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Regional dairy production: short-term projections and expected demand for inputs

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Regional dairy production: short-term projections and expected demand for inputs*

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Abstract

Over the period 1991-2003, New Zealand's milk production more than doubled. At the same time, dairy farming expanded its boundaries into non-traditional dairy production regions.

The distribution of regional production is of particular interest because of effects on supply and demand balances for key inputs and outputs. Changes in the geographical distribution of dairy production alter local economic output and, consequently, income distribution and community viability.

The aim of this paper is to present regional short-term estimates of demand for selected key production inputs and milk output. Short-term estimates for milk production and land use were derived based on past growth rates in stocking rate, cow numbers and productivity per cow for each region. Input demand forecasts were, in turn, derived using regional milk production and land use forecasts and baseline estimates of input and energy use reported in Wells (2001).

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Results indicate that by season 2006/07, the effective area devoted to dairy production will be at 1.56 million hectares, a 7% increase with respect to the 2003 baseline. However, contrary to what happened prior to 2003, almost all the gain in dairy area is explained by increases in the South Island. Over the same period, national milk production is expected to increase by 20% to 1,431 million kgs. MS. Similarly, the South Island accounted for much of the gain, increasing its share in total milk production to 34% up from 28% in 2003.

It is expected that the use of inputs such as nitrogen, potassium, phosphorous and sulphur per unit of area will intensify for all dairy regions. However, the increase in the use of inputs per unit of area relative to the baseline is lower in long-established dairy regions, Northland, South Auckland and Taranaki, than in non-traditional dairy regions like, North and South Canterbury, Otago and Southland.

Introduction

"Conversions" from sheep and beef units into dairy were significant in the years that followed the 1984 economic reforms (Jaforullah and Devlin, 1996; Johnston and Frengley, 1994; Sandrey and Scobie, 1994). Prior to deregulation, wool and lamb production enjoyed a higher level of support than other agricultural economic activities thereby encouraging sheep production (Johnston and Frengley, 1994; Morrison et al, 2000).

Johnson (2000) and Johnston and Frengley (1994) pointed out that, following deregulation, sheep production was displaced by dairy and where suitable by forestry.

In the same vein, Ruaniyar and Parker (1999) observed that even in the presence of substantial development costs, the relative stability and steady cash flow of dairy relative to sheep and beef farming promoted conversions.

Yet, problems in the international wool market following the failure of the Australian Wool Board support scheme in 1991 (Johnson, 2000) and the favourable outcome of the GATT/WTO Uruguay Round (Jaforullah and Devlin, 1996) may have played a role too.

Over the period, herd numbers exhibited a small decline from 13.241 in 1991 to 13.140 in 2003. This apparent tranquillity, however, conceals the extent of the internal transformations. Whereas herd numbers in the North Island declined by 13% from 12.5 thousand in 1991 to 10.8 thousand in 2003, the South Island herds increased by more than two fold in absolute terms. As a result, 17% of New Zealand herds are now located in the South Island, compared with only 7% in 1990/91.

Herd numbers in traditional dairy regions like South Auckland, Taranaki and Northland, even though they still account for more than half of New Zealand dairy herds, declined by 20% from 9.4 thousand in 1991 to 7.6 thousand in 2003. On the contrary, regions like North Canterbury and Southland experienced four-fold increases in herd numbers.

New Zealand effective dairy area[1] has increased 59% since 1991, reaching 1.46 million hectares in 2002/03. New area has been incorporated into dairy production in all regions. However, the pattern of dairy expansion has been uneven across regions. Since 1991, new area added to dairy in the non-traditional dairy regions of North and South Canterbury, Otago and Southland, accounted for 45% of the 542 thousand hectares of New Zealand's new dairy area.

Accompanying the geographical expansion in dairy area, cow numbers increased to 3.74 million in 2003 from 2.2 million in 1991, of which 708 thousand were in the North Island and 807 thousand were in the South Island.

National milk production grew at 5.6% per annum, reaching 1,197 million kgs. MS in 2003, up from 571 million kgs. MS in 1991. The South Island contributed 47% to the 625 million kgs. MS output gain.

