Organic dairy farming: cost of production and profitability

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Abstract. Organic milk production in the European Union (EU) costs more than conventional production and therefore requires a price premium (15-25%) and an increase in direct payments to ensure the same level of profitability. In European comparisons, milk yields per cow are lower (9-30%) and stocking rates are also 20-40% lower due to lower yields in forage production. The International Farm Comparison Network (IFCN 2003), comparison between organic and non-organic farms in the EU calculated 22-37% higher costs of production. Similarly the cost increase measured in California ranged from 13-23% for organic versus conventional milk production. However comparisons between low producing and low cost systems as described by MafPolicy (2002), and for the Argentinean farms compared by IFCN (2003), suggested a minimal increase of 3% in costs.

This paper compares the cost of production and profitability of organic and conventional dairy farming over the first three years of a Massey University system comparison trial. The difference between these pastoral farming systems was predicted to be less than that noted in the more intensive EU and US dairy farming systems as minimal changes are required to achieve organic certification. Recognising that the organic farm has only just achieved certification and has not yet reached its steady-state, the results highlight the vulnerability of both pastoral systems to climatic variability and identify the additional risks of organic dairy systems.

Keywords: production costs, organic dairy farming, farm business management

Introduction

The food industry has been evolving into an array of niche markets with consumers demanding healthy, nutritional and convenient food products. Organics is one of these niche markets offering perceived benefits over undifferentiated commodity goods. Global markets in organics are expanding by an estimated 20% per year, with the organic dairy product growth in the European market in 2001 estimated at 26% (Hallam 2002). Dairy has been one of the fastest growing segments of the organic foods industry in the US (from 1997-2001) with milk cows now accounting for over half of all certified animals (Greene 2002). The organic sector is principally located in the developed countries, with the EU and the US being the main markets. Countries such as Austria, Denmark, the Netherlands and Switzerland now have well-established organic markets but growth is slow, static or declining. When supply exceeds demand in those countries, the organic product is sold as a non-organic product (Nieberg 2004)

Prior to such recent expansion, the motivation for adopting organic practices was farmer concern about risk to their health and the environment from current conventional practices. In the '90s consumer awareness about such risks also increased, with much of the growth being motivated by fears of food safety. This resulted in an increased consumer demand for organic products. With demand growing at a faster rate than supply, higher prices have been obtained for organic products. The third motivation to convert to organics was, therefore, the financial one of government support and price premiums (in Europe, the government policy has been to support organics) (Table 1 - Appendix). Organic foods typically command a price premium over conventionally produced foods as a result of higher production and distribution costs and as a result of demand exceeding supply (Hallam 2002). Government policy supporting organics through direct payments to farmers in order to assist them both through and after conversion to organics is quite significant in the EU (Neiberg & Offerman 2002). Similarly in the US some states are subsidising conversions to organic systems, funding for multidisciplinary organic research trials has increased in recent years and federal intervention has included assistance with the costs of certification and market facilitation (Greene 2002).

The goal of most European countries is to increase their area of organic production, even in those countries with static growth in demand (Neiberg 2004)

Price premiums observed by Hallam (2002) in the EU market are higher for fruit and vegetables (20-40%), poultry (50%) and eggs and pork (100%) than for meat and dairy products (20-30%). Nieberg & Offerman (2002) also note a similar relationship between products and price premiums, with the farmer of organically produced milk receiving an 8-36% premium over conventional milk and organic wheat growers receiving 50-200% higher prices.

The ability of price premiums and government support payments to counter increased costs of production on EU farms is illustrated in Figure 1 - Appendix. While the arable farmers achieve quite significant improvements in profit, the dairy farmers on average achieve similar or slightly better profitability than their conventional peers.

Successful organic dairying requires exceptional proactive management ability and good record keeping skills; as with many niche markets, it is not necessarily an easy option. Like in all management systems, a range of skill levels have been observed on organic farms in the EU. It is useful to keep this range in mind when determining cost of production and return figures for an 'average' farm.

