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"NEW LIVESTOCK INDUSTRIES: THE DYNAMICS AND IMPACTS OF GOVERNMENT POLICIES"

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Abstract

New Zealand's two new glamour livestock industries, deer and goats, have demonstrated many of the classic characteristics of a new product cycle. These characteristics are the pre-condition stage, disequilibrium phase and maturity.

The preconditions of economic incentives and institutional environment can be referred to as the necessary conditions. These are the property rights, technological sophistication, institutional and social constraints, market structures, biological considerations and Government policies.

The disequilibrium or expansion phase is characterised by excess demand for breeding stock. The important feature of this phase is high values associated with this excess demand, and breeding stock values above so-called productive values.

Finally, for the new industry to continue, there must be a viable sustained demand for the end product. This can be referred to as the sufficient conditions. When and at what level this equilibrium is reached is unknown during the early stages.

Relevant policy questions addressed are the linkages between the three phases, and importantly, the impact of Government policies upon the development and growth of new livestock industries. Special attention is paid to the impacts of the new livestock industries. Special attention is paid to the impacts of the new livestock taxation scheme. This scheme was introduced as part of an overall taxation neutrality objective. The dramatic decline in livestock values following both the announcement and introduction of this tax allows us to put forward a hypothesis. The hypothesis tested was that previous taxation policies had a considerable influence upon disequilibrium livestock values.

This paper represents the views of the authors, and not necessarily those of the New Zealand Ministry of Agriculture and Fisheries. The authors acknowledge helpful suggestions from Professor Lovell Jarvis, Davis, and the gem of the property rights concept from discussions with Professor Don Jamieson, Fort Collins, Colorado.

1 Introduction

A feature of New Zealand's recent pastoral agriculture has been the rise of deer and goat farming as important new domestic livestock industries. Both industries were built up from feral stocks which were being actively eradicated as "pests" during the early development stages of the industries, and both grew in response to economic stimulus. This economic stimulus has been driven by medium to long term "market led" prospects. The result was excess demand for livestock during the development phases of the industries with consequential disequilibrium livestock values. Recently, livestock values have stabilised nearer possible long term equilibrium values. Both herds continue to grow.

Thus, both deer and goats exhibited many of the classic characteristics of a new product cycle. A feature of the cycle is the development phase, with livestock values being driven up by new entrants endeavouring to capture future expected rents. Once those expectations were dampened, livestock values become more closely aligned to so-called "productive values". This equilibrium has occurred much sooner than many observers had predicted, resulting in an early dissapation of rents and resultant financial trauma to many investors.

The new product cycle theory suggests emerging livestock industries pass through three distinct phases. Firstly, the preconditions of economic incentives and the favourable institutional environment must exist. Secondly, the expansion phase - fuelled by a disequilibrium market for breeding livestock, possibly accentuated by government policy. Finally, an equilibrium is reached. Equilibrium will be sustained only if economic prospects for the industry are justified by market realities.

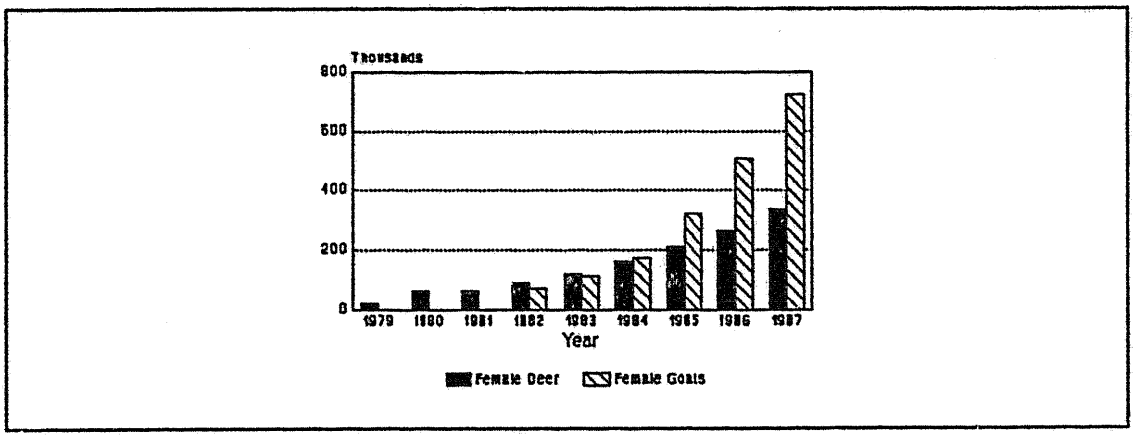
Relevant questions to be examined are the circumstances leading to the establishment of these new livestock industries and the policy requirements needed to continue and maintain the industries once established. This examination is formulated in terms of necessary and sufficient conditions. The necessary conditions are the pre-condition and subsequent expansion stages. In order to sustain the growth, long term market lead prospects for the end product must exist. This is the sufficient condition to ensure the industries survive up to and through the maturity phase.

