



Summary Report

The structure of the GB dairy farming industry – what drives change?

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The University of
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Introduction from DairyCo

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Introduction from DairyCo

Everyone knows the structure of the dairy farming industry is evolving, but what are the real drivers of structural change and how might wider industry developments impact on the dairy farming industry of the future?

Since 1970 there has been a steady decline in the number of milk producers and cow numbers with a slight overall decline in total milk output. Average herd size, however, has increased as has average yield per cow. There has been a trend to larger herd sizes with an increasing proportion of total production coming from businesses producing more than one million litres annually. But what factors have influenced these changes and which are most likely to affect the future shape of the industry?

To develop a better understanding of these issues, we commissioned The Anderson Centre and The University of Nottingham to review published research in this area, and to bring together various datasets to build a cohesive picture of the main drivers of change and to prevent second guessing about the factors influencing the shape of the industry. In so doing they have managed to dispel some commonly quoted myths about the industry.

Dispelling the myths

The report dispels some commonly held myths about the factors driving change in dairy farming structure.

Myth 1 The UK dairy industry is unique?

It is often argued that the UK dairy farming sector is in some way different. However, the trend of declining producer and cow numbers combined with increasing herd size and yields has occurred in most of the major dairying countries, with some declining faster than the UK. The rate of change in the UK is about average for the 15 original EU Accession States. As the dairy industry becomes more global, it is expected that the structure in different countries will become more similar.

Myth 2 Larger units are forcing smaller units out.

There is no evidence for this. While larger units have the potential to make a higher level of profits as a direct consequence of potential economies of scale, they don't necessarily do so. They don't unilaterally receive a higher milk price and are not in a position to influence the market. There is a range of profit levels among farms of all herd sizes, which is more a function of management than of size.

Myth 3 Milk price is the main driver for exiting the industry.

While milk price is an important and high profile economic indicator, it is only one of the influencers on business profitability and no significant link was found between milk price and the rate of exit from the industry. Producers receiving a higher milk price were not found to be any more likely to expand than other producers.

What drives change?

A range of factors contribute to the decision by an individual milk producer regarding the future direction of the business. No two businesses are the same and the combination of factors affecting the decision of whether to expand, contract or leave the industry will vary by farm.

Factors can be split into two main categories. Social drivers are those which are related to personal circumstances and individual milk producer outlook. Economic drivers are those related to the business performance and its ability to react and develop in the wider economic environment.

The table below lists the main social and economic factors and the degree of impact they have on producer decisions to expand or exit the industry. The more ticks the greater the impact. For example, the presence of a successor is a key determinant behind a decision to expand while the absence of a successor is a major factor in producers looking to exit the industry.

EXPANSION	FACTOR	EXIT
████	PRESENCE OF SUCCESSOR	
	ABSENCE OF SUCCESSOR	██████
██	YOUNGER AGE	
██	HIGH PROFIT LEVEL	
	LOW PROFIT LEVEL	██
██████	COST LEVELS	██████
	MILK PRICE	██
	LARGER HERD SIZE	██

The social drivers include:

Succession – the presence of otherwise of a successor was found to be one of the biggest single factors affecting business intentions. Businesses with a successor in place were found to be considerably more likely to be looking to increase production than those without. The absence of a successor on the other hand was found to be a key factor with producers looking to exit the industry.

Age – while the age of the business proprietor was not found to be a major factor affecting future intentions, younger farmers tended to be more business focussed and were more likely to be looking to expand production.

Education – it was found that farmers intending to expand tended to have higher qualifications than those looking to exit the industry.

The economic drivers include:

Profit – while profit is an important factor, the link between farm profit and the rate of exit from the industry was weak. Farms with high levels of profit were more inclined to consider expansion but farms with lower profits were also prepared to expand, presumably in the hope of increasing profit levels.

Cost levels – input prices and their effect on profit were found to be a major driver influencing decision making as they account for the majority of variation in profit.

