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Forum

A Comment on An Application of Spatial Equilibrium Analysis to the Transport and Processing of Wholemilk in New South Wales

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There has been considerable discussion in recent years about the future of the New South Wales milk industry. This discussion has largely concerned the sources of supply for the Sydney market. With the recent abolition of the Milk Zone, and the consequent lowering of all legal barriers which previously prevented outlying farmers from sending milk to Sydney, the recent article by Mackay and Toft [6] appears most timely. However, there are several aspects of the paper which appear deficient if it is used as a basis for policy determination. Mackay and Toft have made several assumptions in the models used which depart radically from the reality of the New South Wales dairy industry. On some occasions, these assumptions are explicit, while on others they are implicit.

The spatial equilibrium analysis models used simplify reality to the extent that transport costs and plant capacity are the sole determinants of the optimal distribution of the New South Wales dairy industry. No justification is given for this assumption, nor is it expressed formally. If the model was intended solely to analyze the interaction of these two factors without proceeding to recommend a large-scale redistribution of the sources of supply of New South Wales milk, all would be well. However, Mackay and Toft state that "on locational grounds, wholemilk for Sydney need not be drawn from the Far North Coast or the Far South Coast, as is now occurring". [6, p. 17]. This is a sweeping conclusion from a model that has only examined two of the relevant locational forces.

In treating transport costs as the principal criterion for optimal location of factories (a subjective assumption) and consequently ignoring factors such as climate, soils, herd composition, costs of production, *etc.* , the analysis will inevitably be biased towards those producers who farm most closely to the main markets. In concluding this, the authors ignore the fact that dairy areas close to the Sydney market have the highest production costs in New South Wales (see Table 1).

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Table 1: New South Wales Dairy Industry: Regional Production Costs 1975-76. (Cents per litre; Opportunity Cost Labour Allowance)

	Total Cost		Marginal Cost	
Region	All farms	Year-round producers	All farms	Year-round producers
Richmond-Tweed	13.00	13.56	3.45	4.65
Clarence-Hastings	15.66	15.28	4.23	4.45
Hunter	15.32	15.09	4.42	4.47
Outer Sydney	18.62	18.62	7.98	7.98
Illawarra	16.54	16.59	5.01	5.03
Lower South Coast	12.25	11.98	3.43	3.50
Central Murray	10.87	—	2.62	—
N.S.W. Total	15.50	15.92	4.81	5.23

Source: Graham, M. A., and Hayward, M. A., "Milk Production Costs in New South Wales: 1975-76", *Miscellaneous Bulletin 29* (Sydney, Division of Marketing and Economics, 1978). pp. 10, 14.

Although high land costs make the Outer Sydney zone less profitable in which to produce milk (it costs 53% as much to produce milk on the Far South Coast and 60% as much on the Far North Coast), when this cost is ignored it is still the least economic area (see Table 2). The reasons for this are manifold, but they can be summarized as the high cost production methods used, particularly the extensive handfeeding and mechanization used to boost production. In places, handfeeding has ceased to be efficient, and is simply wasteful. This contrasts with those areas outside the old Milk Zone where very extensive use is made of pasture feeding.

Table 2: New South Wales Dairy Industry: Preliminary Regional Production Costs 1975-76. (cents per litre)

Region	Total cost	Cost less land
Richmond-Tweed	13.39	8.92
Clarence-Hastings	14.87	10.05
Hunter	15.43	10.57
Outer Sydney	22.16	12.84
Illawarra	19.66	11.70
Lower South Coast	11.71	8.94

Source: N.S.W. Department of Agriculture, Division of Marketing and Economics, *Preliminary Regional Milk Production Costs for New South Wales*, (Sydney: Division of Marketing and Economics, 1977) p. 17.

It was calculated in 1976 that the cost of transporting milk to Sydney by road from Bega was 1.17 cents/litre [2, p. 36]; this compares to Mackay and Toft's figure of 1.57 cents/litre [6, p. 12]. It is however significantly cheaper to bring milk from the Far North Coast and Far South Coast than to produce it close to Sydney as transport costs do not match the higher production costs in the Sydney area (see Table 3).

A comparison can be seen between this situation and that existing during the 1920s. In 1923, a report by the N.S.W. Board of Trade found that there were 427 dairymen (with 7856 dairy cows) in the Sydney metropolitan area. [7, p. 46]. It stated "The suburban dairies generally are so close to their market that the milk produced by them can be delivered without treatment of any kind to the consumer". [7, p. 43]. At the same time, suburban dairies were for the first time finding themselves in competition with country

Table 3: Approximate Freight Cost Incurred in the Transport of Wholemilk to the Sydney Market and the Aporoximate Cost of Milk Delivered to Sydney (cents per litre; Opportunity Cost Labour Allowance).

