Dairy Farmland Prices and Return Expectations in New Zealand

A paper presented in the 17th Pacific Rim Real Estate Society Conference,
Gold Coast, Australia, 17-19 January 2011

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Abstract

Using transactional data of New Zealand dairy farms over the period of 1981 to 2009, this paper investigated the relationship between dairy farmland prices and farmers' return expectations based on the present value model. In short-term dairy farmland prices were positively correlated to farmers' income expectations but negatively related to total return expectations. In long-term dairy farmland prices were significantly influenced by the growth expectation from farmers for both income returns and capital gains. It is debatable whether the current high growth expectation on New Zealand dairy farms is sustainable.

1. Introduction

The price paid for dairy land in New Zealand increased at a real rate of over eight percent compound per annum between 2000 and 2009. This very rapid increase in the value of dairy land without a similar increase in earnings prompted commentary that land was overpriced (Eves and Painter, 2008, Hargreaves and McCarthy, 2010, Wilson, 2009). Since the early 1980s rapid increases in dairy land prices in New Zealand have twice been followed by significant declines. The recent volatility in world dairy commodity prices has increased the risk of greater volatility in land prices and early indications are that land prices have declined since a peak in 2008. The real national average dairy farmland prices and gross milk incomes are presented in Figure 1.

<Insert Figure 1>

This research was prompted by concern that growth expectation in total returns from dairy farming is too reliant on an expectation of high capital growth and this may not be sustainable. The key questions considered are; how do farmers formulate land prices at purchase, how much long term growth is built into the price formation? And is the growth expectation for future cash flows and capital gains sustainable?

One obvious tool to answer these questions is the present value model. In this study we applied the log linear present value model proposed by Campbell and Shiller (1988, 1988) for dairy farmland prices over the period from 1981 to 2009. There are several new innovations in this study. Firstly, we use the next financial year's industry average incomes and total returns at regional levels to proxy individual farmer's income and total return expectations on the farm at purchase. The assumption is if the log linear present value model holds, they should have a significant impact on the current price. We called this the short-term impact of the farmer's return expectations on dairy farmland prices. Secondly, we incorporated the growth expectation of future cash flows and capital gains to count for the shortfall as evidenced in the short-term impact analysis. During this process, the growth is defined as the difference between the required total rate of gross return and the capitalisation rate accepted by the investor at purchase. We called this the long-term impact of the farmer's growth expectations on prices. Thirdly, we applied a pooled time-series cross-section model to overcome the problem of small sample size. As there had been significant structural changes over the study period, we split the data into several time periods to see if economic and industry changes lead to differences in price and return expectations.

There are several reasons for us to choose New Zealand for this study. The dairy industry is a major contributor to the New Zealand economy with dairy products accounting for 28 percent of merchandise export earnings in 2009. New Zealand is also a major player in world trade of dairy products with Fonterra[1] responsible for more than a third of international dairy trade. New Zealand dairy farmers operate in a competitive farming environment with farmer control leading to early uptake of technology and improved management systems. Farming systems are generally low cost pasture based systems; feed grown on farm is the major feed input so land productivity is a critical determinant of farm income. DairyNZ (2009) data shows that average farm size has increased over the study period from 63 hectares in 1981 to 134 hectares in 2009, average herd size has increased from 130 cows to 376 cows and the total number of farms has decreased from around 16,000 in 1981 to 11,700 in 2009.

More importantly, New Zealand dairy farmers operate in an unprotected environment where the risk is carried by the industry without any significant government subsidies since the 1980s. Government subsidies/payments can be viewed as a more stable source of income by farmers and as such

[1] Fonterra Co-operative Group Ltd processes approximately 90% of New Zealand's milk production; currently the government regulates the behaviour of Fonterra to ensure efficient operation of dairy markets in New Zealand.

requires a lower discount rate than market based returns (Weersink, et al., 1999). In addition, the influence of changing expectations regarding transfers in an era of government authority could cause the problem to become even more complicated. For these reasons we expect that the New Zealand market for dairy farmland is market driven and the results of this study should have boarder implications.

