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# **Determinants of Dairy Farm Ownership in New Zealand**

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# Determinants of Dairy Farm Ownership in New Zealand

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## Abstract

*Sharemilking is an integral and important part of the New Zealand dairy industry. Historically, it has provided a realistic pathway for highly motivated young people to enter dairy farming and attain farm ownership. However, the system has been under pressure in recent years because of sharply increased land prices, the need to purchase shares in the local dairy company and declining real returns for milksolids. To confirm these concerns a study was undertaken to identify the determinants of sharemilkers attaining farm ownership, using the mail survey responses of 100 sharemilkers in the Manawatu region. Six logistic regression models were estimated and the likelihood and odd-ratios of attaining farm ownership were explained. Variables positively associated with farm ownership were availability of equity, age, working on a family farm (short-term), and access to off-farm employment for the sharemilker's partner within a reasonable distance of the property. The survey responses indicated that on average 4% of sharemilkers annually will attain farm ownership in the study region, although 67% of the sharemilkers aspired to this goal. Progression to farm ownership from sharemilking will continue to become more difficult, with potential negative consequences to the dairy industry in the long-term, unless proactive industry strategies to assist sharemilkers accumulate equity and experience are adopted.*

*Key words: sharemilking, farm ownership, dairying, socioeconomic determinants, logit model.*

## Introduction

Over the past half century the dairy farming sector in New Zealand has experienced substantial improvements in economic efficiency. For example, the number of dairy herds has declined from 53,100 in 1951 to 14,649 in 1995, while the number of milking cows has increased from 1.8 million to 2.8 million (LIC 1995a). Average herd size has quadrupled over the same period. Per cow and per hectare production of milksolids (that is, fat plus protein solids) has increased by 21% and 53%, respectively, during the past two decades and an average dairy farm has become 40% larger and milksolids production per farm has more than doubled over the same period. The payout received by farmers (in real terms), however, has decreased from NZ\$7.30 in 1951 to NZ\$3.40 in 1995 (LIC 1995a).

A well-established sharemilking structure is unique to the New Zealand's pastoral agricultural system and has helped the dairy farm sector to keep pace with innovation in dairy farming. It has provided an entry path for many aspiring young people into dairying and eventual farm ownership. In a 1992 survey, conducted in the Waikato region, 84% of sharemilkers reported obtaining farm ownership as their primary goal (Hall and Martyn 1993). The changing economic environment, steadily increasing production cost structures, recent increases in dairy farm land prices, the requirement for greater capital outlays in order to purchase larger dairy farms, and barriers to entry into dairy industry imposed by dairy companies for new entrants (in the form of mandatory share purchases at a premium price) have collectively dampened sharemilkers' expectation of achieving farm ownership (Rauniyar

and Parker 1996a). It is against this background that a number of sharemilkers have come to that realisation that dairy farm ownership is a distant dream for them and have hence focused their efforts on maximising short- to medium-term net income from sharemilking.

The long-term economic viability of dairy farming in New Zealand faces a number of challenges, including a production cost squeeze and an emerging problem, due to the factors described above, with an aging dairy farming population. With respect to the latter, a recent study indicated that an average sharemilker was 37 years in 1996 compared to 32 in 1989, and an average owner operator was 51 years old in 1996 compared to 42 in 1989 (Rauniyar and Parker 1996b). An aging dairy farming population New Zealand may ultimately decrease New Zealand's competitive position over its counterparts in the Northern Hemisphere, because older farmers are generally less willing to adopt new technology.

Physical characteristics associated with sharemilking and dairy farm ownership have been adequately analysed (LIC 1995b), but sharemilkers' socioeconomic and attitudinal characteristics have not been well explained. In this paper we therefore examine socioeconomic factors associated with dairy farm ownership in the Manawatu region of New Zealand. The objectives of this study are to identify sharemilker characteristics important to the expectation of dairy farm ownership, and to further identify the socioeconomic characteristics of sharemilkers that are consistent with the ownership of (a) a non-family dairy farm, (b) a dairy farm in 5 years and (c) a dairy farm in 10 years. The results of this study could be used by New Zealand dairy industry to design strategies to maintain its relatively young population of dairy farmers.

