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FARMING AT THE EDGE

SEARCHING FOR PRODUCTIVITY AND COMPETITIVE ADVANTAGE ON NEW ZEALAND DAIRY FARMS

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Abstract:
The New Zealand dairy industry is susceptible to volatile international prices, and depends on cost leadership at the farm level to maintain its international competitive advantage. The industry has accepted a target of 4% productivity improvement per annum. However, cost-based benchmarks of productivity are not used widely by farmers. It is argued that at the farm level, overall gains in resource efficiency need to be assessed in terms of cost per unit of output, and that these benchmarks need to be calculated in both cash and economic terms. These output-based cost benchmarks are tools both for assessing alternative

Introduction

The dairy industry contributes more than 20% of New Zealand's export income and is arguably New Zealand's most important industry. Despite a considerable emphasis on value adding, most of New Zealand's dairy products are still sold in international commodity markets that are highly volatile. The volatility of prices received by farmers is further increased by a freely floating market-determined foreign exchange system. In addition, there has been a long term trend over the last 25 years for real milk prices at farm gate to decline by between one and two percent per annum, although this trend has been less clear for the period since 1990 than prior to that time. Since 1990 the dominant price feature has been volatility. Despite the apparently difficult economic environment, the New Zealand dairy industry has continued to expand, and total milk production increased 94% between 1990 and 2002 (LIC 2002).

The volatility of prices is illustrated by the annual range of product prices received throughout the 12 year period up to 2002. In inflation adjusted terms (2002 values), milk payments ranged from a low of $NZ2.96 to a high of $NZ5.35 per kg milk solids (LIC 2002). In 2002/2003 the final payment is estimated to be only $NZ3.60 for farmers supplying Fonterra, which is the major co-operative. Currently, most New Zealand dairy farmers are budgeting on expected long term prices of about $NZ3.60 to $4.00 per kg milks solids. These 'milk solids' on which farmers are paid comprise the fat and protein component of the milk but exclude other solids such as minerals and lactose. In broad terms, a price of $NZ4 per kg milk solids equates to about 19c US per litre of milk at exchange rates applying in the first half of 2003.

A key to prosperity within the New Zealand dairy industry is the capacity of dairy farmers to produce milk at a total cost less than the milk price. Given the likelihood of an ongoing trend for output prices to decline, and the certainty of price volatility,

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farmers need to be striving for productivity improvements. In this paper we address some of the issues of how farmers can assess whether they are making productivity improvements in an industry where competitive advantage is built on cost leadership.

Farming Systems and Productivity

The farming systems that have developed in the New Zealand environment are pastoral based. Dairy production is seasonal, with most farmers calving all of their cows in late winter and early spring, and drying off the total herd late the following autumn. Dairy farms are typically large (the average herd size is about 270 cows and trending upwards) with an increasing number of large herds between 600 and 3000 cows. Labour productivity is also high, with a typical farm carrying about one labour unit for about every 150 cows. However, milk production per cow is typically low by international standards at about 3800 litres per cow.

This particular configuration of inputs and outputs has become accepted as the most appropriate system given the relative costs of the various inputs and the milk output. However, there is concern within the industry that New Zealand's position of cost leadership is open to challenge from industries in other countries. This concern is increased because the late 1990s and then through to mid 2002 were, in general, favourable years in which farmers could prosper due to benevolent external conditions without having to improve on-farm efficiency. However, these conditions are not necessarily typical of the longer term situation, as evidenced by the substantial decline in product prices in 2002/2003. The perceived need for ongoing productivity improvements in farm efficiency has led to a target set by Dexcel (the farmer-owned research, extension and education arm of the industry) that farmers, and hence the industry, should be aiming for a 4% productivity gain per year. (Dexcel 2001, Dexcel 2003)

The concept of what is meant by an increase in total productivity of 4% per annum is not well understood within the industry. Often, it is misunderstood as meaning total growth of 4% in output, or 4% growth in output relative to a particular input (such as land or labour). In essence, an increase of 4% in total productivity means the ability to not only produce 4% more milk per year, but to do so without using any more resources. Alternatively, it could be achieved by maintaining milk production but doing so with 4% less total resources of land, labour and capital. Clearly this is a very daunting task, and considerably greater than historical long term estimates of agricultural productivity increases of well under 2% per annum (Forbes and Johnson 2001).

Initially Dexcel attempted to measure productivity as the *value* of outputs divided by the *cost* of inputs (Dexcel 2001). Applying this approach to the industry data of the previous 15 years led to two conclusions, both apparently distressing. The first was that in all years the cost of inputs exceeded the value of outputs. The second was that the total productivity of dairy farms was lower in 2000 than in 1986.