Cost of production

Cost of production is the sum of both cash and non-cash expenses and includes both operational costs that occur irrespective of how the business is funded or owned, and funding costs reflecting business ownership and financing. The difference between the cost of production and returns is termed the entrepreneur's profit (IFCN 2002) and is akin to achieving a positive Economic Value Added (EVA©) for the business. The greater the entrepreneur's profit, the stronger the business is positioned for future growth and wealth creation. It also provides the business with a risk 'buffer' against adverse climate or markets.

While costs are often expressed on a per enterprise, per hectare or per stock unit basis, the most relevant measure is cost per unit of output, as this can be readily compared against the returns per unit of output to determine the entrepreneur's profit. Factors such as stocking rates, milk production per cow, replacement rates, variable and fixed costs and net income from livestock all impact on cost calculations. Buron de Machado (2004) found when analysing four years of the Dexcel Profit Watch database, that cost of capital and milksolid production per hectare were the two variables with the greatest impact on cost per kilogramme of milk-solids, irrespective of the size of the farm and its feed policy.

As with all financial measures, the cost of production should not be viewed in isolation. The obvious benefit for a large farm from economies of scale is a lower per unit cost of production, but the profitability measures such as return on assets and EFS/ha need also to reflect advantages of scale (Shadbolt 2004). Achieving the lowest cost of production may not result in the optimum profit level for that business; the level at which a business sets its costs is a reflection of the ability of the farmer to both manage risk and production efficiency.

Operating costs are a combination of the cash expenses incurred (Farm Working Expenses - FWE) and non-cash expenses. The non-cash expenses account for changes in the amount of input inventory on hand at year-end (e.g. chemicals, feed supplement), the annual allocation of capital costs through depreciation charges, and the inputs that have not been paid for such as family labour and management.

Funding costs are the cost to the business from meeting the requirements of the providers of capital. Funding costs reflect the fact that capital employed by the business can be owned or leased and that the capital that is owned, the assets of the business, can be funded by the bank (or by family loans) as debt, or by the owner as equity. Leased capital usually incurs an annual lease or rent, similarly debt requires interest to be paid (Figure 2 - Appendix).

The cost of equity is owner specific, reflecting the opportunity cost of their money, attitude to risk, lifestyle expectations, capital gain expectations, the stage in the lifecycle of the business, and the family, including their desire to invest in a farm in addition to non-financial reasons (e.g. being self-employed, security, quality of life, fulfilling a dream…). Therefore, calculating a cost of equity can be quite difficult.

The cost of milk production is a net cost, that is, the total costs of the dairy enterprise (operating costs and funding costs) less the returns from non-milk returns. The non-milk returns include cull cows, calves and, in some countries, government payments.

In Figure 3 - Appendix, based on a sample of non-organic farms reported in the IFCN Report (2003), it can be seen that for some countries the milk price is greater than both the cash costs net of non-milk returns and the calculated opportunity cost of owned land, non-land equity and family labour. These farms can be said to be generating an entrepreneur's profit for their business. The remainder are able to cover their cash costs with the price they receive, but are not able to cover their opportunity costs, an unsustainable, uneconomic situation. The countries in the graph from left to right are (East) Germany, The Netherlands, Denmark, India, Argentina, Brazil, the U.S. and New Zealand, and the number of cows on each farm is noted on each country's abbreviated name, e.g., NZ 447, a farm with 447 cows.

The cost of organic dairying

Organic milk production in the EU costs more than conventional production and therefore requires a price premium to ensure the same level of profitability. In European comparisons (Nieberg and Offerman 2002; IFCN 2003) milk yields per cow are lower (9-30%) and stocking rates are also lower (20-40%) due to lower yields in forage production. In a high fixed cost system, the cost of production ($ per kg milk) is very dependent on milk yield, the lower the yield the higher the cost.

The IFCN (2003) comparison between organic and non-organic farms in the EU calculated 22-37% higher costs of production using full economic costing methods as described above. In Argentina, where the two production systems are similar, the smaller the difference of 11% in costs of production was mainly the result of the cost of organic certification. In Argentina the price premium is just 3% so it is not feasible to increase costs under organic dairying. In the EU the higher costs of production are met by price premiums of 15-25% on milk, 20-46% on beef and 100-200% on direct payments.