Milk price – commonly quoted as a major factor influencing farmer intentions, milk prices affected business intentions through its impact on business profits. However, no correlation between herd size and milk price was found and those farms achieving a higher milk price were no more likely to expand than other producers.

Herd size – the average herd size of businesses looking to expand was not found to be substantially different to those looking to exit the industry. It was found that there is a range in profitability at all herd sizes, indicating that while larger herd sizes offer the potential to increase profits, the actual level of profit achieved is determined by other factors. Existing herd size *per se* was not found to be a significant factor in decisions to expand or exit the industry.

Family labour – the proportion of family labour employed appears to influence decision making. Businesses with a higher proportion of family labour were found to be more likely to be looking to expand. Interestingly, it was also found that the larger businesses generally had a smaller proportion of family labour.

How might future developments impact on the shape of the industry?

The research focussed on historic drivers and the drivers as they would apply given a status quo in the industry. However, significant external pressures will influence how the industry develops. Therefore it was considered worthwhile to examine how future scenarios may change the structure of the industry.

Abolition of quotas – Should milk quotas be removed in 2015 as is currently proposed, the expectation is that EU milk production will increase by around 5% while prices may fall by up to 6%. As the UK has been running around 10% above the national quota it is questionable whether output will increase further, especially if prices fall.

The research would suggest that the abolition of quotas will not significantly increase the rate of exit from the industry immediately as milk price was not found to be a major driver of the decision to leave. However, downward price pressure will affect the less efficient businesses irrespective of herd size and may in time lead to an increase rate of businesses leaving the industry.

The removal of quota may encourage progressive businesses to expand faster or to a greater extent in an attempt to capture economies of scale.

Increased participation in global markets – the UK could export a greater volume of production into EU and world markets. If these products are commodities then the price for raw milk will have to be internationally competitive. Alternatively opportunities may exist to increase the production of higher value products.

If growth is in commodity markets then this might accelerate expansion of units with businesses focussed of efficient production and economies of scale.

Both approaches could have an impact on industry structure. Growth in value-added products could bring with it an element of price security and price premium for those farmers supplying such markets. This might offer a particular advantage to small producers if supply contracts include specific requirements which are more easily achieved by smaller producers.

Increased or decreased GB processing capacity – recent years have seen both a rationalisation of processing capacity and investment in new and substantial processing capacity. What is important is the net change in total capacity.

Any increase in total capacity will put upward pressure on raw milk prices as processors seek to secure the milk they need. Assuming that increases in capacity are demand led and that there is no overcapacity, then this could be a signal for progressive producers to expand, particularly if they farm in close proximity to the new processing capacity. Even if prices remain unchanged, producers may take advantage of economies of scale to generate increased revenues, and promote a move towards larger herd sizes. A static price is likely to have little effect on the rate of exits.

If processing capacity declines leading to less demand for milk then milk prices will fall. In this case progressive farmers may still seek to expand herds to offset falling prices by producing more, because it is in their mindset to expand. However, lower prices would put pressure on the margins of the less-efficient producers and in time, this may lead to an increased exit rate.

This report helps give a better understanding of the factors that really shape the GB dairy farming industry. We hope you find it useful and illuminating.

DairyCo.

1. INTRODUCTION

DairyCo commissioned The Andersons Centre and the University of Nottingham to undertake a study into the factors influencing dairy producers' decisions to expand, continue unchanged, or exit the industry. The project aims to analyse the factors influencing changes in farm size and farmer behaviour in relation to farm competitiveness in the UK in order to identify the drivers of increased scale of production.