The first conclusion stemmed from particular assumptions as to the cost of capital. This issue will be taken up later in this paper. The second issue stemmed from failing to separate out the issue of volatile and generally declining terms of trade from the separate issue of resource productivity. To illustrate with a simplistic example, if farmers maintained milk production, and did so with the same area of land and the same inputs of capital, but with less labour, then there would be an overall

improvement in total productivity. But if there were a concurrent drop in milk prices, then the ratio of outputs to inputs, measured in dollar terms, could well decline.

Subsequently, Dexcel has reworked the productivity calculations, using a methodology consistent with that used by ABARE for the Australian dairy industry. Based on survey data from more than 200 owner-operated farms, and after removing price fluctuations in outputs and inputs, they have concluded that total productivity on owner operated farms increased at 1.4% per annum throughout the 1990s (Dexcel 2003).

The methodology used by Dexcel for the total productivity calculations is based on aggregate data and can not be readily applied at the individual farm level by farmers. This leads directly to the question as to how should individual farmers assess whether or not they are improving the efficiency of their business. What are the farm management principles that farmers and their farm management advisers should be using to guide the design of their farming systems, and to monitor the efficiency of their operations? It is these issues that are addressed in the remainder of this paper.

Cost Leadership and Profit Maximisation: Are they in Conflict

Farm management thinking in New Zealand and in many other countries has been heavily influenced by production economics principles and marginal analysis. Many farm management graduates owe an intellectual debt to the work of the late Earl Heady from Iowa State University, although it is many years since students were exposed directly to his 'blue brick' (Heady 1952). At a practical level, a lot of farm management analyses are still built around the partial budget and the marginality concept. Those with a more formal background in production economics can readily demonstrate how minimising costs per unit of output (in this case milk) typically leads to lower output and lower profit than operating at the point where marginal revenue equals marginal cost.

But there are some important assumptions that belong to this simple production economics framework. One is that the analysis is essentially static. This means that the issue of volatile prices and the response time that is required to adjust the farming system are assumed away. There is also the assumption that some resources are fixed (typically land) and that others are variable. This is undoubtedly true in the short run, but there has been a long term trend for dairy farm size in New Zealand to increase, suggesting that land is indeed a variable resource when considered within the strategic planning horizon. And profit maximisation is surely too simple a goal. Perhaps it is more realistic to consider a goal of surviving the bad times so as to remain in business to reap the rewards when the business environment is in a more benevolent phase. If any of these arguments are accepted, then minimising costs per unit of output becomes an attractive strategy.

The concept of cost leadership as a business strategy has come out of the general management literature rather than from the economics discipline. Within the field of strategic management it is widely held that a business can build a competitive advantage through one of three strategies. The first is by product differentiation, the second is by cost leadership, and the third is through focusing on a niche market (Porter 1985). In the case of dairy production, individual New Zealand dairy farm businesses have minimal options to differentiate their product from that of other dairy farmers, (although the marketing co-operatives have opportunities to do so post farm gate through development of branded products). Also, the scale of production is such that the industry relies heavily on commodity markets that are certainly not niche markets. Accordingly, at the level of the farm, maintaining a competitive advantage relies on cost leadership.

Observation of farm business behaviour provides some complex evidence as to the extent to which farmers adjust their level of inputs in response to changing product prices. Dexcel data shows that farmers do spend more money on inputs when product prices are high, but this appears to be related more to the availability of cash (from income) rather than seeking out the elusive and ever changing point of profit maximisation where marginal revenue equals marginal cost. For example, dairy farmers consider, with considerable justification, that investing money in phosphate fertiliser is somewhat like investing money in the bank, with the added advantage that it is tax effective. And so they vary their investment in fertiliser not because they are trying to adapt to an expected change in milk price, but as a response to changes in income. We contend, therefore, that expenditure is at least as much a function of current income as expected prices.

Within the dairy industry, business consultants place considerable emphasis on the concept of economic farm surplus (EFS) as a means of benchmarking farm performance. In essence, the economic farm surplus is obtained by adjusting cash farm surplus to include a deduction for depreciation, by removing any debt servicing expenditure, and by adjusting for changes in livestock numbers. An imputed allowance is also made for family labour. The resultant EFS is typically expressed on a per hectare basis. The EFS acts as a measure of economic profit.

There are two major difficulties with EFS as an efficiency benchmark within New Zealand dairying. The first is that EFS varies considerably between regions depending on soil type and climate. The second is that any changes in EFS tend to reflect changing prices for milk solids rather than underlying changes in efficiency. There is simply too much noise in the system to get a reliable picture from EFS calculations as to what is happening to productivity. However, EFS does provide a basis for comparing similar farms in the same season.

Farmers intuitively recognise the problems with EFS and it is probably for this reason, and also for simplicity, that farmers often make benchmark comparisons based on production per hectare and per cow. But once again there are multiple problems. If it were simply a case of more production per cow being better, then this could be easily achieved by changed feeding strategies. After all, the genetics of the New Zealand industry are heavily influenced by European and North American genetics, and there is no doubt that average yields per cow could be greatly increased. What is also recognised, however, is that such a farming system would be uneconomic. Similarly, there is considerable data that maximising milk solids production per hectare is not a sensible strategy (Penno 1998).