[1] Effective dairy area refers to the milking platform exclusively; it does not take into account other areas such as run-off. According to SONZAF 2003, page 97, (MAF, 2003) total dairy area was estimated to be at 2.1 million ha. in 2003. Herein effective dairy area is considered, unless otherwise specified.

The long-term trend toward larger units continues. In 2003, an average farm in the South Island had a herd of 422 cows and an area of 164 ha., compared with 170 cows and 84 ha. in 1991. An average farm in the North Island had a herd of 166 cows and a milking platform of 69 ha. in 1991 whereas in 2003 average herd size was 256 cows and average of area 100 ha.

The outcome of the changes outlined above can be summarised by noting that whereas in 1991, the South Island accounted for 8% of total dairy area, 7% of total number of cows and 7% of national milk output; by 2003 the South Island accounted for 25%, 26% and 28% respectively.

The geographical distribution of regional production is of particular interest because of effects on supply and demand balances for key inputs and outputs. Changes in the geographical distribution of dairy production alter local economic output and consequently income distribution and community viability (Roe et al., 2002).

Milk is produced daily and is highly perishable. Its expansion to new areas will therefore modify the utilization of infrastructure (especially road networks).

Abdalla et al. (1995) pointed out that local agro-ecological conditions and current contamination affect the resilience of the environment to cope with additional pollution. Further, some other features of the landscape, like groundwater reserves and lakes, are site-specific. (Abdalla et al., 1995)

Soils, climate and landscape differ across regions influencing, for example, the amount and type of feed grown, the opportunity cost of land and the level of scale economies (Sumner and Wolf, 2002).

Holmes (2003) pointed that pasture production varies substantially across dairy regions causing regional differences in productivity per unit area. Different agronomic conditions imply the use of different types and doses of fertilizer to maintain or increase pasture production. Wells (2001) found statistically significant differences in fertilizer application across New Zealand regions.

Different types of fertilizer are associated with different types of pollution concerns. Thurow and Holt (1997) recognised that in Florida for some counties the major non-point pollution problem was associated with phosphorous runoff in surface water whereas, for others, nitrate leaching into groundwater was the main environmental concern.

Therefore, the expansion of dairy production into new areas and the trend towards larger dairy herds and the consequent increase in manure production and fertilizer use may trigger site-specific environmental problems or may intensify already existing pollution problems.

The aim of this paper is twofold. First, short-term regional forecast for milk production and land use are estimated. Second, regional demand for selected key production inputs are derived using the short-term regional forecasts. In doing so, useful information will be provided which in turn may promote fresh insights into the expansion of the New Zealand dairy industry and associated impact on resource use.

Data and Methods

Regional dairy statistics were taken from various issues of Livestock Improvement Corporation's "Dairy Statistics" for the season 1990/1991 to 2002/2003. The "season" goes from June to May, the "regions" were those used by LIC from 1990, which took into account the new system of local territorial authorities. The analysis was therefore restricted to the period that spans from season 90/91 to season 02/03. In addition, data for season 1991/92 were not reported. As a result, the data set is composed of 12 years of observation for 16 regions. (10 in the North Island and 6 in the South Island)

Prior to the 1990's, the North Island explained more than 90% of herd numbers, cow numbers and hence milk production, most of the geographical changes occurred after 1990.

Production variables used were "stocking rate", "productivity per cow" and "total number of cows" per region. Regional "milk production" was estimated as the product of "total number of cows" times "average milksolids per cow". Similarly, "total dairy area" per region was estimated dividing the "number of cows" by the "stocking rate".

Regional milk output forecasts for season 2006/07 were generated independently for each region as follows. First, regional forecast for season 2006/2007 were calculated for "stocking rate", "productivity per cow" and "total number of cows" assuming two baseline values and two growth rates. In order to minimise the effects of seasonality, average of the last 5 seasons was used as baseline value as well as the last reported value. Two rates of growth for each variable were then used; one includes the whole time series (1990/91 to 2002/03) while the other includes only the last 7 seasons (1996/97 to 2002/03).

As a result, four forecast values for each variable and each region for season 2006/2007 were generated.

