Competition Policy in Agriculture: A Review of Methods

by

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The nature of the competition policy public benefit tests, applied to various agricultural industries, is reviewed. Then, various analytical techniques that have been applied to the assessment of the public benefit test are examined. These techniques include analysis of price premiums, consideration of pooling and averaging, pricing to market tests, what-if scenarios, market power analysis, and price discriminating monopolist models. Some of the advantages and disadvantages of these approaches are summarised. Generally, all of these approaches have various strengths and a number of weaknesses so that the case for the assessment of costs and benefits must substantially depend on the logic of the effects of the regulation rather than the results of any particular model.

Introduction

In 1992 the Keating Labor government established a Committee of Inquiry into competition in the Australian economy. This became known as the Hilmer Committee. All State and Territory governments and the Commonwealth Government agreed to a set of principles for competition policy deriving from this report in February 1994 at a meeting of the Council of Australian Governments. The governments agreed to a set of principles which involved '… anticompetitive conduct against the public interest, universality and uniformity of competition rules and procedures to evaluate claims of public benefit from anticompetitive conduct' (King 1997, p. 270). It is the third area of approaches to evaluating the benefits and costs of anticompetitive conduct that this paper is directed towards.

Although there may be a wide variety of approaches to the calculation of costs and benefits in various contexts the context for the material in this paper is that of the techniques used to analyse a number of cases in the agricultural industries. Nor are the cases exhaustive of the approaches used. Only some of the possible methods of analysis will be examined.

First, a brief review of the nature of the competition policy will be provided, then various techniques will be considered and finally some evaluative comments will be made on the efficacy of the various approaches.

Background on Competition Policy

A major review of the National Competition Policy is provided in King (1997). He notes that Part IV of the Trade Practices Act 1974 has been the cornerstone of competition policy and has resulted in significant changes in business behaviour. Thus, competition policy must be interpreted within the context of the Trade Practices Act 1974.

The Hilmer report was delivered in August 1993 and made recommendations for changes to Part IV of the Trade Practices Act 1974 and some changes that were at that time outside the scope of the Act. The Council of Australian Governments in Hobart in February 1994 accepted all the major recommendations and in April 1995 the Competition Policy

Agreement was signed by the Commonwealth, State and Territory Governments to implement the key recommendations of the Hilmer report.

As stated at the beginning of the report (Hilmer et al 1993, p. xv) 'Australia is facing major challenges in reforming its economy to enhance national living standards and opportunities'. Hilmer et al (1993 p. xvi) also noted that:

> Competition policy is not about the pursuit of competition *per se*. Rather it seeks to facilitate effective competition to promote efficiency and economic growth while accommodating situations where competition does not achieve efficiency or conflicts with other social goals.

Although, the Hilmer report makes clear the very general nature of competition policy there have been many complaints about the nature and effects of competition policy. For example, Senator Ron Boswell (1998) has stated:

> I believe the Hilmer competition policy … acts like a giant vacuum cleaner sucking people out of the bush and putting them on the shores in the seaboard.

Sorensen (Productivity Commission 1999, p. 2) has noted that people are liable to attribute many of the changes they perceive to competition policy and that it is difficult to:

> … separate out the effects of Competition Policy from a mass of secular trends engulfing rural Australia. … the enormous and interconnected roles of changing technology (especially transport, telecommunications, farming and mining) international commodity prices, entrepreneurial capacity, demography, and lifestyle preferences in shaping Australia's space economy. Government controls none of these to any significant degree (Submission 58 to the Productivity Commission, *Impacts of NCP Reforms* 1999, p. 2).

In a broader context Quiggin (1998) points out that the gains from the microeconomic reforms seem to have been small and points to the disagreement about the claim that competition leads to increases in technical efficiency.

How Competition Policy Works

The basic starting point for competition policy is '... there should be no regulatory restrictions on competition unless clearly demonstrated to be in the public interest' (Hilmer et al 1993, pp. 205-6). From this position many of the recommendations of the Hilmer reforms follow. The national competition policy has to do with:

- Anti-competitive conduct
- Unjustifiable regulation restricting competition
- Reform of public monopolies
- Third-party access to essential facilities
- Restraint of monopoly pricing behaviour
- Competitive neutrality.

To put in place the structure for Competition policy involved three agreements: a principles agreement, an agreement on conduct and an agreement on implementation.

The Competition Principles Agreement states that (Industry Commission 1997):

> Legislation should not restrict competition unless:
> a) the benefits of the restriction to the community as a whole outweigh the costs, and
> b) the objectives of the legislation can only be achieved by restricting competition.

The Competition Principles Agreement relates to (Productivity Commission 1999, p. xxvii):

- reforming government monopolies,
- prices oversight of government businesses,
- reviews of legislation,
- access to some 'essential' infrastructure facilities, and
- placing government businesses on a competitively neutral footing with each other and private businesses.

The Conduct Code Agreement extends Australia's competitive conduct rules to all businesses — unincorporated businesses were previously exempt (Productivity Commission 1999, p. xxvii). This required the States and Territory Governments to pass relevant legislation in order to extend the operation of Part IV of the Trade Practices Act 1974.

The implementation agreement (Agreement to Implement the National Competition Policy and Related Reforms) (Productivity Commission 1999, p. xxvii):

- recommits governments to earlier reforms in gas, electricity, water and road transport.
- specifies a program of $16 billion in financial grants to State and Territory governments, contingent on implementation of reforms.

The agreement by the Commonwealth, State and Territory Governments to adopt a national competition policy applying uniformly throughout Australia has resulted in a series of reforms including (Australian Consumer and Competition Commission 1997 summarised from the website):

- legislation to extend the competition rules in Part IV of the Trade Practices Act to cover almost all business enterprises in Australia, including government business enterprises, unincorporated businesses such as sole traders and partnerships, and the professions;
- introduction of Part IIIA to the Act to assist third parties to gain access to certain essential facilities such as electricity grids and gas pipelines. Rural facilities may also be the subject of an access regime if they meet certain criteria contained in the Act;
- merger of the Prices Surveillance Authority and the Trade Practices Commission to establish the Australian Competition and Consumer Commission as the national enforcement agency;
- agreement by the Council of Australian Governments (COAG) that all governments will review by the year 2000 every form of regulation that affects competition in every department of government in every sector of the economy to determine if it is in the public interest. A review of such legislation will occur every ten years;

- the National Competition Council (NCC) to review the review process, in the access regime and other important tasks.
- agreement by all governments to implement competitive neutrality principles. The object of this is to ensure that all government businesses and firms do not enjoy any net competitive advantage simply as a result of their public sector ownership. For this purpose, tax equivalent levies are being introduced for many government business enterprises to ensure that they compete on a level playing field with private competitors; and
- all governments are to be committed to the review processes and the Commonwealth has provided State and Territory Governments with a very large financial incentive to do the job properly.

