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2-5-2000

Mr Ed Willett
Executive Director
National Competition Council
2 Lonsdale St
Casselden Place
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Melbourne 3000

Dear Mr Willett

Re: Information arising from meeting of 27-4-2000

I would like to thank you for the opportunity you extended to Duke Energy (DEI) to meet with the Secretariat to discuss a number of issues arising from our submission to the National Competition Council (NCC). Following these discussions it was apparent that additional information on a number of matters may prove helpful to the Secretariat's decision-making. Accordingly, this letter address the following matters:

1. the relevant market definitions for consideration by the NCC;
2. the DEI corporate structure and the incentives for open access;
3. likelihood of tacit collusion;
4. methods for assessing market power and tacit collusion; and
5. information on changes to FERC regulation of gas transmission pipelines.

Market Definition

Clarity on the relevant market was sought by the NCC on two accounts:

- first, whether the service provided by the means of the pipeline is a point-to-point transport market or a transport market to the Sydney area; and
- second, whether the relevant downstream market was the wholesale gas market or the energy market.

On the first point DEI considers that the service provided by means of the pipeline is a gas transport service to the Sydney region and the ACT. This can be supported on the basis that once gas is processed to pipeline standard it is a relatively homogenous physical commodity. Gas from any field in eastern Australia can therefore be substituted for gas from any other field. In this case the EGP and EAPL pipelines provide a competing transport service to the Sydney region rather than a point-to-point service such as Moomba to Sydney or Longford to Sydney. As the gas transported is homogenous customers can readily substitute between various service providers.

On the second point, DEI highlighted that it considered the market to be the energy market, and not the wholesale gas market, for two main reasons:

- First, the greatest growth in demand for gas in the NSW market is going to come from electricity generators.
- Second, gas as a form of energy competes directly with and is substitutable for electricity as a form of energy. That is, consumers (especially residential) view the two products as highly substitutable.

Additional information on the growth in demand for gas in the NSW market from electricity generation and competion between gas and electricity is included in Attachment 1.

Corporate Structure and Incentives for Open Access

The main problem being addressed by criterion (a) of section 1.9 of the Code is when an owner of a single bottleneck pipeline has market power in the pipeline market, and is using that power in a downstream or upstream market with adverse consequences for social welfare.

The owner of a single bottleneck or unique pipeline could theoretically have incentives to grant access to only a single retailer. The single retailer thereby becomes a monopoly by virtue of its sole access to supply through the bottleneck and is thereby able to extract monopoly profits from end-users. The argument then goes that the owner of the bottleneck asset can then appropriate these ‘rents’ through its license fee or by direct ownership of the downstream retailer. The effects one might observe from this behaviour are excessively high prices that do not reflect the true scarcity of the pipeline relative to demand, restrictions on quantity supplied, or lower than efficient quality at a given price. This will have distributional and efficiency effects.

Such a pipeline owner could theoretically also use its market power in the pipeline market to act as a monopsonist on the demand side in an upstream or factor market with adverse consequences for social welfare. The effects one might observe are underutilisation of resources available for supply, or more than efficient quality required at a given price. This will have distributional and efficiency effects.

In this case Duke Energy Australia Ltd constitutes a number of separate companies, including:

- Duke Energy Australia Trading and Marketing (DEATM); and
- Duke Energy International Eastern Gas Pipeline (Joint Venture).

Attachment 2 provides an outline of the Duke Energy Australia corporate structure.

I understand that the NCC's concern is the potential incentive on DEI to offer favourable prices for capacity on the Eastern Gas Pipeline to DEATM. The current structure of Duke Energy Australia provides an environment in which each business is striving to maximise its own profits. With respect to the Eastern Gas Pipeline this implies that capacity will be sold to users that value it the highest. If this were not the case it would cost DEIEGP in terms of foregone profits. In addition, because Duke Energy Australia does not have upstream (production) or downstream (distribution) interests there are limited incentives to restrict access to the EGP (which essentially is a 'market maker' between gas basin and gas consumers).

Moreover, DEI has indicated its willingness to post on its website the details of all contracts between EGP and DEATM.