There have been two significant changes in the New Zealand dairy industry over the study period. In the early 1980s New Zealand underwent wide economic reforms. For the agricultural sector this meant rapid removal of subsidies and incentives (major assistance had come from supplementary minimum prices, producer board subsidies, and interest and taxation concessions). There was a period of adjustment as farm incomes fell without the corresponding expected fall in off farm costs. Until the removal of the supplementary price scheme in 1984 farmers received a clear signal of the total milk payout at the beginning of each farming season and payout levels and total farm income levels were stable. However farmland values had been inflated by subsidised income streams and favourable interest rates and as incomes declined and interest rates increased rapidly land values fell. Dairy land values were over 40 percent lower in real terms in the late 1980s than they had been in the early 1980s and reached the lowest thirty year price in real terms in 1988. Land prices increased steadily from 1989 until the Asian Crisis in the late 1990s. From 1989 farmers adjusted to farming without subsidies and productivity gains were significant. Johnson and Forbes (2000) report total productivity growth increasing from 0.7% to 1.9% per annum after subsidies were removed in 1985.

The second significant structural change occurred in 2001 when the Dairy Industry Restructuring Act was passed removing the single seller status of the Dairy Board, allowing the formation of Fonterra and removing restriction on dairy processing firms exporting from New Zealand. Since this time we have seen increased volatility in the market for dairy commodities and a very rapid rise in the value of dairy farm land. Fonterra announce a forecast payout per kilogram milk solids at the beginning of the dairy season revise this each quarter. Fonterra introduced globalDairyTrade[2] in July 2008 and farmers now have a credible and transparent means of following product price trends on a monthly basis. We analysed the data in three separate time periods (1981–1988, 1989-2000 and 2001-2009) to investigate differences in farm pricing with the major changes in the industry.

[2] Fonterra’s internet-based electronic trading platform for cross-border trade in commodity dairy products

The remainder of the study is organised as follows: Section 2 reviews the literature. Section 3 presents the theoretical framework and regression models used in this research. Section 4 describes the data utilised. Section 5 reports the empirical results. Section 6 provides a conclusion.

2. Literature

Under the traditional present value model, an asset price is simply the capitalised future cash flows, where the investor's required rate of return is assumed to be constant over time. The assumption of a constant expected discount rate is analytically convenient, but contradicts the evidence that the investor's expected rate of return will vary over time. Campbell and Shiller (1988, 1988) further developed the traditional present value model and proposed a log linear present value model, where the investor's required rate of return can change over time. The model requires measuring the asset's future cash flows and total rate of return for each period in infinity.

There is extensive coverage of applying the present value model to farmland prices in the literature. Broadly two approaches exist. One is within a modern time-series framework and the other is within a traditional discounted cash flow or capitalisation framework. For the time-series approach, results on using the present value model to interpret the behaviour of farmland prices were varied depending on the stochastic process of generating farm returns (Clark, et al., 1993, Engsted, 1998, Falk, 1991, Lloyd, 1994). The obstacle with time-series methods such as using cointegration tests and the VAR model, is due to the problem of small sample size (i.e. 50 – 100 observations). In addition to small samples, time-series methods may also suffer from non-linearity problems. A finding of non-linear cointegration between prices and rents does not necessarily imply that a price bubble exists. This is because there may be unobserved factors in market fundamentals that are causing this nonstationarity.

On the other hand, using capitalisation theory to model farmland prices has been seen in the literature for many years (Vantreese, et al., 1986). This method involves measurement of farmer’s expectations and discount rates. Alston (1986) analysed the growth rate of US farmland prices from 1963 to 1982. She found farmland price growth was mainly caused by the growth in rental income; increases in expected inflation had little effect on land prices.

In New Zealand, Seed (1986) examined the relationship between real land price and expectations of real income, real capital gain and rate of inflation for New Zealand sheep and beef farms from 1962 to 1983. He found a positive relationship between real land prices, expected real net rental income and the rate of general price inflation. His results also suggested that expected capital gains need to be formulated over a sustained period to impact on real land price. Anderson (1991) studied the role of financial leverage on farmland values using a present value model to compare a calculated farm asset value with a proxy series of actual values. He found that farmland values increase as expectations of future income are raised and as level of debt increases.