Source region	Cost in region (from Table 1)	Freight cost	Cost delivered in Sydney
Richmond-Tweed	13.56	2.43	15.99
Clarence-Hastings	15.28	1.62	16.90
Hunter	15.09	.77	15.86
Outer Sydney	18.62	.24	18.86
Illawarra	16.59	.52	17.11
Lower South Coast	11.98	2.10	14.08

Source: Graham, M. A., and Hayward, M. A., "Milk Production Costs in New South Wales: 1975-76, *Miscellaneous Bulletin 29* (Sydney, Division of Marketing and Economics, 1978). p. 16.

dairies (*i.e.* Seven Hills, Blacktown, Liverpool, Campbelltown) sending pasteurised milk to Sydney. Many were alarmed at the costs of transporting milk to Sydney over such distances, and advocated government protection to the suburban dairies. Some suggested the government reserve huge tracts of land around La Perouse for the continuation of suburban dairies, [13, p. 10] but others were more far-sighted and saw that the growth of Sydney must eventually lead to the demise of the suburban dairy.

If a study such as that of Mackay and Toft had been completed in the early 1920s, emphasizing the importance of transport costs to the exclusion of almost all other costs of production, there is no doubt it would have recommended against the importation of "country" milk. The significance of the land cost factor for outer Sydney dairies in Table 2 indicates the same process is occurring today in these areas as occurred in the suburban dairies in the 1920s. To conclude that Sydney should not draw low-cost milk supplies from the Far North Coast and Far South Coast on the sole basis that it will cost more to transport that milk is a clear example of an implicitly false assumption leading to an absurd conclusion.

The implicit assumption of the model that transport costs are the dominant consideration in determining source regions for milk supply leads to some other incomplete conclusions. For example, when comparing the results of two runs of the short-run model based on different estimations of plant capacity, Mackay and Toft conclude that if some factories were to close down, economies of scale could be exercised in the remaining factories. This would reduce transport and processing costs from $10,891,000 in the model situation nearest to present-day reality, to $10,667,000, a saving of $224,000, or 2 per cent. [6, p. 14]. Apart from the fact that the basis of estimation of plant capacity is imprecise by their own admission [6, p. 12], the authors' conclusion that there is adequate plant capacity around Sydney to handle metropolitan demand (with the implication that supplies should no longer be drawn from further afield) [6, p. 14] is to read too much into the limited inputs of the model. If nothing else, the economic costs, and certainly the social costs of adjusting to this situation would almost certainly exceed $224,000, especially when it is remembered that this 2% saving represents a compensation for adjustment of only $134 to each dairyman outside the former Milk Zone (based on 1667 farmers; figure given in [8, p. 5]).

There are other examples of conclusions being drawn which the model has too narrow a field of investigation to justify. For example, the conclusions are reached that Deniliquin should supply milk to Broken Hill, Wauchope and Armidale or Wyong to Moree, and that Albury and Canberra should supply milk to Parkes [6, p. 15]. (This is despite the fact that on their figures on p. 9, Mackay and Toft indicate that Canberra supplies only 15% of its own requirements). From the information given in the article, the model itself does not give these conclusions. Rather, these are conclusions which are interpreted from the model's results. This interpretation is based on the implicit assumption that milk should only be transported as short a distance as possible. Again, such an assumption ignores all other factors of production, and leads to a conclusion which is, at least, open to question.

An explicitly false assumption for the model is given in several places where both supply and demand are assumed to be perfectly inelastic. [6, pp. 8; 9]. While such an assumption makes the workings of the model much easier, it leads again to an unnecessarily narrow view of reality. It is generally agreed by farmers that supply is not inelastic, while retailers, milk vendors and consumers will agree that demand is not inelastic. Furthermore, the Industries Assistance Commission works on an Australia-wide elasticity of supply of 0.5 [4, p. 184], while Kinsman and Anderson quote an elasticity of demand of 0.35 [5, p. 20]. The fact that country factories will raise or lower prices for surplus milk in accordance with their needs indicates there is a positive elasticity of supply, [1, p. 4] while the N.S.W. Department of Agriculture acknowledges there is an elasticity in demand, saying "milk consumption in the Sydney metropolitan distribution zone will decrease with any increase in price". [12, p. 14].

The effect of unrealistic assumptions about supply and demand elasticities in the Mackay and Toft paper is to reinforce the bias in favour of producers near Sydney. As shown above, dairymen operating close to Sydney have the highest production costs in the state. Therefore, to ignore price elasticity of demand in the model is to ignore the increase in price, the consequent decrease in production and the decline in consumption which results from heavy reliance on Outer Sydney metropolitan production.