Accordingly, stringent ringfencing of the Eastern Gas Pipeline from other parts of Duke Energy Australia is not necessary to ensure appropriate market incentives. Ringfencing the business activities of vertically integrated entities has been an important element in economic regulation. Ringfencing is a method of encouraging structural change in markets by reducing the scope and extent of barriers to entry stemming from vertical integration. That is, ringfencing aims to encourage competition or contestability by removing the ability for the incumbent vertically integrated firms to realise 'unfair' competitive advantages through cross-subsidisation, cost-shifting and information asymmetries. As these incentives do not prevail in the current situation the value of imposing ringfencing is questionable.

The Likelihood of Tacit Collusion

In our meeting the Secretariat raised an issue concerning the ability for Duke Energy Eastern Gas Pipeline (joint venture) to tacitly collude with other pipelines serving the Sydney region and thereby use market power to restrict access and increase prices. At the meeting we argued that the existence of excess capacity created incentives for DEI to price competitively and not to restrict output. A draft literature review by LECG, which is attached, assesses the impact of excess capacity on tacit collusion. This work supports our hypothesis and concludes that:

- Capital intensive industries, such as gas transmission pipelines, have a greater incentive to cut price slightly below the cooperative level to expand output.
- Excess capacity, as in the case of the EGP pipeline, reduces incentives for cooperation in fixing prices above the competitive level and increases cartel instability.
- Excess capacity may act as a credible threat to deter entry. This argument is unlikely to have a significant impact on the facts of this case. It seems

unlikely the uncertain gains from excluding a new entrant would out weigh the substantive costs of building the EGP pipeline combined with the potential negative impact on both DEI and Australia Gas and Light's revenues from the excess capacity.

Methods for Assessing Tacit Collusion and the Abuse of Market Power

The Secretariat also indicated that it would be interested in information relating to how tacit collusion and abuse of market power could be ascertained. A draft review of some of the economic literature on empirical approaches to the detection of tacit collusion is attached. The paper explains what has been done, what sorts of data were needed, and the results.

FERC Deliberations

Information on how the FERC may approach the regulatory question at hand is still being researched by DEI and its consultants. This information will be forwarded as soon as possible.

Partial Regulation of the Pipeline

The secretariat also raised the issue of the partial regulation of the EGP pipeline. I wish to reiterate that from DEI's perspective this is an unworkable solution. Firstly, the intermediate markets are very small in comparison to the Sydney and ACT regions; secondly, DEI intends to post prices for intermediate zones that are tied to the price for delivery to the Sydney region; and finally there are too many shared and common costs in the pipeline to attribute them to any segment of the overall pipeline. Consequently, performing an asset valuation for the purposes of partial regulation would be difficult. Also DEI have no incentive to abuse market power to price highly on one segment of the pipeline where there are mall customer bases, given the risk of the loss of market share in Sydney the main endpoint which will also use that segment and the consequent risk of regulation of the entire pipe.

DEI hopes that this letter and its attachement provide you with adequate responses to your questions. Should you wish to discuss them further, or have further queries, please contact myself or Richard King.

Yours sincerely

Max Kimber
Acting General-Manager (Regulatory Affairs)

ATTACHMENT 1

The greatest growth in demand for gas in the NSW market is going to come from electricity generators. This growth is highlighted in Table 1. Demand for gas will likely be highly correlated with growth in demand for electricity.

Table 1: Growth in Demand for Gas in Electricity Generation[1]

New South Wales

AGA Forecast Growth in Demand

Year Ended June	Electricity Generation Peta Joules
2000	20.4
2001	25.5
2002	30.6
2003	35.6
2004	40.7
2005	45.7
2006	50.8
2007	55.9
2008	60.9
2009	66.0
2010	71.1
2011	71.0
2012	71.9
2013	72.2
2014	72.5
2015	73.0
2016	73.5
2017	74.3
2018	74.8
2019	75.7
2020	76.4

Gas as a form of energy competes directly with and is substitutable for electricity as a form of energy. That is, consumers (especially residential) view the two products as highly substitutable. This substitutability has not been examined recently in Australia, although the following tables and commentary from the Australian Gas Association[2] based on data to 1993 provide a preliminary basis for supporting DEI's suggestion that the downstream market of relevance in the NCC's decision is the energy market.

