



Dairy Industry Farm Monitor Project

The influence of farm size on income, costs and profitability: results from the Dairy Industry Farm Monitor Project 2006-07 to 2010-11

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This report has been produced in conjunction with Dairy Australia.

Further information regarding the Dairy Industry Farm Monitor Project and Feature Article may be obtained from:

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Introduction

The Dairy Industry Farm Monitor Project (DIFMP) provides a financial and physical comparative analysis of dairy farms from across the three key dairying regions in Victoria, Northern Victoria, South Western Victoria and Gippsland.

This is the fifth year of the project which is a joint initiative between the Department of Primary Industries (DPI) and Dairy Australia. The project provides farm level data relating to profitability and production on farms in the Victorian dairy industry.

In 2010-11 the annual report highlighted a return to form for the industry across all regions of Victoria. The milk price opened more strongly than many expected with most companies paying between \$4.70 and \$4.75 per kilogram of milk solids. Despite the strong Australian dollar, milk price step-ups including several late in the season helped push the average milk price to \$5.64 per kilogram of milk solids.

Combined with improved seasonal conditions, including 100 percent irrigation allocations in northern Victoria, the rise in milk price was more than enough to offset the six percent increase in cost of production that occurred compared to 2009-10. With this combination of factors, farmers were provided the best opportunity for many years to record a healthy profit and many did so with 72 of the 74 farms surveyed recording positive earnings before interest and tax. Across the state the average earnings before interest and tax was \$1.73 per kilogram of milk solids or \$1,260 per hectare, a significant rise from 65 cents per kilogram of milk solids or \$507 per hectare recorded last year. Return on assets recovered similarly, rising from 2.2% last year to 6.2% highlighting the improvement in overall economic efficiency of Victorian dairy farm businesses.

The annual report is available on the project website at www.dpi.vic.gov.au/dairyfarmmonitor or by sending an enquiry to farm.monitor.project@dpi.vic.gov.au.

The feature article allows further interrogation of the data to identify trends relating an issue of interest. The focus of this year's feature article is the influence farm size, defined by the number of cows milked, has on overall business profitability. In part one of the article we report on farmers' perceptions regarding the influence of farm size has on profitability and what factors or barriers there are to changing farm size. In part two of the article we have broken down and

compared the income, costs and various financial key performance indicators across farms of differing size between 2006-07 and 2010-11. Analysis will be performed on the income and cost categories reported in the project annual report and broken down to per kilogram of milk solids sold to enable comparison between farms of different size. A flow chart of explaining the method for calculation of figures can be found in appendix one. In addition, a statistical analysis has been performed on the data reported. The results of this analysis and the statistical significance between the different groups are displayed in appendix two.

Part one: Does farm size matter?

“Get big or get out!” Sound familiar? The topic of farm size and the question “is bigger always better” continues to be hotly debated by farmers, agricultural economists and farm management consultants from around the world. In general the arguments for increasing size stem from the belief that by increasing the size of businesses farmers will be able to take advantage of economies of size. That is, they’ll be able to produce more with lower input costs per unit of production. The reduction in costs comes predominantly from spreading total overhead costs over a greater level of production.

In order to increase size, farmers have two options at their disposal; they can expand, that is purchase or lease more land, or intensify, which is working their existing land more intensively. Over the period from 1982-83 to 2002-03 the number of farms in Australia fell by from around 178,000 to 132,000. Over the period from 1988-89 to 2008-09 herd size increased from 103 to 212 cows; farm size increased from 150 to 264 hectares (ABARE 2000, ABARE 2010, Productivity Commission 2005). These changes indicate that dairy farms have been both expanding and intensifying production simultaneously. In addition to this there has been an increase in the proportion of larger milking herds on Australian dairy farms. The largest 30 percent of farms by value of output produced around 60 percent of total milk output (Malcolm 2011).

Farmer perceptions regarding farm size

There are many ways in which to define farm size; hectares, value of output, or kilograms of product sold. In the following analysis we have classified farm size based on the number of cows milked. During the 2010-11 DIFMP data collection period participant farmers were asked a series of questions regarding how they thought farm size influenced profitability. Questions asked were:

- Do you think farm size has a significant influence on profit?
- What are the main factors that influence farm size?
- What are the barriers to changing farm size?
- Are you considering changing you farm size in the next five years?

Of the 62 farmers who responded to question one the results were slightly in favour of the negative with 35 farmers responding that they did not think farm size influenced profitability while 27 indicated that they thought it did.

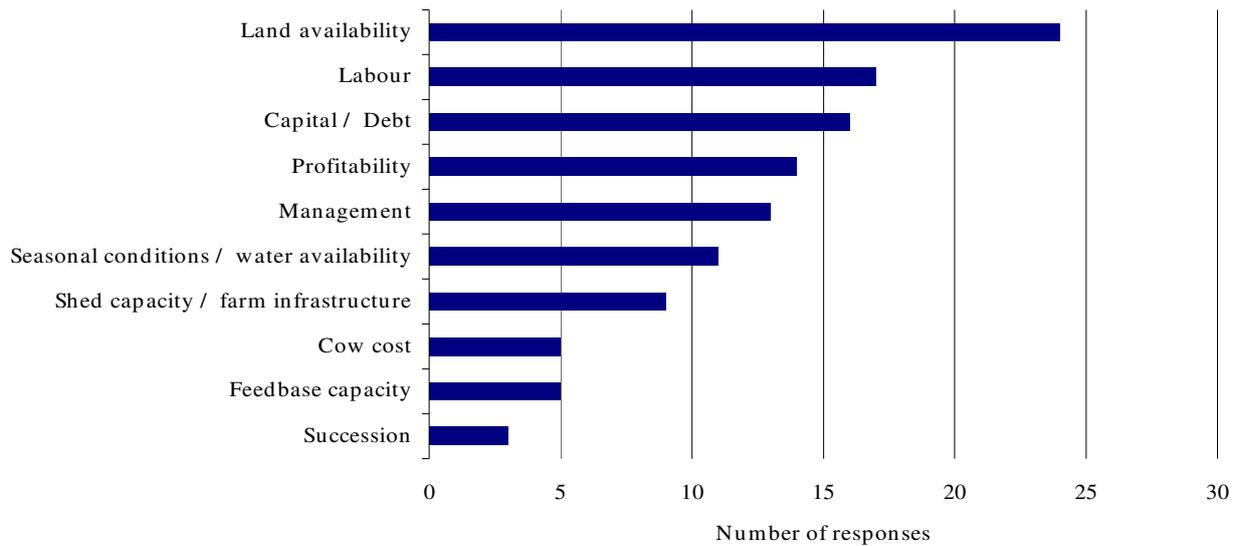
Of those farmers who didn’t think farm size influenced profitability, the most common response was that profitability is more dependent on farm management than the size of the operation. Close behind was the response that as farms get larger they become less technically efficient and therefore profitability remains proportionally the same as that generated by smaller farms.

The most common answer of the 27 farmers who indicated that farm size did influence profitability was that they believed farm size influenced profitability up to a point, after which greater size only yielded proportional increases in profit. The second most common response was that farm size influenced profit by enabling larger farms to decrease their overhead costs proportionally compared to small farms, thereby taking advantage of economies of size.

The factors that influence farm size were grouped into 10 broad categories and are displayed in figure one. The most common response was land price and availability. Many farmers indicated that there wasn’t any suitable land nearby which they could purchase and in some cases land values were prohibitively high and prevent purchasing. Following this, the next most common factor was labour with farmers responding that they didn’t want to work additional hours and that they didn’t want to have to employ labour to increase their farm size. The third most common response was the access to capital or debt load.

The fourth most common response was that relative profitability or current level of profitability were constraining the ability of farms to change their size. The fifth most common response regarding factors influencing farm size was management aspirations. Many farmers indicated that they preferred to keep their farms and farming systems smaller and simpler allowing them to sustain their work/life balance as opposed to growing farm size or increasing complexity. Other factors influencing farm size included, seasonal conditions and water availability, dairy shed capacity and other farm infrastructure, feedbase capacity, the cost of purchasing additional cows and lastly succession planning.