More recently, Eves and Painter (2008) commented on the discrepancy between increasing farmland values and farm incomes in New Zealand between 1990 and 2005. Farmers were receiving a high total return over this time with associated high variability and they raised the question of a correction in land prices. Eves (2009) developed a New Zealand South Island rural investment performance index using sales transaction data from 1991 to 2007. These results showed an average capital return of 11.6% to dairy land with 14.8% volatility.

3. Theoretical frame work

3.1 Present value model

This paper followed the present value model developed in finance to estimate the fundamental values for an asset. The model relates the price of an asset to its expected future cash flows discounted to the present by using an expected discount rate. If it is assumed the discount rate is constant, the current asset price P at time t is written as follows:

$$P_t = E_t\left[\sum_{i=1}^{n} \frac{D_{t+i}}{(1+R)^i}\right] + E_t\left[\frac{P_{t+n}}{(1+R)^n}\right] \qquad (1)$$

where D_t is the dividend or cash flow at time t and R is the expected discount rate.

In the finance literature the first term is often called the fundamental value and the second term is the price bubble. When n is sufficiently large, the second term will converge to zero. The model implies that the current asset price is simply the sum of all expected present value of future cash flows, discounted at a constant rate.

The well-known Gordon growth model is accordingly set as follows:

$$P_t = \frac{(1+G)D_t}{R-G} \quad \text{or} \quad P_t = \frac{D_{t+1}}{R-G} \qquad (2)$$

where G is the constant growth rate of cash flows and is less than R.

The above formula assumes a constant expected discount rate R and growth rate G. The assumption is analytically convenient, but contradicts the evidence that the investor's expected rate of return will vary over time. Campbell and Shiller (1988, 1988) suggest a log linear present value model with time-varying expected returns, where a log asset price at time *t* is written as follows:

$$p_t = \frac{k}{1-\rho} + E_t\left[\sum_{j=0}^{n} \rho^j \left[(1-\rho)d_{t+1+j} - r_{t+1+j}\right]\right] + E_t\left[\rho^j p_{t+j}\right] \qquad (3)$$

Where $p_t = \log(P_t)$, $\rho = 1/\left(1+\exp\left(\overline{d-p}\right)\right)$, $\overline{(d-p)}$ is the average log dividend-price ratio, $k = -\log(\rho) - (1-\rho)\log\left(1/\rho - 1\right)$, $r_{t+1} = \log(P_{t+1} + D_{t+1}) - \log(P_t)$ and $d_{t+1} = \log(D_{t+1})$

When the time horizon n increases to infinity, the third term, which is the discounted expected value of asset price, will shrink to zero. Accordingly, the current asset price will be presented as follows:

$$p_t = \frac{k}{1-\rho} + E_t\left[\sum_{j=0}^{\infty} \rho^j \left[(1-\rho)d_{t+1+j} - r_{t+1+j}\right]\right] \qquad (4)$$

The above equation (4) implies that the current price is positively correlated with the future dividends but negatively correlated with the total returns in the future. One problem with the above equation is that these expected future cash flows and total returns cannot be accurately estimated in infinity, so posses a major limitation to price valuations. However it is more likely that next period (t+1) cash flows and total returns should have the largest impact on the current price than those in later time period.

3.2 Estimation of individual farmer's return expectations

We followed the approach suggested by Ahrendsen (1993), the individual farmer's return expectations on next period cash flows and total returns can be defined as follows:

$$\begin{aligned} d_{it+1} &= d_{t+1} + \mu_{it} \\ r_{it+1} &= r_{t+1} + e_{it} \end{aligned} \qquad (5)$$

where d_{t+1} and r_{t+1} are next period average industry dividends and total returns, μ_{it} and e_{it} are idiosyncratic effect known to the individual farmer.

Accordingly, we used a pooled time-series and cross-section model to estimate the short-term impact of farmer's return expectations on dairy farmland price. The regression equation is as follows:

$$p_{it} = c + d_{t+1} + r_{t+1} + Dis_i + Area_i + regional\ dummies \qquad (6)$$

where Dis_i is the log distance of *i*th property to the nearest town/city and $Area_i$ is the land area of *i*th property.