Converting to organic dairying in California, where they rely on mostly purchased feeds and grow little of their own, requires a long-term commitment (Butler 2002). Butler (2002) proposed that with anticipated lower production per cow, organic feed costing 25-50% more than conventional feed, herd replacement costs being 10-20% higher, and operating costs up 12% (including annual certification costs of $2000-3500) the overall effect would be 15-20% higher costs on an organic dairy relative to a conventional dairy. His research with case study farms indicated that feed costs were not significantly higher as farmers limited the amount of expensive purchased feed and made better use of pasture, operating costs also did not differ, and herd replacement costs were 30% higher on a unit of milk basis. The costs included in his analysis are incomplete as full funding costs are not included (no value for family labour and we do not know the value of cow and calf sales). However on the basis of his results and after removing the interest, tax and insurance figures that were identified as being anomalous, the difference between the costs he presented for organic and conventional case study farms was 13% per unit of milk. This is lower than the state-wide costs of organic milk production which he states is 23% higher per unit of milk than conventional milk production. Although these farms receive a higher price for their milk (21% net of marketing costs) their net farm income is 84% of their conventional peers on a per-unit of milk basis.

Conversely a three-year study in Canada comparing technical and economic performance of organic and conventional dairy farming found superior technical performance on the conventional farms in terms of milk yield, whilst economic performance was better on the organic farms, although revenues were lower (Stonehouse, Clark & Ogini 2001).

Another aspect to consider when comparing organic with conventional systems is how long the organic system has been converted from the conventional. Kim (2004) recommends that a long-term approach is taken with such system comparisons as it takes time for the changing biological and ecological processes and interactions to both be understood and to take effect. His research, with organic rice production stated that it took 5 years before environmentally friendly systems generated more revenue than conventional systems.

This recommendation is reinforced by results from a study in Italy in which an integrated economic and environmental accounting framework was applied to three case study farms to assess the sustainability of organic, integrated and conventional farming systems (Pacini et al. 2001). The organic farming system performed better than the other two on most environmental indicators, and in a steady-state performed better financially than the conventional system (due mainly to better market prices for its products). However the study found that systems in conversion experienced serious financial difficulties that were not addressed by support payments at that time. Improved returns have therefore been recorded for organic farms, but the length of time between being conventional and benefiting from being organic could be a deterrent to those considering converting.

The approach taken by MafPolicy (2002) was to develop a view of what a steady-state organic operation would be like and do the cost comparisons based on that view. This approach was driven as much by the lack of organic farms to analyse, as by the hope that such an approach would enable a model to be built of what could be achieved, by as wide a group of interested people (organic and conventional farmers, scientists, consultants and policy makers) as possible. The result was an organic dairy farm that replaced nitrogen enhanced grass growth with maize silage grown on farm, a strategy that they acknowledge some organic farmers may be reluctant to pursue. The farm reared fewer replacements (19% against 22%), ran them on-farm and reduced the number of cows milked by 7.4%. Based on this strategy the farm required a price premium of less than 3% to return the same cash surplus as the conventional model at that time. No allowance was made, however, for the costs associated with feeding out maize silage.

The conventional model used for comparison grew no maize silage, made grass silage and hay, and applied just 65kg N/ha in the winter and spring. Today a typical farm in that area (IFCN 2003, ProfitWatch 2003) would apply twice that amount of nitrogen, would purchase or grow maize silage and be producing another 120kg of milk-solids per hectare. In comparison with this revised base, the organic farm as described in the MafPolicy report, would require a 10% higher milk price to achieve the same cash surplus.

