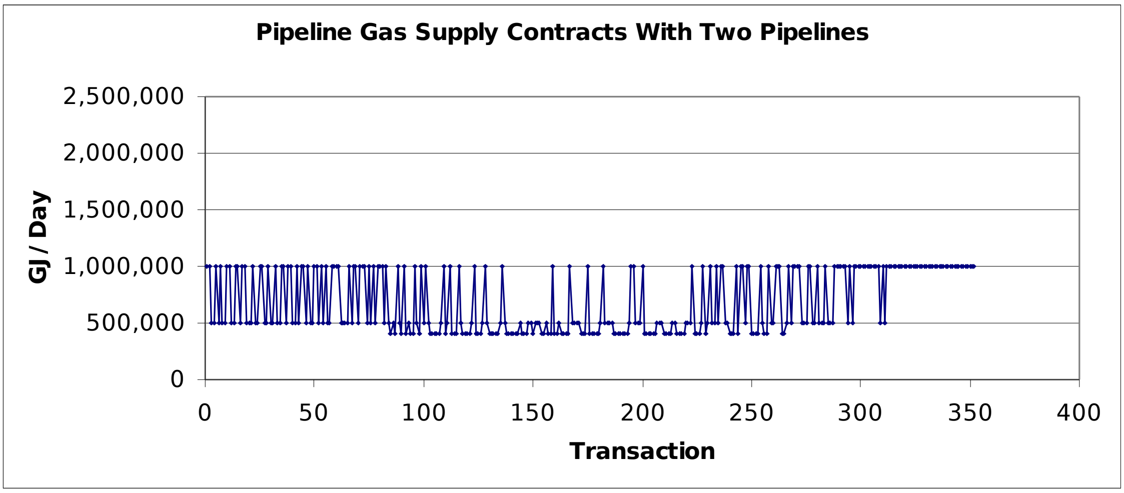


Figure 9 Pipeline Gas Supply Under Two Pipelines and Three Retailers



Finally, figure 10 final earnings in experimental dollars, lists how much each human participant was paid in experimental dollars. The experiment was designed such that each participant had the opportunity to earn the same amount of money. Therefore we can make inferences about market power when looking at final payouts of participants. When looking at the figure in general, it is quite noticeable that earnings in the one pipeline market were higher for each participant when compared to their counterpart.

This would indicate that, first, the monopoly pipeline had more market power than it's two counterparts. Also, the retailers in the monopoly pipeline case were able to make comparatively higher earnings than the retailers in the control group. It is noted here that all retailers in the one pipeline treatment were initialized with equal share of the market. This may indicate that when the retailers all start on a level playing field, there ability to coordinate their asks to sell is increased.

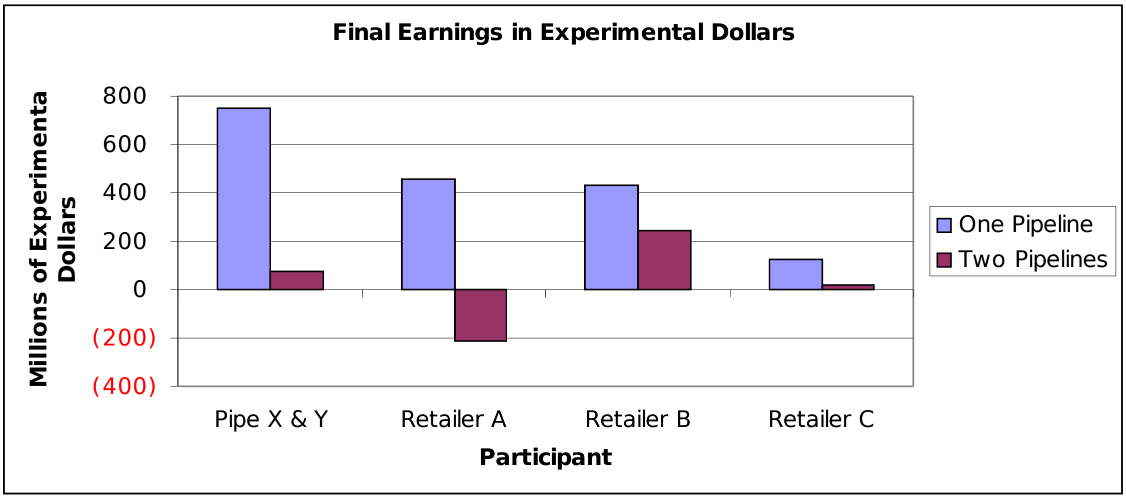
It is not surprising that some, if not all, participants in the two pipeline control group made lower earnings. In this group prices received were lower for both the pipelines and the retailers, and supply and consumption higher, when compared to the treatment group.

It is interesting to note that retailer A in the duopoly control group was initialized with supplying the whole market, and they were the only ones to lose money. This may be due to less of a market attribute and more of a human one. It is hypothesized here that the participant was initialized with a large share of the market, and adverse to losing any of their market share. This line of action would lead the retailer to offer offers to sell lower than the price off buying the gas from the pipeline[5].

[5] This type of reaction has been documented elsewhere, including Kagel and Roth 1995.

CONCLUSIONS

Figure 10 Final Earnings in Experimental Dollars



AGL and Alinta are two large diversified energy utilities in Australia, which have recently been seeking to merge. This potential merger gives a relevant backdrop for studying how wholesale and retail prices are affected by an industry merging from two to one suppliers. The research methods employed in this analysis enable analysis of the profit and behaviour of all parties can be analysed, and lessons drawn about future mergers and major market shifts.

Experimental economics is the research method of choice used in this study. Experimental economics is a tool in which the researcher can emulate an existing or possible economic environment and institution in a controlled setting to observe behaviour of participants and outcomes of prescribed treatments. The experimenter can then modify the environment and/or institution in a specific parameter and observe the results. Experiments are done for a number of reasons, one of which is to compare environments and/or institutions.

In our experiments we employ four or five human participants to play the roles of pipelines or gas retailers, with the computer simulating end use consumers. The design of the experiment is such that there is a control group with two competing pipelines, and one incumbent retailer servicing the entire retail market, with two retailers that are initialized with no customers. The treatment group has only one pipeline, and three retailers that initially share the retail market.

Pipelines make money by buying gas at a predetermined well head price, and selling the gas above the wellhead price and the cost of haulage. The retailers make money by simply buying gas from the retailers and selling that same gas to end use consumers. Every participant has the opportunity to earn the same amount of money.

The results of the experiment are that prices received by both the pipelines and the retailers are higher when there is only one pipeline. Furthermore, under the one pipeline case, wholesale transaction quantity was higher, and number of wholesale transactions were lower, indicating a lower level of robustness, or competition. The final earnings of participants in the monopoly pipeline session were higher than their counterparts in the control group, indicating market power due to the single pipeline, and potentially increased ability for retailers to collude when starting the experiment with the same number of customers.

It is this type of study and experimentation that can be conducted for nearly any type of market, market system, or market rule. The environment to be tested may be currently in existence, existed in the past, or a rule or system that is being proposed. The research is statistically sound, and moderately easy to conduct when compared to alternatives. Economic experiments can and should be conducted before any market rules are added or changed to an existing market.

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