Pipeline Regulation Consultation Regulation Impact Statement – Stakeholder feedback template

Submission from Lewis Grey Advisory

Chapter 5: Effectiveness of Part 23

No.	Questions	Feedback
1	If you are a shipper that has negotiated with the operator of a non-scheme pipeline since August 2017, or a service provider of a non-scheme pipeline, how effective do you think Part 23 has been in terms of:	No comments
	(a) enabling shippers to make more informed decisions about whether to seek access and to assess the reasonableness of a service provider's offer?	No comments
	(b) reducing the information asymmetries and imbalance in bargaining power that shippers can face in negotiations?	No comments
	(c) facilitating timely and effective commercial negotiations between shippers and service providers?	No comments
	(d) constraining the exercise of market power by service providers during negotiations by providing for a credible threat of intervention by an arbitrator?	No comments
	(e) enabling disputes that cannot be resolved through negotiations to be resolved in a cost-effective and efficient manner?	No comments
2	Do you agree with the observations and recommendations made by:	No comments
	(a) respondents to the OGW shipper survey (see section 5.1)? If not, please explain why not.	No comments
	(b) the Brattle Group in its review of the financial information (see section 5.2)? If not, please explain why not.	No comments
	(c) the ACCC in its review of the operation of Part 23 (see section 5.3)? If not, please explain why not.	No comments

No.	Questions	Feedback
3	Are there any changes that you think need to be made to Part 23 to make it more effective or efficient in terms of achieving its stated objective (i.e. to facilitate access at prices and on other terms and conditions that, so far as practical, reflect the outcomes of a workably competitive market)?	Lewis Grey Advisory is pleased to propose the attached framework for the analysis of workably competitive market outcomes consistent with a smooth transition from regulated to fully competitive market pricing.

Attachment
Workably Competitive Markets – An Analytic Perspective

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Contents

Statement

This report is the independent work of Lewis Grey Advisory, which has received no financial contributions or other support or inputs in relation to its preparation.

It is submitted in the belief that it covers a largely undeveloped aspect of Australian regulatory debate and may shed useful light on outcomes in markets that are not fully competitive i.e. are workably competitive.

Richard Lewis, Director LGA, December 2019

Executive Summary

The COAG Regulatory Impact Statement (RIS) for consultation, “Options to Improve Pipeline Regulation”, invites submissions on Part 23 of the National Gas Rules. The concept of a “workably competitive market” outcome is an important element of Part 23.

This submission is not a review of previous definitions of the meaning of “workably competitive market” outcomes but looks for a definition of the meaning in a more general framework consistent with a smooth transition from regulated to competitive market pricing. The framework consists of the following steps:

1. A market model applicable to markets ranging from unregulated monopoly to fully competitive is used to establish a “Margin Curve” describing how the price margin over cost reduces from the unregulated monopoly margin to zero with increasing competition.

2. A widely accepted benchmark, the Herfindahl-Hirschman Index (HHI), is used to define the least competitive market that does not need to be regulated.

3. It is proposed that regulated prices in less competitive markets that require regulation should not be lower than those prevailing in any market that does not need regulation. If regulated prices were lower than this, additional competition would be to the detriment of consumers, who would face increased prices as markets became more competitive and were deregulated.

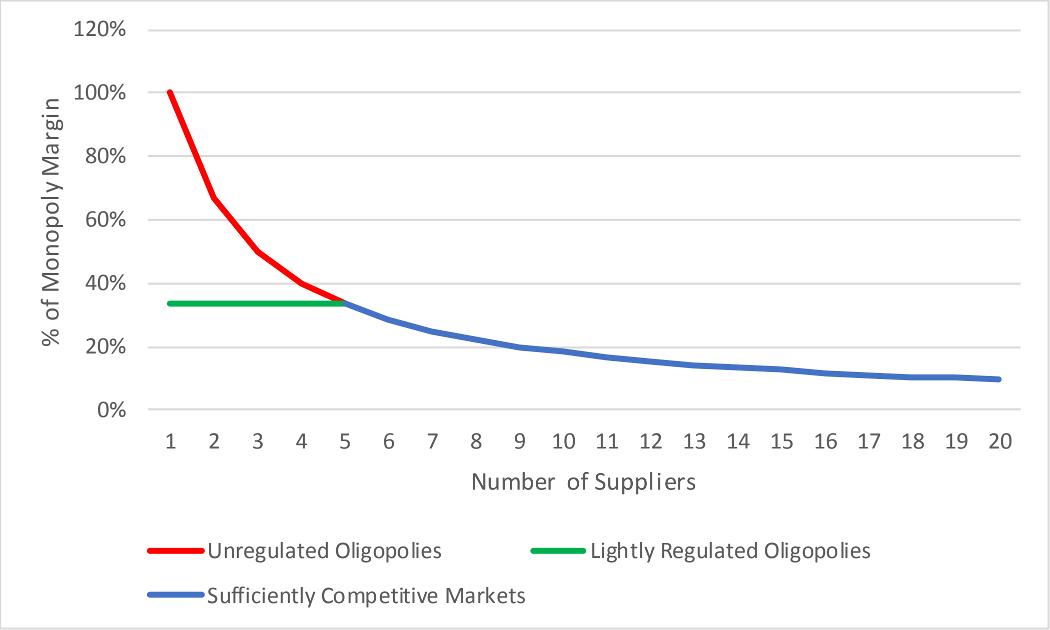
4. Consequently the margin for the least competitive market established in Point 2 sets the lowest logical margin for regulated prices, including arbitrated outcomes under Part 23.