The objectives of the paper are, therefore, to study necessary and sufficient conditions for the establishment of new domestic livestock industries using New Zealand deer and goats as a case study. Of particular interest are the impacts of government policy upon both the development and maturity stages, and the influence that changes to these policies may have had upon the dynamics of the two industries.

2 Background

Commercial deer farming was legalised in 1969, but it wasn't until the early 1980's that the breeding herd reached a size whereby the increase in absolute numbers became important. Excepting for obvious breeding faults no female animals have been culled up to now, and the annual growth of the deer has averaged 26 percent over the past eight years. This indicates the herd has grown (and is still growing) at close to its biological potential. Deer numbers at June 1988 were some 618,000 with over two-thirds of these being hinds (females). Most observers expect numbers to reach one million during the 1991 season (figure 1).

Figure 1: New Zealand Livestock Populations
Deer and Goats



Source: New Zealand Department of Statistics

Commercial goat farming has followed a different path from deer. Periodically the industry has been advocated by enthusiasts as an alternative to traditional livestock, but it was only in the 1980's that renewed interest in alternative livestock products provided the catalyst for a rapid expansion of the herd. From 1981 to 1987 female domestic goat numbers increased from 52,659 to 725,413 - an almost 14 fold increase in six years. Recent figures show this increase has been sustained, with total goat numbers rising by 25 percent over the previous statistics period to 1,317,000 in June of 1988 (figure 1).

Unlike deer, commercial goat herds have been an historical feature of New Zealand's agriculture, and there was a small commercial base to launch the 1980's expansion from. This base was augmented by the capture of feral animals. These feral animals provided a base to upgrade from, with many of the purebred sire animals being imported. Despite having been in New Zealand since 1773 (introduced by James Cook, the British

"discoverer" of New Zealand), goats have never really been accepted as an important part of the pastoral sector. It remains to be seen as to whether the industry can be sustained.

3 Industry Dynamics

Necessary Conditions

The basic tenet of managerial economics is that producers will react to market signals and pursue an activity if the returns to them are greater than the costs involved in obtaining those returns. These rules apply to a new livestock industry - expansion will take place as long as the individual producer perceives financial remuneration. Costs include the direct costs of enclosure, feeding, maintenance and capital tied up in the enterprise as well as the indirect or opportunity costs of resources. In the case of New Zealand's deer and goat industries, the development capital requirement was substantial.

Necessary conditions are those conditions which must exist before an event can take place, or a set of prerequisites. Embodied in the conditions necessary to induce an expansion of a particular new livestock industry are several issues. These include the following:

(i) Property rights - reflected in the certainty equivalent of the value of both the individual animal and the offspring.

(ii) Technology - reflected via the cost component of inputs and productivity of the animal.

(iii) Institutional and Social constraints - for example, the velvet harvest which is denied to some of New Zealand's competitors.

(iv) Market structure - both for venison and velvet and live progeny in deer and fibres for goats.

(v) Biological considerations - access to a livestock pool with the potential to initiate the industry.

(vi) Government policies - both direct policies such as taxation advantages to encourage investment and access to capital and indirect policies influencing all of the above conditions.

These issues will be discussed and their relevance to the deer and goat industries examined.

3.1 Property Rights

Since the seminal work of Gordon (1954) economists have been familiar with the proposition that free and unconstrained access to a common property resource will result in inefficient use of that resource. This is generally considered to be a "pricing" or market failure whereby the so-called "user-cost" has not been incorporated into the cost of harvest facing the individual. Two distinct but, in many ways similar, methods of overcoming this problem have emerged.