One of the essential elements of the whole package of reforms was the incentive given to the states to review legislation through the financial grants which are contingent on the reviews and implementation of reforms. Also, the reform process was designed with a uniform structure and to be all-encompassing so that one industry or sector could not argue that it was being singled out for reform while others were not so treated. In addition, there is a comprehensive set of reviews across all significant pieces of legislation which impact on competition.

Estimation of Economic Gains

The economic gains from programs of economic reform are clearly not easily measured and are subject to many errors of estimation. However, the Industry Commission in 1995 (Industry Commission 1995, p. 53) estimated that the long run annual gain in real GDP would be about 5.5 per cent (or $23 billion), and generated mainly from lower prices and more competitive industries. Quiggin (1998, p. 3) argued that such estimates were subject to overestimation because of the nature of the model closure used in the ORANI type models and the fact that changes in the level of GDP are used when capital stocks are likely to be variable. More recent estimates by the Productivity Commission of selected areas of reform are given in Table 1, where a 2.59 per cent increase in GDP is indicated across a set of major reforms.

Table 1 Estimated Macroeconomic Effects of Selected NCP Reforms

	Electricity and gas	Rail transport	Road transport	Telecom	Water	SMAs	Total NCP reforms
	%	%	%	%	%	%	%
Real GDP	1.16	0.21	0.23	0.83	0.04	0.12	2.59
Real consumption	1.11	0.27	0.25	0.96	0.04	0.26	2.89
Export volumes	2.13	-0.03	0.27	1.31	0.11	-0.41	3.39
Import volumes	0.70	0.00	0.17	1.01	0.04	0.05	1.96
Terms of trade	-0.14	0.04	-0.02	-0.53	0.00	-0.03	-0.69
Post-tax real wages	1.52	0.18	0.19	0.98	0.17	0.48	3.52

Source: Productivity Commission (1999). Based on results from the MONASH-RR model.

Estimates by the Industry Commission in 1995 of the sectoral effects of reforms of Statutory Marketing Authorities (SMAs) and other reforms related to agriculture are given in Table 2. The major negative impact of reforms on 'milk cattle' stands in contrast to the positive gains in sugar, northern beef and many other industries.

Table 2 Hilmer Reforms – Projected Implications for Industry Output

	State		Commonwealth	
	SMAs	All other	SMAs	All other
	%	%	%	%
Pastoral zone	-1.99	1.99	0.74	0.64
Wheat sheep zone	3.72	3.62	0.53	0.86
High rainfall zone	-2.47	2.20	0.44	1.02
Northern beef	-0.38	10.15	2.30	2.97
Milk cattle	0.38	0.14	-15.61	0.07
Pigs	0.41	5.50	0.51	1.65
Sugar cane	0.53	14.18	2.10	4.53
Other farming export	0.64	3.36	0.05	1.03
Potatoes	0.71	1.79	0.10	0.5
Other farming import	0.42	2.30	-1.77	0.63
Poultry	0.24	3.62	0.33	1.08
Services to agriculture	0.07	1.98	-0.01	0.62

Source: Industry Commission (1995, Tables C2.4 and C2.8) in Godden (1999).

Although overall gains to the agricultural sector as a whole would seem to be apparent from the Industry Commission estimates there will be distributional consequences of competition policy implementation. In reviewing the impacts on rural Australia, the Productivity Commission (1999) comments that there is likely to be more variation in the incidence of benefits and costs of National Competition Policy in country regions than in the metropolitan areas and that the early effects of the policy have favoured metropolitan areas rather than rural and regional areas.

In the following sections some of the methods used to estimate benefits and costs at an industry level as opposed to an economy level will be considered. First, the general approach to such reviews will be considered.

Methods of Industry Reviews

The various states have provided general and detailed instructions for the conduct of reviews of legislative restrictions (for example, Victoria, Department of Premier and Cabinet 1996). The review process involves a number of steps:

- Describe the industry and existing regulations
- Test for restrictions on competition
- Show restriction is necessary to objective
- Assess costs and benefits to the community

In describing the industry a description is provided of the current state of the industry and the regulatory arrangements involved. In the test for the restrictions on competition it is

suggested that a description be given of how the legislation affects market, the objectives of the legislation and the link to restrictions on competition. An examination of alternative means (with statutory restriction) of achieving the same desired outcome should also be considered. In assessing the costs and benefits to the community it is necessary to identify who is affected by the proposed restrictions on competition, to identify the effects of the restriction on both productive and allocative efficiency, to assess the costs of the restriction to the community, to assess the benefits and to deal with the question of whether or not the costs exceed the benefits (Table 3 is illustrative of the calculations involved).

Table 3 Illustrative Cost-Benefit Calculations

Benefits of deregulation	NPV ($)	Costs of deregulation	NPV ($)
Benefit transfers			
Gains by consumers (area A)	xx.00	Loss by producers (area D)	xx.00
Revenue gain by processors and retailers	xx.00		
Efficiency effects			
Administration costs saved	xx.00	Adjustment costs	xx.00
Consumer efficiency gain (consumer surplus, area B)	xx.00	Unemployment of farm labour	xx.00
Producer efficiency gain (producer surplus, area D)	xx.00	Cost of underutilised plant capacity	xx.00
Net benefit/costs	**xx.00**		**xx.00**

Within Table 3 the general approach to calculating the costs and benefits is illustrated and these are broken into two categories of revenue transfers and efficiency effects. In Figure 1 the area A+B is the consumer surplus gain from deregulating an industry where the area A is the transfer from consumers to other industry participants. The area B is the loss of benefits that consumers incur by consuming too little at the higher regulated price P_1 and compared to the deregulated price P_2.