[1] AGA - Natural Gas Supply and Demand Study 1997

[2] AGA (1996) AGA Research Paper No 3 – Price Elasticities of Australian Energy Demand.

Table 2: Long run price elasticities of demand – residential sector

	In response to a one percent change in the price :		
Percentage changes in demand for:	**Electricity**	**Gas**	**Other**
Electricity	-0.24	0.15	0.06
Gas	0.83	**-0.78**	-0.08
Other	0.45	-0.10	**-0.37**

For the residential market, a key feature is the relatively high responsiveness of gas demand to changes in electricity prices (estimated cross elasticity of demand of 0.83). If electricity prices fall, residential consumers are quite willing to substitute out of gas in applications such as space heating, water heating and cooking. In contrast, residential consumers of electricity are less willing or able to reduce their consumption of electricity if gas prices fall (estimated cross elasticity of 0.15). This is most likely the result of the relatively limited substitution possibilities – that is, there are some applications for which electricity will continue to be used even if gas prices fall.

Table 3: Long run price elasticities of demand – industrial sector

	In response to a one percent change in the price		
Percentage changes in demand for:	**Electricity**	**Gas**	**Other**
Electricity	**-0.19**	0.00	-0.04
Gas	0.00	**-0.30**	0.07
Other	-0.03	0.02	**-0.22**

For the industrial sector there is a zero cross price elasticity for electricity and gas. However, the AGA indicates that this feature masks high cross price elasticities within segments of the industrial market. For example, in mining the estimated cross price elasticity of gas demand with respect to changes in electricity prices is 1.47.

Table 4: Long run price elasticities of demand – commercial sector

	In response to a one percent change in the price :		
Percentage changes in demand for:	**Electricity**	**Gas**	**Other**
Electricity	**-0.27**	-0.03	-0.01
Gas	-0.37	**-0.10**	0.16
Other	-0.09	0.14	**-0.36**

With respect to the commercial sector the AGA indicates that while the results are not supportive of high degrees of substitutability they do not provide an accurate and reliable indication of the nature and extent of price responsiveness of commercial sector energy demand primarily because of the effects of aggregation. For example, wholesale and retail trade shows that for

a 1% increase in electricity prices there would be an estimated 0.94% increase in gas demand.

It should be noted that the above AGA data is from a study covering the period 1973-74 to 1993-94 and hence takes into account data which existed prior to significant reforms in Australian energy markets. Therefore, it is indicative only of the substitution effects between gas and electricity prior to reform. As the AGA notes in the concluding comments of this study *"The changes in the energy market, together with changes in the technology for using gas in a variety of applications, are likely to result in further changes to the nature of gas demand."*

To supplement the AGA findings, DEI has asked its consultants to find the cross-elasticities of demand from nations that have experienced longer periods of energy market reform. These will be forwarded in due course to the NCC.

Tacit Collusion Literature

Excess capacity reduces incentives for cooperation in fixing prices above the competitive level and increases cartel instability .

Scherer and Ross (1990)

Traditionally, economists have believed that excess capacity reduces incentives for price collusion, thus increasing the instability of cartels. When operating with excess capacity in periods of low demand, oligopolists face a trade-off between looking out for their own short-run interests or cooperating in fixing prices above the competitive level. Scherer and Ross discuss the interaction between demand shifts and cost structures on the ability of oligopolists to cooperate in maintaining price above the competitive level.[3] The authors state:

> "There is reason to believe that industries characterized by high overhead costs are particularly susceptible to pricing discipline breakdowns when a cyclical or secular decline in demand forces member firms to operate well below designed plant capacity. This tendency has been especially marked in industries with heavy investments in developed natural resource deposits (such as petroleum extraction and underground coal mining) and those using highly capital intensive production processes (such as railroads, petroleum refining, chemicals, steel, aluminum, cement, glass, and papermaking)."[4]

Scherer and Ross illustrate this point with a simple example in which two firms have the same average total costs, but differ in fixed costs. The "high fixed cost firm" has fixed costs equal to 50% of total average total cost, while the "low fixed cost firm" has fixed costs equal to 15% of total average cost. Marginal costs are assumed to be constant up to 85% of designed capacity, then increase sharply thereafter. Higher fixed costs result in lower marginal costs for a given level of average total costs.