A recent survey of organic dairy farmers in NZ (Shadbolt & Evans, pers. comm.) identifies that, from a limited sample (6 farmers), a reduction in stocking rate of 13-20% had occurred on those farms once fully converted. The farms analysed had been organic from 6-25 years. There also had been no significant change in feed supplement provided, there were no farms that had gone from grass and hay supplement to maize, although some had continued with their existing maize policy. One of the common issues identified by these farmers was the inability to source organic feed off-farm, hence the requirement, as presumed in the MafPolicy study, that feed be sourced on-farm. For these farmers in the absence of maize silage, this resulted in a drop in numbers. Both the much greater drop in stocking rate and the absence of a significant shift in feed policy are in contrast to the assumptions made in the MafPolicy study.

If we impose the changes that occurred on these survey farms on the current conventional farm model (IFCN 2003, ProfitWatch 2003) for the Waikato as described above, the increase in actual milk price required to offset their reduced milk production is 17% to achieve the same cash surplus.

Massey University organic/conventional comparison trial

In 2001, Massey University set up its Dairy Cattle Research Unit (DCRU) as a system comparison between organic and conventional farming. It is unique because it is the only comparative grassland-based open grazing dairy study in the world. The DCRU began its organic conversion period on 1 August 2001, at which time the unit was split into two similar farms, one conventionally managed and the other organically managed. On 1 August 2003, the organic farm achieved its full AgriQuality organic certification.

The long-term aim of this research is to better understand organic dairy farming systems by investigating component interactions in these systems, and by determining how impacts and interactions change over time as organic systems mature. Extensive monitoring continues to be carried out on both farms, which forms the basis for a long-term project with the following objectives:

1. develop farm and herd management systems that optimise performance over time;
2. compare the impacts of organically and conventionally managed dairy systems on:
   a) soil health (quality, flora and fauna) & water quality,
   b) pasture and forage crop productivity (quantity and quality), and
   c) animal production and health;
3. identify practices that improve the biological activity of soils;
4. develop pasture management practices for organic dairy pastures that optimize clover content and best maintain biological N fixation;
5. determine the stability and sustainability of high biodiversity organic dairy pastures including the control of weeds; and
6. develop best management practices for mastitis control and other health issues in organic milk production systems.

This farm was chosen because of its research capability, but its size (41.6 ha running 88 cows) has meant that careful interpretation of results is required before comparisons can be made of economic performance. Average levels of production for smaller farms (47 ha) in the region are 298 kgMS/cow and 839 kgMS/ha (Buron de Machado 2004), which are below the research farm at 410 kgMS/cow and 935 kgMS/ha. It must therefore be clearly understood that this trial has not started from the low-production, low-cost system assumed in the MafPolicy study. On that basis alone, it can be surmised that the difference in cost of production and therefore the price premium required will be greater.

In general, the results of the first two years of the trial showed little difference in productivity, animal health, and soil and herbage quality between the two farms. The conventional and "in conversion" organic farms produced similar amounts of milk-solids per cow and per hectare, and somatic cell counts were low for both herds.

The first year for the two herds (2001-02) had favourable grass growing conditions which, with the lower stocking rates, meant similar quantities of supplement were fed and good production levels were achieved. Milk-solids per hectare were 993 and 959, and per cow were 451 and 436 for the conventional and organic farms respectively. These compare favourably with the district average of 314 kgMS/cow that year (Dairy Monitoring Report, MAFPolicy) and 302 kgMS/cow from small size farms in the region (Table 2 - Appendix).

In year one, breeding, fertiliser, feed, wages and administration costs were slightly higher in the organic unit reflecting both the higher cost of organic inputs and the cost of establishing an organic management plan for certification. These increases combined with 3% less milk resulted in the cost of production per kilogramme of milk being 9% greater. No price premium was available and this was reflected in the reduced return on assets.

The small size conventional farm average data also had a higher cost of production (29%) than the Massey University conventional unit, due to its lower milk production.

There was a drought in the second year of the trial; the impact of the dry conditions in that year was that feed costs were increased significantly on both farms. The decision to provide similar ME intakes to both herds throughout the milking season to maintain target condition scores and predicted production levels meant 20t more feed had to be supplied to the organic cows in that year. The organic feed was also more expensive to purchase. Both herds were dried off in March resulting in lower milk yields (Table 3 - Appendix).