For producers there is a loss in benefits with deregulation since the producer price, FP_1, falls to FP_2 and the amount produced will also fall from Q_1 to Q_2. The net producer surplus loss is the area D+E in Figure 1. The area E is the efficiency gain to the community as a result of freeing the over-used resources for use in other parts of the economy and the area D is the loss of benefits transferred from consumers and other parts of the system.

There are clearly other gains and losses in an industry and these will to some extent depend on the nature of the industry. Those illustrated in Table 3 reflect the effects on a processing, distribution and retail sector, adjustment and resource use costs including unemployment and excess capacity involved in plant and machinery may also be involved.

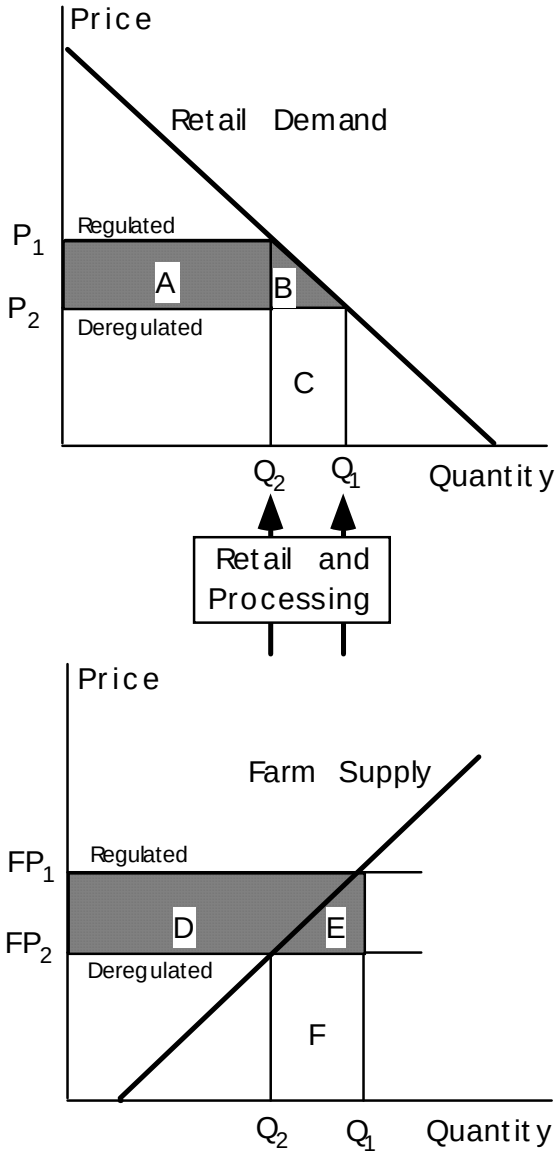

Figure 1 Measuring Benefits and Costs

Techniques of Analysis

As indicated, various techniques have been used in an effort to estimate the effects of deregulation at an industry level. At the more aggregate level, general equilibrium models have been used, such as in the work of the Productivity Commission (1999). The general equilibrium approach will not be considered. The techniques to be considered are the simple calculation of price premiums using historical data including what is known as the market mix premium, pricing to market tests, market power analysis, price discriminating monopoly models and 'what-if' scenario models. Within the category of 'what-if' scenario models econometric models, value chain models and spatial equilibrium models have been used.

Price premiums

Price premiums or discounts are often referred to in a very general and rather loose manner (premiums will be used to be both positive and negative). This can lead to considerable confusion. It is also apparent that simple arguments about regulations, such as those for a single-desk, often are seen in terms of the achievement of price premiums or not. It should be immediately apparent that there are factors other than price premiums which will determine the balance in the public benefit test calculation since price premiums are not the only variable in changes in net revenue or consumer and producer surplus. However, the existence of premiums is one element in the calculation of the benefits and costs.

In considering price premiums MacAulay and Richards (1997) outlined three different types of premiums and also the nature of the market mix gains and losses. These were the competitor price premium or discount, a price discrimination premium or discount and a market restriction premium or discount. These are briefly summarised below.

A ***competitor price premium***

The competitor price premium can be defined as the difference in price between two suppliers of the same product into the same market at the same time. This price difference reflects normal market activities and may reflect slight differences in the nature of the product and the services associated with the product as well as opportunistic differences between suppliers and buyers. These premiums have no connection to market power. Measurement is best done in relation to prices offered by the next best competitor.

Price discrimination **premiums**

Price discrimination premiums are defined as price differences for the same or similar product supplied by a single supplier to different markets (over time, space or customers). Normally these premiums will be associated with price discrimination and some form of market power and an ability to keep the markets separate. There will also usually be different elasticities of demand in the different markets. The work of Knetter (1989) provides one approach to estimating these premiums and discounts and has been used by Carter (1993) in Canada for barley and Griffith, Mullen, Fagan and Jones (1995) for rice in Australia and MacAulay and Richards (1997) for barley in Australia.

Market restriction premiums

Market restriction premiums are generated as a result of intervention in a market such as with quotas, tariffs, subsidies and taxes. They reflect the 'shadow' value of the actual or implied market restrictions. Such values are not easily measured using actual data since it is not always clear what the market prices would be in the absence of the restrictions. However, in practical terms it may be possible to obtain approximate estimates by comparing the prices in the restricted market with those of a closely related but unrestricted market. The difficulty is that when the market restriction is actually removed all other markets may be affected. Thus, the alternative approach to using actual historical data is to use models in which 'what-if' scenarios can be examined.

Market mix gains or losses

The market mix effect is a measure of the inequity with which the available markets are shared. Booz, Allen and Hamilton (1995, p. 44) have used this approach in an effort to measure the ability of a firm or organisation to sell a relatively higher share of product into the higher priced markets than would be expected on the basis of an equitable sharing of the available markets. The market mix calculation reflects a measure of the inequity with which the available markets are shared. Clearly this is not a measure of the ability of a firm or organisation to use market power since an equal proportionate share of a given country's total trade is not an outcome that would be expected with or without market power involved (for a detailed discussion see MacAulay and Richards 1997).

It is clear the there is no particular reason to presume an equitable share of markets is an outcome that will be generated in a free market or in a regulated market. Thus, the idea of inequity of market share as a foundation on which to base the calculation of a premium would not seem to be justifiable. There would also not seem to be any good reason for an exporter to choose to distribute sales across markets so that they are equally shared. There may be good economic reasons not to do so.