The first is the use of an artificial "cost" in the form of a tax or royalty to the harvester of these resources. The second is to institute a property rights system which induces the individual to follow a more socially optimal use of the resource. This can be achieved in several ways. One is to allocate transferable quotas to the individual. Another is to change the entire pattern of the animal's habitat and ownership rights, as has been done in both deer and goats. Economic incentives to retain these animals is directly related to the degree of certainty that can be placed on ownership.

Property rights to animals were altered dramatically in New Zealand with the passing of the 1977 Wild Animal Control Act. Caughley (1983) considers this Act "arguably the most radical that had ever come before Parliament" (p152). Under its provisions "deer that yesterday belonged to the people were today confiscated without compensation or apology" (Caughley, p152). Ownership passed to the landholder where the deer were found. Although deer farming had started prior to this in New Zealand, the 1977 Act legalised the property rights issues of wild deer ownership. As Demsetz (1967) wrote "....the emergence of property rights takes place in response to the desires of interacting persons for adjustment to new benefit-cost possibilities, "(p350). Pressure to introduce this Act came from deer farmers who saw a change in property rights necessary to guarantee ownership of animals and the right to windfall gains from ownership. A similar situation applied to goats, although the deer ownership issue preceded the expansion of the goat herd thus some precedents were established.

3.2 Technology

Technology causes the production function to move outwards, or alternatively, the cost isoquant to shift inwards. This is purely a physical relationship, and is related to economic reality by the Schumpeterian concept of latent and economically feasible technology. Technological change offers another reason for the rapid development of both the deer and goat herds. The use of darkened yards to handle captured deer is an example of disembodied technology, and without this breakthrough, industry persons consider that current techniques in deer farming may not have become viable.

Most management practices are a transfer of existing technology from traditional sheep and cattle farms to the new industries. New Zealand, through its technological lead and climatic advantages, is considered to have a comparative advantage in "traditional" livestock farming, thus the expertise for rapid development of these new industries has been readily available. However, the advent of high wire fences, helicopter live capture methods and veterinary expertise have all contributed to the deer industry, and the use of embryo transplants and a clearly outlined cross-breeding program have been of great value to the goat industry.

The distribution of "rents" gained from technological change is closely linked to the economic incentives and property rights. Early entrants to deer farming and adapters of the new technologies received considerable economic rents. This in turn accentuated the high disequilibrium values of breeding stock as others tried to be "be in on the ground floor".

3.3 Institutional and Social Constraints

An important advantage New Zealand had in deer was the legal harvesting of velvet, creating returns from velvet substantially above the slaughter value of stags during the early years. This had two effects - firstly, a very low venison supply, as few stags were culled, and secondly, the provision of short run returns to finance the expansion of herds. This second effect is, in essence, an endogenous source of funds from the industry as it expands.

In contrast, velvet antler cropping in Britain was made illegal on humanitarian grounds in 1980. Fletcher considered, with respect to velvet cropping, "The ensuring public relations problem could easily have sounded the death knell for a very small and vulnerable new branch of agriculture" (Fletcher, 1982, p50).

Other potential competitors face similar institutional constraints. Potter (1982) estimated that over 10 million people hunt big game in the United States. Much of the satisfaction from hunting is from the experience itself and not the kill, leading to different attitudes towards big game. Elk provide a case in point, with exposure to nature and the opportunity to be outdoors ranking as the two most important satisfactions gained from the hunting experience. This in turn leads to very high economic values being accorded to elk in the wild, thus reducing the economic incentive for domestication of the animal.

3.4 Marketing

These new livestock industries are considered to be "demand led", meaning that the demand for the end product was already established. Demand is generally considered to be a function of several components, including own price, incomes, tastes and

preferences, substitute availability and price and exogenous shocks to the system.

The demand for venison embodies many of these components. Venison markets are associated with high price and high income markets or segments of markets. Similar statements may be made regarding goat fibres. An additional feature for goats has been exogenous shocks to the system influencing "demand" in the form of political problems in South Africa for mohair and a change in the quantity of cashmere being exported from China. The new livestock industries discussed here developed because, inter alia, the marketing institutions existed before production, and this facilitated the growth of both industries. Hence the "led" claims of both industries.

Low financial returns from traditional livestock (sheep and cattle) encouraged diversification, accentuating the excess demand for goats and deer.

