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INSURANCE MILK

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Where the production of milk for sale on the fresh milk market at 'controlled' prices is subject to nontransferable quotas the holders of quota who wish to maximise profits have a motive to maintain production above the quota level to insure against variations in demand for over-quota sales and yield. The concept of 'production of milk as insurance' is used to clarify the way in which such behaviour gives rise to social costs which could be avoided in a competitive market, by a permissive attitude to arbitrage, or where quotas can be traded.

Introduction

Quota schemes operate for a number of Australian agricultural products. Wherever such schemes operate to restrict supply to a market, producers may gain monopolistic profits from possession of quota shares.

At the individual producer level, actual production may fall short of the requirements of the preferred (quota-restricted) market because production is uncertain and the requirements of the preferred market for over-quota sales are uncertain. Two potential opportunity costs are associated with such a shortfall. There is the opportunity cost of revenue losses from forgone sales in the preferred market in the current year. In addition, quota shares may be permanently reduced as a result of a shortfall, resulting in a loss of revenue in the current year and in all future years.

If a producer of such a product could buy an appropriate insurance policy, he would be prepared to pay a premium for that policy up to the expected opportunity costs of a shortfall. He cannot 'buy' an insurance policy in the usual sense but he can insure against a shortfall by either (a) aiming to produce in excess of his quota or (b) adopting more costly input combinations and production techniques which embody a smaller risk of a shortfall of actual production from planned production.¹ The latter approach would cause the 'behavioural' supply function to shift upwards to the left of the 'real-cost' supply function (corresponding to the industry marginal cost curve). A profit maximising producer would choose the two forms of insurance in a combination such that the marginal value of the last dollar spent on each was the same. The latter form of insurance, however, can insure producers only against shortfalls

* Thanks are due to a number of people for helpful comments and suggestions. These include Malcolm Graham, David Godden, and four anonymous referees. We are especially grateful to Geoff Edwards, John Freebairn and Ross Parish whose comments have led to substantial revision of the manuscript. Nevertheless, we accept full responsibility for any remaining errors.

¹ This notion was initially suggested by G. W. Edwards. A detailed analysis of this in interaction with excess production as insurance was included in an earlier draft but has been taken out in pursuit of brevity.

arising from uncertainty on the supply side. Its physical and economic importance as a substitute for insurance in the form of excess production depends on the importance of supply variability as a contributor to the total risk of a shortfall, as well as on the availability of less risky input combinations and production techniques.

There are several reasons for expecting the aggregate fresh milk supply function to be above and to the left of the real-cost supply function. Firstly, quotas have been allocated amongst producers according to criteria other than economic efficiency; secondly, the terms of quotas are such that quota holders must supply to their quota on every day of the year regardless of individuals' seasonal comparative advantages; thirdly, there are the S-inefficiencies specifically mentioned by Godden and Drane (1978); and, fourthly, there is the use of more costly production techniques as insurance. Whilst it is recognised that this latter form of insurance is likely to exist, and that it may be important, the specific aim of this paper is to expose the less well recognised phenomenon of excess production as insurance.

The aims in this paper are (a) to introduce the concept of excess production as a means of insurance of profits from shares in a preferred market; (b) to develop a model of this phenomenon applied to the New South Wales milk industry; and (c) to identify the social costs, additional to those normally recognised in analyses of discriminatory pricing policies, which arise from excess production as insurance.

The concept of excess production as insurance is developed within the framework of the dairy industry in New South Wales. There has been a variety of complex institutional arrangements in the fresh milk industry in New South Wales. Currently, fresh milk pricing and the quota system are administered by the New South Wales Dairy Industry Authority. The model developed here is admittedly simplified but it captures the essential features of the individual quota system in New South Wales. With slight modifications this model can be applied to other industries where market share quota schemes induce excess production as insurance. In Australia such schemes have operated, or operate currently, for many agricultural products, including wheat, sugar, tobacco, and wholemilk. Overseas there are many more examples.

The Model

In the New South Wales dairy industry, the preferred market is the fresh milk market for which producers have quotas; the nonpreferred market is the manufacturing milk market.