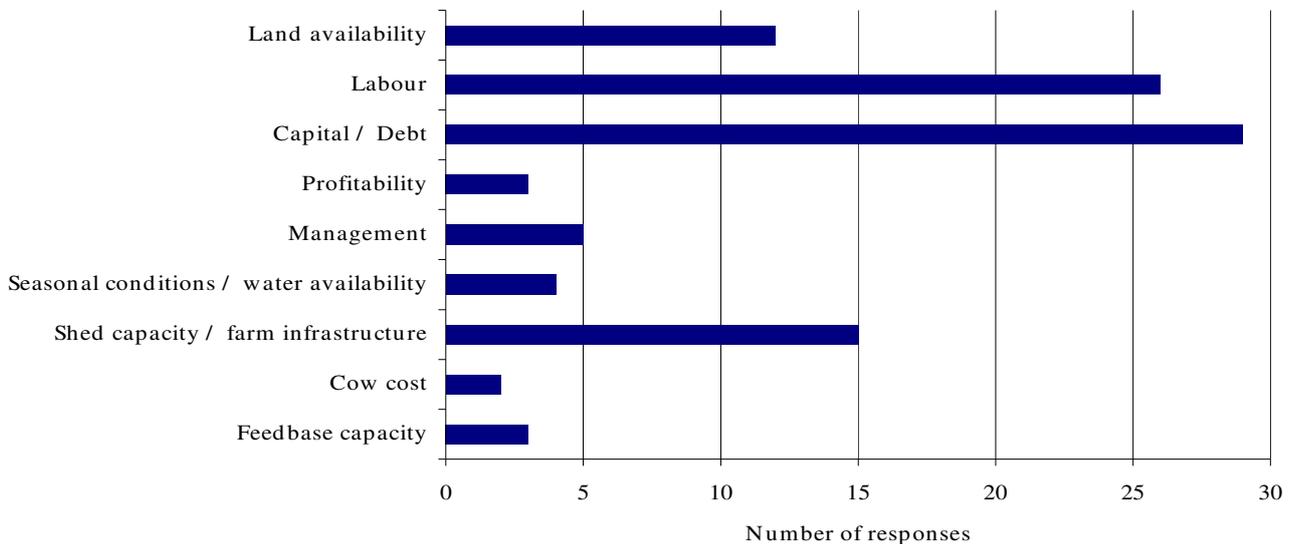
Figure 1: Factors considered to influence farm size



The major barriers to changing herd and farm size as identified by farmers are displayed in figure three below. Interestingly, with the exception of succession, the barriers to changing farm and herd size identified were the same as the factors determining farm size. As can be seen farmers identified four key barriers. The two

most commonly identified barriers to changing farm size were the capital requirements including borrowing capacity and access to quality labour. The next two most commonly identified barriers to changing farm size were shed capacity/ farm infrastructure and suitable land availability.

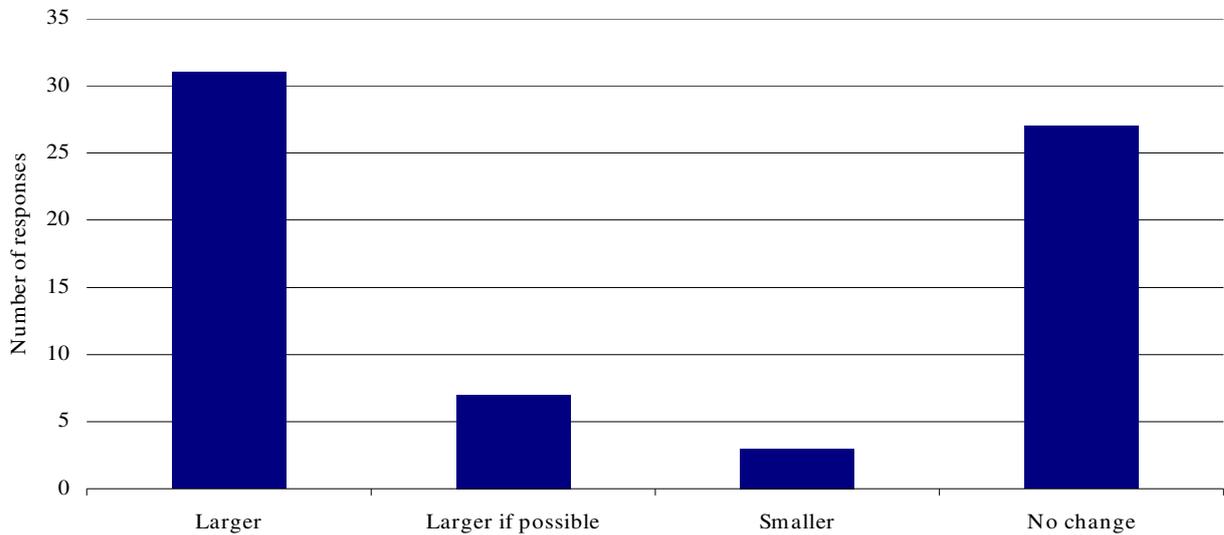
Figure 2: Barriers to changing farm size.



When asked if they were considering changing the size of their farm over the next five years 69 farmers responded with 41 farmers saying “yes” and 28 “no”, as shown in figure three. Of the respondents who answered yes, three quarters, or 31, of indicated that they would be looking to increase farm size. The majority said this increase would come in the form of

greater cow numbers. In addition to this seven more farmers indicated they would increase farm size if opportunities to purchase suitable land arose. Three farmers indicated that they be down-sizing their operation during the next five years. Land, labour and infrastructure constraints were common reasons for maintaining current farm size, as was the preference to maintain work/life balance.

Figure 3: Expected changes to farm size over the next five years.



The results from the farmer survey indicate that the question of appropriate farm size is not simply a matter of economics. Many other issues including land availability, labour requirements and shed capacity/farm infrastructure being central to farmers thinking with regards to farm size. Interestingly some farmers may have contradicted themselves in response to some questions, with over half of farmers surveyed indicating they do not think that farm size influences profit while over half the farmers also intend to increase farm size during the next five years. It is possible that some of these farmers were in the category that indicated that profits only increase proportionally with farm size and by increasing they will generate greater wealth over time.

Part two: Income, costs and profit

Defining farm size

In part two of the feature article we discuss the influence of farm size on farm profitability from 2006-07 to 2010-11 based on the project dataset. Firstly we have explored whole farm performance and then how income and costs vary across farms of differing size and how these variations contribute to differences in whole farm performance. In order to make comparisons between the different sized farms, income and costs have been broken down and presented per kilogram of milk solids sold. All figures displayed are averages for each group for each year and are expressed in nominal terms.

As mentioned earlier, there are many ways in which to define farm size. In the following analysis we have classified farm size based on the number of cows milked. The following definitions align to the definitions of farms size used by Dairy Australia in the National Dairy Farmer Survey.

Table 1: Farm size category definitions.

Farm size	Cows milked
Small	Less than 150
Medium	151 – 300
Large	301 – 500
Extra large	Greater than 500

The distribution of farms sizes in the Dairy Industry Farm Monitor Project over the last five years is presented in the table two. On average, 11 percent of farms included in the project over the study period were in the small category, 49 percent were in medium category, 23 percent were in the large category while 18 percent were in the extra large farm size category

Table 2: Number of farms in the Dairy Industry Farm Monitor Project by farm size, 2006-07 to 2010-11.

	Small farms	Medium farms	Large farms	Extra large farms
2006-07	9	21	14	12
2007-08	5	38	15	15
2008-09	6	32	16	14
2009-10	10	35	16	10
2010-11	7	42	16	9

Top 25 percent performance

The project reports individual farm performance, regional and statewide averages and regional and statewide top 25 percent performance, which is based on earnings before interest and tax per hectare. Table three below indicates the make up of the statewide top 25 percent on an annual basis. The number of farms in the top 25 percent from each category needs to be considered in light of the total

number of farms in that category. As can be seen the medium, large and extra large farms make up the majority of farms that are in the top 25 percent however small farms also appear in 2006-07 and 2009-10. On average between 25 and 29 percent of the total medium, large and extra large farms were ranked in the top 25 percent each year indicating strong performers in all categories.

Table 3: Number of farms from each category in the top 25 percent by farm size, 2006-07 to 2010-11.