3.5 Biological Considerations

Important biological features are access to potential breeding stock from wild or feral herds to initiate the industry and the animals biological capability to reproduce at an economically acceptable rate. It is difficult to envisage a new industry developing which does not meet these conditions. Unless the potential reproduction of animals is relatively high, discounting will remove the economic incentive to increase stocks. Without an acceptable reproductive rate the equilibrium phase would not be viable, and the disequilibrium expansion phase would not taken place.

Relationships between the discount rate, reproductive rate and the animal's value and the precondition phase are, in effect, a corollary of the mathematical proof by Clark (1973) that a high discount rate, low reproductive capability and non-rising valuation of the mammal can lead to its extinction. For the precondition phase, future returns must be greater than present slaughter values, and these future returns are a function of the discount rate, the reproductive capability and expected progeny value.

3.6 Government Policies

During the expansion phase of both industries (late 1970's and early 1980's) an economic climate existed which was designed to stimulate growth in the agricultural sector in general. A subset of the policies were several taxation schemes in place which are likely to have had an impact upon the dynamics of these industries. These included a high marginal tax rate, a livestock standard values scheme, development expenditure write-offs and an offsetting losses provision. Effects of these policies were cumulative, and accentuated by New Zealand not having a capital gains tax and, in many cases, access to cheap loan monies for agricultural development.

Policies changed following the election of the fourth Labour Government in July 1984. As part of an overall economic liberalisation drive a complete revamping of the taxation structure has taken place. The desired intention of these changes have been to neutralise investment opportunities, or, in the vernacular of the day, to create a level playing field.

Firstly, the marginal tax rate at higher incomes has been halved from 66 to 33 cents in the dollar. This has reduced incentives to enter into creative schemes simply to delay, defray or avoid income tax in the short to medium term. Therefore, even had they have stayed in place, many of the other policies would have had less effect. However, investments for development expenditure are losing their tax deductibility over a four year phase-out commencing in 1987/88. Many special depreciation type allowances have been withdrawn and the livestock stardard values scheme altered. These changes have taken place concurrently with a withdrawal of subsidised agricultural credit.

It is the livestock valuation changes which have caused the most trauma to the deer and goat industries. These changes were announced on 12 December 1985 and became law under the Income Tax Amendment Act No 4 1986, coming into effect at the beginning of the 1987 financial year. Any write-up in value of livestock is now treated as taxable income. Partial relief was granted from the initial write-ups from the old low values to the new market related values in the form of a 75 percent of the write-up being exempt from tax.

The deductibility allowances for development are now on a par with the other sectors of the economy. This had particular relevance to deer and goats as there were many new farmers entering the industries, with substantial initial costs incurred in the construction of specialised fencing, handling yards and housing.

4 Sufficient Conditions

It is instructive to examine the sufficient conditions for the industries to become an accepted component of the pastoral livestock sector. Quite simply, the sufficient condition is that market realities for the end product are such that a sustainable industry can exist based upon the economics of that end product.

Exports of feral venison peaked at 4,390 tonnes in 1972 and then began to fall as stocks of feral deer decreased and the opportunity costs of female animals for breeding purposes reduced venison supply. Volumes steadily decreased until 1980, when domestic supplies started to become important. It is interesting that 16 years (and a major growth of the domestic industry) later venison exports are (in 1988) back to the 1972 levels. Throughout this period the real price of venison remained very constant. This tends to indicate a stable

demand. Market returns for the (now) "by product" of velvet have remained relatively high throughout the herd expansion.

The early 1980's interest in goats was accentuated when the fibre processing company Dawsons International moved into Australia and New Zealand promoting the fibre industry by offering medium to long term contracts for fibre. At that time world shortages of cashmere fibre and the recent low point on a 20 year mohair production cycle resulted in good prices for both products. Both products tend to be luxury goods, and as such are subject to the whims of international fashions. However, unlike farmed venison, both fibres are internationally traded products with a history of world production. New Zealand is moving towards meeting some of the shortfall in production which has recently occurred rather than developing a market niche for a new product. Both fibre prices have remained stable over the recent time period.

One exception to this is the cross-breeding of feral goats to develop cashgora. This fibre is obtained from "middle of the road" animals, and New Zealand is one of the few countries producing cashgora. This places New Zealand in a position of comparative advantage should future goat production concentrate on this fibre. It is too early to tell as to the direction the New Zealand goat industry will take with respect to the fibre type. One additional advantage that proponents of goats advocate is their role as a biological weed control agent. Sandrey (1986) discusses this in detail.