Using this example, Scherer and Ross show that firms have an incentive to expand output from the cooperative level under the following conditions: "(1) the prevailing price exceeds marginal cost and (2) the output expansion is limited so as to avoid retaliation."[5] The threat of "retaliation" refers to a situation in which rival firms have sufficient capacity to cut prices sharply in response to output expansion by a competitor.

Nocke (1999)

More recently, Nocke provides an alternative theoretical basis for the negative predicted relationship between excess capacity and cartel size in a game theoretical model of Cournot competition. The model examines firms'

[3] Scherer, F. M. and David Ross, *Industrial Market Structure and Economic Performance*, Boston: Houghton Mifflin Company, 1990, 285-294.
[4] Ibid., p. 286.
[5] Ibid., p. 288.

decisions to participate in a cartel or to free ride on the cartel's effort to restrain output.[6] In this model, "cartel members internalize the externalities they impose on each other" and therefore produce less than fringe firms.[7] The author shows that the when the level of excess capacity is low, free-riding on the cartel is not very profitable since fringe firms face a binding capacity constraint in equilibrium. Thus, the lower (higher) the level of excess capacity, the lower (higher) the incentive to join the fringe and the higher (lower) the incentive to join a cartel. Moreover, the maximum stable cartel size (measured in terms of the number of participating firms) is decreasing in the level of excess capacity.[8]

The incentive to maintain price above the competitive level depends on the level of fixed costs .

Scherer and Ross show that the greater differential between price and marginal costs in high fixed cost industries provides firms in capital intensive industries with a greater incentive to cut price slightly below the cooperative level to expand output.[9] " When demand falls below levels that will sustain capacity output, the profit-maximizing enterprise with high fixed costs cuts prices more sharply and suffers more severe erosion of profits than a similarly inclined firm with low fixed costs."[10] The authors conclude: "the probability of pricing discipline breakdowns increases with the burden of fixed costs borne by sellers, ceteris paribus…."[11] [emphasis added] Thus, when faced with excess capital, firms in capital intensive industries are more likely to deviate from maintaining price above the competitive level than are firms in less capital-intensive industries.

However, the authors point out that "the problem is more complicated" and qualify this conclusion by pointing out that "recognition of this danger may stimulate institutional adaptations nullifying the tendency."[12] Scherer and Ross state that "firms in high fixed-cost industries seem to exercise extraordinary restraint in their pricing actions" and that "when tacit restraint fails, firms in high fixed-cost industries have an unusually high propensity to scurry into formal collusive agreements." For example, British breweries responded to sharp declines in output in 1982 by raising prices.[13]

Upon review of several industries, Scherer and Ross note that some industries have been successful "in minimizing rivalrous pricing despite high fixed costs and low variable costs and depressed demand…."[14] The authors

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[6] Nocke,Volker, "Cartel Stability under Capacity Constraints: The Traditional View Restored." *Social Science Research Network,* 1999.

[7] Fringe firms set quantity to maximize their own profits, while cartel firms are constrained by "cartel rules" to set quantity in order to maximize the cartel's joint profit

[8] Nocke,Volker, "Cartel Stability under Capacity Constraints: The Traditional View Restored." *Social Science Research Network,* 1999, p. 15.

[9] The practice of offering a slightly lower price to elicit increased demand is known as "chiseling." See Scherer, F. M. and David Ross, *Industrial Market Structure and Economic Performance,* Boston: Houghton Mifflin Company, 1990, p. 245.

[10] Ibid., p. 288.

[11] Ibid., p. 290.

[12] Ibid., pp. 289-290.

[13] Ibid., p. 289.