As in year one, breeding, fertiliser, feed, wages and administration costs were all higher in the organic unit. So although milk production per hectare was slightly higher from the organic unit, the cost of production per kilogramme of milk was 19.6% greater than the conventional unit. No price premium was available as the unit was still in conversion to organic production.

Not all farms represented in the small size conventional farm average data were affected by drought conditions. Their production was only 6% less than the previous year, while the Massey University farm was 37% less and 29% less for the conventional and organic units respectively. Their operating expenses reduced by 2%, while the Massey University farm increased operating expenses by 10% and 24% for the conventional and organic units respectively in response to the drought. Their cost of production per kilogramme of milk was, as a result, 11.6% less than the Massey University conventional unit.

The dry year doubled the requirement for feed on the conventional farm and tripled it on the organic farm when the target was to achieve similar feeding levels for the cows and similar levels of production. One of the outcomes of discussions subsequent to that season was to develop systems on the organic unit that provided a better buffer for climatic uncertainty. These include reducing stocking rate by 6%, delaying calving date by a week, developing pasture swards that include species that will produce better at both ends of the season, and developing sources of reliable and lower cost supplement.

By the third year the organic farm had achieved its accreditation status and its milk began to receive the 10% premium from Fonterra. There were excellent grass growing conditions in that year due to consistent rainfall throughout the season. The expectation was that the two units would revert to the production levels of year one and the cost of production difference between them would be about 10%. The outcome however was the conventional unit exceeded its production in year one and produced 19% more than the organic unit (Table 4 - Appendix). This was the result of 15% more milk per cow and a 6% higher stocking rate. The organic unit produced 7% less than year one but still produced 10% more per hectare than the MafPolicy estimate for Manawatu dairy farms in that year.

There were few constraints to grass growth in that year; it is assumed at this stage that it was the conventional farm's ability to apply nitrogen fertiliser throughout the season that enabled them to grow more grass and achieve a higher milk production. As a result of the yield difference, even though the absolute costs of the organic unit were less, the cost of production ($/kgMS) was 16% greater. In comparison with the MafPolicy monitoring farm estimates, for 2003/2004 the return on assets was doubled and nearly tripled by the organic and conventional units respectively, and the conventional farm's cost of production per kilogramme of milk was 35% less (Table 4 – Appendix).

Years two and three of the trial can both be described as quite extreme environmental conditions, one very dry and the other wet throughout the summer. In the first the organic unit was disadvantaged by the high cost of out-sourced organic feed, and in the second it was not able to compete with the nitrogen-induced feed boosts available to the conventional farm.

Although the organic farmlet has achieved full certification, the actual transition from conventional to organic production is continuing, with many of the biological systems taking longer than two years to make the adjustment from conventional management (Dabbert and Madden 1986). Thus, the whole farming system, and resulting profits, is still in transition.

Summary

The Massey University Organic/Conventional Comparative Systems trial to date suggests the ability to return a profit on NZ organic dairy farms will be determined by production levels achieved, prices received, cost of production and the ability to make the transition to organics quickly and manage ongoing environmental uncertainty.

These results are similar to overseas studies, so price premiums are as relevant for pasture based systems as for housed systems with high concentrate use. It should be noted that the Massey University conventional system is highly productive and profitable. If the base conventional system against which comparisons are made is low producing and low cost, as described in the analysis by MafPolicy (2002) and the Argentinian farms compared by IFCN (2003), then the price premium required is significantly reduced as the difference between the two systems is less.