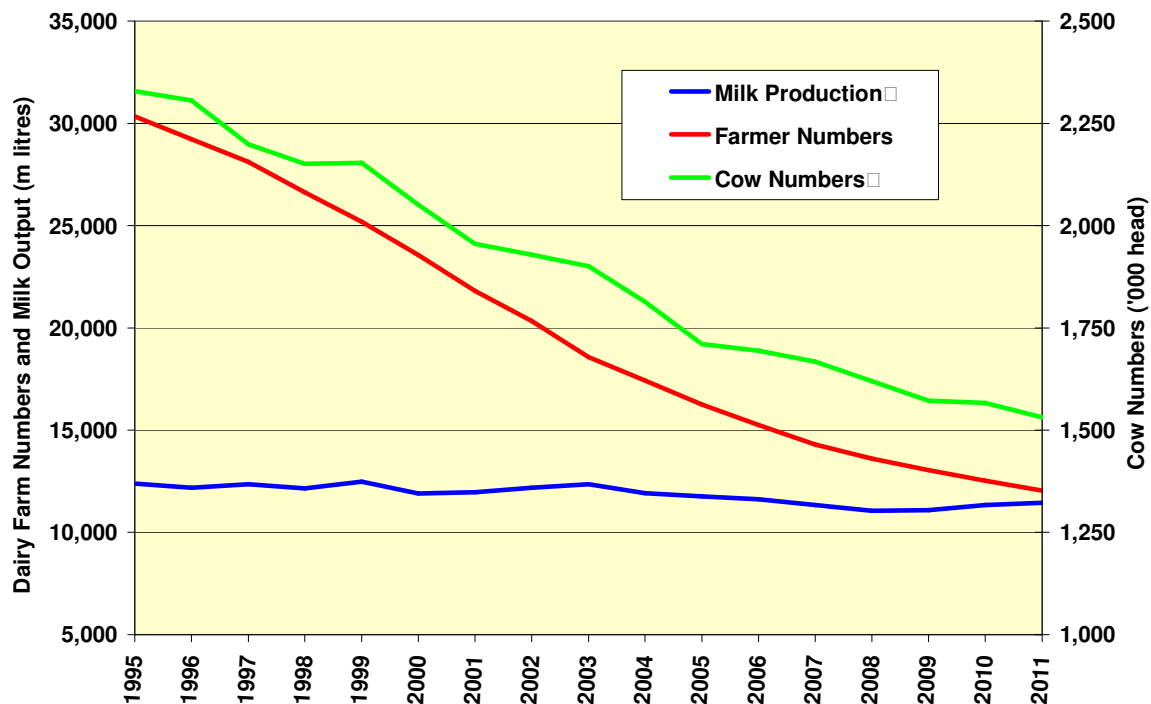
This document is a summary of the project. A full 'technical report' providing more detailed background has also been produced.

2. STRUCTURAL CHANGE IN THE DAIRY INDUSTRY

2.1 Producer numbers

Figure 1 below sets out graphically recent trends in GB milk production, dairy farm numbers, and cow numbers.