[14] Ibid., p. 293.

find that success depends on the presence or absence of other industry conditions. They conclude:

> " When other factors such as the size distribution of firms, the degree of product homogeneity, the extent of acceptance accorded the price leader, the ability and willingness of producers to carry sizable inventories, and deftness in avoiding antitrust action are favorable, pricing discipline may be maintained despite substantial fixed costs. When they are unfavorable, a heavy fixed cost burden makes independent pricing during business downturns all the more probably."[15]

***Excess capacity may affect entry* .**

Excess capacity may serve as credible threat to deter entry.

The "Excess Capacity Hypothesis," introduced by Pashigian and Wenders, asserts that firms deter entry by maintaining high excess capacity.[16] The underlying idea is that firms will carry excess capacity in order to make credible the threat that, in the event of entry, the incumbent firms will cut price and expand output, driving the potential entrant's profits to zero.[17] Deviating from the Sylos Postulate, which maintains that firms deter entry by producing a constant level of high output *whether or not it is profitable to do so* , the Excess Capacity Hypothesis allows firms to freely vary its output.

Dixit extends the Excess Capacity Hypothesis and finds that when fixed costs are present, "the Excess Capacity Hypothesis allows the established firm to block entrants who could not be effectively deterred with a conventional limit pricing strategy."[18]
Spence (1977)

[15] Ibid., p. 293.
[16] Pashigian, Peter, "Limit price and the market share of the leading firm," *Journal of Industrial Economics,* July 1968, 16, 165-77, and Wenders, John T., "Excess capacity as a barrier to entry," *Journal of Industrial Economics,* November 1971, 20, pp. 14-19, as referenced in Spulber, Daniel, "Capacity, output, and sequential entry," *American Economic Review,* June 1981, p. 504.
[17] The potential entrant operates on the residual demand curve.
[18] Dixit, Avinash, "A model of duopoly suggesting a theory of entry barriers," *Bell Journal of Economics,* Spring 1979, 10, 20-32, as referenced in Spulber, Daniel, "Capacity, output, and sequential entry," *American Economic Review,* June 1981, p. 504. The limit price theory "maintains that low price and high quantity are the proximate deterrents of entry….Entry is deterred if x [bar] is sufficiently large to leave no profits in residual demand. Hence the industry will either set *x* greater than the minimum *x* [bar] to deter entry…or set x=x[bar]=k[bar]…." See Spence, Michael, "Entry, capacity, investment and oligopolistic pricing," *The Bell Journal of Economics,* 1977, p. 536.

Spence argues that "entry is deterred in an industry when existing firms have enough capacity to make a new entrant unprofitable."[19] The minimum level of industry capacity that must be installed to deter entry, denoted here as *k**, is that level for which the entrant's profits are non-positive.[20] "The threat of entry effectively places a lower bound on capacity…."[21]

The author notes that "once capacity [*k**] is installed to deter entry, it may or may not be profitable to expand output to [*k**]. It depends on the structure of demand."[22] Thus, "the excess capacity hypothesis implies that price may exceed the limit price, and quantity be lower than the limit quantity," resulting production that is inefficient.[23]

This result complicates the hypothesis that firms may tacitly agree on capacity in order to enforce tacit collusion on price. Usually, capacity has the added benefit of being difficult to expand without being noticed. However, in the situation where at least one firm in the industry is operating with excess capacity, that firm has an incentive to cut price and expand output. Spence states that "the effect of entry is to remove the capacity level as a means of enforcing a supercompetitive price level in the industry…the threat of entry may operate on price by making it more difficult to maintain price at a high level."[24]

Further, Spence considers the case where capacity is "interpreted as irreversible capital investment in plan and equipment," serving as an upper bound on output.[25] In this situation, capacity is likely to affect marginal costs, such that increases in capacity reduce marginal costs, shifting down the marginal cost curve, and reducing residual demand. The authors show that under these conditions, "the [incumbent's] profit maximizing quantity…increases with *k,*" suggesting output is greater in capital intensive industries.[26] Some believe that the excess capacity hypothesis holds under very limited conditions.