5. This approach is supported by an analysis of the benefits of regulation, in the form of the economic value added by such a regulatory scheme.

Figure E 1 illustrates the key results. Margins for unregulated markets with varying numbers of suppliers are established using a Nash-Cournot market model familiar to those analysing less than fully competitive markets. The benchmark level of competition above which regulation is unnecessary is based on the Herfindahl-Hirschman Index used by FERC in the US in relation to gas pipeline competition, namely 5 to 6 competing pipelines. The recommended oligopoly margin under light regulation is as shown.

This regulatory arrangement would eliminate most of the economic value lost to market power in insufficiently competitive markets.

Figure E 1 Margin Outcomes for Oligopoly and Sufficiently Competitive Markets.



1. Introduction

1.1 A Workably Competitive Market

The COAG Regulatory Impact Statement (RIS) for consultation, “Options to Improve Pipeline Regulation”, describes a gas pipeline regulatory framework that has become increasingly complex over time, with many different regulatory categories and concepts. Recently, Part 23 of the National Gas Rules (NGR), was introduced to govern access negotiations between pipeline service providers and shippers seeking service. Part 23 includes a new arbitration framework for when negotiations are inconclusive, which includes the pricing principal that arbitration outcomes should reflect outcomes in a “workably competitive market”.

In defining what “workably competitive market” means, regulatory advisers tend to revert to concepts associated with fully competitive markets such as marginal pricing and cost plus rate of return pricing. It is difficult to see how this differs from pricing under full regulation and in a survey of shippers undertaken for COAG a number of shippers expressed dissatisfaction with this.

This submission does not propose to review previous definitions of “workably competitive market” outcomes but looks for a definition of the meaning in a more general framework consistent with a smooth transition from regulated to fully competitive market pricing. The framework consists of the following steps:

1. A market model applicable to markets ranging from unregulated monopoly to fully competitive is used to establish a “Margin Curve” describing how the price margin over cost reduces from the unregulated monopoly margin to zero with increasing competition.

2. A widely accepted benchmark, the Herfindahl-Hirschman Index (HHI), is used to define the least competitive market that does not need to be regulated.

3. It is proposed that regulated prices in less competitive markets that require regulation should not be lower than those prevailing in any market that does not need regulation. If regulated prices were lower than this, additional competition would be to the detriment of consumers, who would face increased prices as markets became more competitive and were deregulated.

4. Consequently the margin for the least competitive market established in Point 2 sets the lowest logical margin for regulated prices, including arbitrated outcomes under Part 23.

5. This approach is supported by an analysis of the benefits of regulation, in the form of the economic value added by such a regulatory scheme.

   The development of this concept presented below is based on the most straightforward analysis available and further details will need to be considered before it can be used in practise.

2. Pricing Outcomes in Less Than Fully Competitive Markets

2.1 Pricing in Monopoly and Fully Competitive Markets

Let us first consider the familiar price outcomes in monopoly and fully competitive markets.

An unregulated monopoly supplier completely controls the price and will set a price that maximises its profits, in line with the following calculations. Assume that the monopolist's unit cost of supply is C (including operating and capital costs) and that demand for its product, U, is inversely related to the price P set by the monopolist, $U=a-bP$, alternatively expressed as $P=A-BU$, where A and B are both positive. A is the price at which $U=0$ and A therefore has to be larger than C. This demand specification implicitly assumes a diverse customer base – a different model is required when there are a small number of larger customers.