Figure 1: Trends in the GB dairy sector: 1995 to 2011



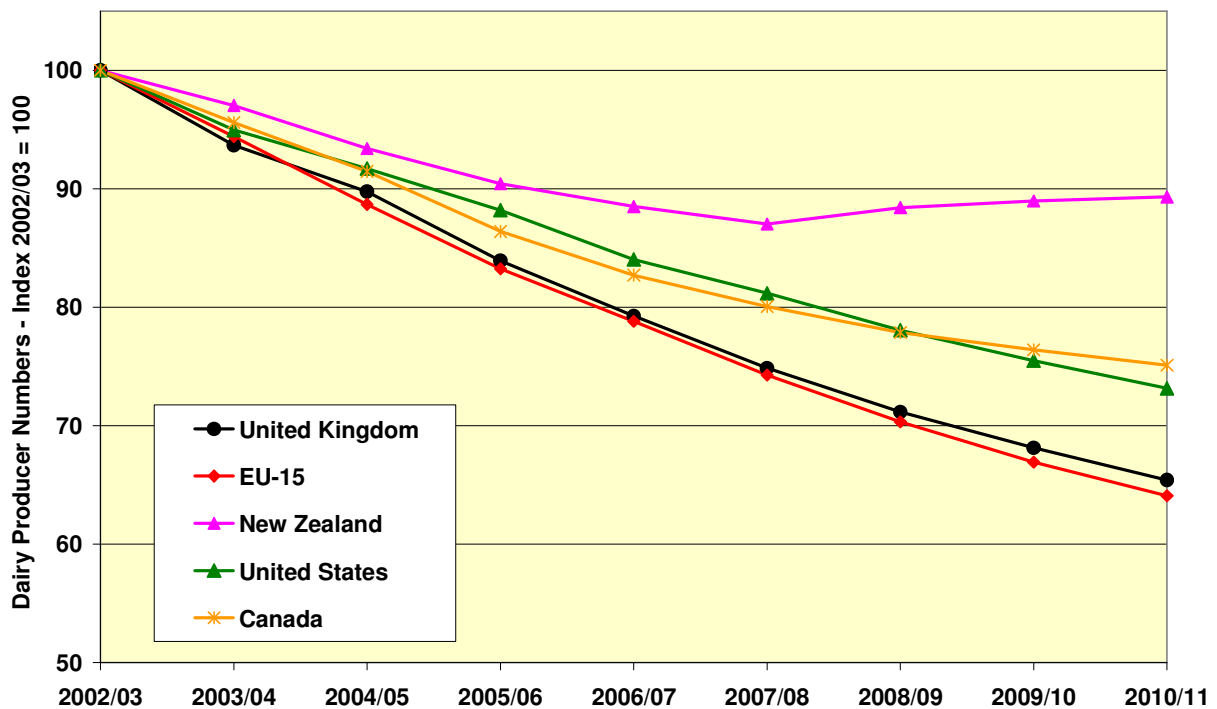
Source: DairyCo, Defra, RPA

Due to the scale of the axes, the slight overall fall in total GB milk output during the period is almost un-noticeable. This is in sharp contrast to the number of dairy farmers which has obviously declined dramatically. On average, there has been a loss of over 1,100 dairy farmers across Great Britain each year since 1995. This illustrates the huge structural change the sector has already undergone.

This phenomenon is not unique to the UK; Figure 2 plots an index of dairy farmer numbers, based on the 2002/03 year as 100. It shows the trends for a selected number of countries and the 'old' EU-15. These have been chosen as, climatically, economically and socially, these countries can be considered good comparisons with the UK. It can be seen that the UK is almost on the average for the EU as a whole.

The New Zealand, US and Canadian dairy sectors have also all seen a decline in producer numbers overall. This indicates that restructuring of the producer base is not a factor confined to the UK or even EU. New Zealand is the only country to show evidence of a recent reversal in this decline since 2007/08. The majority of New Zealand production is exported and NZ dairy producer's production costs are among the lowest of the major dairy producing nations (IFCN); as a result, the NZ dairy industry was well placed to benefit from the boom in global dairy commodity values from 2007. This, combined with falling returns from other agricultural sectors, has led to a large area of dairy 'conversions' to exploit their comparative advantage.