In summary, both the venison and goat fibre market appear to be promising for New Zealand. Venison from commercial herds is a relatively new industry supplementing and supplanting a traditional feral and wild product. Cashmere and mohair are internationally traded fibres, and although subject to whims are an accepted luxury fashion fibres. Cashgora appears to be a promising new product. Current indications are that market expectations are being fulfilled, with prices remaining stable throughout the euphoric livestock prices period for both industries. The sufficient conditions, at this stage, appear to have been met for the deer and goat industries in New Zealand.

5 Animal Valuation

5.1 Theoretical

Sandrey and Zwart adapted profit function equations from the Jarvis cattle portfolio model to indicate the economic valuation of a deer hind (female) animal. The first order conditions were shown to be:

$$\tfrac{1}{2}\left[\pi_o(\tau) + P_o(\tau)\right] F(i,\tau) + pw^o + wp^o = rpw + ci \quad (1)$$

where:

π_o (τ)=the value at birth of a male offspring,

P_o (τ)=the value at birth of a female offspring,

F (i,τ)=a probability function reflecting the birth rate and mortality of the female,

p & w = venison prices and weights respectively, with p^o and w^o indicating the changes to each variable,

r = interest rate, and

c and i= unit costs and the vectors of inputs respectively.

Values at birth of both male and female offspring are discounted back to present values.

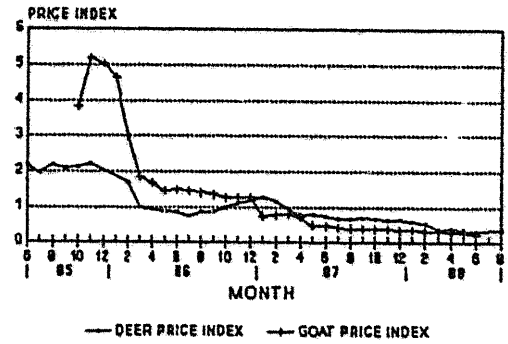
Simplifying assumptions negating the probability of slaughter vis a vis breeding potential enables the pw^o, wp^o and rpw components to drop out of equation 1. As ci includes all opportunity as well as direct costs, equation (1) shows that the value of a female animal is largely a function of future female animals. This highlights the difficulty measuring the future income stream where the value of a female calf is endogenous to such a calculation. Values of male offspring can be (and have been for some time) equated to productive of venison value, thus accentuating the problem of valuation while female prices are in the disequilibrium excess demand situation of herd build-up.

We do not know when an equilibrium will be reached, but we do know that an equilibrium will be reached only if the sufficient conditions are met. At equilibrium the present value of a marginal female (for breeding purposes) will be its slaughter value. Given the uncertainty associated with the time frame in reaching equilibrium, expectations and the appropriate discount rate become the dominating determinants of a female animals valuation during the disequilibrium phase.

5.2 Actual

An index of female prices for both deer and goats are shown in figure 2. Dramatic declines in both cases can be seen in early 1986. Some controversy still exists as to the causes of this decline, but this decline is primarily associated with the announcement of changes to the livestock taxation system.

Figure 2: Female Livestock Prices
New Zealand Deer and Goat Price Trends



Source: New Zealand Deer Report, New Zealand Goat Report

These adjustments to the taxation laws were announced in December of 1985, and by February of 1986 both the New Zealand Goat Price Index and the New Zealand Deer Price Index[1] had fallen substantially from their levels before the announcement of the new tax laws. For goats, the index suggests that the fall was in the order of 64 percent, and for deer 55 percent.

Over a three year period, Angora purebred prices have dropped from some $3,300 (November 85) to $350 in August 1988. The sharemarket value of the newly listed Goat Companies have reflected this decline, and with the added impact of an October 87 sharemarket crash many of these once-glamour companies are in liquidation. Convergence to equilibrium was reached earlier than many observers had predicted (hoped for?), causing financial trauma to many investors.