Average annual growth rates were estimated by ordinary least squares (OLS) as the trend coefficient from a regression of the natural log of the variable on a constant and linear trend. This procedure uses the whole time series information and is robust against short-term effects of shocks and cycles, as well as minimising problems with measurement errors and some missing data.

Second, regional "milk production" was estimated as the product of "total number of cows" times "average milksolids per cow". The combination of the four forecast values for each variable yields 16 different scenarios for each region. Each scenario renders a different forecast value for the New Zealand milk output. The Situation and Outlook for New Zealand Agriculture and Forestry 2003 (SONZAF) (MAF, 2003) projections for New Zealand's milk output were used to select the most credible ones. The selected scenarios were then averaged and a forecast of milk output for each region was obtained.

Cow numbers were derived as a linear combination weighting each vector of forecast by the frequency of appearances and it probability. In the present case, from the 16 possible scenarios for New Zealand milk output, 11 were selected applying the selection criteria (SONZAF forecast, at 1,400 million kgs MS $\pm$ 10%). It was assumed that each vector has the same probability (1/11); "cow forecast vector 1" appears 4 times, "cow forecast vector 2" appears 3 times, "cow forecast vector 3" appears 4 times and finally, "cow forecast vector 4" does not appear.

Regional forecast for dairy area were obtained by dividing the four vectors of forecast values of cow numbers by the four vectors of forecast values for stocking rate. From the 16 different scenarios, only those in which the associated vector of regional forecast for cow numbers coincided with the selected scenarios for milk output were selected. The scenarios selected were then averaged to get a regional forecast for total effective dairy area.

A weighted average stocking rate for each region was obtained dividing the forecast number of cows (obtained as indicated above) by the forecast for regional effective dairy area.

Wells (2001; Table 4.9, page 55) reported the application of nitrogen, phosphorous, potassium, sulphur and electrical energy intensity (units per hectare) for a group of surveyed farms in the main dairy regions for year 1998/99. As indicated by Wells (2001, page 54) regional samples were not representative and some possible bias may exist. Therefore, regional input use per unit of area in the Wells report was weighted by regional average herd size reported by LIC. This means Wells' figures of input use were multiplied by the ratio (LIC/surveyed farms) of average herd size.

Finally, regional forecasts of milk output and dairy farming area were combined with input indicators to obtain estimates of potential input demand for the main dairy regions for the season 2006/07.

Two approaches were considered, first, a linear relationship between stocking rate and input use, and second a linear relationship between productivity per unit area and input use.

Some of the assumption underlying the forecasts may prove to be audacious, if not bold.

First, international and domestic economic conditions are assumed to remain stable (i.e. like in the past few years) through the period. According to MAF (2001) and SONZAF (2003), world demand for dairy products is expected to rise over the period considered for these projections. Furthermore, it is estimated that New Zealand export volumes and FOB export values will increase by 16% and 37% respectively, compared to 2003.

Second, even though the procedure employed to estimate growth rates for productivity per cow, number of cows and stocking rate is robust in the short term the slope of the regression is not statistically significant for some variables and regions. Linear relationships were assumed for simplicity as the forecast values of the variables and the projections of input use are intended only as rough indicators of the direction of the changes and its relative size. Moreover, the authors recognised the trade off between covering all regions and accurately modelling variables and interactions for each region.

Third, even though it may appear as an over simplification, input forecasts were obtained assuming a linear relation with stocking rate and with productivity per unit area. A linear relationship between stocking rate and input use implies that efficiency in pasture use is optimal at the initial period. It also implies that gains in productivity per cow will not be affected by pasture production. Hence, the increases in input use per area with respect to the initial period will be those necessary to accommodate more cows.

Conversely, the linear relationship between input use and productivity per unit area implies that gains in productivity per unit of area will only be the result of increases in input use. Consequently, the two approaches used to derive the forecast in input use per unit of area may be viewed as an upper and lower limit of the real unknown value. The upper limit corresponds to the approach where productivity per unit area is linearly related to input use, i.e. increases in input use are solely responsible for gains in productivity per unit of area. The lower bound represents the linear relationship between stocking rate and input use, i.e. increases in input use per area are aimed at accommodating more cows.