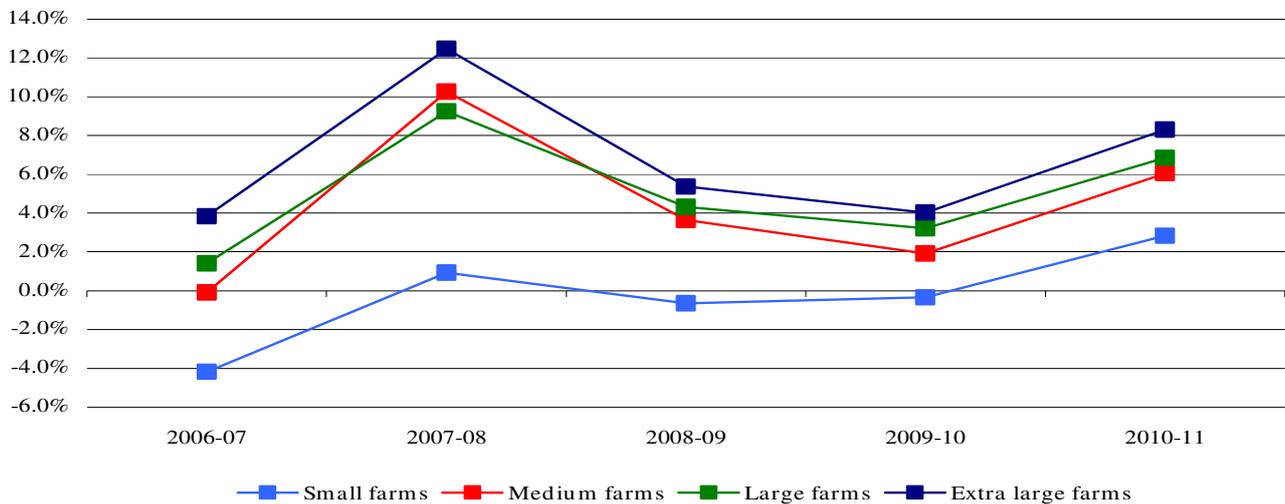
	Small farms	Medium farms	Large farms	Extra large farms
2006-07	1	4	4	4
2007-08	0	10	5	4
2008-09	0	9	6	2
2009-10	1	10	2	5
2010-11	0	10	4	2

Whole farm performance

Whole farm performance of farms of differing sizes over the five year project period was examined in terms of return on assets and return on equity. Return on assets is the earnings before interest and tax expressed as a proportion of the total assets under management. This performance measure indicates how efficiently the assets managed by the business have been used to generate profit.

In figure four below you can see that in general larger farms have generated higher returns on asset over the past five years. The exception to this was in 2007-08 when medium farms recorded a return on asset of 10.3 percent compared to 9.2 percent recorded by large farms. Over the period average return on assets has been negative 0.6 percent for small farms, 4.9 percent for medium farms, 5.0 percent for large farms and 7.1 percent for extra large farms.

Figure 4: Average annual return on assets (%) by farm size, 2006-07 to 2010-11 (annual earnings before interest and tax / total assets managed).



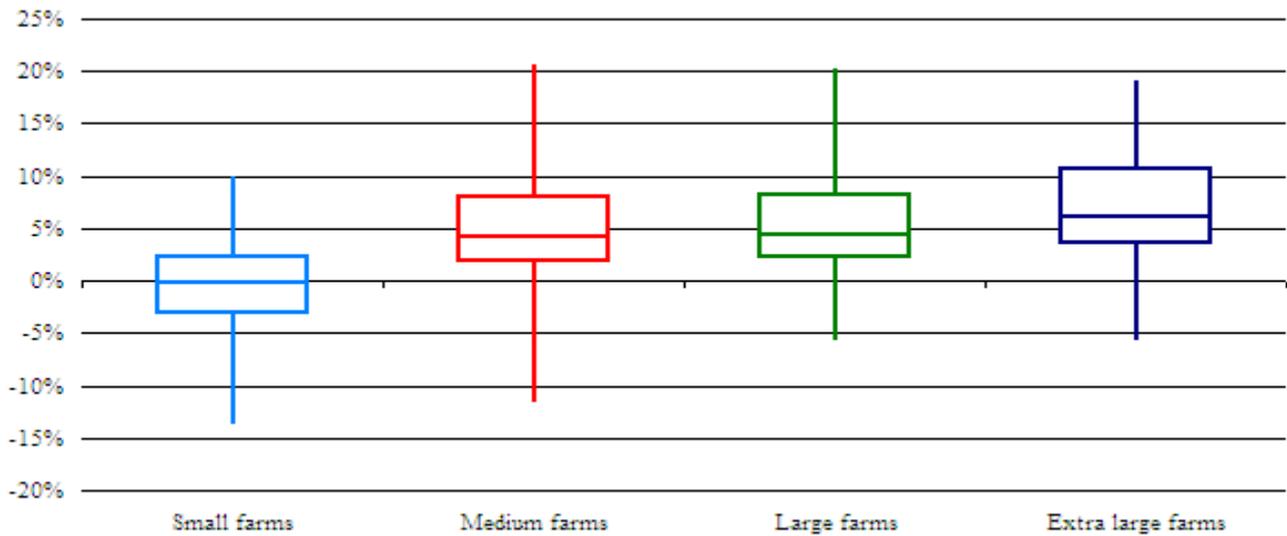
While this data indicates that the larger the farm the higher the annual return on assets, when the distribution of returns over the total period is examined, as shown in the 'box and whisker' plots in figure five, we see slightly different results. In figure five, the middle horizontal bar indicates the median or middle value for the data set, while the top and bottom horizontal bars of the 'box' represent the first (25th percentile) and third (75th percentile) quartile ranges respectively. The middle 50 percent of farms sit

within this range. Finally the long vertical 'whiskers' at each end of the boxes represent the total range for all data. While extra large farms achieve the highest average and median return on assets, medium and large farms performed similarly and had a greater range of returns than extra large farms. Large farms recorded a similar minimum return on assets, while the minimum recorded by medium size farms was much lower. These results indicate that while on average extra large farms recorded

a higher return on assets, well managed medium and large farms can perform equally as well as extra large farms. Small farms stand out clearly as having lower average return on assets. The median value indicates that half the farms made a profit while half did not. Across the three larger farm size groups it can be seen that the

median is toward the lower half of the Q1 to Q3 range indicating that the data is not evenly distributed and that there is a skew toward lower returns. A breakdown of distribution of return on assets by farm size by year can be found in appendix three.

Figure 5: Distribution of return on assets (%) by farm size, 2006-07 to 2010-11.

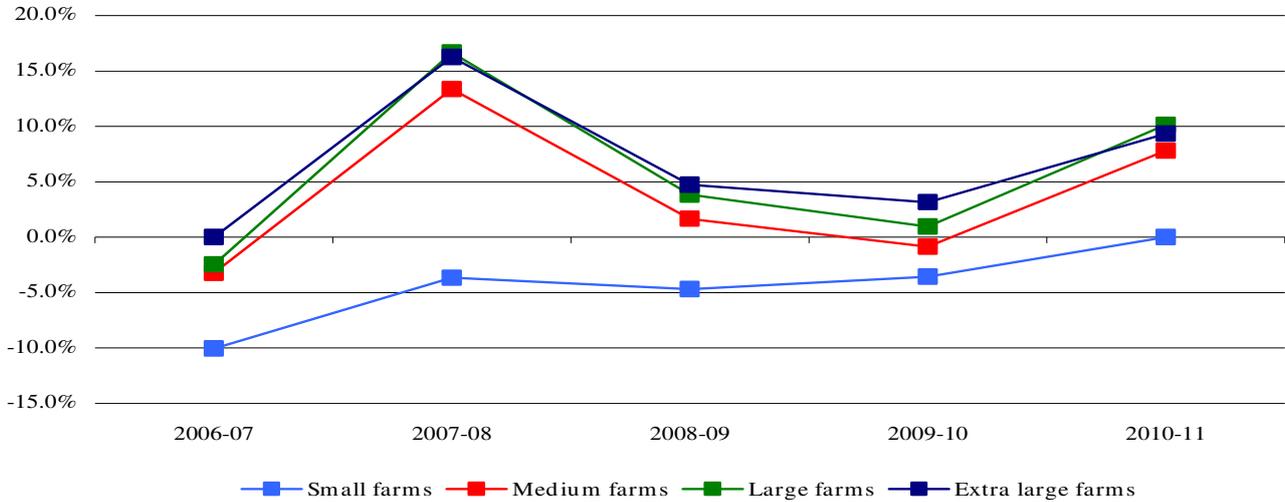


Annual return on equity provides another whole farm indicator of business performance. Return on equity is calculated as net farm income (EBIT minus interest and lease costs) divided by the owners' equity in the business.