With these assumptions the monopolist's profit $\prod$ is a quadratic function of the volume it sells (or the price it sets).

Equation 2-1 $\prod = U(P - C) = U(A - BU - C)$

Straightforward calculus shows that the monopolist's' profit maximising volume and price are:

Equation 2-2 $U = (A - C)/(2B)$ **and** $P = (A + C)/2$

The monopolist takes a margin over its cost equal to (A-C)/2.

By way of an example, if A=$10/unit and C=$5/unit, then the monopolist's price would be $7.50/unit i.e. 50% above cost. The volume supplied would be 250 units if B=0.01.

In a fully competitive market on the other hand, there are so many suppliers that no individual supplier can influence prices, which are therefore set as near to costs as makes no difference. In the above example, if all the suppliers' costs were near to $5/unit, the competitive market price would be $5/unit, 33% less than the monopoly price, and the volume supplied would be 500 units, which represents a significant increase in economic value to the consumers, some of which has been captured by the supplier in the monopoly case.

2.2 In Between Monopoly and Fully Competitive Markets

There is obviously a significant gap between monopoly and fully competitive market outcomes and the question is how to describe the markets and calculate the price outcomes. Markets with a small number of suppliers, for example two or three suppliers, are frequently referred to as oligopoly markets and the suppliers can still independently try to maximise their profits subject to the constraints imposed by their competitors, by controlling their outputs, without any collusive behaviour.

Oligopoly markets are decentralised decision making problems with two or more decision makers, mathematically equivalent to a game with multiple players. The relevant mathematical tools are those of game theory, as developed by the late John Nash and applied by Jean Tirole, economics Nobel laureates in 1994 and 2014 respectively. Nash's contribution was to provide a clear definition of the equilibrium point (solution) in a game.

The simplest game is the Nash-Cournot game in which the participants set their production volumes – Cournot was a 19^{th} century French economist who first conceived the structure. There are other approaches to games, such as Nash Bertrand models in which competitors offer prices, but the Nash-Cournot model has several attractive features, including that it replicates competitive outcomes when there are many competitors and monopoly outcomes when there is just one. Nash-Cournot games are widely used to model oligopoly markets and are recommended for use in merger assessments by Henry Ergas, Eric Ralph and Alex Robson in their 2015 publication "The ACCC Merger Guidelines: A User Manual".

2.2.1 Market Specification

Conceptually the market is similar to the simple monopoly market described above except that there are multiple suppliers. The number of suppliers is designated by n. Each supplier aims to maximize its profit:

Equation 2-3 $\prod_i = u_i (P - c_i) \quad i = 1,\ldots n$

$u_i >= 0$ are the quantities produced and sold and c_i are the unit costs of production of supplier i. P is the single market price received by suppliers and paid by consumers, whose price resistance is expressed by the inverse demand function, as before:

Equation 2-4 $P = A - BU$

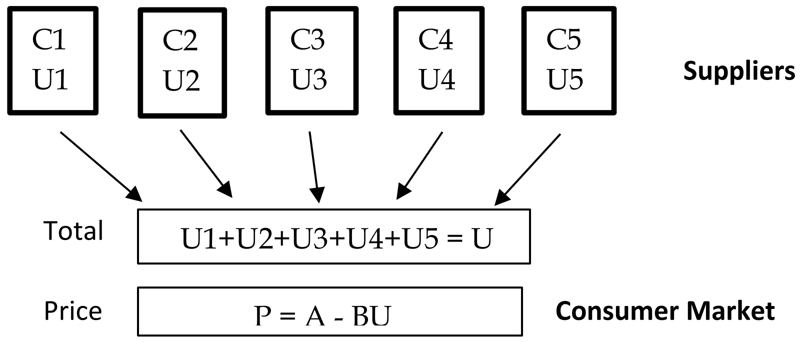
Here U is the total production

Equation 2-5 $U = \Sigma u_i$

Σ denotes the sum of all suppliers' production. The model is illustrated in Figure 2-1.

Each supplier controls only its own production and the market price is set by Equation 2-4. Technically this is known as a "post-entry" model because it deals only with production "operating" decisions rather than investment "entry" decisions.