<u>Spulber (1981)</u>

Spulber notes that Spence's model requires the incumbent firm to "choose capacity at or above the entry-deterring level *whether or not it is profitable to do so.*"[27] Furthermore, Spulber states that the Excess Capacity Hypothesis "fails to recognize that the established firm's choice of costly capacity involves a tradeoff between pre- and post-entry requirements."[28]

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[19] See Spence, Michael, "Entry, capacity, investment and oligopolistic pricing," *The Bell Journal of Economics*, 1977, pp. 536.
[20] Again, the entrant operates on the residual demand curve.
[21] Ibid., p. 534.
[22] Ibid., p. 536. Note, the author uses *k bar* rather than *k**.
[23] Ibid., p. 536.
[24] Ibid., p. 537.
[25] Ibid., p. 538.
[26] Ibid., p. 539.
[27] Spulber, Daniel, "Capacity, output, and sequential entry," *American Economic Review*, June 1981, p. 504.
[28] Ibid., p. 504.

Spulber introduces a dynamic analysis that allows the *established firm* to behave as a Cournot-Nash or Stackelberg leader. The *entrant* behaves in Cournot-Nash fashion, setting output based on "expected post-entry profits at the equilibrium of the post-entry game."[29] A monopolist chooses output and capacity in the first period, knowing another firm will enter in the second period. As a basis of comparison, Spulber shows that the monopolist sets capacity at the level that equates the discounted sum of marginal returns (marginal profits) with the cost of capacity. However, this result does not hold given entry in the second period. Spulber examines "how the established firm's capacity and output choices are affected if the post-entry market has a Cournot-Nash or Stackelberg equilibrium."[30]

Spulber shows that the Excess Capacity Hypothesis is inconsistent with post-entry Cournot-Nash behavior. Rather, holding excess capacity before entry *only* occurs when "the established firm is a Stackelberg leader, the Stackelberg output exceeds the short-run monopoly output and the cost of capacity is low relative to net discounted marginal returns at the entry-deterring output."[31] Thus, the credibility of excess capacity as a deterrent to entry is in doubt, unless the cost of capital is low. Moreover, with respect to the Sylos Postulate, "when entry does take place, a necessary and sufficient condition for the established firm to maintain a constant output is a high cost of capacity relative to the net discounted marginal return."[32]

Spulber concludes:

"These results imply that the Excess Capacity Hypothesis is only valid under quite limited conditions…. Since excess capacity observed in industry is in large part due to random demand fluctuations, the question of strategic capacity investment and entry need to be reexamined when market uncertainty is present."[33]

<u>In some instances, entry is preferred.</u>

<u>Mason and Nowell (1992)</u>

Mason and Nowell identify conditions under which an incumbent firm is likely to allow entry and then negotiate a cartel with the entrant. The model is based on a framework introduced by Dixit (1979) in which the incumbent firm has a first-mover advantage in that it knows that the entrant will behave as a Cournot oligopolist. Moreover, the incumbent may be able to commit to an output level by signing some contract *prior to entry.* It is assumed that entry requires a payment by the entrant of a fixed sunk cost, *S*. Using this framework, the authors show that the minimum level of output the incumbent firm must produce to deter entry is a function of the amount the entrant must pay to enter (*S*). It follows directly that the incumbent's profits from deterrence are increasing in the cost of entry, *S*.[34] Thus, there exists some critical level

[29] Ibid., p. 503.
[30] Ibid., p. 505.
[31] Ibid., p. 504.
[32] Ibid., p. 504.
[33] Ibid., p. 513.
[34] Mason and Nowell, "Entry, collusion, and capacity constraints," *Southern Economic Journal*, *58,* April 1992.

of entry costs, *S'*, above which the incumbent prefers deterring entry to allow entry and earning profits as a Stackelberg leader.[35]

The authors further extend the model to consider the situation in which the incumbent allows entry and then constructs a cartel ("the collusion strategy"). In a 2 period game theoretical model, the authors examine an incumbent firm's decision of whether to deter entry ("deter"), allow entry and collude ("collude"), or allow entry and act as a Stackelberg leader ("lead"). Similar to Dixit's model, the incumbent can commit to his first period output, but *cannot* commit to his second period output. In addition, the incumbent can subcontract part of his period 1 output to the entrant if he so desires. As the authors indicate, "since the incumbent's first-mover advantage does not persist into the second period, there is every reason to expect the entrant to threaten dissolution of the cartel. Further, the entrant's threat is credible unless her portion of cartel profits at least equal those she would earn at the non-cooperative equilibrium."[36] Thus, the minimum level of profit that the entrant will except is not *S*, but rather the Cournot-Nash profits.