An efficient firm with the power to price discriminate between markets is likely to maximise revenue by equating marginal revenues to marginal cost. The marginal revenues in the different markets are likely to differ because of different elasticities of demand. This will depend on the excess demand elasticities the firm faces.

Overall, it would seem that price premiums are not a satisfactory method of assessing the costs and benefits of regulations. This is particularly because they are only one component of the benefit equation. Market mix measures are particularly unsatisfactory because they are a measure of inequity from an artificial standard.

勒Pooling and Return or Cost Averaging

One of the consequences of a single-desk seller is the pooling of returns and costs. Although pooling may take place in circumstances other than under regulation of some kind it is common within regulated markets. The physical pooling of grain from different producers and then the averaging of returns from a pool is an example. There are arguments that relate to the equity of this approach and significant problems with the economic efficiency of it. Work by the Royal Commission into Grain Storage, Handling and Transport (Quiggin and Fisher 1988) demonstrated that there were significant inefficiencies involved in pooling and particularly the pooling of the transport, storage and handling costs. It is worth also noting that the use of pooling may derive from the need to assemble large volumes of grain for purposes of storage and shipping. The net effect is that the return that any particular grower receives is made up of the growers' own contribution and the effect on the average per unit return of the actions of all other growers within the pool.

An alternative way to consider pooling is to view the difference between the pooled return and the return a producer would have received in a non-pooled system as either an insurance premium or an insurance payout where the burden and benefits are spread amongst the members of the pool. Considered in this context pooling has a benefit in providing an insurance-like mechanism but has a possible cost in leading to inefficient resource allocation. The consequence is that too much low-valued grain will be produced and too little high valued grain will be grown. Little work seems to have been done in devising methods to

assess the extent of the benefits and costs of pooling. It would seem that there will be an optimal level of pooling where the benefits derived from the insurance aspects of pooling are considered against the resource distortions generated as a result of pooling.

The basic economic problem with pooling is indicated above, however, in practice, there are a number of practical issues involved which modify this basic economic problem (MacAulay and Richards 1997). In brief, these are summarised below.

(1) More than a single pool is used and quality premiums and discounts may be charged leading to the idea of an optimal degree of segregation.

(2) Ship sizes of 35,000 to 50,000 tonnes require some degree of pooling in the filling of a ship.

(3) Substitution between grains of different types means pricing of pooled grains with non-pooled will need to be reasonably competitive.

(4) Through pooling some of the information and other transactions costs can be spread across larger volumes.

It is apparent that these various effects do not remove the resource misallocation problem but provide an indication that to evaluate the economic consequences of pooling there is a set of trade-offs between the direct economic costs of pooling and some of the benefits of aggregation that should be evaluated. Although the consequences of pooling are not directly measured in the analysis discussed below they should be recognised as a possible resource cost of single-desk marketing. To assume that pooling only leads to resource misallocation would seem to be a misconception of the benefits and costs of pooling.

Pricing to market models (Knetter/Carter models)

The basic economic idea behind the 'pricing to market' test is an assessment of the ability to price discriminate and has been previously outlined in MacAulay and Richards (1997). If a marketing board with single-desk selling power has the capacity to effectively price discriminate then it would be expected that returns over and above those of a competitive market would be obtained. The technique proposed by Knetter (1989) and used by Carter (1993) and MacAulay and Richards (1997) uses the assumption that the competitive market outcome would imply the same price for all importing countries from the same exporter. Thus, in a regression of export prices obtained by a competitive exporter to a number of countries there should be no effect of the destination country or the bilateral exchange rates.

Using the work of Knetter (1989), Carter (1993) developed the following model for Canadian barley exports:

$$(1) \qquad \text{Ln } P_{it} = \sum_{i=1}^{n-1} \alpha_i D_i + \sum_{t=1}^{k} \delta_t T_t + \sum_{i=1}^{n} \beta_i \text{ Ln } X_{it} + u_{it}$$

where
Ln P_{it} is the natural logarithm of export prices to country i and at time t;
D_i is a set of dummy variables designed to capture the country effects for n countries;

T_i is a set of annual time dummies with one variable for each of k years and designed to capture the between year differences resulting from different crop years and different costs of production;
Ln X_{it} is the i-th country's bilateral exchange rate (foreign currency in Australian dollars);
u_{it} is a well-behaved error term.

Expectations for the coefficients can be summarised as:

For a competitive market
$\alpha_i = 0$ or no country effects
$\delta_t = 0$ or no effect of bilateral exchange rates on prices
For an imperfect market or price discrimination
$\alpha \neq 0$ and/or $\beta \neq 0$

If $\alpha \neq 0$ and $\beta = 0$ it is assumed that there is a constant elasticity of demand with respect to the importer's currency, but that the exporter's markup over different destinations varies, thus implying price discrimination (Knetter 1989). If $\alpha = 0$ and $\beta \neq 0$ it is assumed that the demand elasticities vary with changes in exchange rates, also implying price discrimination.

Using confidential data on contract prices for barley exports obtained by the Australian Barley Board, MacAulay and Richards (1997) were able to estimate the equivalent of equation (1) for the period 1986 to 1995. Data were expressed in $US terms since the Board negotiated many of its contracts in US dollars and exchange rate data were obtained from the Reserve Bank of Australia and a variety of other financial institutions. The data set formed an unbalanced set of time series of cross sections across different countries.

Since it is possible that factors other than the ability to price discriminate may cause price differences between countries from a single seller then it is difficult to attribute direct causality. Quality differences, differences in the level of services provided to different countries, and distortions from regulations within the importing country, such as import quotas in Japan, may all affect the estimates. Corrections can be made for some of these factors. However, one implication of this analysis is that a detailed knowledge of the market is needed so as to appropriately interpret the results obtained.

Because trade contracts occur on an irregular basis through time and to different groups of countries from year to year it was necessary to choose the countries to be included in the analysis quite carefully so as to have sufficient observations for reliable parameter estimates. For feed barley contracts the countries included in the analysis were Iran, Japan, Kuwait, New Zealand, Oman, Qatar, Saudi Arabia, Taiwan and the United Arab Emirates. For malting barley contracts the countries were China, Japan, Peru, Taiwan, South Korea and Zimbabwe. Two sets of estimates were made for feed barley by first including and then excluding the domestic sales in Australia.