Figure 2-1 An Oligopoly Market Structure



The equilibrium outcome for this game is characterised by the Nash Cournot conditions, which are expressed as "no supplier can unilaterally improve its profit". The equilibrium outcomes are derived in Appendix A. Formulas for the equilibrium total volume and market price are:

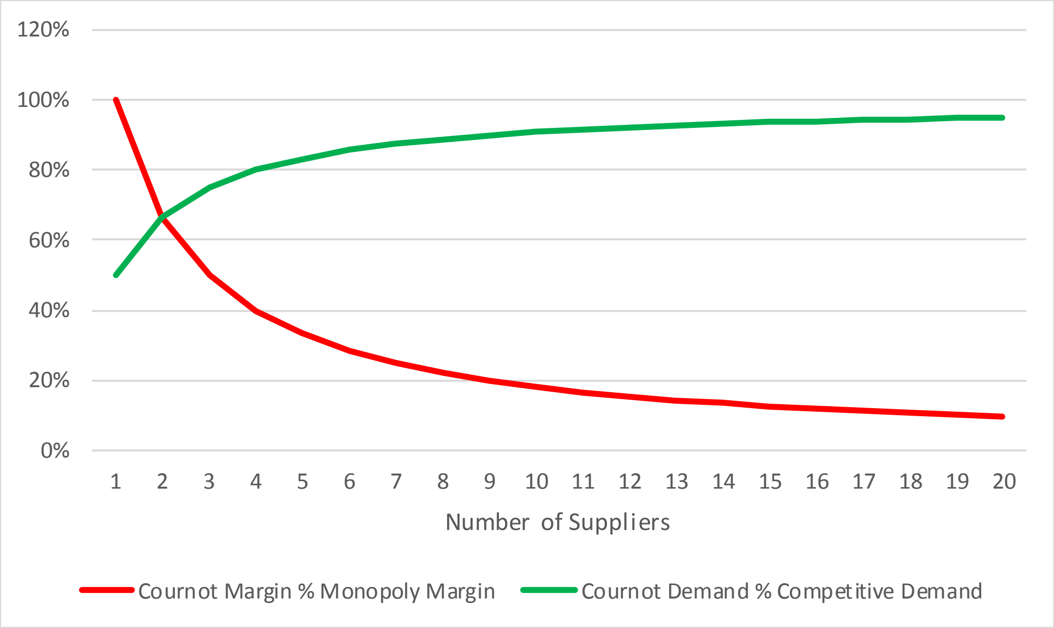
Equation 2-6 $\mathbf{U = (nA - \Sigma c_i)/(B(n + 1))}$

Equation 2-7 $\mathbf{P = (A + \Sigma c_i)/(n + 1)}$

It is immediately apparent that, firstly, the monopoly case n=1 is exactly the same as in section 2.1 and secondly as n becomes very large the price converges on the average cost, which if costs are similar is the same as the fully competitive market price.

If all suppliers have the same costs, C, then $\Sigma c_i = nC$ and P = A/(n+1) +Cn/(n+1). The margin above cost is M = P – C = (A - C)/(n + 1), which is inversely proportional to the number of suppliers and proportional to the inverse of the price elasticity, A, as illustrated in Figure 2-2. Expressed as a percentage of the monopoly margin, M%=2/(n+1). This is the "Margin Curve" that is recommended as a benchmark for pricing under Part 23.

Figure 2-2 Variation of Cournot Margin and Cournot Demand with Number of Suppliers



3. Markets That Do Not Require Price Regulation

Price regulation is generally applied in markets where the number of competing suppliers is so few that they will have sufficient market power to unilaterally influence or set prices at levels detrimental to consumers and the economy as a whole. The Herfindahl-Hirschman Index (HHI) is a market index that is frequently used by observers and regulators to determine the level of competition in a market, and reach decisions regarding the need for regulation or the impact of a proposed supplier merger.

The HHI is equal to the sum of the squares of the market shares of the suppliers: $HHI = \Sigma u_i^2 / U^2$. Here the sum is over all suppliers, u_i is the volume supplied by the ith supplier and U is the total supply. Some authors express the market shares as true percentages, so the HHI ranges between 0 and 1, while others multiply the shares by 100, in which case the HHI ranges between 0 and 10,000. When all suppliers have the same or very similar market shares, the HHI is simply $n^* (1/n)^2 = 1/n$ or 10,000/n where n is the number of competitors.
This has an obvious parallel with the Margin Curve concept. In fact there is a more general relationship, namely that the margin as a percentage of the price equals the HHI divided by the price elasticity, which provides theoretical justification for the HHI (for more details please refer to Wikipedia).