The reason for including the distance variable in the above equation is because farmland values are widely believed to be influenced by the degree of urbanisation. Cavailhès and Wavresky (2003) found expectations of farm landowner about conversion to urban uses have a large impact on farmland prices in periurban belts. In the research by Shi, Phipps and Colyer (1997), farmland values in West Virginia were found to be inversely related to the distance from urban centres.

The regression also includes land area and regional dummy variables. The land area variable is included because a larger land parcel will generally have a lower price per hectare. Regional dummies take account of regional differences such as the attractiveness of region's climate, soil and population density.

3.3 Determining the expected long-term growth rate

In this study, we use the concept of the long-term growth rate being approximately equal to the investor's required return less the cap rate (Geltner, et al., 2007). The relationship can be shown as follows:

$$G_{it} = R_{it} - Y_{it} \tag{7}$$

Where G_{it} is the individual farmer's expected growth rate in cash flows and values, R_{it} is the total required return by the *i*th farmer and Y_{it} is the cap rate implied in the individual sale.

Since the equation (6) only incorporates a short-term impact of farmer's return expectations on price, we have added growth rate G_{it} to equation (6) in order to take account of its long-term impact. The regression is written as follows:

$$p_{it} = c + d_{t+1} + r_{t+1} + G_{it} + Dis_i + Area_i + regional\ dummies \tag{8}$$

4. Data and Preparation

All farm sales recorded as being used for dairying, which had sold between 1 January 1980 and February 2010, were obtained from the Headway

Systems Ltd ValBiz™[3] database. Erroneous data was identified and removed including; transactions of less than five hectares, non-market sales, duplicate sales, transactions with a sale price less than $NZ100 per hectare or greater than $NZ1,000,000 per hectare. This produced a database of 25,381 sales. Sale details, land area and location information were extracted for each sale. Unfortunately, income data was not available for individual properties and was estimated using district averages. DairyNZ[4] has divided New Zealand into eight broad dairying regions with 61 districts defined within these regions. These districts experience uniform climatic conditions and, in general, low variability of productive land capacity. District data was matched with each sale transaction using Territorial Local Authority reference numbers. Figure 2 shows the geographic location of these 8 regions.

<Insert Figure 2>

[3] The ValBiz database records every property sale in New Zealand as soon as conveyancing is completed.

[4] DairyNZ was established in 2007 and is an industry good organisation representing New Zealand dairy farmers. Prior to 2007 statistical information collected by DairyNZ was collected by the New Zealand Dairy Board (until 1984), and then by Livestock Improvement Corporation.

Milk income for each district and region, based on total payout and production for the farming year[5], was used for the income variable in the analysis. Farmers do receive additional annual income from stock sales and other sources equating to approximately 5% of total dairy cash income. As farm expenditure could not be sourced on a district basis the main analysis was based on gross income returns.

Gross milk payout per kilogram of milk solids ($/kgms) for each district was sourced from Dairy Company Annual Reports and was based on Dairy Company payout for the dominant dairy company in that district in each financial year. Milk production data was provided by DairyNZ from data used in the New Zealand Dairy Statistics publications (LIC and DairyNZ)[6]. Summarised statistics are presented in Table 1.

<Insert Table 1>

In this study the influence of urbanisation on farmland prices was estimating by the linear distance from each sale property to the nearest town or city

[5] The dairy farming year runs from 1 June to 31 May, total payout equals advance plus deferred payments with deferred payments made in the following financial year.

[6] These publications summarise production from a sample of farms that are representative of regional herd size, farm size and productive capacity, initially published by Livestock Improvement Corporation and now by DairyNZ.

with a population of over 9,000. The estimated distance data set was provided by QuickMap® Custom Software Ltd, a provider of New Zealand property information.

5. Empirical Results

5.1 Short-term impact of farmer's return expectations on price

As indicated by equation (4) farmland prices should be positively related to the future cash flows but negatively related to the future total returns. Since it is difficult to estimate the individual farmer's return expectations at purchase, the best alternative is to use the industry average returns to measure individual farmer's return expectations. In this study, industry average returns are measured at regional levels for both income returns and capital gains. They are measured on a yearly basis for each farming year. Regional income return is calculated by multiplying the regional payout ($/kgms) and regional production (kgms/hectare). Capital gain is estimated by the change in annual price movement in regions. Total returns are the sum of the income return and capital gain. The regression results are listed in Table 2.