Examining figure six identifies similar trends to figure four although figure six highlights a slight improvement in the performance of large farms compared to extra large farms. In two of the years, 2007-08 and 2010-11 large farms outperformed extra large farms in terms of returns on equity.

This trend can be explained in part by the varying levels of equity held on average by farms of different sizes where small farms on average had 78 percent equity, medium farms 70 percent, large farms 69 percent and extra large farms 66 percent. The lower equity held by larger farms would enable greater return on equity levels to be generated in years when return on assets exceeded costs of borrowing.

Figure 6: Average annual return on equity (%) by farm size, 2006-07 to 2010-11.



Farm size and gross farm income

In order for a farm business to survive and prosper, the gross farm income generated must exceed the total expenditure to obtain that income, including imputed and interest and lease costs. Gross farm income includes income from milk sold as well as income from livestock and feed inventory gains and other sources such as agistment and dividends from farm held shares.

five years is presented in figure seven. As can be seen most farms have a similar level of income per kilogram of milk solids sold each year. Extra large farms tend to generate gross farm income between three and seven percent higher than smaller farms although these differences have been as high as 10 percent as was the case in 2008-09.

Gross farm income per kilogram of milk solids sold of small, medium, large and extra large farms over the past

Figure 7: Average annual gross farm income (\$/kg MS) by farm size, 2006-07 to 2010-11.

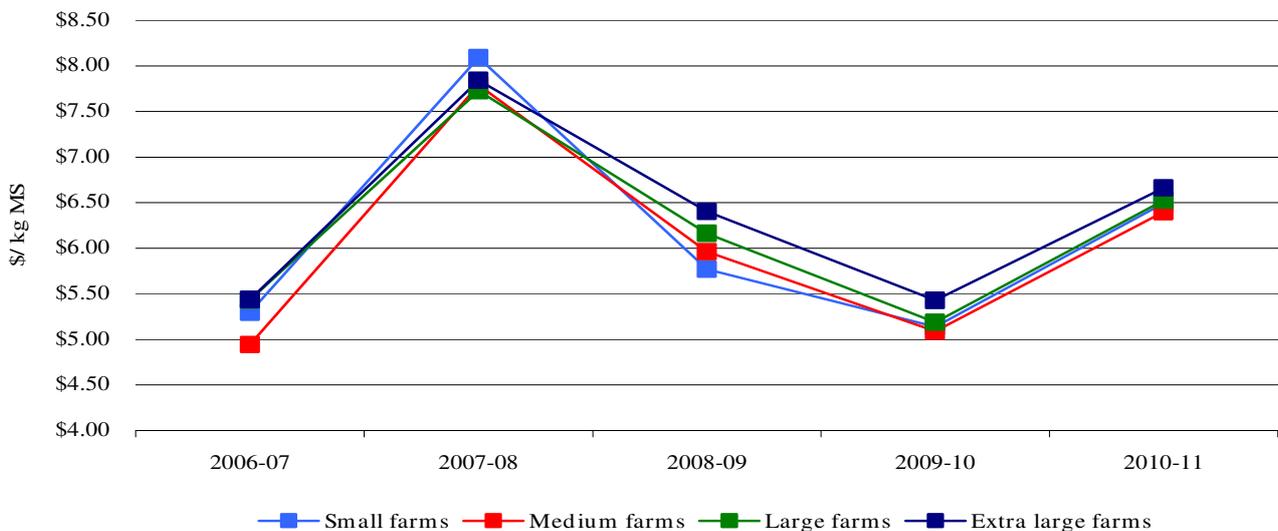
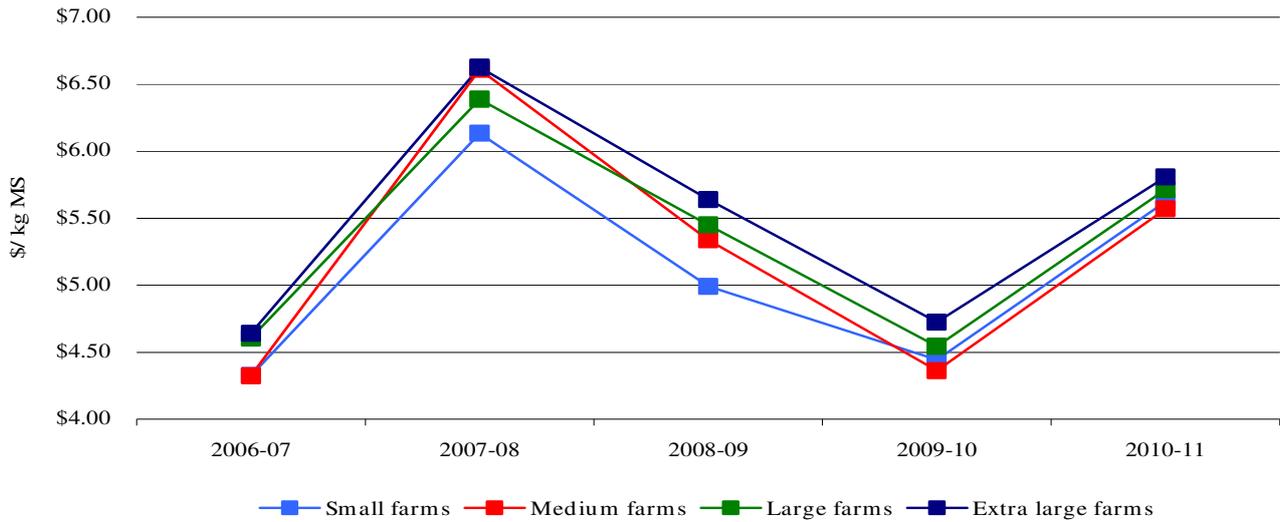


Figure eight highlights the milk price received by each of the different sized farms. Despite the mix of export and domestic suppliers across all categories extra large farms receive the highest milk price of all farms. On average

extra large farms receive a milk price that is higher by 2.6 percent (15c/kg MS), 4.8 percent (25c/kg MS) and 7.0 percent (38c/kg MS) per kilogram of milk solids compared to large, medium and small farms respectively. This in turn produces higher gross farm incomes on larger farms.

Figure 8: Average annual milk price received (\$/kg MS) by farm size, 2006-07 to 2010-11.



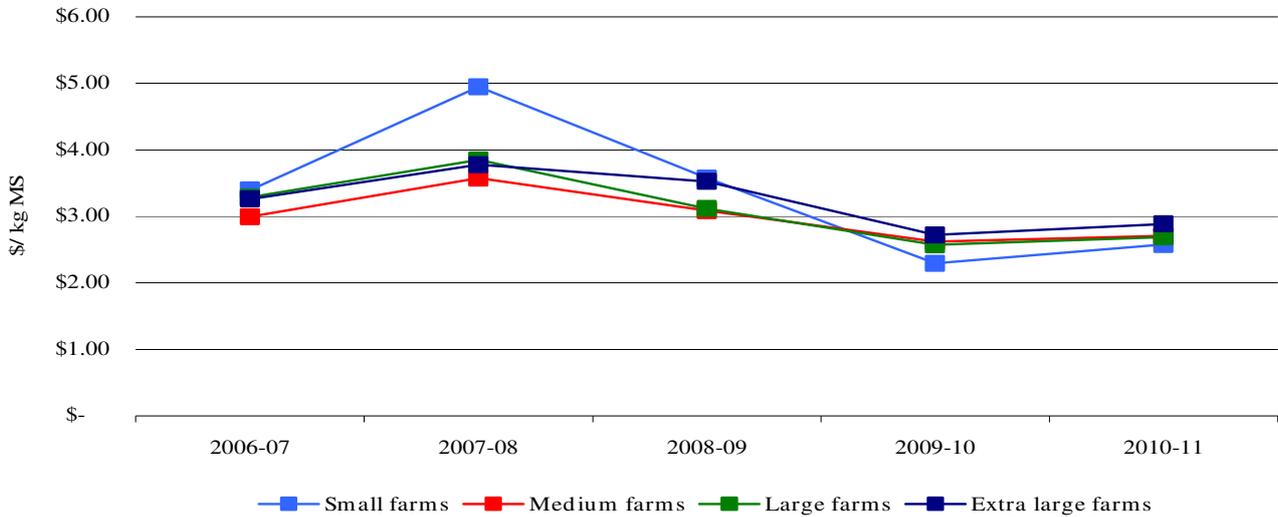
Farm size and variable costs

In the Dairy Industry Farm Monitor Project variable costs are segmented in to sub categories of herd, shed and feed costs. Feed costs comprise the majority of costs for dairy farming businesses and over the past five years have accounted on average for between 48 and 62 percent of total costs annually.