The HHI is frequently used to assess whether a market is:

- competitive – prices will always be set competitively;
- moderately concentrated – market power may influence pricing from time to time; or
- highly concentrated – market power will frequently influence pricing.

The benchmark indices used to indicate whether a market is competitive, moderately concentrated or highly concentrated vary from one application to another. According to Investopedia the US Department of Justice uses the following benchmarks: competitive – HHI 1,500 or below; moderately concentrated – HHI 1,500 to 2,500; and highly concentrated – HHI over 2,500.

According to the COAG RIS, FERC applies a benchmark of 1,800 to measure the lower threshold of market concentration for gas transmission. For a market to be viewed as sufficiently competitive not to require regulation, there must be at least 10,000/1,800 = 5 or 6 equally sized transmission suppliers. This is taken to define the least competitive market that would not need to be regulated.

Note: if there is one or more suppliers with a larger than average market share there would need to be more than 6 competitors to achieve an HHI of 1,800. For example, if one supplier has 42.4% of the market, this supplier alone contributes 1,800 to the HHI and the market cannot therefore be regarded as sufficiently competitive no matter how many other suppliers there are.

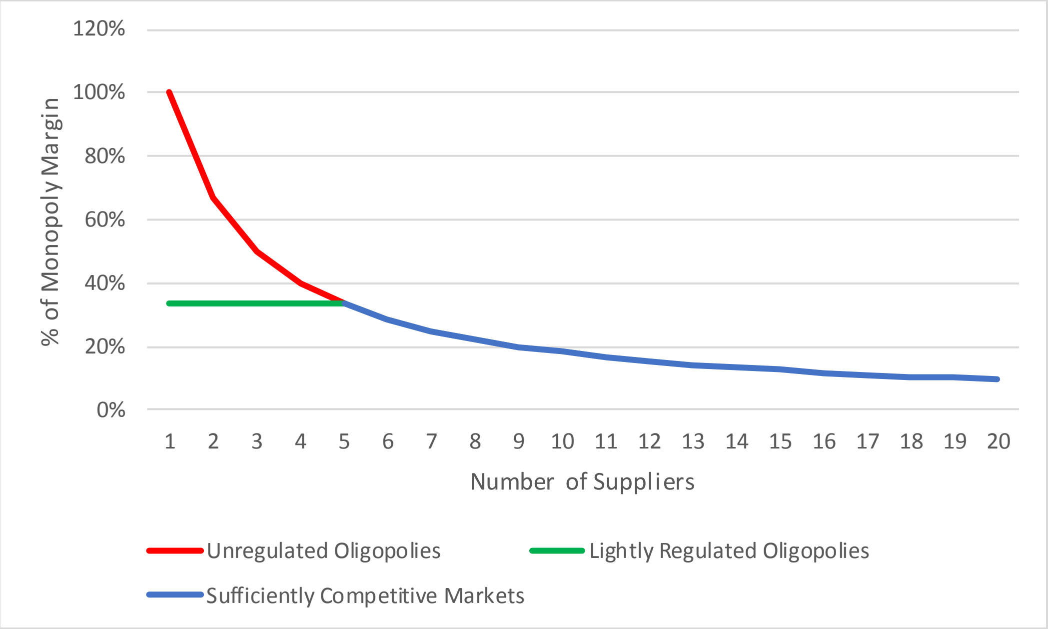
3.1 Workably Competitive Market Outcomes

Using the FERC HHI criterion of 5 to 6 competitors as a benchmark for the least competitive market which would not be regulated, the Margin Curve shows that that level of competition reduces the equilibrium market margin to 33% (5 competitors) or 29% (6 competitors) of its monopoly value.

Consequently, using the logic in Points 3 and 4 in section 1, these margins set the lowest logical margin for regulated prices, including arbitrated outcomes under Part 23. Figure 3-1 compares the price outcomes for Unregulated Oligopolies, Lightly Regulated Oligopolies (under Part 23 with the above margin allowance) and Sufficiently Competitive Markets.

In the example in section 2.1, these margins would lead to prices of $5.83/unit and $5.71/unit respectively, or 17% and 14% margins above cost.

Figure 3-1 Margin Outcomes for Oligopoly and Sufficiently Competitive Markets.