Finally, the same linear relationship applies to all inputs and it is assumed that no efficiency gains in input use will occur over the period.

Results

Total milk production in New Zealand is forecast to reach 1,431 million kgs. MS in season 2006/07, an increase of 20% with respect to season 2002/03, at 1,197 million kgs. MS. (Table 1) In absolute terms national milk output will increase 235 million kgs MS, of which 65% would be explained by production gains in the South Island, and 35%

in the North Island. As a result, the relative contribution of the South Island to national milk output would be 34%, up from 28% in 2003.

Table 1.- Milk production per region (million kgs. Milksolids)

	Forecast		Range forecast		**Change (%) 2007/2003**
	2006/07	Std. dev.	Max	Min	
Northland	**93**	5	99	86	**9%**
Central Auckland	**44**	4	50	39	**3%**
South Auckland	**356**	20	389	330	**3%**
Bay of Plenty	**61**	3	67	57	**4%**
Central Plateau	**72**	5	79	65	**15%**
Western Uplands	**10**	1	11	9	**34%**
East Cost	**1**	0	2	1	**31%**
Hawkes Bay	**17**	3	21	14	**69%**
Taranaki	**149**	8	161	140	**4%**
Wellington	**66**	3	71	61	**19%**
Wairarapa	**75**	11	85	60	**52%**
Nelson/Marlborough	**30**	2	33	27	**13%**
West Coast	**39**	2	42	36	**23%**
North Canterbury	**146**	17	175	117	**52%**
South Canterbury	**46**	5	53	37	**49%**
Otago	**72**	8	87	59	**43%**
Southland	**155**	19	175	126	**56%**
North Island	**943**	32	996	901	**9%**
South Island	**488**	51	563	402	**46%**
New Zealand	**1,431**	71	1,534	1,309	**20%**