## Methodology

The data set analysed comprised of the responses of 100 sharemilkers to a postal survey in the Manawatu region, in the lower North Island. Survey questions sought information about sharemilker's opinions on a set of statements relevant to the future sustainability of sharemilking in New Zealand, their socioeconomic background and the characteristics of the farm on which they were located. The survey instrument was pre-tested on three sharemilkers and administered after some minor modifications. The 173 potential respondents were selected randomly from a Tui Milk Products Ltd. mailing list. A reminder postcard sent two weeks after the first posting improved the survey response rate from 35 to 58%. The final sample of respondents represent about 30% of the total sharemilkers in the Manawatu region.

Models using limited dependent variables represent an accepted approach for dealing with problems involving discrete choices, such as the expectation to own a dairy farm (Pindyck and Rubinfeld 1981). A logistic regression model was used to explore the relationships between the characteristics of sharemilkers and dairy farm ownership. The log of the ratio of the probability that an event will occur to the probability that it will not occur can be expressed as:

$$\log \frac{P_i}{1 - P_i} = \alpha + X_i \beta \quad (1)$$

where,  $P_i$  is the probability that the  $i$ th sharemilker will own a dairy farm,  $X_i$  is a row vector of attributes of the sharemilkers,  $\alpha$  is the intercept and  $\beta$  is a column vector of parameters defining the relationship between the attributes and the probability a sharemilker will own a dairy farm.

## **Characteristics of sharemilkers in the Manawatu region**

### **Dairy herd size**

The average dairy herd in the study area had 230 cows and average farm was 90 ha effective in the 1995/96 season. The sample respondents, therefore appear to be representative of the New Zealand dairy farms which have an average 229 cows and an average effective farm area of 92 ha effective farm area in the same financial year (LIC 1996).

### **Dairy farm ownership expectations**

The socioeconomic characteristics associated with sharemilkers are summarised in Table 1. Two-thirds of the sharemilkers surveyed expected to own a dairy farm at some stage in their lives, while nearly half of them expected to own a non-family farm (excluding those obtained through an inheritance). One in five sharemilkers expected to own a dairy farm by 2001, while 42% expected to own a farm in 2006, if the present economic environment continued. Of those who expected to own a dairy farm, 73% expected to own a non-family farm, 27% expected to own a farm by 2001 and 58% expected to own by 2006. If growth is assumed to be linear, then on average, only 4% of all the sharemilkers in Manawatu will get to own a dairy farm annually.

### **Experience on dairy farm**

Fifty seven percent of the sharemilkers were brought up on a dairy farm, while others were urbanities, farm workers or non-dairy family members. On average, sharemilkers had gained 5 years of full-time and less than 3 years of part-time employment on a dairy farm prior to obtaining their present position. Also, they sharemilked for the family for less than 3 years. Sharemilkers who expected to own a dairy farm had more or less a similar amount of dairy farming experience as other respondents.

### **Relationship with the owner**

Half of the sharemilkers had obtained their present sharemilking position through an invitation from the owner, while others had either received assistance from private consultants or were recruited for the position advertised in newspapers. Four out of five sharemilkers reported directly to the owner, while the remainder reported to a supervising consultant.

### **Age and dependency**

An average respondent was 36 years old, but those who expected to own a dairy farm were relatively younger group (33 years). The majority of the sharemilkers had no children, so that only 0.6 of a child unit was supported by an average sharemilker.

### **Partners' involvement in sharemilking and employment of paid worker**

The involvement of the partners of sharemilkers in the sharemilking operation was quite high, with nearly three-fourths being involved in some way. This suggests that because of high unit labour costs, the majority of sharemilkers have opted for their partners' assistance at a lower direct cost than employing a paid worker. An average sharemilker employed 0.5 units of a full-time worker and only 0.13 units of a part-time worker. The partners of sharemilkers who expected to own a dairy farm had a similar involvement in the sharemilking operation, and level of employment of paid workers, as those who did not expect to own a dairy farm.