4. The Economic Value of Markets

All markets generate economic value for suppliers and consumers. The typical measures of economic value are the supplier surplus, which is the sum of the suppliers' profits, and the consumer surplus, a measure of the amount consumers have gained by not having to pay the maximum they may be prepared to pay. For linear demand as used in the above Nash Cournot model, the consumer surplus is the area of the triangle depicted in Figure 4-3 below, in which the red line joins the equilibrium price to the equilibrium volume.

The economic values of a Nash Cournot market at its equilibrium point can be expressed as:

Supplier surplus = $\Sigma\, u_i\,(p - c_i)$

Consumer surplus = $0.5 * (A - P) * U$

In these equations the parameters have the same meaning as in the equations above. The Nash Cournot equilibrium solutions can be used to examine the dependence of the economic values on critical parameters. When all the suppliers have the same unit costs, C, it follows from the Nash Cournot solution that:

Equation 4-1 Supplier surplus $= (A - C)^2 / B * (n / (n + 1)^2)$

Equation 4-2 Consumer surplus $= (A - C)^2 / B * (0.5\, n^2 / (n + 1)^2)$

Equation 4-3 Economic value $= (A - C)^2 / B * (n + 0.5 n^2) / (n + 1)^2$

It follows that the relative values of the surpluses are determined solely by the number of competing suppliers, n, as illustrated in Figure 4-1 below. Important points to note are that monopoly pricing cuts 25% off the total economic value generated by fully competitive markets but that 5 or 6 competitors restore almost all of that loss (total economic value is 97% and 98% in those cases). Regulating prices as suggested in section 3.1 would preserve most of the economic value lost to market power in uncompetitive markets (Figure 4-2).