The authors show that "[t]here is a range of sunk costs for which entry is *effectively impeded* and the incumbent prefers to allow entry and then collude."[37] [emphasis added] This situation arises when sunk costs from entry are sufficiently small (collusion is preferred to deterrence). Deterrence profits increase with sunk costs. Thus, at larger sunk costs, the reverse is true: deterrence is preferred to collusion.

The authors also consider the effect of capacity constraints on the incumbent's choice between deterrence and collusion strategies. The game is one with asymmetric costs. The incumbent's marginal costs are assumed to be zero for production at or below capacity. However, "the entrant must build from scratch, and so her marginal costs explicitly include the marginal cost of an additional unit of capacity."[38] The authors find that allowing entry and colluding is more likely to be adopted when the marginal cost of additional capacity is small, since increases in capacity reduce the attractiveness of the collusion strategy. The result reflects a tradeoff between a reduction in capacity costs due to collusion and the change in discounted revenue flow under collusion relative to the change in revenue under deterrence, as capacity increases. The authors state that "increases in the unit cost of capacity raise deterrence revenues more than they raise the incumbent's revenues as part of a cartel" and "this difference in added revenues is larger than the cost savings he [the incumbent] would realize from colluding rather than deterring entry."[39]

[35] Ibid., pp. 1002-1014.
[36] Ibid., p. 1004.
[37] Ibid., p. 1009.
[38] Ibid., p. 1009.
[39] Ibid., pp. 1010.

The authors note that their results, taken together with those of Spulber suggest "that when holding excess capacity to deter entry is credible, it is frequently preferable to adopt the collusion strategy."[40]

Summary of the effects of excess capacity in capital intensive industries on entry deterrence and price.

The literature provides some insight into the relationship between the cost of capital and the credibility of the excess capacity entry-deterrence strategy. Spulber shows that, under limited conditions, excess capacity may serve as a credible deterrence strategy. Specifically, holding excess capacity to deter entry is unlikely, unless capacity costs are low. In the situation where holding excess capacity is credible, this strategy may preclude tacit agreements to limit capacity as a method of monitoring cheating in cooperative pricing. However, Mason and Nowell show that when the cost of capital is low, an incumbent firm is likely to allow entry and negotiate a cartel.

Scherer and Ross provide some foundation for the theory that excess capacity is more likely to result in pricing disciplines breakdowns in capital intensive industries where high fixed costs create greater incentives to cut prices. The authors qualify this conclusion, noting that firms in high fixed-cost industries have "an unusually high propensity" to form collusive agreements. Nocke proposes that within an industry, firm size and capacity utilization are negatively correlated.

[40] Ibid., pp. 1010.

ATTACHMENT 3

Testing for Tacit Collusion

The purpose of this attachment is to summarize some of the more important papers in the economic literature on empirical approaches to the detection of tacit collusion. The intent is not to provide the econometric details, but rather to explain conceptually what has been done and what sorts of data were needed.

Tacit collusion refers to the idea that firms in an industry might be able to sustain the monopoly price by colluding in a purely non-cooperative manner. That is, they would, by virtue of their repeated interaction and ability to retaliate against one another, be able to sustain the monopoly price without actual communication or overt collusion. Such collusion can be thought of in game theoretic terms as achieving the cooperative outcome in a prisoners' dilemma game. While the cooperative outcome is not an equilibrium in a one-shot game—indeed, it is strictly dominated for both players—it has been shown that, in theory, repeated interaction can sustain that outcome as an equilibrium under certain conditions. Specifically, the "folk theorem" for repeated games says that for sufficiently low discount rates, any price between the monopoly price and marginal cost can be sustained as an equilibrium in the infinitely repeated prisoners' dilemma game. Repeated interaction creates an opportunity for players to punish each other for deviating from cooperative play and "rewarding" each other through their own cooperation for cooperative play.