### **Off-farm employment**

Fifteen percent of sharemilkers and 42% of sharemilkers' partners had some form of off-farm employment. Off-farm employment was directly linked to the desire to accumulate equity for farm

purchase. The significant number of partners employed off-farm suggests that in many cases their involvement in the sharemilking operation was part-time. A slightly higher proportion of sharemilkers who expected to own a dairy farm were involved in off-farm work. This is consistent with the younger age of the respondents who expected to own a dairy farm, relative to the average sharemilker in the region (33 vs 36 years). More than half of the sharemilkers who planned to purchase a farm and who were willing to take up off-farm employment were constrained by commuting distance. On average, they were willing to commute 17 km each way. This implies the high on-farm labour demand, prevented partners from taking up off-farm positions that involved a long commuting distance (that is, travel time) and associated travel time.

### Opinion of sharemilkers

The opinions expressed by sharemilkers who expected to own a dairy farm were consistent with those of an average sharemilker in the region. Half of the sharemilkers thought that the 1991 Resource Management Act (RMA) was good for the environment, but only two-fifths of them agreed that technology to improve per cow productivity is readily available. Similarly, 83% of the respondents agreed that high feed costs (other than pasture) were a major problem in dairy farming and nearly three-fourths of them agreed that uncertain milksolids prices made their financial planning difficult.

### The logistic regression model

Given the general framework presented in equation (1) six similar models were estimated. All six models included the same set of regressors and each model had a different dependent variable as shown in equation (2).

$$\log \frac{P_i}{1 - P_i} = \beta_0 + \beta_1 AGE + \beta_2 AGESQ + \beta_3 HERD + \beta_4 SMFAMILY + \beta_5 OWNEQTY + \beta_6 FTEMP + \beta_7 EDUC + \beta_8 SMOFF + \beta_9 PARTOFF + \beta_{10} DISTOFF + \beta_{11} RMA + \beta_{12} TECHNO + \beta_{13} FEEDCOST + \beta_{14} FINPLAN$$

(2)

where,

AGE	=	age of the respondent in years
SQAGE	=	squared age of the respondent
HERD	=	herd size (number of cows per herd)
SMFAMILY	=	number of years the respondent sharemilked for the family
OWNEQTY	=	respondent's own equity available for farm purchase (%)
FTEMP	=	number of full-time farm workers employed by the sharemilker
EDUC	=	Educational attainment of the respondent (high school or above =1, else 0)
SMOFF	=	sharemilker engaged in off-farm employment (yes=1, else 0)
PARTOFF	=	sharemilker's partner engaged in off-farm employment (yes=1, else 0)
DISTOFF	=	distance the respondent is willing to commute for off-farm work each way (km)
RMA	=	The Resource Management Act is good for the environment (agree=1, else 0)
TECHNO	=	Technology to improve per cow productivity is readily available (agree=1, else 0)
FEEDCOST	=	High feed costs (other than pasture) are a major problem in dairy farming (agree=1, else 0)
FINPLAN	=	Uncertain milksolids prices makes financial planning difficult (agree=1, else 0).

and where,

- $P_i$  probability a sharemilker will own a (a) dairy farm sometimes, (Model 1),  
(b) non-family dairy farm, (Model 2),  
(c) dairy farm by 2001, and (Model 3), or  
(d) dairy farm by 2006 (Model 4)

The intercept represents the probabilities for the base socioeconomic characteristics, which include no experience in sharemilking for the family, an educational attainment of the respondent of less than high school, neither the respondent nor respondent's partner being involved in off-farm employment, and the respondent's opinion stating disagreement or neutrality with respect to the four statements: (a) the RMA is good for the environment, (b) technology to improve per cow productivity is readily available, (c) high feed costs (other than pasture) are a major problem in dairy farming, and (d) uncertain milk solids prices makes financial planning difficult. The choice of the base affects the size of the coefficients, but not the explanatory power of the model. Multicollinearity was not a problem in the data (all correlation coefficients were less than 0.25).