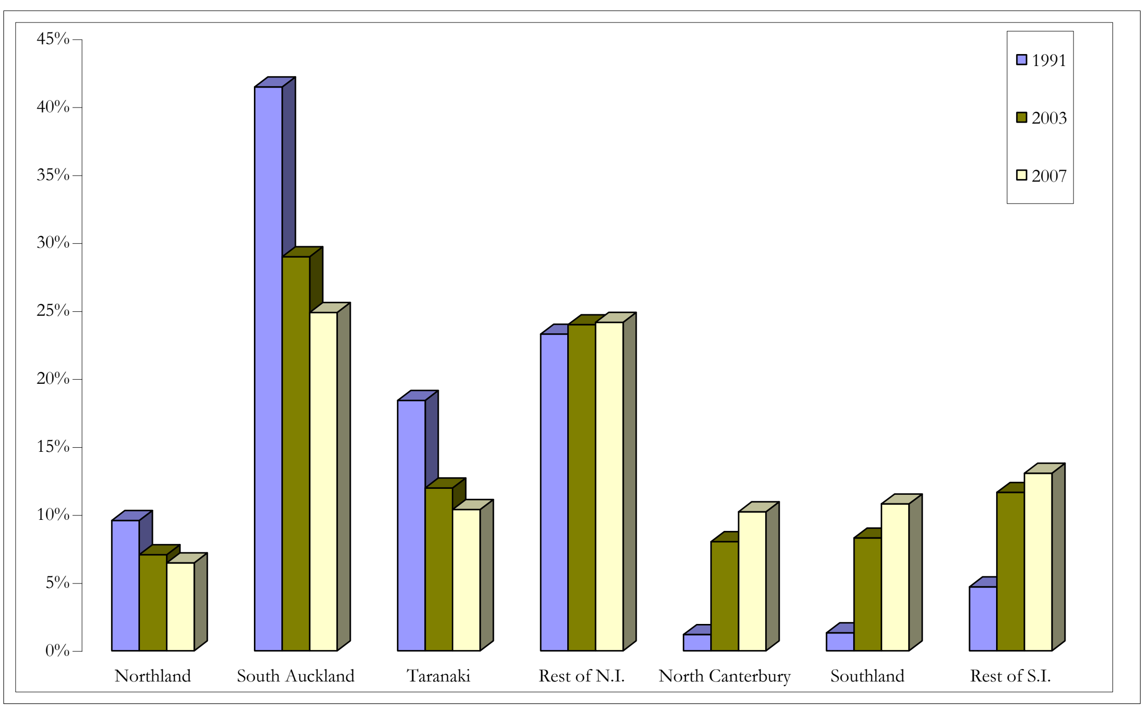
Source: own calculation based on LIC

Long-established dairy regions are forecast to experience moderate production increases (Table 1), whereas production increases in new regions are expected to be much higher. Hawkes Bay and Wairarapa are expected to grow at 13% and 10% per annum, while annual growth rates for North and South Canterbury, Otago and Southland are predicted to range from 9% to 11%. On the contrary, for Northland, South Auckland, Bay of Plenty and Taranaki growth rates are forecast to range from 0.7% per annum in South Auckland to 2.3% per annum in Northland. Consequently, the relative contribution of long-established dairy regions to national output is predicted to decline, meanwhile the forecasted contribution of new regions is expected to increase. (Figure 1)

Some of the most relevant results are:

- South Auckland would still be the most important dairy regions explaining 25% of national milk output
- North Canterbury and Southland share would equal, or even surpass, Taranaki's share

Figure 1.- Geographical distribution of milk production



Source: LIC, 2007 own forecast

Total number of cows is expected to increase 14% from 3.7 million in 2003 to 4.3 million in 2007 (Table 2). The South Island's dairy herd is predicted to expand by 326 thousand cows, accounting for 65% of the net national gain in dairy cows. North Canterbury and Southland would experience the highest growth in cow numbers, 98 and 120 thousand respectively. Combined their net gain in dairy cows would exceed those expected for the entire North Island. Even though loosing share at a national level, South Auckland would still account for the majority of the national dairy herd, 26%. However, the centre of gravity is shifting towards the South Island. It is forecasted that by 2007, 30 % of the national dairy herd would be in the South Island, up form 26% in 2003.

Table 2.- Evolution of the number of cows and its regional distribution (cows in thousand)

	1991		2003		2007 f	
	cows	share	cows	share	cows	share
Northland	254	11%	296	8%	318	7%
South Auckland	901	40%	1,071	29%	1,096	26%
Taranaki	398	18%	484	13%	492	12%
Rest of N.I.	520	23%	931	25%	1,080	25%
North Canterbury	27	1%	255	7%	353	8%
Southland	25	1%	291	8%	411	10%
Rest of S.I.	99	4%	413	11%	521	12%
New Zealand	**2,225**		**3,741**		**4,270**	

Source: LIC

(f) own forecast

Effective dairy area is forecasted to increase 100 thousand hectares, or 7% from 1.46 million ha in 2002/03 to 1.56 million hectares by season 2006/07. It is expected that the South Island will increase its dairy area by 92 thousand hectares accounting for 92% of the national newly created dairy area. North Canterbury and Southland combined are predicted to convert 62 thousand hectares to dairy farming, accounting for the greater part of the national increase in dairy area over the period. The North Island, in turn, is predicted to increase marginally as the result of gains in Hawkes Bay and Wairarapa that more than offset area loss in traditional regions, like Central and South Auckland, Bay of Plenty, Northland and Taranaki. (Table 3)

Table 3.- Regional effective dairy area (thousand hectares)

	Dairy area (forecast)		Range forecast		**Change (%) 2007/2003**
	2006/07	Std dev	Max	Min	
Northland	**143**	1	145	141	**-1%**
Central Auckland	**57**	3	62	53	**-5%**
South Auckland	**383**	12	405	368	**-2%**
Bay of Plenty	**69**	3	74	65	**-4%**
Central Plateau	**81**	5	88	73	**3%**
Western Uplands	**12**	1	14	11	**13%**
East Cost	**2**	0	2	1	**-24%**
Hawkes Bay	**15**	3	19	13	**40%**
Taranaki	**173**	9	186	164	**-6%**
Wellington	**80**	5	89	73	**4%**
Wairarapa	**84**	13	95	67	**35%**
Nelson/Marlborough	**37**	2	40	34	**8%**
West Coast	**55**	4	59	49	**6%**
North Canterbury	**119**	12	134	101	**34%**
South Canterbury	**38**	5	46	31	**30%**
Otago	**69**	8	84	56	**23%**
Southland	**146**	19	170	117	**28%**
North Island	**1,099**	16	1,128	1,076	**1%**
South Island	**464**	46	523	392	**25%**
New Zealand	**1,563**	57	1,631	1,469	**7%**