<Insert Table 2>

The results showed that the current farmland price is positively correlated with the next period income return as measured by the payout and production, but negatively related to the next period's total return. Put another way, if the current land price is high, then farmers must be expecting some combination of high future incomes and low future returns. The results are highly consistent with the log linear present model as suggested by Campbell and Shiller (1988, 1988). Due to the problem of potential structure change, we have further split the data into different time periods over the last three decades. The results showed that both components of income returns (expected milk payout and production) have significantly affected land prices. For example, the elasticity of price with respect to payout in the regression was 0.41 for the period of 1981 to 1988, but climbed to 3.34 for the period from 2001 to 2009. During the same time, the elasticity of production has increased from 0.04 to 0.79. In contrast, the impact of famers' required total returns on farmland prices has increased in much lesser degree from -0.51 for the period of 1981 to 1988 to –1.03 in the period from 2001 to 2009.

Interestingly, there is no significant change of distance to town/city on prices over the whole study period. The findings implied urban influences on farmland prices stayed similar over time. This could be due to the strict land-use policy in New Zealand to preserve rural areas for agriculture rather than to develop them into urban uses.

5.2 long-term impact of farmer's return expectations on price

In order to test the long term growth expectation of both future cash flows and capital gains on farmland prices, we introduced the growth variable in the regression based on equation (7). The growth variable is served as the long-run prediction by farmers into the future. The results are presented in Table 3.

<Insert Table 3>

In general, the regression results are much improved with the adjusted R squared increasing to above 0.80 when compared to the results from the first regression. Growth expectation has a significant impact on farmland prices. For example, the semi-elasticity of price with respect to growth over the whole study period was 2.39, indicating 9.91% change in price when the growth rate increases by one percentage point[7]. More importantly, the impact of growth on land price has increased significantly for the last time period during 2001 to 2009. The semi-elasticity of price with respect to

[7] The percentage change in price when the growth rate increases by one percentage point is calculated as [exp(2.39)-1]=9.91

growth has been increased from about 2.20 to 2.81 over the years. In another word, one percentage point change of farmer' growth expectation has resulted in a price increase by 15.61% for the time period of 2001 to 2009 comparing to 8.03% on average in the past.

Equation (2) gives the effect of growth expectation on price. Assuming the total return R is relatively stable, a change in the growth has a greater effect on price when the growth expectation is high. Table 4 presents the average annual total return and growth expectation by farmers over the study period. It shows that the famer's expected total returns haven't changed over time. They are historically between 30 to 35%. However the farmer's growth expectation for both future cash flows and capital gains has substantially increased over time. The historically high growth expectations by farmers resulted in a high farmland price. The results are fully consistent with what we have expected from equation (2). The question of whether the current growth is sustainable is subject to further research. However, it is certain that as the growth rate is already high, a small change in farmer's growth expectation will result in a much volatised rural market.

<Insert Table 4>

6. Conclusions

This paper examined both short-term and long-term impact of farmer's return expectations on dairy farmland price in New Zealand. It was found that the current farmland price is positively correlated to the expected future incomes and negatively related to the expected total returns. The findings have supported the log linear present value model in general. On the other hand, the long-term growth expectation of future cash flows and capital gains is significantly important when farmers formulate their price expectation. Since 2001 farmers have expected increased growth in income and land prices while their expectation for total return has stayed almost the same or just slightly increased. Growth in income is achieved with productivity gains and increased payout. Productivity gains are likely to continue as farmers adopt new technologies but growth in payout is increasingly volatile. Currently international demand for dairy products is strong; globalDairyTrade auction results have been above the ten year average throughout 2010. If demand eases and the price for dairy commodities drops farmers will reduce their expectation for growth and land prices could fall significantly. The findings posse a major risk for farmers as the growth rate is already high; a small change in farmer's growth expectation will result in a much volatised rural market.