The model must take account of the particular pricing arrangements in the dairy industry. In the Australian manufacturing milk industry, producers in all States receive an equalised price which is derived by pooling returns from all sales on Australian and export markets. The level of returns to New South Wales producers from sales of milk for manufacturing purposes is determined from total Australian supply of manufacturing milk and the equalised price schedule for milk for manufacture. Thus the production of insurance milk in New South Wales has implications for manufacturing milk producers in other States, and the milk in-

dustry in New South Wales cannot be treated in isolation from those in other States.²

The analysis is simplified if we consider production of fresh milk as a completely separate enterprise from the production of milk for manufacture. Hence we have two distinct milk industries in New South Wales (and in other States): the fresh milk industry and the manufacturing milk industry. Although quota holders may engage in both enterprises, a part of their production beyond the requirements of the fresh market can be considered as a product of the fresh milk enterprise — insurance milk.³

It is postulated that fresh milk producers in New South Wales aim to produce in excess of their quotas as a form of insurance against the risk of incurring the costs associated with a seasonal shortfall of actual production from the requirements of the fresh milk market — quota plus any over-quota sales.

The effects of insurance production in the New South Wales fresh milk industry on the total Australian manufacturing milk industry and its component in New South Wales are analysed in the framework of a transfer of supply between the different sectors.

Marginal insurance value

The greater the uncertainty of either production or the requirements of the preferred market, and the higher the costs of a shortfall of production from the requirements of the preferred market, the higher is the expected value of excess production as insurance. A marginal insurance value (*MIV*) curve can be derived which describes the producer's valuation of successive units of excess planned production as insurance. For any producer, the position and slope of the *MIV* curve depend on the probabilities and the costs of shortfalls of actual production from the available share of the preferred market.⁴ The higher the amount of a possible shortfall, the lower is the probability that it will occur. Consequently, marginal insurance value declines with increasing quantity of insurance and the *MIV* curve slopes downwards to the right.

² There are numerous examples of preferred markets and insurance behaviour outside New South Wales and outside the dairy industries; but the New South Wales dairy industry is an outstanding example and one for which solutions have been suggested and ignored. The Victorian dairy industry has had arrangements similar to those currently existing in New South Wales but the government has recently taken steps to 'rationalise' marketing arrangements in the industry, removing market share quotas and the need for insurance.

³ This does not mean, however, that fresh milk and insurance production decisions are always entirely independent of the manufacturing milk enterprise, although they are for most farmers at certain times of the year (particularly in the winter months when in many instances it is entirely uneconomic to produce milk for manufacture), and for certain farmers at most times of the year (such as high cost urban fringe farmers specialising in fresh milk production). They are not independent in that the size of the manufacturing milk enterprise affects the risk of a shortfall. Thus some producers, at least at some times in the year, may not find it profitable to produce any insurance milk. This will depend on their costs and the relative sizes of their fresh and manufacturing milk enterprises.

⁴ This depends in part on the institutional arrangements and the conditions of quota ownership. If quota is not tradeable and there is no permanent loss of quota associated with a shortfall, the *MIV* curve describes producers' expected returns, as sales on the preferred market, to successive units of excess planned production. If a permanent loss of quota is involved, the *MIV* curve is augmented by the expected value, discounted back to the present, of forgone sales in the preferred market in future years. In the New South Wales fresh milk sector, continued shortfalls can result in a permanent loss of quota and so the *MIV* curve would lie somewhere between the two cases outlined above.

Quasi-marginal cost

For any producer, the marginal costs of producing insurance are described by that section of his marginal cost curve extending beyond his quota on the fresh milk market. However, insurance production decisions are based not on the real marginal costs of fresh milk production, but on the quasi-marginal costs. The quasi-marginal cost of producing any quantity of insurance milk is given by the real marginal cost less the marginal insurance value of that quantity of insurance.

Thus the producer's quasi-marginal cost curve for the production of insurance is given by the algebraic difference between his marginal cost curve for excess production and his *MIV* curve:

$$S_i S'_i = CC_i - MIV_i = QMC$$

where for the *i*th producer $S_i S'_i$ = quasi-marginal cost, CC_i = the real marginal cost for excess production, and MIV_i = the marginal insurance value. The derivation of $S_i S'_i$ is shown in Figure 1.