Unsurprisingly farms of all sizes reported similar variable costs per kilogram of milk solids as shown in figure nine. The exception is small farms in 2007-08 who reported

significantly higher variable costs for that year. Over the three most recent years medium and large farms have reported very similar levels of variable costs per kilogram of milk solids sold, while extra large farms have reported costs between four and seven percent higher. The differences in variable costs was due to differences in feed costs for the different size farms, as herd and shed costs were similar and stable across all four groups.

Figure 9: Average annual variable costs (\$/kg MS) by farm size, 2006-07 to 2010-11.



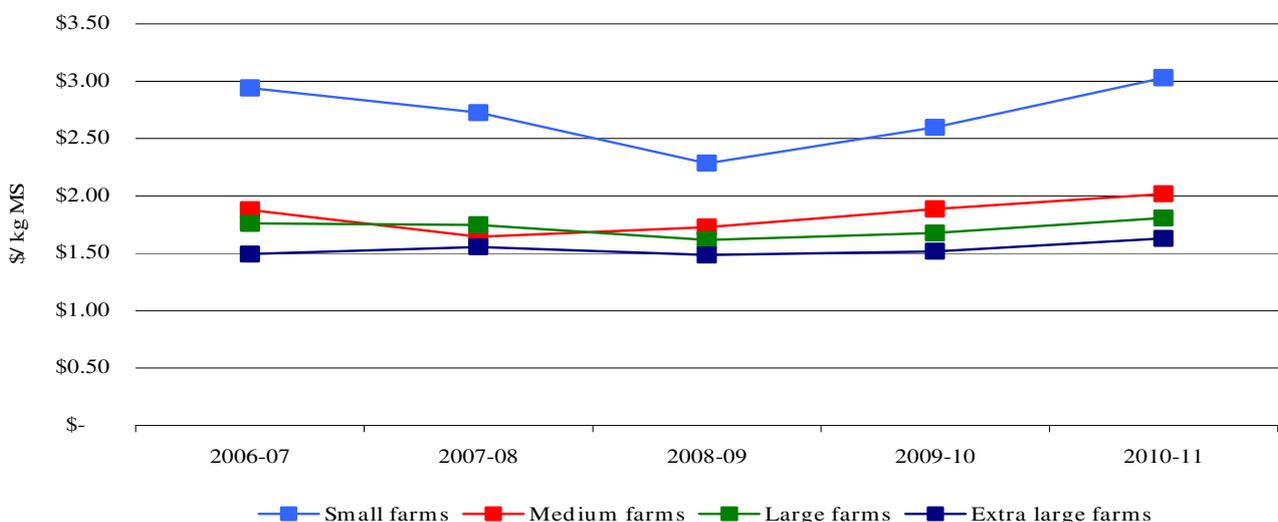
Farm size and overhead costs

As opposed to variable costs where farms of all sizes reported similar costs per kilogram of milk solids there are very noticeable trends and differences in the overhead costs incurred by farms of different sizes as shown in figure 10. In general larger farms reported lower overhead costs per kilogram of milk solids sold. Generally speaking extra large farms had the lowest overhead costs which have been stable around \$1.50 per kilogram of milk solids sold, with a small increase in 2010-11. Similarly large and medium farms have reported relatively stable overhead costs although they are slightly higher at approximately

\$1.70 and \$1.85 per kilogram of milk solids sold respectively.

Overhead costs on small farms however stand out in terms of dollar amount and annual variability, despite following a similar trend in terms of rising and falling. Over the five year period studied overhead costs on small farms have been between 32 and 66 percent higher than those reported on medium farms, with an average for the period of around \$2.70 per kilogram of milk solids sold. It is the variation in overhead costs that is having the greatest influence on profit levels between farms of different sizes.

Figure 10: Average annual overhead costs (\$/kg MS) by farm size, 2006-07 to 2010-11.

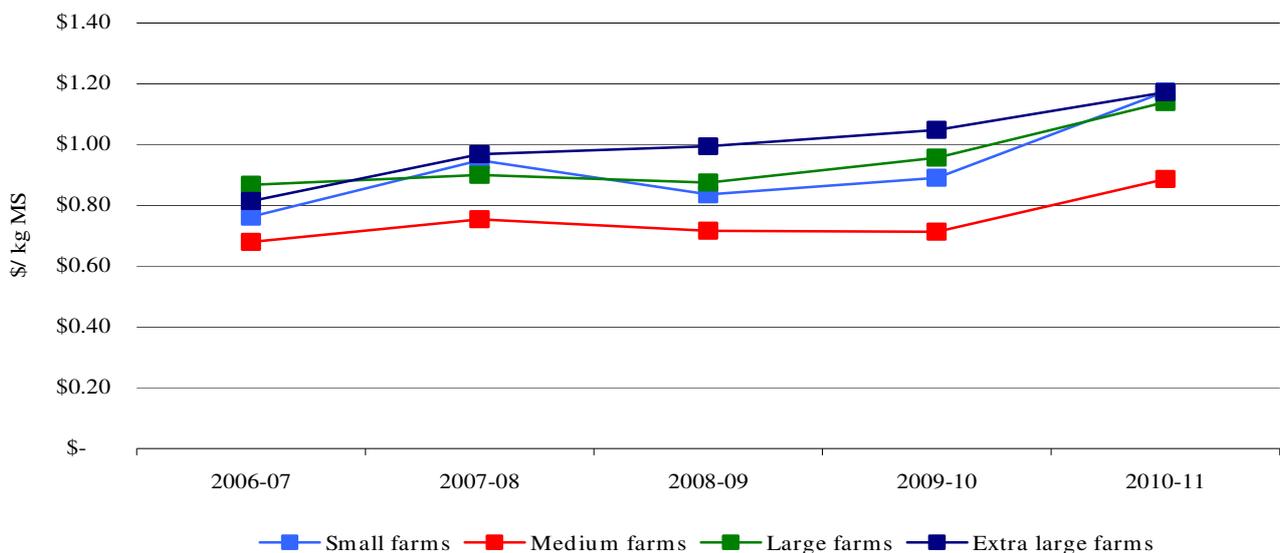


In the Dairy Industry Farm Monitor Project overhead costs are segmented into sub categories of cash and non-cash costs. Cash overhead costs are those associated with actual cash costs to the business such as rates, repairs and maintenance and employed people (paid labour) while non cash costs include depreciation and an imputed operators allowance for labour and management.

Figure eleven below compares cash costs between the farms of different sizes and interestingly it is the large and extra large farms that incur the highest cash costs. Small farms also incur cash costs similar to these large

enterprises while medium farms report significantly lower cash costs than all other farms. Medium farms report significantly lower expenditure on employed people than farms in the large and extra large category, while they have lower costs than small farms in the areas of farm insurance, repairs and maintenance and other overheads compared to small farms. This suggests that farms of small and medium size are predominantly staffed by owner operators while larger farms require additional labour units which must be employed.

Figure 11: Average annual cash overhead costs (\$/kg MS) by farm size, 2006-07 to 2010-11.

