Monopoly gas marketing

the welfare effects of joint marketing

Report to NGC

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1. SUMMARY

This note provides an indication of differences in the welfare between separate and joint marketing of Pohokura gas. pattern

For one estimate, we have used a simple depletion model. Our results indicate (given the assumptions described below) that competitive marketing (assumed analogous to separate marketing) produces an economic surplus around $1.5 billion more than with monopoly marketing (assumed analogous to joint marketing). This difference does not appear to be correlated with changes to the assumed price elasticities of demand. It seems likely that higher welfare can be realized in an environment where Pohokura gas is marketed separately. As one might expect, the monopolist initially restricts output and raises the price, producing on a depletion path that is considerably flatter than in the competitive situation.

An alternative approach sets aside depletion effects and concentrates on the effect on oligopoly outcomes of the number of players selling a homogeneous product. We use a simple Cournot representation, familiar from electricity market analyses. With this method, we can allow for the fact that joint marketing reduces the number of independent wholesalers by two, so the counterfactual has three or four players but is not a fully competitive market. In a market with a turnover of $500 million pa, the Cournot estimate for the order of magnitude of the (present value) welfare loss associated with joint marketing is between $0.35 and $1.1 billion.

At this stage, these models are not exactly tailored to the Pohokura marketing scenarios. In particular, we have not captured the relationship between joint *development* and separate *marketing*. The main value of the estimates is to emphasise that the welfare consequences of allowing joint marketing in an already concentrated market could be substantial so the benefits of allowing this additional concentration – in terms of savings in transactions costs or delays – would need to be substantial as well before such an arrangement might be authorised under the Commerce Act.

2. A DEPLETION MODEL

We expect that different market structures (ownership concentration) will give different depletion paths and prices. The CRA paper notes "a natural hypothesis is that a monopolist will restrict output and raise price, initially, as compared to a competitive industry."[1] They reason that this outcome may not necessarily be the case, depending on the nature of demand. In looking at this, we have assumed a demand structure similar to that adopted in the CRA report.

Calculating the depletion paths, prices and quantities for each type of market structure will enable us to identify the resulting economic surplus in each case.

[1] Charles River Associates, *Co-ordinated Marketing of Pohokura Gas – An Economic Analysis"*, December 2002 p.81

2.1 Approach

We assume a fixed linear demand, representing the "curve" by the demand of 125 PJ per annum at $4/GJ and an assumed elasticity of demand of – 0.67 at this point. Convenient parameters are a slope (-0.048) and intercept ($10/GJ) for the demand line,

$$p = \hat{p} - \alpha Q .$$

The monopoly and competitive price paths are then as follows. The monopoly path maximises profits; the competitive track maximises welfare.[2]

Monopoly Price (p_m)

$$p_m = \tfrac{1}{2}(\hat{p} + c) + \left[p_b - \tfrac{1}{2}(\hat{p} + c)\right] e^{-\delta(T-t)}$$

Competitive Price (p_c)

$$p_c = c + (p_b - c) e^{-\delta(T-t)}$$

Here, δ is the discount rate, taken to be 10% and both tracks move towards p_b, the backstop price applying when all gas is exhausted. (We have assumed this backstop is LNG at a marginal cost of $9/GJ.) c is our estimate of the *ex ante* marginal cost of gas production. We assume there is no significant marginal cost once production facilities are installed at the outset. The monopoly price track starts close to the static monopoly level ½($\hat{p}$ + c) that would apply in the absence of depletion effects.[3]

We first solve by trial and error for the depletion times in the two scenarios,[4] and then compare the economic surpluses:

$$W = \sum_{t}^{T} PV(Q_t \tfrac{1}{2}(\hat{p} + p_t)) .$$

Here, PV is the present value (at the discount rate δ), and Q_t is the quantity produced at time t (as determined by the price).

2.2 Results

- The simple model endorses the statement in the CRA report, that a monopolist initially restricts output and raises the price, producing on a depletion path that is considerably flatter than in a competitive situation.
- The modelling shows that the economic surplus in the competitive scenario (assumed in this approach to be the result of separate marketing) is substantially higher than under monopoly marketing (assumed to be the effective result of joint marketing). In gross present value terms this equates to $8.0 billion (competitive) compared to $6.5 billion (monopoly).
- Competitive depletion reaches the backstop price, with reserves depleted, by around 2024 compared to 2036 for the monopolist.