The statistical significance of the estimated coefficients can be tested using F-tests. MacAulay and Richards (1977) found that, for feed barley with the domestic data included, the hypothesis that the country effects were all zero was rejected but the hypothesis that the exchange rate effects were all zero could not be clearly rejected. When the domestic data were excluded then both hypotheses were rejected. Thus, it was concluded that the hypothesis that the Australian Barley Board was not exercising market power was rejected.

The markets for which price discrimination appeared likely were Japan (a quota controlled market), the United Arab Emirates and other Middle Eastern markets. With the domestic data included there would also appear to have been price discrimination between the domestic market and the export markets.

For malting barley, the domestic data were included and the hypothesis that the Australian Barley Board does not exercise market power could not be rejected both in terms of different countries and different exchange rates.

'What-if' scenario models

'What-if' scenario models are used to compare alternative scenarios. If the base scenario is a reasonable representation of the regulated situation then experiments simulating deregulation can be carried out and an assessment made of the differences involved. The value of such experiments depends both on how well the base scenario is represented and how well the relationships connecting the base to the deregulated scenario are specified. A good degree of fit for the base scenario does not necessarily imply that the correct endpoint values will be obtained when deregulation is simulated. The behavioural and structural relationships in the model must take into account the mechanisms by which deregulation affects the industry. Thus, the specification of the regulatory mechanisms becomes an important part of the modelling work. The nature of these mechanisms will vary with the nature of the regulations involved and some will be more difficult to represent in a mathematical form than others.

In using the what-if approach the estimation of the prices and quantities produced and consumed with and without regulation and the elasticities of demand and supply are necessary to calculate changes in producer and consumer surplus. Impacts on any intermediate sectors may also be derived. Such models may be static or dynamic. If a dynamic model is used then a time path between the regulated state and the deregulated state following a period of adjustment may be used. Issues about the length of the adjustment period also will need to be resolved.

A variety of models have been used with the 'what-if' approach. Most have been used as static models and issues of the adjustment path ignored. For example, some of the models include a single period spatial equilibrium model such as by MacAulay and Richards (1997) for barley and MacAulay and Owen (1999) for the Australian dairy industry. Value chain models and econometric models have also been used.

In evaluating the role of 'what-if' scenario models the rather difficult issue of the quality of the representation of the base version of the model and the representation of the regulatory mechanisms are the central issues. One approach to understanding the impact of the model structure on the results is to carry out extensive sensitivity analysis and provide a suitable range of results or a summary of the effects of testing the sensitivity of relationships and parameters.

Market power analysis—the case of market milk

A central issue for much of the work on competition policy is the degree of market power held by an organisation such as a marketing board or a single-desk seller. This is frequently an area of debate and of relatively little quantitative analysis. However, some progress has

been made in quantitatively assessing the market power of such organisations using econometric techniques. O'Donnell (1999) and MacAulay, Owen and O'Donnell (1999) have reported results for the estimation of the extent of market power in the Australian dairy industry. The general approach used is outlined below.

Holloway (1991) has examined the farm-retail price spread in the context of an imperfectly competitive food industry. He used the idea of conjectural variations (Kamien and Schwartz 1983) and Varian (1984, p. 102) has shown how conjectural variations represent a generalisation of three different types of oligopoly so that the approach allows for a reasonably wide range of market structures to be covered.

Assume that an industry faces normal supply and demand relationships and, to keep the analysis simple, the amount of raw material used is the same as the final product (a reasonable approximation for one litre of milk). It is also assumed that the industry output is made up of output from n firms producing part of the total production and that each firm has a conjecture about the relationship between the aggregate industry output and its own level of output so that

$$(2) \qquad Y = K_i(y_i)$$

where Y is the industry output and y_I is the output of the individual firm.

The elasticity of industry output conjectured by firm i can be expressed as:

$$(3) \qquad \theta_i = (\partial Y/\partial y_i)\,(y_i/Y)$$

Consider a processing firm which buys milk from producers and sells the same volume and is assumed to maximise profits in doing so. The profit π_i for the firm with output, y_i may be written as (modified from Varian 1984):

$$(4) \qquad \pi_i = p(Y)\,y_i - w(Y)\,y_i - C_i(y_i)$$

where p is the industry output price, w the input price and C_i the firm's cost function.

After some manipulation the first order condition for this maximisation problem becomes:

$$(5) \qquad p - w = C_i'(y_i) - \theta_i Y/(\partial Y/\partial p) - \theta_i Y/(\partial Y/\partial w)$$

where the term, p - w, on the left of the equation is the price spread for market milk, and the demand slope is $\partial Y/\partial p$, and supply slope is $\partial Y/\partial w$. O'Donnell (1999), using a similar but more general form of equation (5), estimated sets of coefficients under regulated and deregulated situations with historical data covering both regulated and deregulated time periods in the different states. Using these coefficients it was possible to estimate the shift in the price spread that would be expected under deregulation.

In carrying out the analysis, O'Donnell (1999) also determined that there was little in the way of expression of market power in the price spreads for manufactured dairy products but that there was expression of market power in the case of retailer carton milk sales to consumers.

In addition, he found that the carton-milk processors also possessed market power in the sale of market milk to retailers and in the purchase from farmers.

Useful though the estimates may be, the mere observation of change with deregulation is not a clear-cut causal argument for the existence of market power. It is possible that, with deregulation, the retailers and processors may be supplying a different set of services, possibly more attuned to consumer requirements. Secondly, there is the possibility that under price regulation typical for market milk, there was cross-subsidisation with other products, particularly in retail stores.

Price discriminating monopoly model (CIE)

Another approach to the estimation of the effects of using market power to manage exports, possibly through a single desk, has been developed by the Centre for International Economics, Canberra, using standard monopoly theory (Centre for International Economics 1998). For this model a combination is used of the 'what-if' scenario approach and numerical estimation of elasticities of demand using historical price and quantity data. The approach has been applied in the case of the Australian Barley Board operating as a single desk and for the New South Wales Barley Board.