Source: own calculation based on LIC

Baseline data on regional input use per unit of area are presented in Table 4. Even though it was not established whether differences in input use across regions are statistically significant, it is worth noting that:

- Nitrogen use is ranked first in 6 out of the 11 regions (underline in Table 4)
- Phosphorous and Potassium are ranked first in 2 regions (underline in Table 4)
- Nitrogen application varies the most across regions compared to other fertilizers
- Nitrogen application in Canterbury more than doubles the level of any other region
- Phosphorous varies the least across regions
- Total fertilizer use per area is lowest for Wellington and Wairarapa
- North Canterbury total use of fertilizer is 1.5 times higher than in Taranaki
- Canterbury use of electrical energy per area more than tripled that of any other region, as a result of irrigation

Table 4.- Baseline for regional input use corrected by average herd size 1998/99 (derived from table 4.9, page 55; Wells, 2001)

	Nitrogen Kg N/ha	Phosphorous Kg P/ha	Potassium Kg K/ha	Sulphur Kg S/ha	E E I *(*)* GJ/ha
Northland	31.6	36.9	30.1	44.4	3.6
South Auckland	<u>71.4</u>	58.0	65.2	62.1	3.8
Bay of Plenty	<u>78.0</u>	62.2	52.0	69.3	2.5
Taranaki	<u>73.5</u>	51.5	49.0	46.6	3.0
Wellington	33.3	<u>39.5</u>	24.6	35.9	4.3
Wairarapa	32.6	<u>38.6</u>	24.0	35.2	4.2
West Coast	<u>75.6</u>	43.1	58.9	51.9	2.2
North Canterbury	<u>147.8</u>	57.7	28.0	88.3	13.0
South Canterbury	<u>157.1</u>	61.4	29.8	93.9	13.9
Otago	73.9	52.3	<u>93.3</u>	64.8	4.3
Southland	72.3	51.2	<u>91.3</u>	63.4	4.2

(*) Electrical Energy Intensity (primary) "defined to be the consumer energy plus all other energy inputs required to deliver that energy to the consumer." (Wells, 2001, page 17);
GJ, gigajoules = 1,000,000,000 joules (joule is the basic unit of energy)

Forecast on input use are presented on Table 1.A and Table 2.A in the appendix. Table 1.A represents the absolute value of the lower bound of input application while Table 2.A the upper bound.

Table 5 summarises the change in input use per unit of area with respect to the baseline for the upper and lower bound.

The lower bound estimation of input use shows that:

- Fertilizer and electrical energy use per unit of area is expected marginally decline for Bay of Plenty, Wellington and Otago
- The West Coast is expected to experience the highest increase in input use
- For all other regions moderate increases in input use are predicted

Table 5.- Estimated change in regional input use with respect to baseline (2007/1999)

	Upper limit (forecast based on linear relationship input use-productivity per area)	Lower limit (forecast based on linear relationship input use-stocking rate)
Northland	31%	6%
South Auckland	31%	2%
Bay of Plenty	27%	-2%
Taranaki	16%	2%
Wellington	21%	-2%
Wairarapa	26%	3%
West Coast	37%	10%
North Canterbury	50%	2%
South Canterbury	47%	5%
Otago	34%	-1%
Southland	35%	4%

The upper bound estimation, on the other hand, shows an heterogeneous picture:

- Taranaki is expected to be the least responsive increasing input use by 16%
- North Canterbury, on the contrary, is predicted to increase input use by 50%
- Other regions are predicted to experience an increase in input ranging from 21% (in Wellington) to 37% (in West Coast)

Estimated change in input use with respect to the baseline reflects the expected change in stocking rate and productivity per area, lower and upper bound respectively, over the same period.