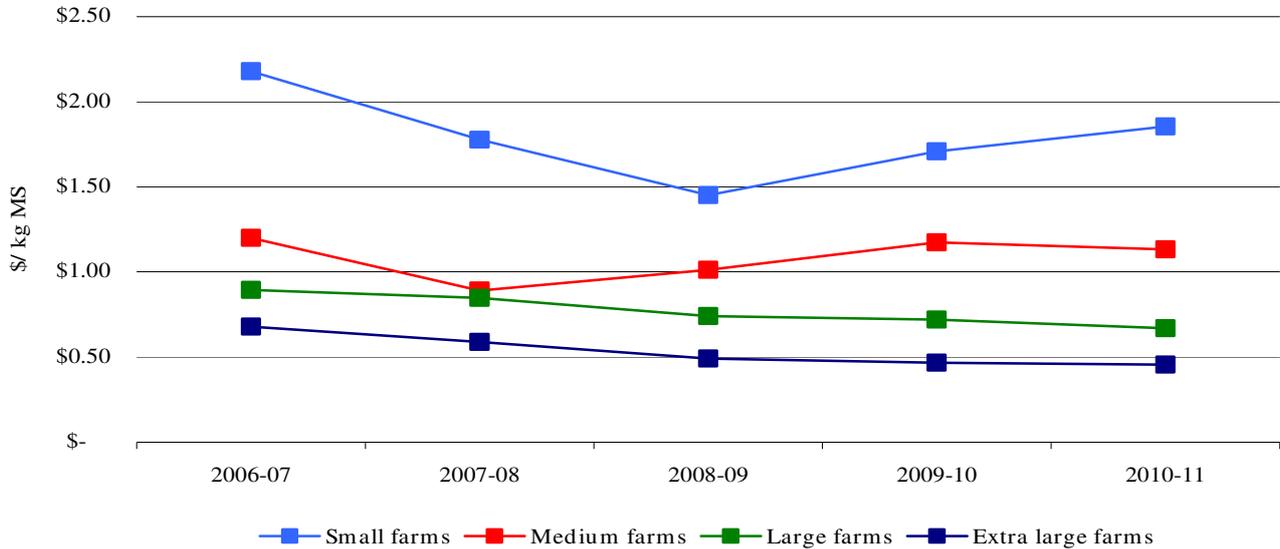


Non cash costs include imputed people (allowance for labour and management) and depreciation costs. As shown in figure 12 below, it is in this category that farm size has a significant influence on cost levels. These differences are predominantly due to the imputed people costs as depreciation costs are consistent between all farm size groups with a range of only 18 to 23 cents per kilogram of milk solids sold across all groups. Conversely imputed people costs rose significantly as farms

decreased in size with small farms reporting imputed people costs up to four times higher than those reported on extra large farms in some years.

It is worth noting that in the DIFMP the imputed cost of labour and management is set at \$20 per hour multiplied by the number of hours worked by the owner/operator irrespective of farm size. In reality, as farm size increases, so does the requirement for management skill and therefore the cost should also increase.

Figure 12: Average annual non-cash overhead costs (\$/kg MS) by farm size, 2006-07 to 2010-11.



When examining the total labour costs incurred by farms the results mirror the non cash overhead costs reported in figure 12 above showing small farms incurring significantly higher labour costs. The variation in labour costs can be partially explained by the differences in labour efficiency achieved on the farms of different sizes.

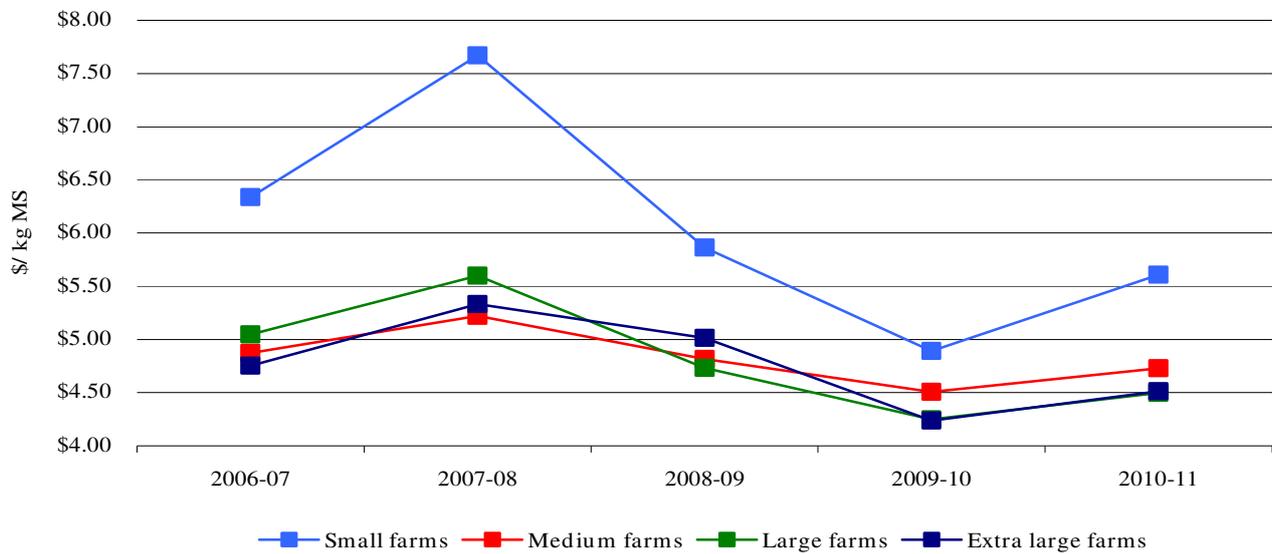
The five year average for total kilograms of milk solids sold per labour unit is around 23,000kg MS for small farms, 42,000kg MS for medium farms, 48,000kg MS for large farms and almost 60,000kg MS for extra large farms. This highlights the concept of increasing returns to size where larger businesses or firms are able to spread overheads over greater production, creating additional efficiencies in the production process. The higher labour efficiency recorded on larger farms may also be assisted by larger

farms having more labour efficient equipment such as rotary dairies.

Farm size and total costs

Total costs are displayed in figure 15 which includes all variable and overhead costs. Over the past five years total costs have been very similar for medium, large and extra large farms with these farms reporting average total costs over the five year period of \$4.83/kg MS, \$4.81/kg MS and \$4.84/kg MS respectively. Small farms on the other hand have incurred significantly higher total costs of \$5.91/kg MS over the period. This difference has been contributed to mainly by non-cash overhead costs of imputed costs for labour and management and depreciation.

Figure 13: Average annual total costs (\$/kg MS) by farm size, 2006-07 to 2010-11.

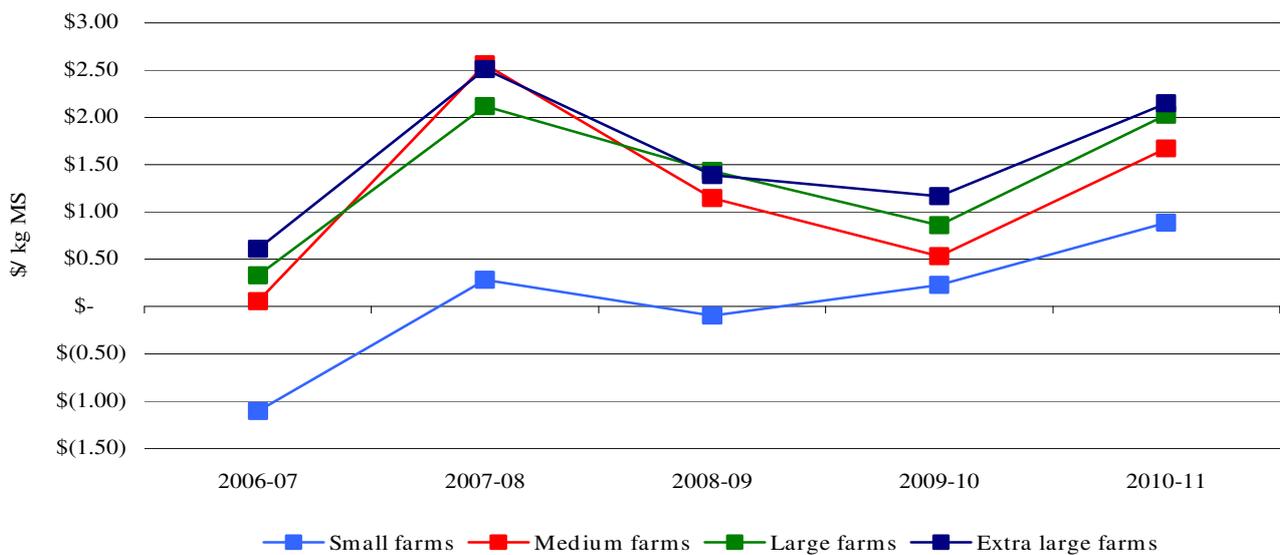


Farm size and earnings before interest and tax

Earnings before interest and tax are calculated as gross farm income minus variable and overhead costs. In figure 14 it can be seen that medium, large and extra large farms have all recorded positive earnings before interest and tax

during each year of the project. Small farms have recorded positive earnings in three out of five years however in every year these returns were much lower than those recorded by the other groups of farms.

Figure 14: Average annual earnings before interest and tax (\$/kg MS) by farm size, 2006-07 to 2010-11.