At the time of the analysis there were three main barley marketing boards and a number of boards and private traders selling grains which competed at the margin with barley in feeding livestock. The marketing boards also competed for sales on an international market in which there were other sellers and a range of buyers. It was claimed that through the use of various marketing activities which develop customer loyalty, through information on the consistency of supply and nature of the product, as well as the fact that countries are spatially separated, there is the possibility of price discrimination between countries which differ in the nature of their demand for the product.

The basic economic behaviour of a price discriminating monopolist is to equate the marginal revenue from each market to the overall marginal cost of producing the product. Since it is reasonable to assume that the marginal cost will not significantly change with allocation to different markets then for the purposes of this analysis it is possible to use the fact that marginal revenue will be equated across markets. The marginal revenue from a market can be expressed as:

$$(6) \qquad MR = P(1 + 1/\varepsilon)$$

where ε is the elasticity of demand.

Using this basic economic relationship between marginal revenue, MR, price, P and elasticity, ε (see any basic microecoonomics text) and, the fact that for a monopolist the marginal revenues are assumed to be equated between regions or markets, then for markets 1 and 2

$$(7) \qquad P_1/P_2 = (1 + 1/\varepsilon_2)/(1 + 1/\varepsilon_1) \quad .$$

Repeatedly applying this formula for every combination over the set of markets and assuming a base elasticity and knowing the prices, it is possible to solve for all the other elasticities conditional on the base elasticity and the set of prices. If also, the set of sales quantities are

known, it is possible to then derive the demand functions that would satisfy the price and sales points and the conditional elasticities derived using the equivalent of equation (7). If the demand function assumed is of the form:

(8) $Q_i = a_i P^{\varepsilon_i}$

then the intercept a_i can be calculated once the sales quantity, Q_i, P_i and ε_i are known for region i. With the estimation of the parameters of the excess demand function for each of the markets to which the marketing board or single desk sells, it is then possible to calculate the competitive market price that would exist if the board did not exist and trade was on a perfectly competitive basis. This is done by summing all the demand functions and solving for a common price since the export price for sales to every market can be assumed to be the same if a perfectly competitive market existed. Thus:

(9) $Q = \sum_{i=1,n} a_i P^{\varepsilon_i}$

This equation must be solved for P in an iterative fashion given the data on total sales to all markets, Q.

From this model it is possible to work out a number of measures relating to revenues from the various combinations of markets and the consumer surplus change as a result of pricing at a competitive price. The consumer surplus is the area under the demand function and above the price line. The consumer surplus change is the change in this area as a result of operating in a competitive environment.

A number of issues arise with the model. The first issue of significance is that, for the model to be operational, the elasticity of demand must be chosen for one country. All the other elasticities become conditional on this choice of elasticity. Changing the choice of country or the value will change to some extent the values obtained for the other elasticities.

The second issue is that problems arise when there are missing observations or a limited number of contracts traded within a year. There are two ways of considering the data for use in the model. In the first case, the data can be derived as an average of the number of annual observations. This implies that if there happened to be a single volume value in only one year, say out of six, then the value for that year would be used as a representative value for the six-year period. This reflects the idea that a particular sale is a representative sale for each year.

An alternative approach is to take the view that in the case of sales in one year out of the six years that this is to be spread over the full time period and is representative of what would happen over repeated six-year periods. In this case, the single observation is divided by the number of years. If this treatment is given to each of the sales and the revenue then the price for the six-year period will also be same as in the case above but the volume used will be one-sixth the size. The major effect of the different approaches will be to change the volumes used in calculating the competitive price. There will be no effect on the derivation of the elasticities since these are determined by the relative prices.

If there is a trend in the data used to calculate the averages this may also have an effect on the results. This is exacerbated if there are only one or two years in which trade actually

occurred and these were in either the low or high priced years. If low priced years are included relative to the major trade flows then the elasticities are likely to be higher than might be expected and the derived competitive price less than might be expected.

To effectively use the results from this model it is first necessary to assume that a marketing board or single-desk seller is acting as a price discriminating monopolist. This analysis does not have the power to establish whether or not the board is acting as a price discriminating monopolist. However, it might also be reasonable to argue that unless the Board did use the power of the single desk for the purposes of price discriminating then there is little argument in favour of having a single desk. This leads to the idea of examining the consequences of different degrees of market power.

Following the work of Holloway (1991) the marginal revenue formula was adjusted so that:

(10) $MR = P(1 + \theta/\varepsilon)$

where θ is a parameter with a range of zero to 1.0 and with a value of zero would reflect perfect competition and with a value of 1.0 reflects a price discriminating monopolist. The results from a number of analyses using arbitrary values within the zero to 1.0 range had relatively little effect. Of course, such experiments should be carried out for each analysis since different data may lead to a different conclusion. An illustration of how the model works can be shown in the case of the results given in Figure 2.