Figure 4-1 Variation of Surpluses and Economic Value with Number of Suppliers

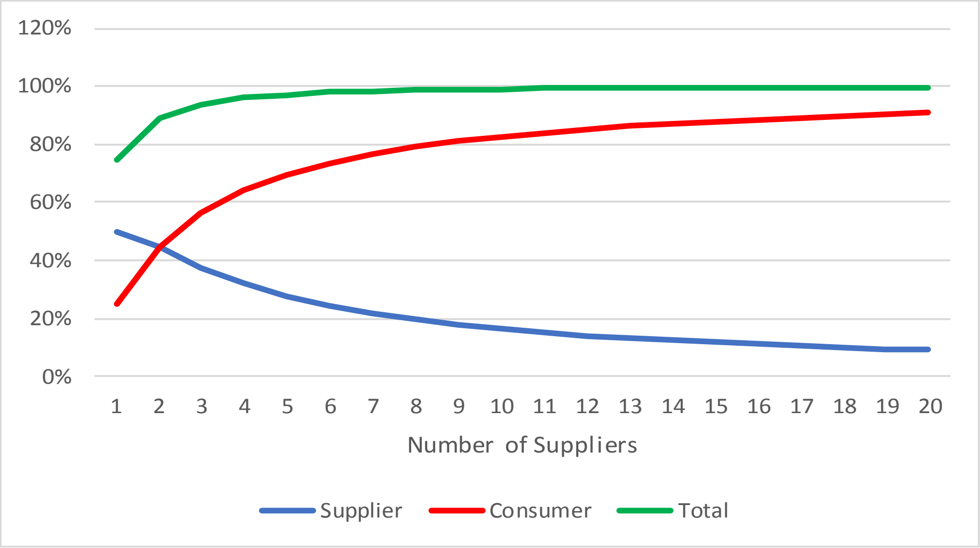


Figure 4-2 Economic Value in Oligopoly and Sufficiently Competitive Markets

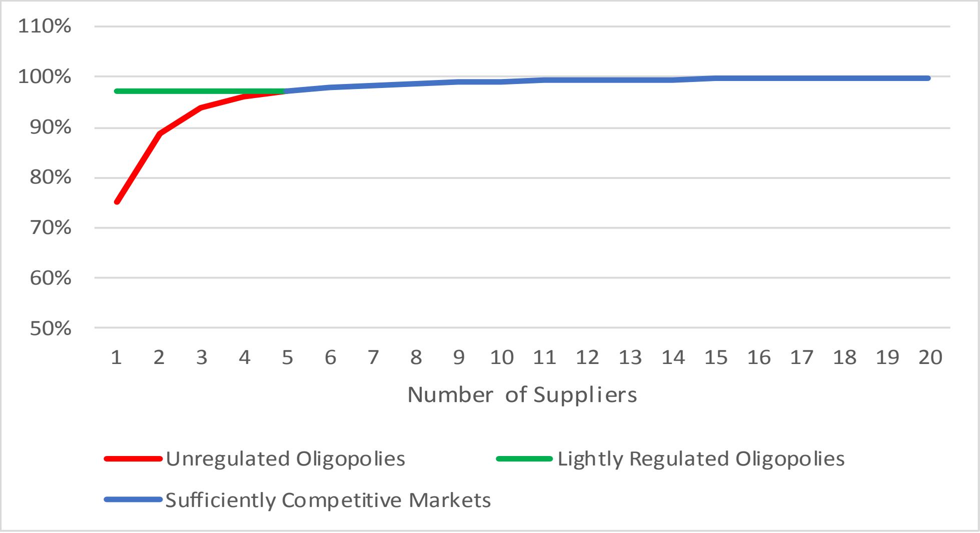
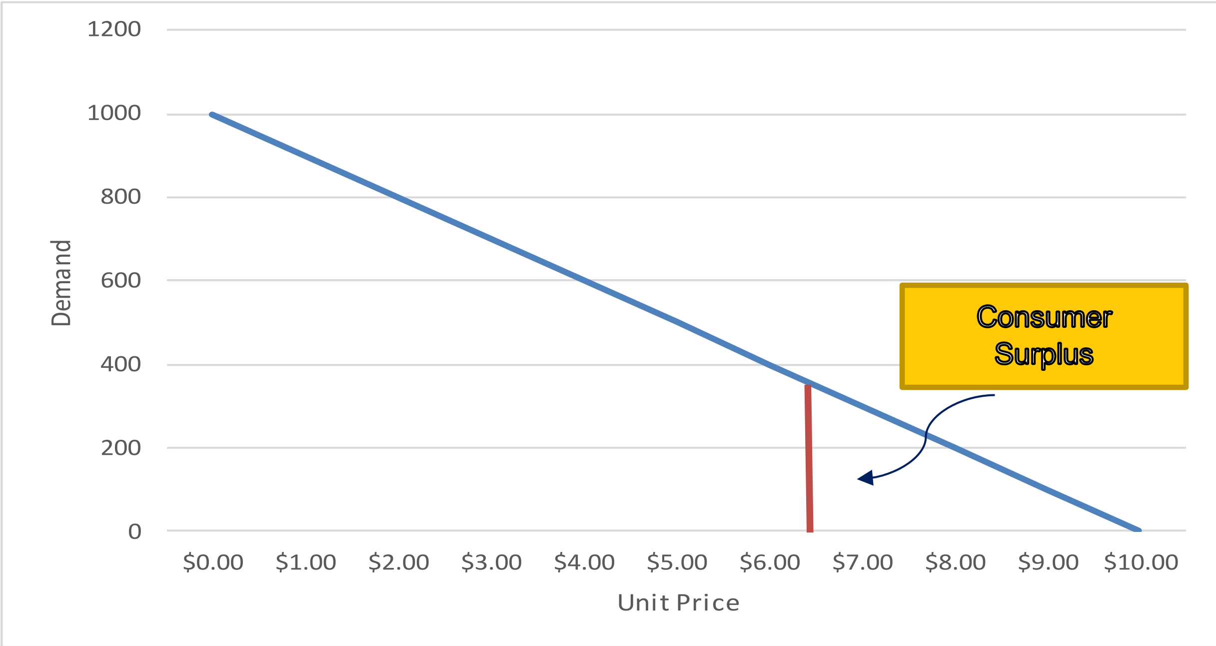


Figure 4-3 Consumer Surplus at a Price of $6.50/Unit



5. Adding Detail

The above modelling is the simplest available. It does not deal with the following factors, amongst others.

5.1 Dynamic Competition

Dynamic competition broadly refers to construction of additional pipeline capacity or new pipelines. Nash-Cournot models of dynamic competition are described in “Dynamic Models of Oligopoly (Fundamentals of Pure and Applied Economics, Book 1)”, J Tirole & D Fudenberg, 2002, and other publications.

5.2 Economies of Scale

Economies of scale can result in lower pricing from fewer suppliers, provided they offset market power. Economies of scale are common in the gas pipeline sector:

- In the investment phase, because pipeline capacity increases as a function of the square of the cost of a pipeline.
- In the operational phase, because most of the costs are fixed.

Simple economy of scale structures can be incorporated in Nash-Cournot models.