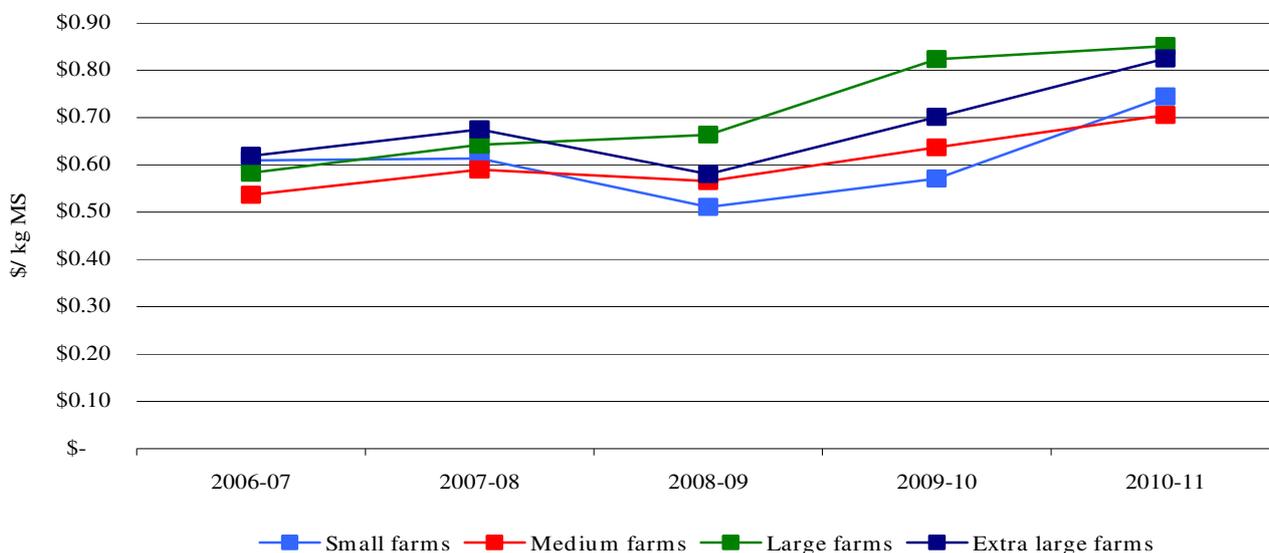


Farm size and interest and lease costs

Interest and lease costs are those costs incurred by the business for interest on bank and hire purchase loans and the costs of leasing additional land or cows for their farm business. Interest and lease costs do not include capital repayments on loans. As can be seen in figure 15 interest and lease costs vary across the different sized farms

however in general it is the large and extra large farms that incur the highest costs in this category. This suggests that these farms have a lower equity or lease a greater proportion of their land compared to small and medium sized farms. This trend was reflected in the relative equity levels reported on page 10.

Figure 15: Average annual interest and lease costs (\$/kg MS) by farm size, 2006-07 to 2010-11.

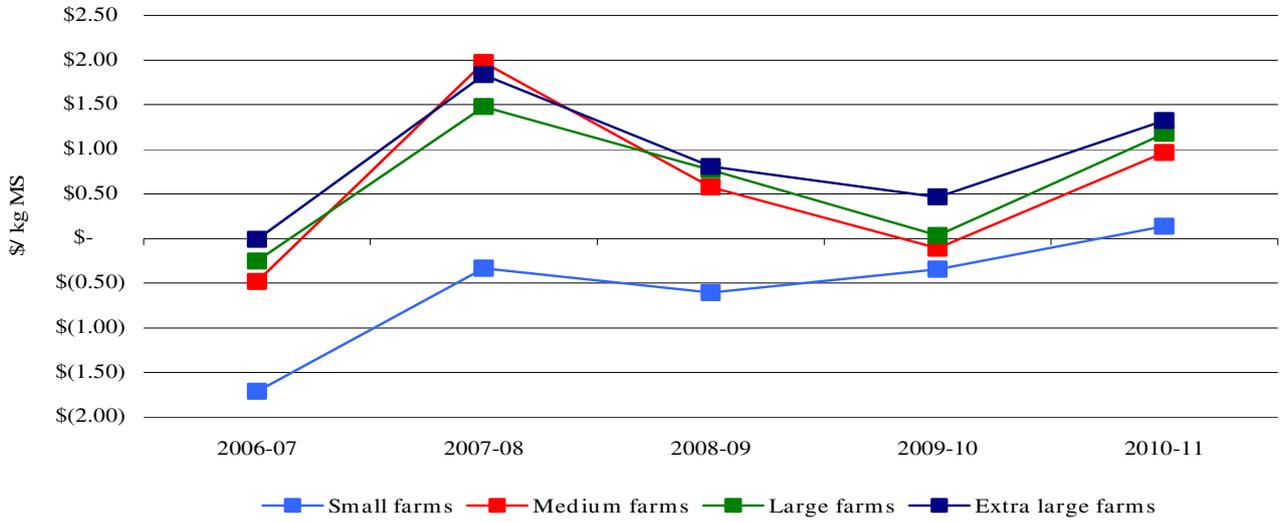


Farm size and net farm income

Net farm income is the final measure of profitability reported in the Dairy Industry Farm Monitor Project and is calculated as earnings before interest and tax minus interest and lease costs. As demonstrated in figure 16

medium, large and extra large farms have had similar net farm income per kilogram of milk solids sold levels over the past five years. Small farms have had significantly lower net farm incomes again caused by high relative imputed labour costs.

Figure 16: Average annual net farm income (\$/kg MS) by farm size, 2006-07 to 2010-11.



Conclusion

The analyses presented in this feature article details farm size specific comparisons of key farm profitability indicators over the past five years.

According to the overall results of the analysis, extra large farms have recorded the highest average return on assets and highest average return on equity over the past five years. These returns have been produced primarily by the high gross farm income earned by extra large farms. Total costs including variable and overhead costs for medium, large and extra large farms are very similar over the period.

Small farms on average have a lower gross farm income and receive a lower milk price than all other sized farms. Variable costs on small farms are similar to those on farms of other sizes however overhead costs are much higher caused mainly by higher imputed costs for labour and management and depreciation and as a result total costs are higher.

Earnings before interest and tax and net farm income were similar for medium, large and extra large farms however these farms all higher than those levels recorded by small farms.

Despite these higher average returns reported by the extra large farms, individual farms across all categories have performed strongly across the years. This was reflected in the number of farms from all categories ranked in the top 25 percent on an annual basis. These results indicate that as opposed to 'get big' the axiom to which dairy farmers should adhere in the twenty first century is 'get smart'. While farm size has an influence over income, costs and profitability, farms of all sizes have the ability to generate strong business returns and smart farm managers are already making this happen.