A negative value for the lower limit implies that the respective regions would experience a decline in the stocking rate with respect to the baseline, and vice versa. Higher absolute values, in turn, indicate that the region in question would experience a higher growth in stocking rate relative to other regions over the period. Although it may happen, this does not mean that at the end of the period the region that experienced a higher growth in stocking rate would have a higher level of stocking rate that other. For example, in 1999 the stocking rate in West Coast was 2 cows/ha. It predicted that stocking rate would be at 2.2 in 2007, a 10% increase. Taranaki, on the other hand, is expected to have a stocking rate of 2.84 in 2007, up 1% from 2.8 cows/ha in 1999. The same reasoning applies to the upper bound predictions.

A forecast of the regional expected demand for inputs in 2007 may be obtained by multiplying forecast input use intensity by the area devoted to dairy in each region (Table 6).

Stylised facts indicate that:

- Demand for nitrogen is expected to be highest in South Auckland
- North Canterbury expected demand for nitrogen is predicted to surpass Taranaki's, doubling actual demand

- Primary electrical energy demand is expected to be highest in North Canterbury

A more interesting approach is to obtain the net difference of the expected demand for inputs and the baseline demand for inputs. In doing so, an estimate of the cost of the expansion in terms of the net increase in input demand is provided.

In Table 6 results for two inputs and selected regions are shown. Some relevant facts are:

- It is expected that North Canterbury would demand an extra 8.5 to 17 thousand tonnes of nitrogen by 2007, roughly 1.80 to 3.6 times more nitrogen than Northland baseline consumption
- South Auckland, in turn, would demand from 0.4 to 2 times more nitrogen Northland baseline consumption for its expansion
- The cost of the expansion for North Canterbury in terms of electrical energy would amount to 1.4 to 2.7 times Taranaki's baseline primary electrical energy
- The net difference in primary electrical energy predicted for North Canterbury approximately equals the annual energy use of a city the size of Napier in one year[2] (Ministry of Commerce, 1992, pg xvi)

[2] A city the size of Napier has a total energy use of 1 PJ per year (1 petajoule = 1000 TJ)

Table 6.- Baseline and expected demand for two inputs in selected regions

(Net difference= forecast 2007 - baseline 1999)

	Baseline (1999)	Lower bound (f)	Upper bound (f)	Net difference Lower-Baseline	Net difference Upper-Baseline
Nitrogen (Tonnes)					
South Auckland	26,198	27,953	35,901	1,755	9,703
Taranaki	13,342	12,902	14,785	(440)	1,443
North Canterbury	9,449	18,005	26,362	8,556	16,914
Southland	4,695	11,003	14,234	6,308	9,539
Electrical Energy (TJ)					
South Auckland	1,405	1,499	1,925	94	520
Taranaki	548	530	608	(18)	59
North Canterbury	833	1,587	2,324	754	1,491
Southland	274	643	832	369	558

(f) forecast

TJ, terajoules = 1,000,000,000,000 joules (joule is the basic unit of energy)

Conclusion

Bockstael (1996) affirmed that public policies might have a strong influence in the spatial pattern and distribution of land. The change in the New Zealand public policies, i.e. the process of deregulation of the economy that started in 1984, was one factor, amid others, that certainly had an influence in the expansion of dairy farming into new areas. The relative profitability of different agricultural industries was altered after deregulation, and as a result, the pattern of land use changed.

The forecasts reported in the present paper for national milk production and total number of cow are of a similar magnitude to MAF estimations. When averaging all the scenarios national milk production is forecast at 1.486 million kgs. MS, 6% higher than MAF estimates of 1.400 million kgs. MS for season 2006/07 (Table 7).

Table 7.- Forecast comparison to season 2006/07

	Milk production (Million kgs. MS)	Number of cows (Million cows)	Total area (Million hectares)
Own estimates (average all scenarios)	1,486	4.40	1.61(‡)
MAF estimate (SONZAF 2003)	1,400	4.17(#)	2.08(†)

(#) at June 2006

(‡) effective dairy area

(†) total dairy area

SONZAF 2003 (MAF) estimates cow numbers to be 4.17 million at June 2006. This papers forecasts cow numbers at 4.4 million for season ending May 2007.