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Figure 1: Farmland prices and gross milk income

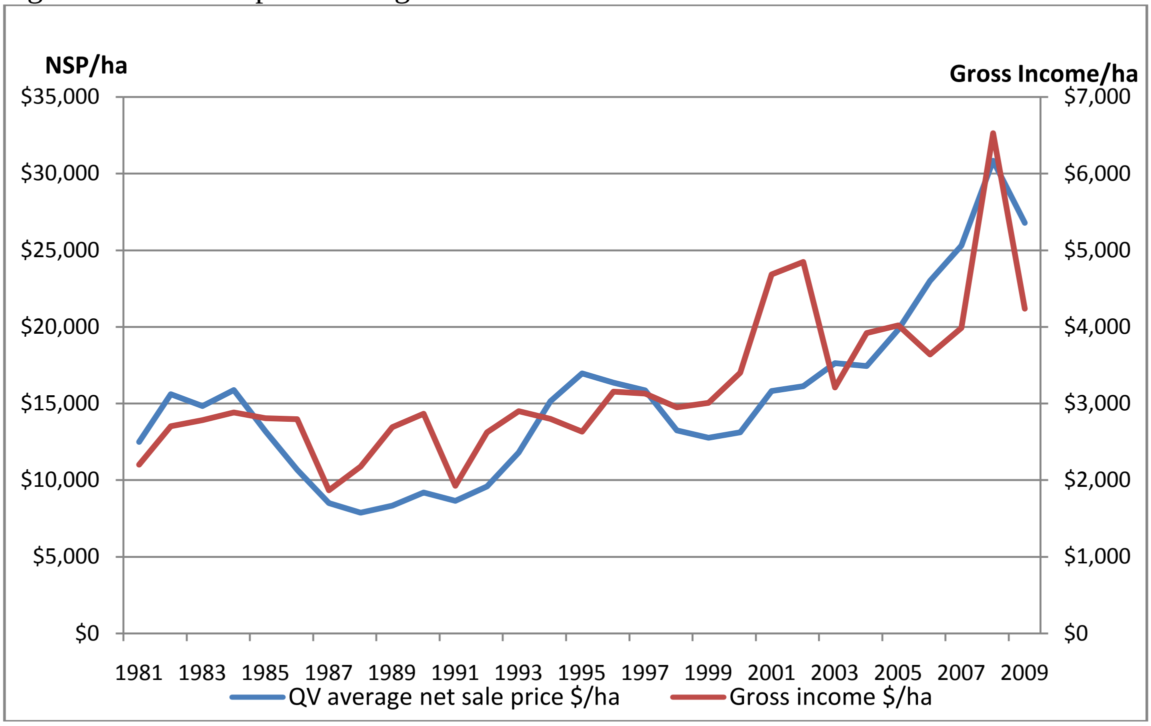

Figure 2: Location map of 8 dairy regions

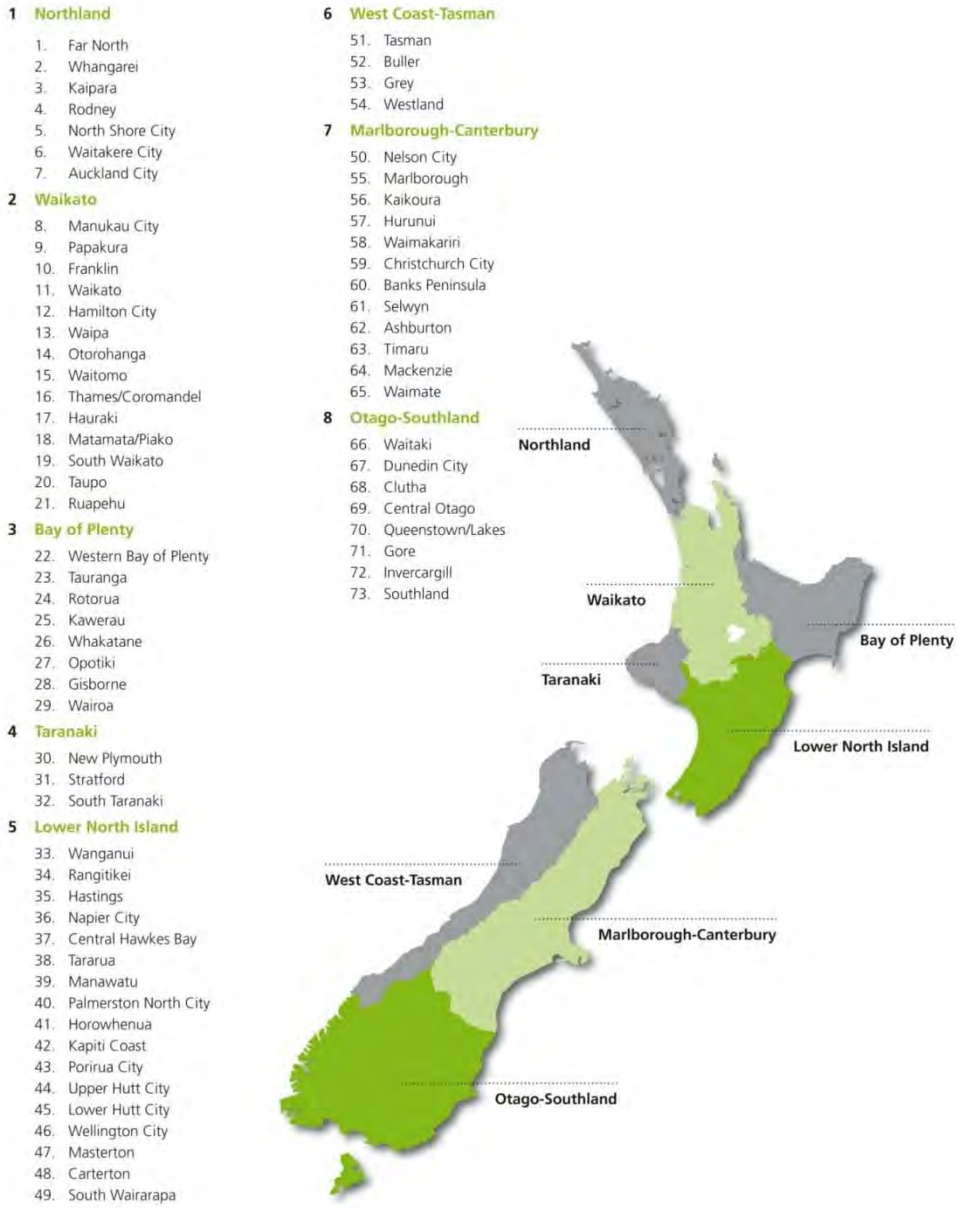

Table 1: Descriptive statistics of national farmland sales, 1982 - 2009

Year	No. of Sales	Ave. Size (ha)	Production (kgms/ha)	Payout ($/kgms)	Farmland Price ($/ha)
1982	396	62.5	536	1.94	5,166
1983	249	59.8	527	2.12	5,305
1984	275	54.0	594	2.11	6,127
1985	218	49.9	639	2.28	6,950
1986	172	60.7	662	2.28	6,040
1987	191	61.7	569	2.01	5,797
1988	261	58.0	647	2.33	5,278
1989	832	60.3	590	3.30	5,601
1990	1360	58.3	610	3.59	6,846
1991	948	59.3	614	2.41	7,533
1992	1379	63.4	614	3.37	7,829
1993	1421	60.7	628	3.66	9,677
1994	1346	60.5	684	3.30	12,310
1995	1257	60.9	646	3.38	13,972
1996	1507	60.7	682	3.99	14,787
1997	1035	58.0	726	3.64	13,823
1998	1027	63.7	720	3.44	13,874
1999	1186	68.7	687	3.61	12,535
2000	1836	77.4	755	3.79	13,695
2001	2074	80.4	833	5.00	14,800
2002	1999	82.4	817	5.33	17,486
2003	1295	81.0	801	3.64	18,773
2004	1178	82.5	864	4.25	22,861
2005	1067	91.3	839	4.59	25,836
2006	954	98.2	893	4.10	32,580
2007	918	84.8	914	4.47	38,133
2008	1114	97.1	873	7.90	44,214
2009	508	91.8	904	5.18	44,593