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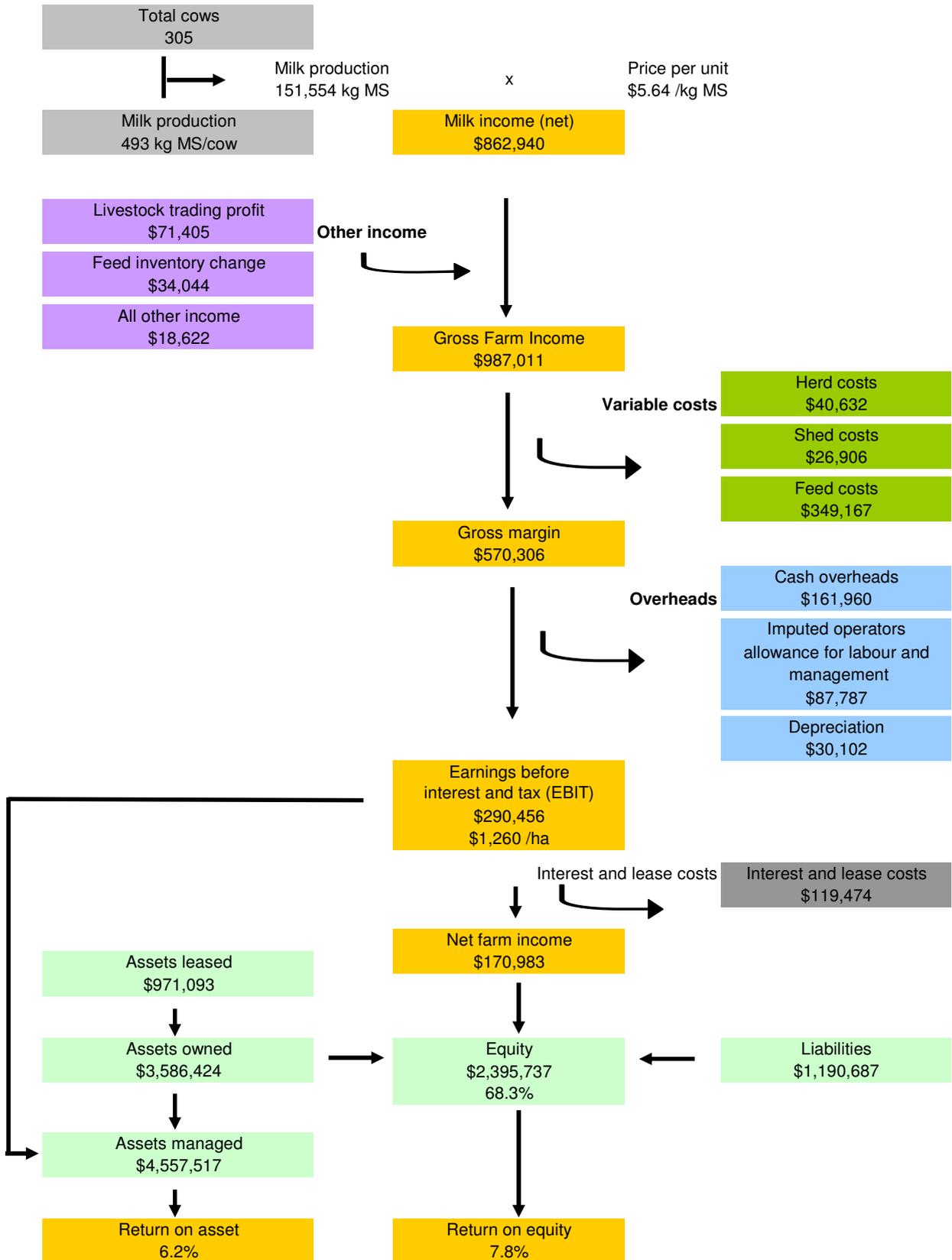
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Appendix one: Dairy Industry Farm Monitor Project Profit Map – 2010-11 State average data.



Appendix two: Statistical significance of differences between farms of different size

Interpretation: Anything highlighted in green - the difference between the averages of the two farm sizes IS SIGNIFICANTLY DIFFERENT TO ZERO (95% chance they don't have the same average)

Example: Return on assets

The average return on assets of a small farm is significantly different to the average return on assets of medium, large or extra large farms.

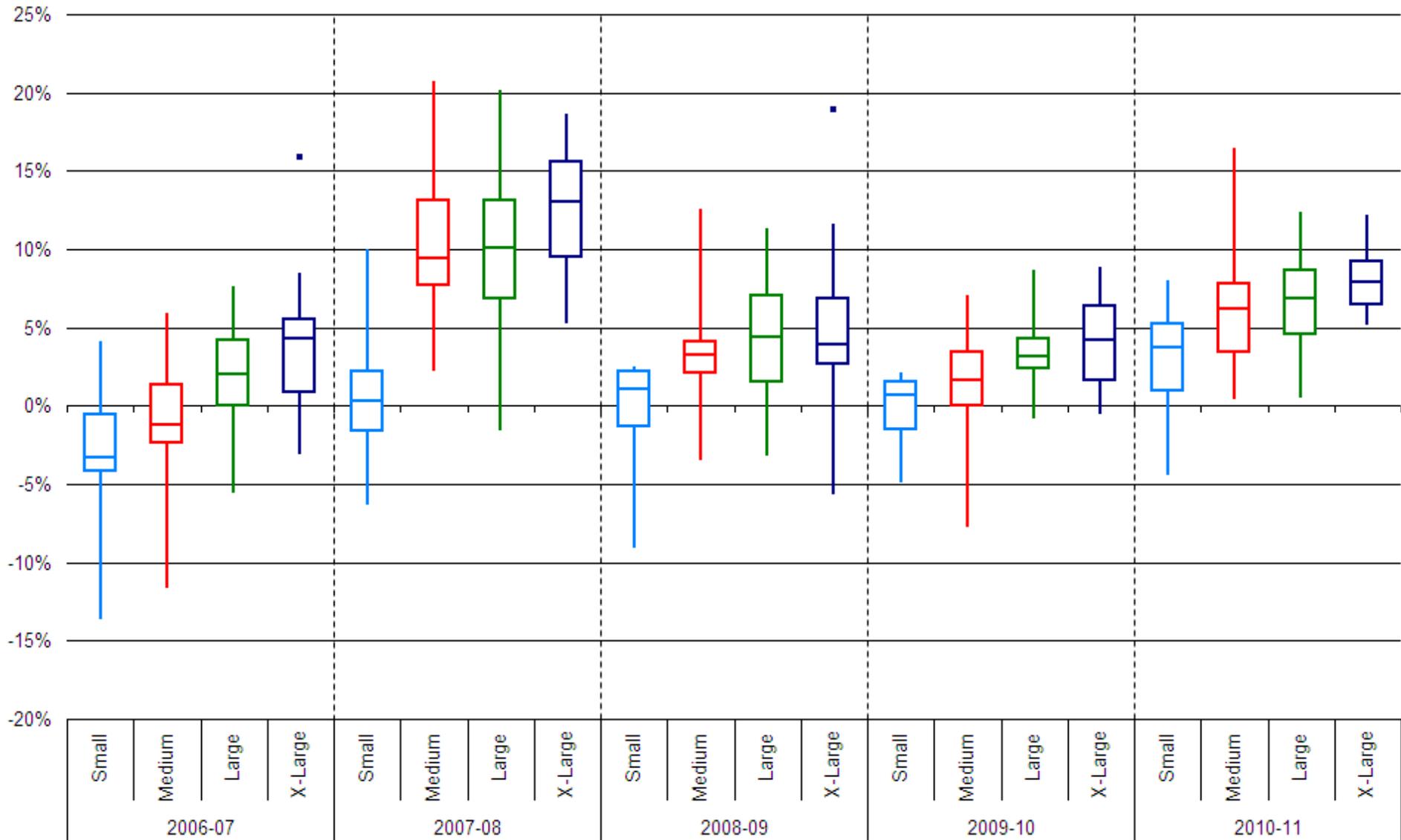
The average return on assets of an extra large farm is significantly different to the average return on assets of small, medium or large farms.

There is no evidence to suggest that the average return on assets of medium and large farms are different.

		Small	Medium	Large	Extra large
Return on assets	Small	-			
	Medium	0.00	-		
	Large	0.00	0.83	-	
	Extra large	0.00	0.01	0.03	-
Return on equity	Small	-			
	Medium	0.00	-		
	Large	0.00	0.46	-	
	Extra large	0.00	0.11	0.53	-
Gross farm income	Small	-			
	Medium	0.27	-		
	Large	0.25	0.82	-	
	Extra large	0.04	0.12	0.23	-
Milk price	Small	-			
	Medium	0.01	-		
	Large	0.02	0.98	-	
	Extra large	0.00	0.13	0.16	-
Total variable costs	Small	-			
	Medium	0.45	-		
	Large	0.76	0.44	-	
	Extra large	0.50	0.01	0.11	-
Total overhead costs	Small	-			
	Medium	0.00	-		
	Large	0.00	0.09	-	
	Extra large	0.00	0.00	0.00	-
Cash overhead costs	Small	-			
	Medium	0.11	-		
	Large	0.71	0.00	-	
	Extra large	0.47	0.00	0.54	-
Non-cash overhead costs	Small	-			
	Medium	0.00	-		
	Large	0.00	0.82	-	
	XL	0.00	0.00	0.00	-

Total costs	Small	-			
	Medium	0.00	-		
	Large	0.00	0.88	-	
	XL	0.00	0.95	0.85	-
Earnings before interest and tax	Small	-			
	Medium	0.00	-		
	Large	0.00	0.79	-	
	Extra large	0.00	0.13	0.25	-
Interest and lease costs	Small	-			
	Medium	0.00	-		
	Large	0.00	0.00	-	
	XL	0.00	0.00	0.00	-
Net farm income	Small	-			
	Medium	0.00	-		
	Large	0.00	0.21	-	
	Extra large	0.00	0.99	0.28	-

Appendix three: Annual distribution of return on asset by farm size, 2006-07 to 2010-11.



Note: Dots above the extra large farms in 2006-07 and 2008-09 represent outliers from the dataset.