5.3 Dealing with The Real Structure of the Gas Market

The pipeline sector is part of a chain of supply, incorporating gas producers, distributors and retailers. Multi-tier Nash-Cournot models can be constructed but the range of options is considerable. In the models that LGA has investigated to date, in which the consumer margin is shared among all tiers of suppliers, margins have an inverse relation to the number of consumers, as in the version considered above.

For example, in a model in which pairs of producers and pipelines compete to supply a market, the delivered price of each pair is the sum of their individual prices, determined independently. If there are n pairs, the equivalent of M% in section 2.2 varies as the function 3/(n+2) instead of 2/(n+1). More competition is required to reduce the margin, the well-known phenomenon of “double marginalisation” in multi-tier markets.

Moreover, each pair of producer-pipelines shares the margin, so if in one pair the production cost is higher, the pipeline will get a lower margin than other pipelines, making the pipeline comparison more difficult.

Appendix A Solution of the Nash-Cournot Model

The Nash Cournot conditions characterise the solution to the game, which is expressed as “no participant can unilaterally improve their profit”. Using Equation 2-4 each supplier’s profit can be expressed as:

$$\prod_i = u_i \, (A - BU - c_i) \quad i=1,\ldots n$$

The Nash-Cournot conditions are equivalent to the derivative of this with respect to u_i being less than or equal to zero:

Equation 5-1 $$\delta / \delta u_i \prod_i = A - BU - c_i - Bu_i \ <= \ 0 \quad i=1,\ldots n$$

The symbol **$\delta / \delta u_i$** in the above denotes the derivative with respect to the ith supplier’s production, u_i.

Assuming that all u_i are unconstrained, so that equality holds in Equation 5-1, and adding for all n suppliers yields:
$0 = x(A - BU) - \Sigma c_i - UB = xA - \Sigma c_i - (x+1)BU$

Consequently:

Equation 5-2 $$U = (xA - \Sigma c_i)/(B(n+1))$$

Equation 5-3 $$p = A - BU = (A + \Sigma c_i)/(n+1)$$

A more detailed exposition of this model and other Nash-Cournot market models, “Game Theory and Oligopoly Markets, An Outline”, is available on request from richard@LEWISGREYADVISORY.COM.AU.

Appendix B About Lewis Grey Advisory

Lewis Grey Advisory is a consulting firm focussed on the gas industry. Dr Richard Lewis, Director of LGA, has over 40 years business experience, starting in industrial R&D and followed by commercial analysis, corporate commercial management (13 years) and energy consulting (22 years). He combines high level analytical and business management skills with deep knowledge of the Australian gas sector, in which he has provided thought leadership for over 30 years.

Consulting

Richard's consulting career spans contributions to over 200 projects, the majority of which he originated, managed and reported. After three years as a sole practitioner, from 2000 to 2010 he was a partner in McLennan Magasanik Associates (MMA), a boutique energy- environmental consultancy which is now part of the global business of Jacobs Engineering. In September 2014 Richard reverted to sole practitioner status.

Richard has specific expertise in regulation and upstream gas markets. From 2000 to 2014 he provided leadership to the gas consulting practices of MMA and Jacobs, widely known for innovative modeling and insightful analyses of the Australian wholesale gas market. He has had a long association with regulation, representing Victoria in the development of the original Third Party Access Code and advising service providers and regulators on Access Arrangements.

Richard is continuing to develop the Nash-Cournot gas supply-demand model he created at MMA, on behalf of Jacobs and other clients. Since 2017 he has developed two new data sets representing the global LNG market and the eastern Australian gas market. He is also extending the underlying game theoretic concepts to multi-tier markets (wholesale and retail in one model) and peak demand supply markets.

Corporate

Richard held successive executive positions in market analysis, finance, regulation and corporate development with Gascor, the former Victorian gas utility, from 1984 to 1997. As GM Corporate Development and Regulation, he headed the company's participation in industry reform and privatisation during the 1990s, liaising with state and federal governments on regulation and market design. He also headed the Gascor team that, together with the State Government, negotiated the resolution of the $1 billion PRRT dispute with its principal gas suppliers in 1996.

His earlier industrial experience was in transport consulting and the steel industry. He held post-doctoral fellowships at the universities of Bath (UK) and Newcastle (NSW) from 1977 to 1979.

Qualifications

Senior Executive Course, Mt. Eliza Management College, 1990

Doctor of Philosophy, Systems Engineering, University of London, 1977

Diploma of Imperial College, London, 1977

BSc Hons (1st class), Applied Mathematics, University of the Witwatersrand, Johannesburg, 1974