A. A Summary of Relevant Literature

Brander and Zhang (1990)

Brander and Zhang (1990)[41] adopt a technique that does not focus explicitly on the implications of specific repeated game models, but rather seeks to identify whether firms are behaving "as if" aggressively or cooperatively in the market. They develop a simple model of oligopoly in which firms' responses to their competitors' strategies can vary as a continuous parameter from Bertrand to perfect collusion. This is known as a conjectural variations model, and the parameter identifying a firm's response is known as the firm's conjectural variations parameter. The first order conditions for oligopolists in a general conjectural variations framework is:

$$v^i = (p - c^i)h(X)/(ps^i) - 1$$

where v^j is the conjectural variations parameter, ?(X) is the demand elasticity as a function of market output X, and s^i is firm i's market share. This equation is converted to a stochastic specification and estimated.

[41] Brander, James A. and Zhang, Anming. "Market Conduct in the Airline Industry: An Empirical Investigation." *RAND Journal of Economics*, Vol. 21, No. 4, Winter 1990, pp. 567-583.

The authors apply this model to 33 duopoly markets in the airline industry. The markets are Chicago-based airline routes served by United and American airlines. For the necessary demand elasticity in the estimation equation, they draw from prior demand studies of airline markets, rather than estimating one themselves.

They find that the results roughly support a Cournot-like market outcome, rather than Bertrand or a perfect cartel. Their approach does not explicitly incorporate a dynamic model of tacit collusion or interpret the results in that context. It is not entirely clear whether this result can be interpreted to support a model of tacit collusion, or whether it instead supports the Cournot model as a noncooperative model, because the empirical specification was not designed to test a dynamic model. In either case, however, the results do support a market outcome that is not "perfectly competitive" in the sense that it rejects Bertrand competition.

MacAvoy (1995)

MacAvoy[42] in his 1996 book and 1995 article (the content of which is more or less contained in the book) adopts an approach that is similar to that of Zhang and Brander. MacAvoy's purpose was to document the claim that the three major long distance companies in the US at the time, AT&T, MCI, and Sprint, were not competing vigorously and were, instead, engaging in tacit collusion. His larger purpose was to support the position of the incumbent LECs that if they were permitted to enter the long distance market, that market would become more competitive, leading to enhanced consumer welfare.

MacAvoy's first "test" for tacit collusion is simply to calculate and examine price cost margins for various long distance services, and their trends over time. He uses tariff data to calculate price indices for different services, and he assumes two components of marginal costs: access charges, and operating costs. For access charges, he relies on tariff rates; operating costs are most difficult to develop and support. For these he relies on a WEFA study, the results of which are, he argues, validated by testimony by AT&T on its costs. MacAvoy shows that price cost margins were growing rather than declining during the time period of study (the decade after divestiture, approximately), while the industry HHI was declining. He interprets this relationship as supporting the contention that the market was becoming less, rather than more, competitive over time.

He also performs a more formal test of competition by estimating the parameter of conjectural variations, *v*, and also tests for the trend of *v* over time to see if the long distance market has become more competitive over time since divestiture. He finds that AT&T's conjectural variations parameter is consistent with AT&T's expecting a minimal output increase from MCI or Sprint if AT&T were to decrease output (a non-collusive response). In

[42] MacAvoy, Paul W. "Tacit Collusion Under Regulation in the Pricing of Interstate Long-Distance Telephone Services." *Journal of Economics & Management Strategy*, Vol. 4, No. 2, Summer 1995, pp.147-175.
MacAvoy, Paul W. *The Failure of Antitrust and Regulation to Establish Competition in Long-Distance Telephone Services.* Cambridge: MIT Press, 1996

contrast, MCI and Sprint both expect a large restriction of output from its competitors if it restricts its output (a collusive response). He argues that this result supports the view that the market is not at or moving toward a competitive outcome.

Attachment 3

ATTACHMENT 4

Corporate Structure

(See Separate Attachement – This corporate structure diagram is provided to the NCC on a commercial-in-confidence basis as the structure has important implications for taxation and commercial operaton issues both in Australian and Overseas. While the information may be obtainable from other sources on a piece-meal basis, it is not available in a public context in the form present to the NCC in this letter.)