SONZAF 2003 (page 97) estimates dairy area at 2.08 million hectares for 2007. SONZAF estimate is 33% higher than the one projected here. However, it should be taken into consideration that these paper projections referred to effective area, i.e. milking platform only. For 2003, SONZAF reported land use in dairy at 2.03 million hectares, whereas LIC (2002/03) reported total effective dairy area to be 1.4 million hectares, a 45% gap.

SONZAF estimate implies that dairy area is going to expand by 2.5% over the period 2003-2007. This rate of growth is less than half the one expected by this projection, at 7%. However, if it were assumed that there is an increasing opportunity cost for converting an additional unit of land to dairy, it would make sense - under the hypothesis that the expansion continues - to incorporate already existing "dairy area" into "effective dairy area". As a result, the growth rate in "effective dairy area" would be higher than the growth rate in "total dairy area", effectively reducing the 45% gap of 2003 between SONZAF and LIC figures. According to this papers' estimate the gap may decline to 33% by 2007.

Adelaja et al. (1998) reported that the survival of dairy enterprises close to urban-influenced areas is influenced negatively by rising land values. Therefore, the forecast of a net loss in dairy area in regions where land prices have been increasing over the last years is possible.

Expected increases in the intensity of input use as well as in the demand for inputs with respect to the baseline are significant[3]. Furthermore, differences in the intensity of input use amongst regions advocate for a local approach. This in turn would demand tailored public policies to address a variety of situations ranging from electricity and water use to runoff in surface water to nitrate leaching into groundwater.

All those issues have important implications in terms of environmental management, infrastructure investment, community development and certainly, to the sustainability of the dairy industry.

[3] A referee pointed out that forecasted input intensity has already been achieved in some regions.

Appendix

Table 1.A - Estimated regional input use in 2006/07 (forecast based on stocking rate)

	Nitrogen Kg N/ha	Phosphorous Kg P/ha	Potassium Kg K/ha	Sulphur Kg S/ha	E E I *(*)* GJ/ha
Northland	33.5	39.1	31.9	47.0	3.8
South Auckland	73.0	59.2	66.6	63.5	3.9
Bay of Plenty	76.4	61.0	51.0	67.9	2.5
Taranaki	74.6	52.3	49.8	47.3	3.1
Wellington	32.8	38.9	24.2	35.4	4.2
Wairarapa	33.7	40.0	24.9	36.4	4.4
West Coast	83.1	47.3	64.7	57.0	2.4
North Canterbury	150.9	58.9	28.6	90.2	13.3
South Canterbury	164.4	64.2	31.1	98.3	14.5
Otago	72.9	51.6	91.9	63.9	4.3
Southland	75.3	53.3	94.9	66.0	4.4

(*) Electrical Energy Intensity (primary) "defined to be the consumer energy plus all other energy inputs required to deliver that energy to the consumer." (Wells, 2001, page 17)
GJ, gigajoules = 1,000,000,000 joules (joule is the basic unit of energy)

Table 2.A - Estimated regional input use in 2006/07 (forecast based on productivity /ha.)

	Nitrogen Kg N/ha	Phosphorous Kg P/ha	Potassium Kg K/ha	Sulphur Kg S/ha	E E I *(*)* GJ/ha
Northland	41.3	48.2	39.3	58.0	4.7
South Auckland	93.7	76.1	85.6	81.5	5.0
Bay of Plenty	99.1	79.1	66.1	88.1	3.2
Taranaki	85.5	59.9	57.0	54.2	3.5
Wellington	40.4	47.9	29.8	43.6	5.2
Wairarapa	41.0	48.6	30.2	44.3	5.3
West Coast	103.6	59.0	80.7	71.1	3.0
North Canterbury	221.0	86.3	41.8	132.1	19.5
South Canterbury	230.8	90.1	43.7	137.9	20.3
Otago	98.8	69.9	124.6	86.6	5.8
Southland	97.4	68.9	122.8	85.4	5.7

(*) Electrical Energy Intensity (primary) "defined to be the consumer energy plus all other energy inputs required to deliver that energy to the consumer." (Wells, 2001, page 17);
GJ, gigajoules = 1,000,000,000 joules (joule is the basic unit of energy)

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