## Logistic regression results

### All sharemilkers

The parameters for the estimated models are shown in Table 2. One meaningful indicator of the effectiveness of the logit model is the percent of correct prediction. The model predicting dairy farm ownership by sharemilkers at some stage had 90% correct predictions, while the predictions for the ownership of a non-family dairy farm model were also 90% correct. Similarly, the model predicting ownership in the dairy farm by 2001 and 2006 had 85% and 79% correct predictions, respectively. The explanatory power of the models is also confirmed by the McFadden R-squared statistics and, given that it was a cross-sectional analysis, the results obtained are respectable. Rather than discuss the individual coefficients it is useful to view them in terms of the direction of association and the odds of an outcome being realised. Odd-ratios provide a superior interpretation of the analysis, compared to marginal probabilities, when the variables are binary (Hosmer and Lemeshow 1989, pp. 39-44). Discussion will be limited to the statistically significant variables in the models and to the relevant odd-ratios (Tables 2, 3 and 4).

### *Expectation to own a dairy farm at some stage (Model 1)*

The results suggest a quadratic relationship between AGE and dairy farm ownership. Older sharemilkers were more likely to get to own a dairy farm than younger ones up to certain stage. As could be expected, a higher proportion of equity available to the respondent enhanced their likelihood of farm ownership. The involvement of the respondent's partner in off-farm work was also important for achieving farm ownership, but willingness to commute longer distances for off-farm work was negatively associated with farm ownership. None of the four perception variables was statistically significant in the model. The odds of farm ownership is higher (6:1) for the respondents whose partners work off-farm.

### *Expectation to own a non-family dairy farm at some stage (Model 2)*

The respondents who did not sharemilk for their family were more likely to own a non-family dairy farm. This suggests that the respondents who sharemilked for their families were likely to inherit or purchase the same farms. As for Model 1, a higher level of equity available for farm purchase and partner involvement in off-farm work, both increased the likelihood of farm ownership. On the other hand, the variable for the distance respondents were willing to commute for off-farm work (DISTOFF) was negatively associated with the expectation of farm ownership. Partner involvement in off-farm work led to more favourable odds for owning a dairy farm (3.8) compared to not owning a farm (1).



### *Expectation of dairy farm ownership by 2001 (Model 3)*

The respondents were specifically asked if they expected to own a dairy farm in five years (2001). A larger herd size and a higher proportion of equity available for farm purchase both increased the probability of farm ownership. However, as for previous two models, the respondents who were willing to commute longer distances for off-farm work were less likely to own a farm. All four opinion variables were negatively associated with farm ownership. Thus, respondents who agreed with the four statements (RMA, TECHNO, FEEDCOST and FINPLAN) were less likely to own a dairy farm (odds were less than 0.25) than those who disagreed.

### *Expectation of dairy farm ownership by 2006 (Model 4)*

The respondents who agreed with the statement that the RMA is good for the environment, who had sharemilked for their families and who had a higher proportion of equity for a farm purchase were more likely to own a dairy farm by 2001 than those respondents who did not agree with the RMA statement or sharemilk for their families. Similarly, the respondents who were engaged in off-farm work and who were willing to commute longer distance for off-farm work were less likely to own a dairy farm than those who were not in this situation. The odds of a dairy farm ownership was higher for the respondents who concurred with the statement that the RMA is good for the environment (3.11)

### **Sharemilkers who expect to own a dairy farm**

A subset of the survey data comprising information about the respondents who expected to own a dairy farm was used to estimate two additional models (Table 3). Models 5 and 6 included 67 of the 100 respondents who expected to own a dairy farm in 5 and 10 years, respectively. The model explaining ownership by 2001 (Model 5) had 84% correct predictions, while the model explaining ownership by 2006 (Model 6) had 76% correct predictions. The respective McFadden R-squared values were 0.38 and 0.34.