Where *QMC* is negative (i.e. $MIV > CC$), the magnitude of *QMC* represents the premium up to which the producer would be prepared to

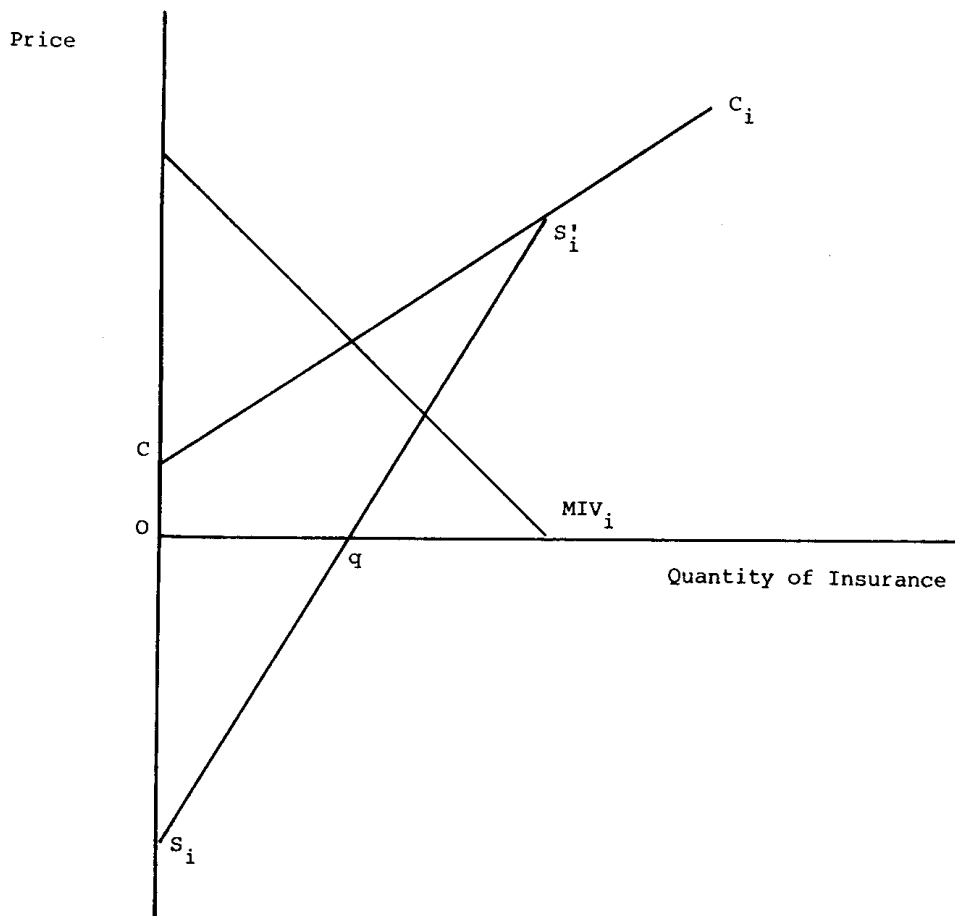


FIGURE 1—The quasi-marginal cost of insurance.

pay for that level of insurance in the form of a traditional insurance policy. In Figure 1, QMC is negative up to the point q which represents the level of insurance at which the marginal insurance value of milk equals the marginal cost of milk production. Beyond q , production for insurance would be unprofitable.

However, insurance milk also has a *salvage value* as it can be 'dumped' on the manufacturing milk market. The quasi-marginal cost curve may thus be thought of as a curve which describes the sale prices on the manufacturing milk market at which successive quantities of insurance milk would be produced. Thus insurance will be produced beyond the level q at which $QMC = 0$. Each producer will produce insurance milk to where his QMC equals the equalised price for manufacturing milk.

The supply of insurance milk

The aggregate supply curve for insurance milk is given by the horizontal sum of the quasi-marginal cost curves of all producers. This curve describes the quantities of excess production as insurance which will be produced at different equalised prices for milk for manufacture. The aggregate supply of insurance milk is represented by SS' in Figure 2.

The effects of insurance behaviour

In Figure 2, CC' is the real cost supply function in New South Wales for production of milk beyond the requirements of the fresh milk