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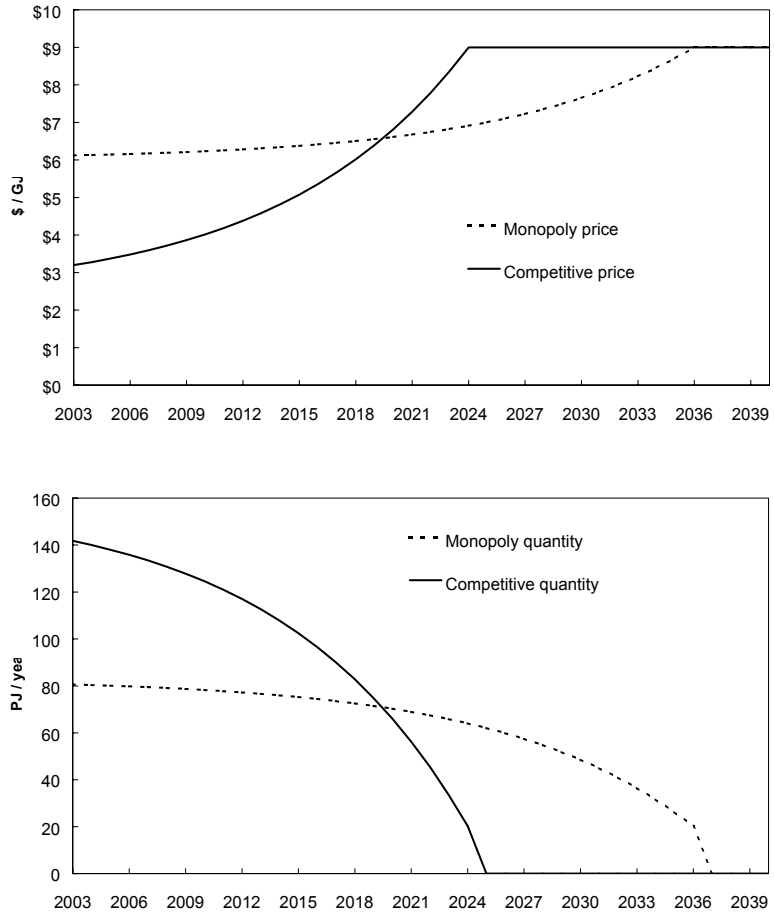
[2] See for example, A C Fisher *Resource and Environmental Economics* chapter 2, Cambridge University Press 1981

[3] We assume a constant marginal cost of approximately $2/GJ to allow for the costs of production facilities since the field has not yet been developed.

[4] where the price track allows demand to use up the available reserves by time T

- The graphs below show the comparative prices, quantities and resulting reserve depletion over time.

Figure 1 Competitive and monopoly prices and production over time



Source: NZIER

Sensitivity

If we assume a higher demand elasticity, the excess of the competitive surplus over monopolist surplus does not change considerably. For example, when the elasticity is assumed to be –0.80 (i.e. less in-elastic) the competitive surplus is approximately $7.9 billion and the monopoly surplus is $6.0 billion. If we assume a more in-elastic demand (e.g. –0.4) the competitive surplus is approximately $10.2 billion and the monopoly surplus is $8.5 billion.

3. A COURNOT ESTIMATE

The Cournot model gives another way of estimating the approximate size of welfare impacts of different degrees of market concentration where the threat of entry is not an effective constraint. As described in the NGC submission, allowing the Pohokura joint venturers to market jointly will reduce the effective number of wholesalers of gas from 3 to 1 or 4 to 2 depending on how likely it is that Kupe gas will come onto the market (as opposed to being completely committed to Genesis).

3.1 The formulae

The core result of the Cournot model in its simplest form is as follows. If there are n firms engaging in quantity competition, again assuming linear demand and linear production costs (i.e. constant marginal costs), the equilibrium price will be

$$p_n = \frac{\hat{p} + n\bar{c}}{(n+1)},$$

a weighted average of the intercept of the demand line and the average of the firms' marginal costs, $\bar{c}$.

The deviation of the equilibrium price from the competitive limit (where there are many firms) can be written

$$\frac{\Delta p}{\bar{c}} = \frac{1}{n\varepsilon}$$

where ε is the elasticity observed in the prevailing market equilibrium (with n firms).

3.2 Welfare effects

By finding the price and quantity changes resulting from a drop by two in the number of competing firms, we can calculate the welfare loss

$$\tfrac{1}{2}\Delta p\,\Delta q + \Delta q\left(p_n - \bar{c}\right)$$

which comes to the compact algebraic form

$$\Delta W_2 = \frac{2R}{n(n-1)^2\varepsilon}$$

where R is the market turnover.

[The same calculation can be completed for a merger of two firms that leaves the average marginal cost unchanged. In this case, the proportionate price rise is $1/n^2\varepsilon$, the quantity contraction $1/n^2$ and the welfare loss,

$$\Delta W_1 = \frac{R(1+2n)}{2n^4\varepsilon}]$$

3.3 Example

Based on a given perception of the likely demand curve and hence the prevailing demand elasticity, ε of say –0.67, the annual welfare losses in going from 3 to 1 or 4 to 2 are

ΔW (3→1) = 0.25 R, and

ΔW (4→2) = 0.08 R.

In present value terms (over say 20 years at 10%), the losses are between

0.7 R and 2.1 R.

The gas market is expected to operate at about 125 PJ pa wholesaling at about $4, a turnover of $500 million pa. The present value welfare losses from joint marketing could then be of the order of $0.35 to $1.1 billion.

Sensitivity

The welfare losses are smaller for more elastic demands. If ε = –0.80, the present value losses are more likely to be of the order of $0.3 to $0.9 billion.

If demand is less elastic, say ε = -0.4, the welfare loss is between $0.6 and $1.8 billion.