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Appendix

Table 1: Importance of price premiums and support payments for organic farming

Importance of price premia and support payments for profits

Importance of Premium Prices

Country	Share of price premia in profits (%) Arable farms	Dairy Farms
Germany	75	48
Great Britain	40	10-17 (51*)
Denmark		>45

Importance of Support Payments

Country	Share of payments in profits (%)	Average payments EURO/ha
Germany (Ø 1995-99)	26	130
Denmark (Ø 1996-99)	15	123
Austria (1996)	18	218
Switzerland (1996)	24	490

(Source: Neiberg & Offerman 2002)

Table 2: Data from year one of the Massey University trial and Profitwatch data from small size farms

	ProfitWatch	Organic/Conventional Comparison Trial MU	
	01/02 Av.conv.	01/02 Conv.	01/02 Org.
Cows Milked	116	44	44
Eff Dairy Ha	47	20	20
Stocking Rate	2.5	2.2	2.2
kgMS/cow	302	451	436
kgMS/ha	743	993	959
Gross Farm Income $/ha	4430	5247	5173
Operating Expenses $/ha	2758	2875	3102
Operating Profit $/ha	1672	2373	2070
Return on Assets %	6.7%	9.5%	8.3%
Cost of Capital $/ha	1250	1250	1250
Cost of Milk $/ha	3520	3650	3841
Cost of Milk $/kg	4.74	3.68	4.00
Difference %	29%		9%

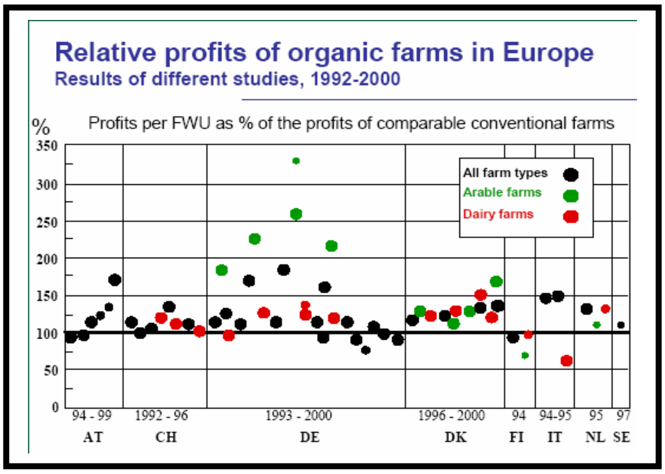
Table 3: Data from year two of the Massey University trial and Profitwatch data from small size farms

	ProfitWatch small farms	Organic/Conventional Comparison Trial MU	
	02/03 Av.conv.	02/03 Conv.	02/03 Org.
Cows Milked	123	49	48
Eff Dairy Ha	48	21.32	20.38
Stocking Rate	2.56	2.30	2.36
kgMS/cow	275	318	317
kgMS/ha	703	722	742
Gross Farm Income $/ha	3268	2860	2858
Operating Expenses $/ha	2695	3178	4061
Operating Profit $/ha	573	-318	-1203
Return on Assets %	2.3%	-1.3%	-4.8%
Cost of Capital $/ha	1250	1250	1250
Cost of Milk $/ha	3586	4428	5311
Cost of Milk $/kg	5.10	5.77	6.90
Difference %	-11.6%		19.6%

Table 4: Data from year three of the Massey University trial and MafPolicy monitoring farm estimates from the Manawatu

	MafPolicy Monitoring 03/04	Organic/Conventional Comparison Trial MU	
		03/04 Conv.	03/04 Org.
Cows Milked	230	51	46
Eff Dairy Ha	90	21.32	20.38
Stocking Rate	2.56	2.39	2.26
kgMS/cow	320	457	410
kgMS/ha	817	1094	925
Gross Farm Income $/ha	3554	4872	4529
Operating Expenses $/ha	2899	3069	3038
Operating Profit $/ha	656	1803	1490
Return on Assets %	2.6%	7%	6%
Cost of Capital $/ha	1250	1250	1250
Cost of Milk $/ha	4149	4319	4288
Cost of Milk $/kg	4.71	3.49	4.06
Difference %	35.0%		16%

Figure 1: Profits of organic farms relative to comparable conventional farms in the EU



(Source Neiberg & Offerman 2002)