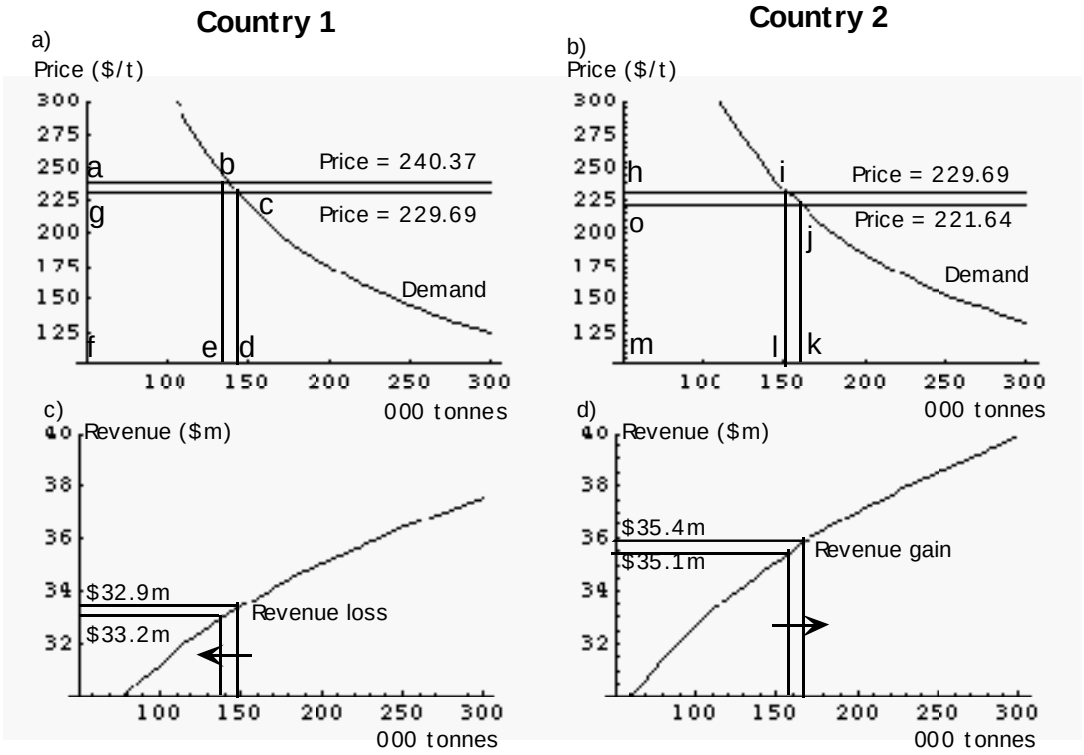

Figure 2. Illustration of the gains and losses in price discrimination for a competitive market price of 229.69 and $\varepsilon_1 = -1.2$

The formula that connects the marginal revenues together can be written as:

(11) $MR_1 = MR_2 = P_1(1 + 1/\varepsilon_1) = P_2(1 + 1/\varepsilon_2)$

That is

(12) $\varepsilon_2 = \varepsilon_1 P_2 /(\varepsilon_1 P_1 + P_1 - \varepsilon_1 P_2)$

If the prices are considered as a price ratio of $P_1/P_2 = R$ then

(13) $\varepsilon_2 = \varepsilon_1 / (\varepsilon_1 R - \varepsilon_1 + R)$.

Using the actual prices of 240.37 and 221.64 and the base elasticity of $\varepsilon_1 = -1.2$ then the elasticity ε_2 can be calculated as -1.24311. This elasticity is similar to the base elasticity and it is apparent that with a price ratio of 1.08451 which is close to 1.0 then the two elasticities will be close in value to each other since the denominator of the above formula approaches 1.0 as the price ratio approaches 1.0. In economic terms this means that if the price ratios actually observed between the two regions are close together and if a price discriminating monopolist sells quantities into the markets so that the marginal revenues are equated, then the implication is that the price elasticities of demand faced by the price discriminating monopolist will be similar. If the prices are substantially different then the price discriminating monopolist has been able to exploit this difference because of the different elasticities.

Consideration of equation (13) leads to recognition of the possibility of a discontinuity as the value for ε_1 approaches a given value and the denominator goes to zero. This will occur when

(14) $R = \varepsilon_1/(1-\varepsilon_1)$

If $\varepsilon_1 = -1.2$, then the value of R = -1.2/-0.2 = 6.0 is a point of discontinuity as is shown in Figure 3. Figure 4 provides an illustration of the relationship between the base elasticity ε_1, the price ratio, R, and the derived elasticity ε_2. The economic significance of the point of discontinuity is that the price difference has become so large that the derived price elasticity of demand is also so large that the demand function is horizontal. Although not economically sensible, the value beyond this point implies a positively sloped demand function rather than the normal negatively sloped function.

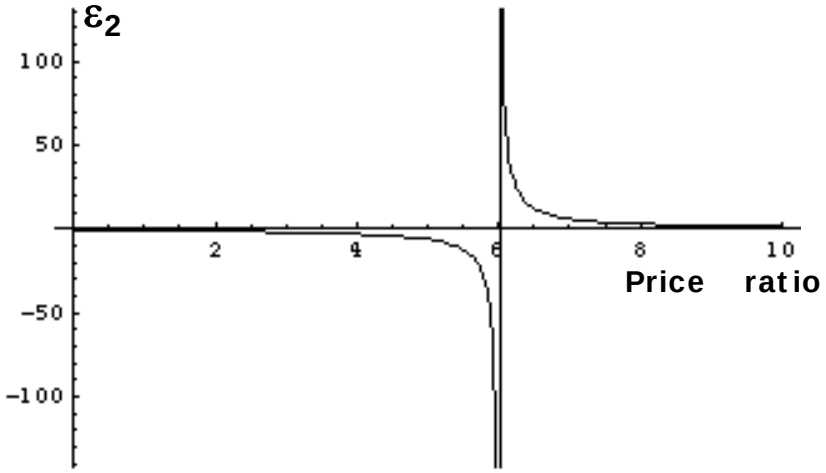

Figure 3. Relationship between the derived elasticity, ε_2, and the price ratio,given a base elasticity of
-1.2