In ignoring a positive elasticity of supply, the model ignores a further force on the industry. Because farmers close to Sydney were within the old Milk Zone, they have had the incentive over the years to produce more milk than farmers outside the Milk Zone. Depending upon the lags in long-term adjustment of production levels that would be expected following the net price decrease received by ex-Milk Zone farmers following the abolition of the Zone (a feature which has never been researched in New South Wales), production levels may still be artificially high on a state-wide equalized basis. Certainly they would have been so in 1971-72 when the data for Mackay and Toft's paper was current. The effect of this is to over-estimate the capacity of near-Sydney dairymen to supply milk to Sydney, and to underestimate the importance of "outlying" dairying areas on a relative basis.

Mackay and Toft's paper indicates that each factory's total cost function is dependent on only one variable, wholemilk production. [6, p. 10]. This assumption is admitted in the paper to be simplistic, but is claimed to be realistic on the basis that although factories can produce more than one product, wholemilk processing is sufficiently independent of other

processing functions. Such an assumption is of highly varying accuracy from factory to factory, particularly when factories concentrating on processing wholemilk within the old Milk Zone are compared to those outside the Zone which developed originally to produce manufactured dairy products.

A further justification given is that the majority of milk produced in New South Wales goes to wholemilk processing [6, p. 10], despite the fact that a footnote on the same page gives this majority as 56% in 1975-76 and 61% (prelim.) in 1976-77. In giving this figure, Mackay and Toft state "In 1975-76, 56 percent of wholemilk produced in New South Wales went to human consumption as distinct from manufactured products such as butter or cheese" [6, p. 10]. Both the terminology and the percentage figure itself are misleading. The 1977 Annual Report of the New South Wales Dairy Industry Authority gives the State's 1975-76 milk production as 942 million litres, and the amount of liquid milk sold as 489 million litres (or 51.8%) [11, p. 4]. The equivalent figure for 1974-75 was 47.2% [10, p. 5]; hardly a satisfactory basis for Mackay and Toft to simplify their calculations on the basis that "the majority of milk produced in New South Wales goes to wholemilk processing" [6, p. 10]. Additionally, the percentage figures given by Mackay and Toft include milk used for separation into sweet cream. This is a misleading procedure as the difference in prices received by dairymen for liquid milk and milk for separation into cream was 20.41 cents per litre against 8.79 cents per litre at the time the Mackay and Toft paper was printed — *c.f.* [9, p. 5]. Liquid milk and sweet cream are two different products, and should be treated as such.

While recognizing the difficulty of obtaining up-to-date statistics, Mackay and Toft's use of 1971-72 figures for their analysis must be questioned. Such figures were collected when the industry was very different from the present; in 1971-72 there was a Milk Zone which strengthened the relative economic position of farmers close to Sydney, there was a situation of quota negotiability within the Milk Zone, and milk consumption in Sydney was still increasing annually. That these conditions no longer apply again biases the case presented in favour of dairymen producing close to Sydney.

It was stated earlier that Mackay and Toft had ignored any social and economic costs which might be incurred should a major structural re-adjustment be necessary in the New South Wales dairy industry. A similar situation exists with another conclusion drawn from the analysis; that under given plant capacities, Goulburn and Nowra should supply Canberra. [6, p. 16]. To suggest this in the name of efficiency is to demonstrate a considerable unawareness of South Coast dairying. At present, Bega supplies a proportion of the Canberra market, and if Mackay and Toft's recommendations were followed, would have significantly greater quantities of surplus milk available for Canberra which were previously supplied to Sydney. Nowra does not at present supply Canberra, and if the recommendations of the paper were followed, would have even less milk with which to supply Canberra because of increased shipments to Sydney. [6, p. 16]. Despite the roughly equal distances between Nowra/Canberra and Bega/Canberra, to suggest that Nowra replaces Bega as a source for Canberra ignores the existing infrastructure which has been built up from Bega (an extensive fleet of road tankers); it ignores the social costs to the Bega Valley of such a switch; it ignores that in

the short-medium term Nowra is committed to rail transport of milk (and there is no direct or convenient railway line from Nowra to Canberra) and it ignores the quality preferences and statutory requirements for wholemilk with a minimum 4% butterfat content for Canberra (most cows around Nowra are Friesians producing 3.2 to 4.0% butterfat, while most cows around Bega are Jerseys producing 4.5 to 5.5% fat).

The Mackay and Toft paper appears to be deficient in a number of ways when used as a basis for policy determination. While appearing objective through the use of its mathematical model, several key implicit and explicit assumptions are false, and these have led to conclusions which are highly questionable when a wider view is taken of the industry. The analysis has over-emphasized the processing sector of the industry while ignoring regional cost-efficiency differences at the farm level, and has concentrated upon transport costs as the main way of determining potential supply source regions for Sydney. The effect of this is to bias the study in favour of dairymen living close to the metropolitan area. The assumption of supply and demand inelasticity similarly biases the model. Because of the reliance (possibly over-reliance) on the mathematical models, an unnecessarily narrow view of reality is achieved, resulting in conclusions which should not pass the test for "reasonableness" when applied to the real world.

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