Figure 2: The sources and costs of capital

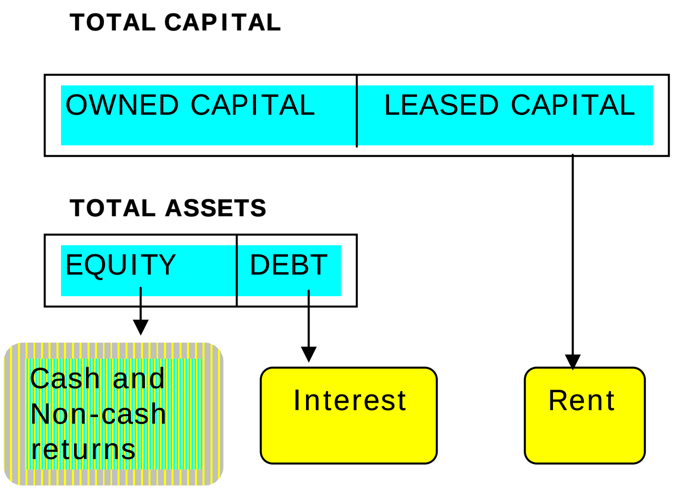
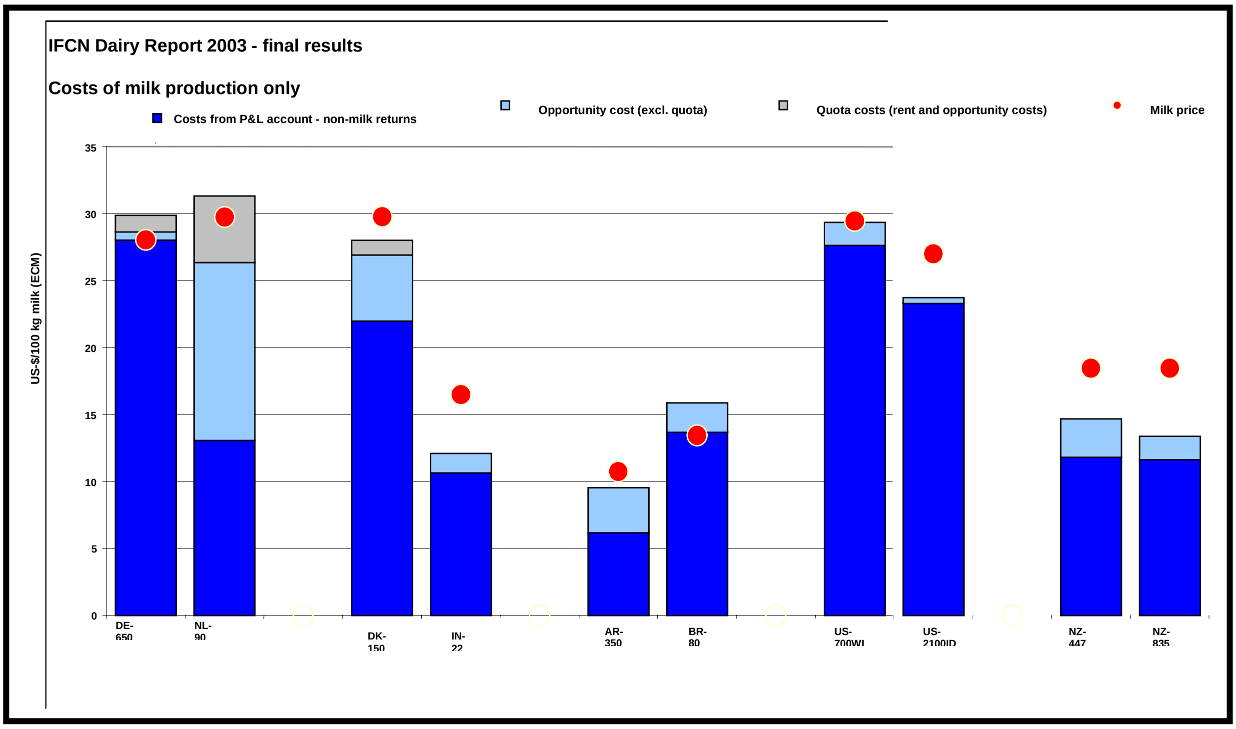


Figure 3: Comparison of cost of milk production in 2002 for 10 countries



Source: IFCN 2003