A related issue is the influence of economic factors upon the dynamics of the herd build-up during the disequilibrium phase. The two industries differ in this respect. High livestock values have had little marginal influence upon the dynamics of deer populations, while in contrast the influence upon the goat herd has been substantial, or even dominant. Technology (and economics) in the form of relatively expensive embryo transplants enabled the goat herd to expand faster, with this growth being accentuated by Australian imports of breeding stock and demand driven increases in the feral herd capture. In contrast, the deer feral herd had been depleted over several years of intensive harvesting, alternative imports (other than superior stags) of breeding animals were not possible and embryo transplants were little more than experimentations. This is essentially a supply issue.

5.3 Impacts of Government Policies

Individual investors have different taxation scenarios. This, coupled with the numerous different paths to approach the investment in the new industries, makes it difficult to analyse a representative investor. We shall eschew an analytical approach, and fall back upon generalities.

Prior to 1987 investors purchasing an animal could write off the difference between purchase price and standard values in the first years. During 1985, rising two year old hinds were changing hands at between three and five thousand dollars (Sandrey 1987), while the standard values were two hundred dollars. Additionally, the marginal tax rates were higher. Thus a considerable potential existed to transfer much of the initial herd development costs to taxpayers. Our best indication of the value of this transfer in the extent of the rapid adjustment to prices which occurred following the announcement of taxation changes. This is assuming investors seek to minimise after-tax liabilities and maximise short to medium term income, and these price falls resulted from investors adjusting to the changes. Other possible factors such as an increased supply of animals entering the market place during that season and constraints upon availibility of funds are ignored.

Most of the deer herd expansion occurred during an inflationary period. The effects of taxation, inflationary expectations and discount rates or the time preference of money combined make it extremely difficult to disentagle the individual effects. Williams (1986) contains a discussion on the effects of taxation and inflation upon an investment decision, and the interested reader is referred to that for an analytical treatment of the issue.

In the absence of emprirical data we can only offer the hypothesis that taxation policies had a considerable influence upon livestock values during the disequilibrium expansion phase of the industry. The problem is, of course, that this merely is a self-fulfilling prophesy, as new investors hope that subsequent entrants to the market will have similar future expectations to themselves. If we accept the above hypothesis, we are still left with the moot point as to whether the livestock industries would have developed in the absence of these taxation advantages. We are unable to proffer an answer to the original question as to the role of government policies as a necessary condition to the establishment of a new domestic livestock industry.

6.0 Conclusions

New Zealand's two new glamour livestock industries, deer and goats, have exhibited many of the classic characteristics of a new product cycle. These characteristics are the precondition stage, the disequilibrium expansion phase and maturity. The preconditons of property rights, technology, institutional and

social constraints, market structures, biological considerations and Government policies are formulated as necessary conditions. The sufficient conditions are that market realities for the end products are such that a sustainable industry can exist based upon the economics of that end product.

Using the Jarvis cattle portfolio model we showed the first order conditions for an animal's valuation. This highlights the role of expectations in the disequilibrium stage, which is charactrised by excess demand for breeding animals.

Circumstantial evidence is used to demonstrate the effects of government policies upon these livestock values. Dramatic declines in livestock prices co-incided with the announcement of changes to the livestock standard values taxation regime. We can only conclude this was not a co-incidence but a causality, and the size of this adjustment to market prices accurately reflected investors benefits of the previous advantages.

In the case of deer and goats, taxation policies were contributing conditions to the establishment of new livestock industries. Now these taxation advantages have been neutralised, the relevant policy questions concern future new domestic livestock industries. Is a taxation concession policy a necessary condition to the establishment of new livestock industries? We suspect not, although it appears to have been a major contributing factor to high disequilibrium livestock prices during the expansion phase of both deer and goats.

The next new livestock industry for New Zealand appears to be alpacas (and llamas). Currently some 1,200 animals (plus 70 offspring born on the way to New Zealand) are in quarantine in Wellington harbour, having been imported from the Chilean Altiplano. Importers of these animals will, no doubt, be anticipating a period of excess demand and high disequilibrium livestock values to obtain economic rents. In contrast to deer, much of that rent may already have been spent in bringing the animals to New Zealand. The necessary conditions of property rights, technology, institutional and social environment, market structures and biological constraints appear to have been met. This new industry has been initiated in a more neutral taxation environment, and by a company whose shareprice is considerably lower than it had earlier been. This adds a little more emphasis to the thesis that taxation advantages may not have been a necessary condition for the take-off phase of a new livestock industry. Only the future will provide final answers to the technological question.

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