This brings us to a remarkable conclusion. The New Zealand dairy industry owes its international position to one of cost leadership, and this has been achieved by the development of farming systems that are successful within the particular constraints of the New Zealand physical and economic environment. But much of the business analyses undertaken by agricultural economists and the farm management profession have slipped behind, largely through focusing on inappropriate benchmarks

It is our contention that the farm management professionals need to focus much more on cost of production per unit of output. We argue that this is the best way for individual farmers to monitor the productivity of resource use, and hence business efficiency, in an industry where product prices are volatile.

Measuring Costs per Unit of Output.

The dairy industry in New Zealand is essentially a one-product enterprise, with more than 90% of income coming from milk products and less than 10% coming from livestock. This greatly simplifies the problems of product costing because there are minimal costing allocations that need to be made between enterprises on the same farm. The situation is therefore much simpler than on either a New Zealand sheep and beef farm, or on a New Zealand mixed cropping farm.

Nevertheless, there are still considerable challenges. First, there is a need to distinguish between cash costs and economic costs. But this is quite surmountable, and is already done for the EFS calculations. A benchmark of cash cost per unit of output is easy to calculate and is useful for addressing questions related to liquidity. It provides an estimate of the survivability of the farm when times are tough, and can be used to indicate the output price at which a farm business will be unable to meet its financial commitments. In contrast, a benchmark of the economic cost per unit of output is useful for assessing the merit of alternative systems, and for assessing whether a business is making productivity gains. It needs to take account of both economic depreciation and unpaid labour. It also needs to remove interest and debt repayment, but to include an imputed cost of total capital employed.

There is a substantial challenge associated with the imputation of the cost of capital for the economic cost benchmark. The traditional approach in costing exercises has been to use a bank rate of interest on total farm capital. In the current New Zealand economic climate, this would be about 7% per annum, but for much of the last decade would have been much higher than this. The problem with this approach is that dairy farm investments are not comparable to investing money in a bank. Money invested in a dairy farm is, to a significant extent, inflation protected through capital gain in land prices, whereas there is no inflation protection for money invested in a bank. Accordingly, we suggest that a much better comparison is the dividend yield on a portfolio of quality shares. In the New Zealand context, a current rate, adjusted to a pre-tax basis, would be about 4%.

Given the 'chicken and egg' conundrum of 'what determines what', there may also be an argument for two economic cost of production benchmarks, one with a cost of capital element included and the other without this element. The two benchmarks may give different but complementary insights.

There will always be practical issues associated with any farm benchmark calculations. Benchmarking based on cost of output rather than profits per unit of input (such as land) removes the noise from the system that is caused by fluctuating product prices. It is also a much more useful approach for comparing farms in different regions. But it does not remove the noise in the data from events such as drought, nor does it remove distortion problems associated with farmers increasing farm inputs as a tax efficient investment strategy when their incomes are high. Further, there may be occasions when wealth creation goals associated with capital gain on land may lead farmers along other paths than cost leadership. These remain as problems of any benchmark that is a function of output, regardless of whether it is cost or profit based. Accordingly, cost of output benchmarks must be used with discretion.

Concluding Thoughts

Our contention in this paper is that in an industry that relies on cost leadership, and where product prices are volatile and determined by market forces, farm management benchmarks are more useful if they are calculated as cost per unit of output

rather than returns per unit of input. We have chosen the New Zealand dairy industry as our example, but the principle applies to any industry that is based around cost leadership principles.

Although some New Zealand dairy farmers do benchmark their cost of production per unit of output, it is not the norm. We find it ironic that the New Zealand dairy industry has achieved a position of international cost leadership but that farm economists and farm management analysts do not have an accepted set of cost of production benchmarks. Remedying this situation would seem a worthwhile challenge for the farm management profession.

One particular challenge in New Zealand will be changing the mindset that associates a drive for low cost of production per unit of output with low input systems. Our own empirical analyses suggest that a low total cost of production per unit of output is often associated with high inputs of fertiliser per unit of land. We suspect, but as yet need more evidence, that there are some other interesting relationships such as this to be teased out. It is important that the benchmarks are not confused with farming systems. Rather, they are the tools of analysis to help determine which farming systems are cost efficient.

Finally, in arguing for cost of production benchmarks, some readers may hear echoes of a distant past when farm economists used to calculate cost of production as a basis for price negotiations in regulated markets. In many countries we are told this still occurs. In New Zealand this is not the case and our suggestions have nothing to do with regulated markets. Our arguments relate to the ongoing need in deregulated markets for individual farmers and their consultants to be assessing alternatives and monitoring progress.

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