### *Dairy farm ownership by 2001 (Model 5)*

When data was disaggregated for the respondents who expected to own dairy farm at some stage, the AGE variable indicated a negative relationship with the probability of farm ownership. The herd size variable was found to be significant as well, which suggests that respondents with larger herds are more likely to own a dairy farm than those with smaller herds. All four opinion variables (RMA, TECHNO, FEEDCOST and FINPLAN) were negatively associated with dairy farm ownership by the year 2001. The odds were nearly 2:1 to own a dairy farm when the respondents either disagreed or were neutral with each of the four statements.

### *Dairy farm ownership by 2006 (Model 6)*

When the same disaggregated data was considered in relation to a 10 year planning horizon four variables were found to be statistically significant (Table 3). The respondents who sharemilked for their families and who agreed with the statements that (a) the RMA was good for the environment and (b) high feed cost (other than pasture) are a major problem in dairy farming had an increased likelihood of farm ownership. The odds were better than 3-5:1 for all these three variables in favour of farm ownership. However, the respondents who were engaged in off-farm work were less likely to own a dairy farm by 2006.

## **Discussion**

The amount of equity a sharemilker has to commit towards the purchase of a dairy farm was an important determinant in all four models (Models 1 to 4) predicting dairy farm ownership. This is consistent with the *a priori* assumption that the probability of farm ownership increases if the



aspirants have a larger amount equity in hand. This is logical, since rural lenders typically require a minimum equity equivalent to at least 60% of the total in-going costs for farm ownership.

Equity is likely to be accumulated more rapidly if earnings from off-farm work are available. However, because the labour requirement for milking and other farm work is high, commuting distance, a proxy for travel time and employment costs, would progressively become prohibitive for undertaking off-farm work. Relatively high unit labour costs also would deter the employment of paid farm workers, unless the net income from off-farm work exceeded the cost of employing a farm worker. The involvement of the respondent's partner in off-farm employment was important whether they were considering ownership of an inherited or non-family farm at some stage.

When a short- to medium-term planning horizon was considered for farm ownership (5 years), the key determinants of farm ownership were a larger herd size and disagreement or neutrality of the respondents with the statements about the impact of high feed costs, unavailability of technology to enhance productivity and uncertain milksolids prices for financial planning. A positive concern for the environment was less important for the 5 year planning horizon than it was for those respondents who expected to own a farm in 10 years.

As the age of the respondents increased, so did the probability that they would own a farm at some stage in their lives. Older respondents could be expected, *ceteris paribus*, to have accumulated more equity in livestock and/or cash, and to be "closer" to gaining an inheritance (if this applies) than their younger counterparts. Younger respondents expected to own a dairy farm in 10 years time (if at all) rather than in 5 years time. It is noteworthy that they appreciated the role of the RMA in protecting the environment better than the older respondents (see below). As expected, the respondents who did not sharemilk for their families were more likely to own a non-family dairy farm in 5 years than those who had sharemilked. A number of respondents who sharemilked for their families could expect to benefit from the inter-generational transfer of the home farm at less than the real market price.

The disaggregated analysis of the respondents who expect to own a dairy farm in 5 and 10 years from now (1996) revealed contrasting results. Those who expected to own a farm in 5 years tended to be at an age when any delay would lower their probability of farm ownership. As such, they may be more willing to undertake risks to acquire the necessary equity and experience, than those who did not expect to own in 5 years. On the other hand, experience in sharemilking for the family, engagement in off-farm work, appreciation of the RMA being "good" for the environment and concern about prohibitive feed costs (other than pasture), all increased the likelihood of farm ownership for those respondents who expected to own a farm in 10 years. The latter could be interpreted as implying that at family support, a second income, good stewardship of the farm's environmental resources (which are likely to become theirs one day) and a focus on controlling production costs, all contribute to the likelihood of owning a farm.