Table 2: Results of OLS estimations of farmland price on the next farming year's regional returns

	Time period			
	1981 - 1988	1989 - 2000	2001 - 2009	1981 - 2009
Dependant variable is individual farm land price per hectare in log form				
Constant	6.228	-2.112	-16.086	-8.773
	(0.963)	(0.276)	(0.659)	(0.158)
Log regional payout ($/kgms)	0.408	1.343	3.341	2.242
	(0.150)	(0.060)	(0.101)	(0.034)
Log regional production (kgms)	0.039	0.539	0.789	0.724
	(0.089)	(0.035)	(0.026)	(0.019)
Log regional total return	-0.514	-0.899	-1.028	-0.956
	(0.088)	(0.026)	(0.037)	(0.021)
Distance (km)	-0.008	-0.005	-0.006	-0.006
	(0.001)	(0.000)	(0.000)	(0.000)
Land area(ha)	-0.006	-0.003	-0.002	-0.002
	(0.000)	(0.000)	(0.000)	(0.000)
Regional dummies	...	...	...	...
Observations	1344	13693	10334	25381
adjusted R-squared	0.466	0.446	0.374	0.534

The above results are based on the following regression:

$$\log(P_{it}) = c + \beta_1 \log(Pay_{t+1}) + \beta_2 \log(\text{Pro}_{t+1}) + \beta_3 \log(R_{t+1}) + \beta_4 Dis_i + \beta_5 Area_i + \sum_{J=1}^{7} \alpha_J \text{ Reg}_j$$

where P_{it} represents the individual farm sales, Pay_{t+1} is the next farming year's regional payout, Pro_{t+1} is the regional production and R_t is the regional total return. Dis_i is the distance of *i*th property to the nearest town/city, $Area_i$ represents the land area of *i*th property and Reg_j is the dummy variable for region j. t denotes the farming year, which is calculated from 1 June to 31 May next year.

Table 3: Results of OLS estimations of farmland price on growth expectations

	Time period			
	1981 - 1988	1989 - 2000	2001 - 2009	1981 - 2009
Dependant variable is individual farm land price per hectare in log form				
Constant	1.683	-2.325	-5.880	-4.517
	(0.500)	(0.147)	(0.376)	(0.089)
Log regional payout ($/kgms)	0.668	1.057	1.688	1.440
	(0.077)	(0.032)	(0.058)	(0.019)
Log regional production (kgms)	0.622	0.936	0.921	0.921
	(0.047)	(0.019)	(0.015)	(0.010)
Log regional total return	-2.882	-3.164	-4.185	-3.476
	(0.060)	(0.018)	(0.030)	(0.016)
Growth	2.185	2.176	2.808	2.394
	(0.036)	(0.012)	(0.019)	(0.010)
Distance (km)	-0.002	-0.003	-0.003	-0.003
	(0.000)	(0.000)	(0.000)	(0.000)
Land area(ha)	-0.001	-0.001	0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)
Regional dummies	...	...	...	...
Observations	1344	13693	10334	25381
adjusted R-squared	0.859	0.843	0.803	0.860

The above results are based on the following regression:

$$\log(P_{it}) = c + \beta_1 \log(Pay_{t+1}) + \beta_2 \log(\mathrm{Pro}_{t+1}) + \beta_3 \log(R_{t+1}) + \beta_4 G_{it} + \beta_5 Dis_i + \beta_6 Area_i + \sum_{J=1}^{7} \alpha_J \,\mathrm{Reg}_j$$

where P_{it} represents the individual farm sales, Pay_{t+1} is the next farming year's regional payout, Pro_{t+1} is the regional production, R_t is the regional total return and G_{it} is the growth expectation of *i*th farmer. Dis_i is the distance of *i*th property to the nearest town/city, $Area_i$ represents the land area of *i*th property and Reg_j is the dummy variable for region j. t denotes the farming year, which is calculated from 1 June to 31 May next year.

Table 4: Average annual total returns and growth expectations

	Time periods		
	1981 -1988	1989 - 2000	2001 - 2009
Total return	31.4%	35.6%	35.1%
Growth expectation	-1.6%	3.9%	9.8%