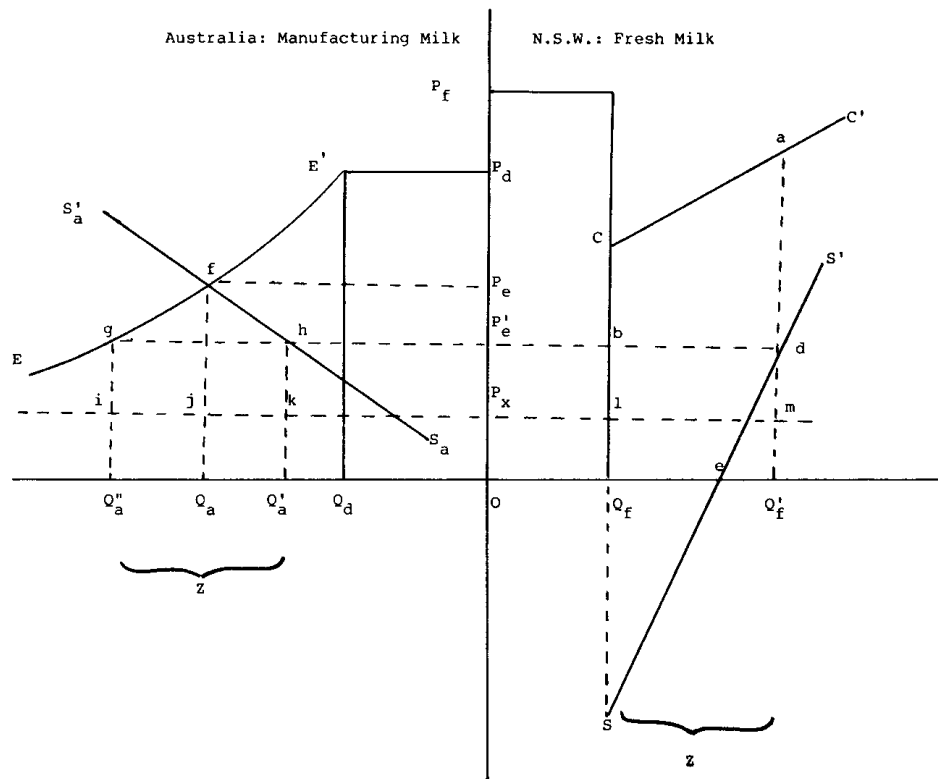


FIGURE 2—The effects of insurance on the dairy industry.

market.⁵ $S_a S'_a$ is the Australian supply function for manufacturing milk including that from the manufacturing milk industry in New South Wales, but excluding insurance milk.

In the absence of insurance production, the Australian manufacturing milk industry would produce Q_a of milk which is given by the intersection of supply ($S_a S'_a$) with the equalised price line (EE'). For this output producers would receive an equalised price P_e . Of Q_a , Q_d would be sold on the domestic market for a price P_d and the residual ($Q_a - Q_d$) would be exported at price P_x .

The total quota on the fresh milk market in New South Wales is set at Q_f and, for that production, fresh milk producers receive a price P_f , the fresh milk market price. Insurance milk is extra production, beyond Q_f , by the fresh milk sector in New South Wales. The increase in the supply of milk for manufacturing purposes causes a reduction in the equalised price; in consequence, the Australian manufacturing milk sector contracts until a new equilibrium is achieved in the manufacturing milk market.

The new equilibrium in Figure 2 is where Q'_a of milk is produced by the Australian manufacturing milk industry. The fresh milk sector in New South Wales produces Z units of insurance milk which is sold as manufacturing milk. Total supply of milk for manufacture is increased to Q'_a bringing forth an equalised price P'_e . At the new equilibrium the marginal cost of producing Q'_a by the manufacturing milk sector equals the quasi-marginal cost of producing Z of insurance by the fresh milk sector, both of which equal the equalised price for Q'_a of milk for manufacture, P'_e , i.e.

$$QMC(Z) = MC(Q'_a) = P'_e$$

Thus, production of insurance milk results in an increased supply by fresh milk producers in New South Wales (from Q_f to Q'_f). This results in an increased total supply of milk for manufacturing purposes (from Q_a to Q'_a), although production from the Australian manufacturing milk sector is reduced (from Q_a to Q'_a), causing a reduction in the equalised price from P_e to P'_e .

Social Costs of Insurance Behaviour

In Figure 2, CC' is the real-cost supply curve under the current marketing quota system for fresh milk in New South Wales. It is likely that this curve is above the supply curve which would apply under a transferable quota system or in the absence of quotas, and there are social costs associated with the supply curve being higher. As a result of excess production as insurance by the fresh milk sector in New South Wales, there are social costs which are separate from and additional to these social costs, the resource misallocation costs in the dairy industry which are discussed by Parish (1962) and many others, and the S-inefficiency costs referred to by Godden and Drane (1978). The analysis below is concerned with the *additional* social costs, directly attributable to insurance milk production.