## Conclusions

The socioeconomic determinants of dairy farm ownership were identified for 100 sharemilkers in the Manawatu region using logistic regression models. The parameter estimates for all six models varied considerably. However, when all sharemilkers were considered, a higher proportion of equity accumulated for farm purchase and shorter commuting distances to off-farm employment centres were both statistically significant in determining the probability of farm ownership at some stage (for both family and non-family farms), as well as ownership by 2001 and 2006. The respondents who sharemilked for their families were less likely to own a non-family farm but more likely to own a farm by 2006 than their counterparts from non-family farming backgrounds. Off-farm work undertaken by the respondents decreased the probability of farm ownership in 2006, the contribution of income by their partner from off-farm had the reverse effect.

The study indicates that unless real milksolids returns in the short-term increase, or land prices decrease, strategies to provide off-farm employment within accessible locations for sharemilkers' partners will increasingly be needed to facilitate the attainment of dairy farm ownership. More extension effort is required to convince sharemilkers in their mid-30s to early 40s that the Resource

Management Act is good for the environment. Also, experience in sharemilking for the family contributes positively towards farm ownership in the short-term. Thus, the study suggests that if dairy farmers want their children to attain farm ownership, they need to come up with pragmatic strategies to keep at least some of their children on-farm, preferably as sharemilkers. Overall, the analysis supports current concerns about the increasing difficulty of sharemilkers achieving farm ownership in New Zealand. This is an issue that the dairy industry will have to address if it wishes to maintain the required in-flow of highly motivated young people into dairy farming and farm ownership.

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Table 1 Socioeconomic characteristics associated with sharemilking and sharemilkers in the Manawatu region, New Zealand (1996). Mean (standard deviation).

Characteristics	All sharemilkers (n=100)	Sharemilkers who expect to own a farm (n=67)
Age, years	35.7 (7.5)	33.1 (5.6)
Effective area, ha	90.0 (65.0)	96.2 (74.0)
Herd size, number of cows	230 (137)	237 (149)
<i>Sharemilker's expectation about dairy farm ownership</i>		
a to own a dairy farm, %	67.0 (47.0)	100.00 (-)
b to own a non-family farm, %	49.0 (50.2)	73.1 (44.7)
c to own a dairy farm in 5 years, %	20.0 (40.2)	26.9 (44.7)
d to own a dairy farm in 10 years, %	42.0 (49.6)	58.2 (50.0)
<i>Sharemilker's experience on a dairy farm</i>		
a brought up on a dairy farm, %	57.0 (49.8)	56.7 (49.9)
b full-time employment, years	5.2 (6.4)	4.5 (3.4)
c part-time employment, years	2.7 (3.8)	2.7 (3.4)
d sharemilked for the family, years	2.3 (4.1)	2.7 (4.1)
<i>Sharemilking position obtained upon the advice of the owner, %</i>		
	51.0 (50.2)	53.7 (50.2)
<i>Sharemilkers directly reporting to the owner, %</i>		
	79.0 (40.9)	80.6 (39.8)
<i>Sharemilker's partner involvement in sharemilking, %</i>		
	74.0 (44.1)	73.1 (44.7)
<i>Children supported by sharemilking, number</i>		
	0.65 (1.16)	0.60 (1.16)
<i>Employment of outside worker</i>		
a Full-time, number	0.51 (0.73)	0.55 (0.78)
b Part-time, number	0.13 (0.34)	0.13 (0.34)
<i>Engagement in off-farm work</i>		
a Sharemilkers, %	15.0 (35.9)	17.9 (38.6)
b Partners of sharemilkers, %	42.0 (0.50)	46.3 (50.2)
<i>Sharemilkers interested in off-farm work to generate income for the purchase of a farm, %</i>		
	58.0 (49.6)	55.2 (50.1)
<i>Sharemilkers willing to commute for off-farm work each way, km</i>		
	16.8 (20.1)	15.1 (14.5)
<i>Sharemilker's perceptions indicating their agreement with the statement:</i>		
a The Resource Management Act is good for the environment, %	50.0 (50.2)	53.7 (50.2)
b Technology to improve per cow productivity is readily available, %	39.0 (49.0)	41.8 (50.0)
c High feed costs (other than pasture) are a major problem in dairy farming, %	83.0 (37.8)	80.6 (39.8)
d Uncertain milk solids prices makes financial planning difficult, %	74.0 (44.1)	73.1 (44.7)