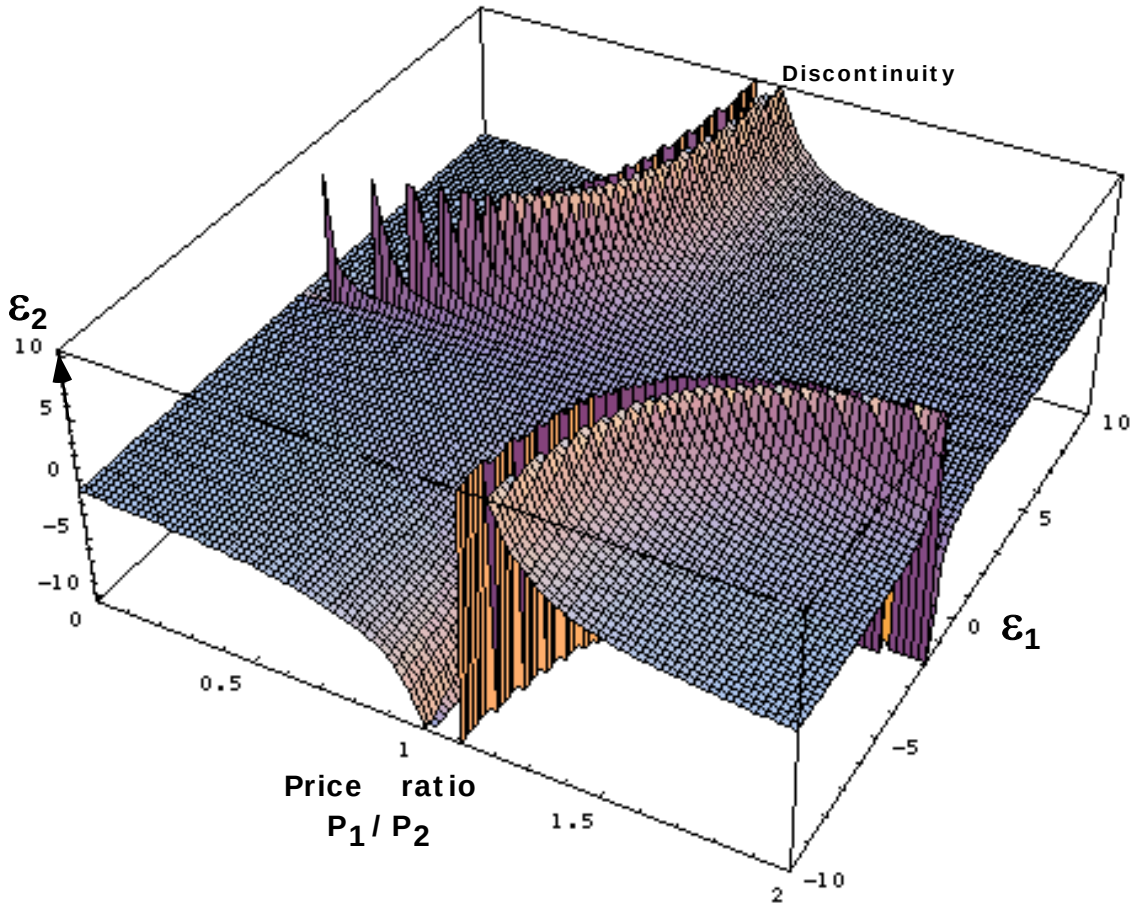

Figure 4. Relationship between the price ratio, the base elasticity ε_1 and the derived elasticity ε_2

Thus, in using the model it is clear that considerable care needs to be taken to avoid a singularity in the stage of estimating the elasticities. Special care therefore needs to be taken in choosing the base elasticity. It is also apparent that the number of data points included in the data need to be sufficient to give a reliable estimate of the prices and quantities. It is also worth noting that the approach requires an assumption on the level of monopoly power to be used and also on the size of the base elasticity. If other data are available on which to choose the base elasticity then greater confidence may be had in the approach providing zones of discontinuity can be avoided. As with other methods, sensitivity analysis is a useful check on the stability of the results to parameter changes.

Concluding Comments

An important part of the process of implementing competition policy is the evaluation of the costs and benefits of the various regulatory mechanisms. Like other industries, agriculture has a significant number of reviews to be undertaken to assess the costs and benefits of regulation. An outline has been provided of the nature of the process of carrying out the benefit cost calculation and consideration was given to a set of modelling approaches designed to provide input to the evaluation. The methods discussed include, price premium

calculations (including the contentious market mix calculations used to assess the extent of the inequity with which the available markets are shared), pooling and return and cost averaging, pricing to market models, 'what-if' scenario modelling, market power analysis, and the price discriminating monopolist model. Each of these models was found to have a number of problems in their use in providing input into the benefit cost calculations. Some of these difficulties are general in nature and others are quite specific to the model.

In the case of price premiums they only form one part of the cost benefit calculation and make no contribution to the quantity part. As well, price premiums are usually based on historical price data which are an amalgamation of many factors affecting markets. Independently observing the effects of deregulation from all the other changes in a market is almost impossible. In relation to the use of market mix calculations to derive a market mix premium there would seem to be no grounds at all to argue that markets should be equitably shared as the base case scenario. Thus, there would seem to be no justification for using the approach to calculate price premiums.

The activity of pooling agricultural commodities or return and cost averaging clearly has resource allocation consequences. Any calculation of the resource effects needs to be tempered against the insurance-like benefits of pooling and the other issues involving optimal levels of aggregation. More work seems to be needed to fully understand this area.

The pricing to market models of Knetter and Carter provide an econometric means of deriving price differences between markets on the basis of observed market contracts or sales. This can provide insight into the extent to which marketing boards or single-desk sellers can price discriminate between purchasers. With this approach there are difficult issues involved in ensuring that one sale or contract is sufficiently similar to another or that the differences have been included in the econometric specification. The use of individual contract data overcomes some of the problems encountered in the earlier work by Carter (1993) who used export unit values as the measure of grain prices. Still, there needs to be a sufficient number of sales to a given market to provide any degree of reliability for the approach.

'What-if' scenario modelling is another broad set of modelling approaches which can be used. The models include econometric models, spatial trading systems (trade is often important for agricultural industries), value chain models and general equilibrium approaches. Proper specification of the policy mechanisms being deregulated is essential in such models since their value depends on measuring change from a base case. It is also vital that the base case be a reasonable representation of the actual regulated situation. Many standard issues of model building are raised in considering 'what-if' approaches, including the significant costs involved in building such models in the first instance.

Market power analysis is a means of econometrically estimating the effects of market power at various points in a processing and marketing chain. This approach relies on data being available for both regulated and deregulated markets. This will not always be the case and thus can only be applied in certain instances. In addition, the mere observation of change in price relationships with deregulation does not necessarily imply a causal relationship with deregulation since other things may happen at the same time such as changes in quality, processors and retailers may supply different services and under the regulated environment there may have been cross-subsidies within processing and retail chains that are removed under deregulation.

The price discriminating monopolist model is designed to make use of historical price and quantity data and uses the strong assumption that the marketing board or single desk seller behaves as a monopolist. This assumption can be modified to allow for assumptions on various levels of monopoly power. The results from this approach give an indication of the elasticities of demand that would exist if the trader were a monopolist given the price and quantity data actually observed. These elasticities can then be used to derive a price that would exist if the market were competitive. Such a model requires adequate data, needs an assumed base elasticitiy (often unknown) and has problems with a singularity given certain base elasticity values.

It is clear that all the approaches discussed have a number of significant limitations. Thus, it would seem that:

1) Care should be taken in using one method only and that significant sensitivity analysis should be carried out.

2) A detailed knowledge of the industry being examined should be developed and the choice of method or methods judged against the nature of the industry and the data available.

3) The final basis for a judgement on the benefit cost calculation for or against regulation should rest heavily on the logic of the situation and the values and calculations derived from models such as those discussed above should be heavily tempered by this logic.

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