⁵ It is highly likely that, as shown in Figure 2, CC_i is above the supply function SS'_a for extra production from the manufacturing milk sector, but the position of the intercept, C , is uncertain.

Because manufacturing milk returns are equalised, at the 'pre-insurance' equilibrium level of production (Q_a) the marginal costs (P_c) exceed marginal revenue (P_x) for manufacturing milk sales. Consequently, the reduction in production by the manufacturing milk sector from Q_a to Q'_a results in a saving in social costs given by the area $fhkj$ in Figure 2.

The fresh milk sector increases production from Q_f to Q'_f , at a cost of the area under the marginal cost curve (CC') over this interval. This extra production is sold on the export market at P_x , leaving a net social cost in the fresh milk sector of the area $lCam$, and a net social cost overall of area $lCam$ minus area $fhkj$. This loss is borne entirely by milk producers, and is distributed as follows (see Figure 2):

(a) the loss of surplus by manufacturing milk producers, the area $P_xfhP'_c$, and

(b) the loss of surplus by the fresh milk sector,⁶ the area $bCad$.

However, in the absence of a suitable measure of insurance production, empirical estimation of these social costs presents a less than tractable problem which must await further investigation.

Summary and Conclusions

In this paper an insurance motive is postulated as one explanator of the production of milk which is surplus to the requirements of the fresh milk market at the prevailing administered price. In the context of discriminatory pricing for fresh milk and for manufacturing milk, an explanation of producer behaviour which complements that presented by Harris and Candler (1960), Neutze (1961), and Parish (1963) is expounded.

A market for quota in continuously divisible units of quantities and time would provide a return to producers in the event of a shortfall of production below entitlements, would provide an opportunity cost and therefore remove the monopolistic profits associated with quota ownership, and would consequently displace the costs of shortfalls and the benefits of insuring against shortfalls. In the absence of a market for quota units, producers are induced to engage in insurance of their returns from the preferred (high price) market by producing additional milk. This additional milk production is sold on the manufacturing milk market, further depressing prices on this lower priced market at the expense of producers of milk for manufacture in New South Wales and in other States, causing inequities and inefficiencies in the dairy industry additional to those recognised in the literature to date.

Powell (1972), drawing on the work of Lloyd (1971) and others,⁷ has summarised the sources of gains which can be made by the development of a market for quota units or by permitting trading in products to meet quota entitlement. To these must be added the benefit of avoiding the social costs of insurance behaviour of fresh milk producers.

⁶ There is also an 'apparent' gain of surplus to insurance producers, the area above the insurance supply function below P'_c .

⁷ Parish (1963) had earlier considered sales of quota rights or product as alternatives and recognised the additional information provided by the establishment of a market for quotas or units of quota. See also Parish and Kerdpibule (1968). Lloyd (1971) has pointed out that '... it is cheaper to transport the quota certificate than the product itself'.

As presented here, the conflict between the various sectors of the dairy industry is made explicit, and the outcome of piecemeal integration of the fresh milk sector with the manufacturing sector, and the consequences of not adopting continuously saleable quotas in the fresh milk sector of New South Wales, are highlighted. Social loss associated with a high level of consumer prices is likely to continue without implementation of the suggestions for reform made by Parish and Kerdpibule (1968) and there is little evidence of other than incremental progress in this direction.

The implementation of saleable quotas, wholly or in units, intraseasonally and interseasonally, would substantially reduce the resource misallocation costs arising from the precautionary behaviour of fresh milk producers. The need for quota to be continuously tradeable is stressed. Arguments for transferable quotas elsewhere have shown that the resource misallocation costs are diminished as additional market supplies are produced by lower cost producers. The analysis in this paper suggests that these lower cost producers will have a stronger insurance motive to protect sales on the preferred market since the profit component of such sales is larger. Where quota is traded at discrete intervals, the increased incentive for more efficient producers to produce insurance milk to protect sales in the preferred market increases the dilution of the manufacturing milk price.

As a final note, if insurance forms a substantial component of producers' decisions, it may well be that much empirical work directed at the estimation of price elasticities of supply in dairying from historical data suffers from specification bias. This extends beyond the dairy industry. It is likely that excess production as insurance is a real-world phenomenon wherever preferred markets are established and non-transferable market shares are allocated. In Australian agriculture there are numerous examples, and wherever market analysis ignores this aspect of producer behaviour, misspecification is likely to result.

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