Table 2 Determinants of dairy farm ownership in Manawatu, New Zealand (1996)  
 Logit regression coefficients (t-ratios) for a sample size of 100 sharemilkers

Determinants	Model 1 Sharemilkers Expecting to own a dairy farm	Model 2 Sharemilkers expecting to own a non- family farm	Model 3 Sharemilkers expecting to own a dairy farm in 5 years	Model 4 Sharemilkers expecting to own a dairy farm in 10 years
Age (years)	1.024** (2.07)	0.2286 (0.69)	-0.3808 (-1.29)	0.0797 (0.28)
Age squared	-0.0176** (-2.34)	-0.0042 (0.28)	0.0049 (1.29)	-0.0023 (-0.60)
Herd size (number of cows)	-0.0031 (-0.65)	0.0016 (0.46)	0.0061* (1.65)	0.0002 (0.09)
Sharemilked for the family (yes = 1, no = 0)	0.745 (0.66)	-0.2055** (-2.32)	0.0474 (0.61)	0.1099+ (1.61)
Own equity available for farm purchase (£)	0.0812*** (3.66)	0.0896*** (4.67)	0.0421** (2.51)	0.0324** (2.72)
Full-time farm workers employed (no = 1, yes = 0)	1.1860 (1.45)	-0.0909 (-0.15)	0.8814 (1.34)	0.5345 (1.06)
Sharemilker's education level (high school and above = 1, else = 0)	0.5052 (0.52)	-1.2104 (-1.53)	+1.3391 (+1.41)	0.2071 (0.33)
Sharemilker engaged in off-farm work (yes = 1, no = 0)	0.3855 (0.75)	-1.3586 (-1.43)	-0.6684 (-0.61)	+1.5481* (+1.94)
Sharemilker's partner engaged in off-farm work (yes = 1, no = 0)	1.8312** (2.23)	1.3238* (1.89)	-0.0634 (-0.08)	0.0358 (0.06)
Distance willing to commute for off-farm work each way (km)	-0.0497* (-1.85)	-0.0376+ (-1.60)	-0.0502+ (-1.88)	-0.0349* (-1.73)
Sharemilkers opinions indicating their agreement with the statement: (yes = 1, no or neutral = 0)				
a The Resource Management Act is good for the environment.	1.0389 (1.31)	0.6328 (0.96)	-1.2708+ (-1.56)	1.1145** (2.00)
b Technology to improve per cow productivity is readily available.	1.0355 (1.27)	0.1018 (0.16)	-1.8211** (-2.06)	0.0158 (0.03)
c High feed costs (other than pasture) are a major problem in dairy farming.	-0.5932 (-0.48)	0.5593 (0.61)	-1.9343** (-2.20)	0.5044 (0.67)
d Uncertain milk solids prices makes financial planning difficult.	-0.8152 (-0.84)	0.06689 (0.86)	-1.4313* (-1.77)	-0.5228 (-0.82)
Intercept	-16.6600* (-1.77)	-4.4747 (-0.47)	6.9088 (1.23)	-1.5613 (-0.30)
Chi-squared statistic (df = 14)	69.9	64.3	36.94	35.3
Correct prediction (%)	90	90	85	79
McFadden R-squared statistic	0.55	0.46	0.37	0.26

+ p < 0.15, \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.001

Table 3 Determinants of dairy farm ownership for sharemilkers who expect to own a dairy farm in Manawatu, New Zealand (1996). Logit regression coefficients (t-ratios); sample size=67.

Determinants	Model 5	Model 6
	Sharemilkers expecting to own a dairy farm in 5 years	Sharemilkers expecting to own a dairy farm in 10 years
Age (years)	-1.5575** (-2.31)	-0.4619 (-1.03)
Age squared	0.0243** (2.33)	0.0069 (1.03)
Herd size (number of cows)	0.0085* (1.93)	0.0036 (1.11)
Sharemilked for the family (yes=1, no=0)	0.0834 (0.83)	0.2115** (2.16)
Own equity available for farm purchase (%)	0.0304 (1.32)	0.0236 (1.48)
Full-time farm worker employed (no=1)	0.6692 (0.84)	-0.3851 (-0.59)
Sharemilker's education level (high school and above=1, else=0)	-1.2949 (-1.24)	1.1209 (1.38)
Sharemilker engaged in off-farm work (yes=1, no=0)	-0.8362 (-0.78)	-1.7200** (-1.92)
Sharemilker's partner engaged in off-farm work (yes=1, no=0)	-1.1573 (-1.17)	-1.0576 (-1.42)
Distance willing to commute for off-farm work each way (km)	-0.0419 (-1.20)	-0.0284 (-1.15)
<i>Sharemilkers opinions indicating their agreement with the statement: (yes=1, no or neutral=0)</i>		
a. The Resource Management Act is good for the environment.	-1.9608** (-2.00)	1.6451** (2.29)
b. Technology to improve per cow productivity is readily available.	-1.8263* (-1.80)	0.0314 (0.05)
c. High feed costs (other than pasture) are a major problem in dairy farming.	-1.8879* (-1.83)	1.7503* (1.84)
d. Uncertain milksolids prices makes financial planning difficult.	-1.8021* (-1.80)	-0.6212 (-0.79)
Intercept	25.0060** (2.28)	4.9466 (0.68)
Chi-squared statistic (df=14)	29.7	21.58
Correct prediction (%)	84	76
McFadden R-squared statistic	0.38	0.34

+ p<0.15, \* p<0.1, \*\* p<0.05, \*\*\* p<0.001

Table 4. Odds ratios associated with the logistic parameter estimates of determinants of dairy farm ownership in Manawatu, New Zealand (1996).

Determinants	Model 1 Share-milkers Expecting to own a dairy farm	Model 2 Share-milkers expecting to own a non- family farm	Model 3 Share-milkers expecting to own a dairy farm in 5 years	Model 4 Share-milkers expecting to own a dairy farm in 10 years	Model 5 Share-milkers expecting to own a dairy farm in 5 years	Model 6 Share-milkers expecting to own a dairy farm in 10 years
Age (years)	2.78	1.26	0.68	1.08	0.21	0.63
Age squared	0.98	0.99	0.99	0.99	1.02	1.01
Herd size (number of cows)	0.99	0.99	1.01	0.99	1.01	0.99
Sharemilked for the family (yes=1, no=0)	2.11	0.81	1.05	1.12	1.09	1.24
Own equity available for farm purchase (%)	1.08	1.09	1.04	1.03	1.03	1.02
Full-time farm worker employed (no)	3.27	0.91	2.41	1.71	1.95	0.68
Sharemilked's education level (high school and above=1, else=0)	1.66	0.30	0.26	1.23	0.27	3.07
Sharemilked engaged in off-farm work (yes=1, no=0)	1.47	0.26	0.51	0.21	0.43	0.18
Sharemilked's partner engaged in off- farm work (yes=1, no=0)	6.24	4.76	0.94	1.04	0.31	0.35
Distance willing to commute for off- farm work each way (km)	0.95	0.96	0.95	0.97	0.96	0.97
<i>Sharemilked's opinions indicating their agreement with the statement (yes=1, no or neutral=0)</i>						
a. The Resource Management Act is good for the environment	2.83	1.88	0.28	3.05	0.14	5.18
b. Technology to improve per cow productivity is readily available.	2.82	1.11	0.16	1.02	0.16	1.03
c. High feed costs (other than pasture) are a major problem in dairy farming.	0.55	1.75	0.14	1.66	0.15	5.76
d. Uncertain milk solids prices makes financial planning difficult.	0.44	0.51	0.24	0.59	0.16	0.54