Figure 2: Producer numbers, selected countries: 2002 to 2011



Source: Eurostat / USDA / NZDA / CDA

2.2 Farm size

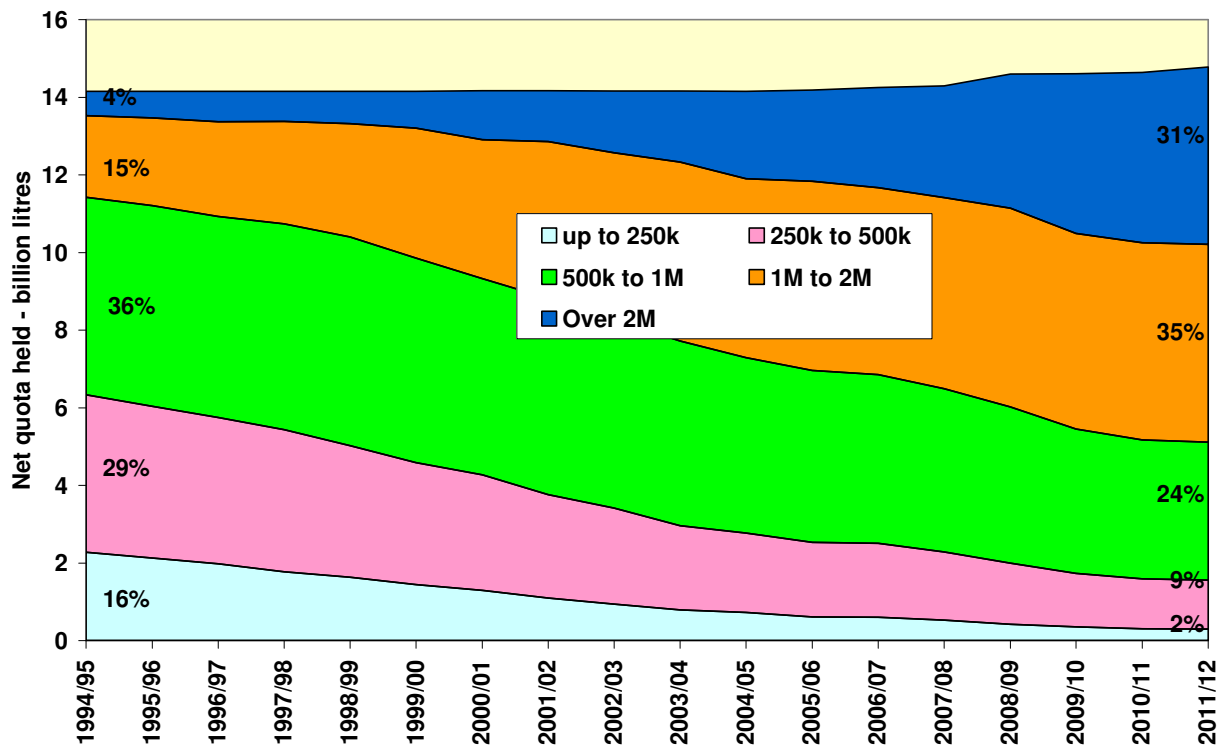
While producer numbers in GB have been falling, milk output has been relatively static over the past fifteen years. This is due to both an increase in average yield and an increase in average herd size. In 1995, the average yield in the GB herd was 5,320 litres per cow with an average herd size of 77 cows. By 2011 the average herd size had increased by 65% to 127 cows with yields increasing by 40% to 7,480 litres per cow. There has been considerable debate in the industry of the reasons behind the move to larger farms and as to whether there is a direct impact between increased prevalence of large farms and decrease in the number of small farms; this issue is considered in this report.

Looking at average dairy farm numbers and sizes, however, does not show the trends that lie behind the aggregated figures. Figure 3 below shows how the distribution of quota (see footnote) between various sizes of quota holders has changed. Note that the 'size' of a dairy business can be measured in a number of ways – cow numbers, hectares farmed, milk output, etc. In this report we have used the milk output measure where possible as it is likely to equate most closely to business turnover. Where it has not been possible to use this measure an explanation is given.

It is immediately obvious that there has been a significant increase in the number of farms holding more than 2 million litres of quota, whereas the smallest category of producers has declined almost to the point of extinction. In total, over 85% of quota is now held by holdings with greater than 500,000 litres and two-thirds on holdings with more than 1 million litres.

Assuming an average yield of 7,500 litres per cow in 2011/12, the largest category equates to average herd sizes of over 260 cows. The smallest band would be below 35 cows. Back in 1994/95, a lower average yield of 5,300 litres per cow means the average herd sizes for the largest and smallest categories would be over 375 and below 50 cow's respectively.

Figure 3: Distribution of UK quota¹ by holding size: 1994/95 to 2011/12



Source: RPA. Note: figures for GB only are unavailable. It is believed unlikely that there would be significant differences between trends in the UK and GB.

¹ It is recognised that, especially in recent years, quota is an imprecise measure of actual milk production. As the UK has fallen consistently below milk quota expanding producers have no longer seen it as crucial to match milk output with quota held. This may well mean the statistics underestimate the trends in business growth

There has been a consistent fall in the quota held by the smallest dairy farms – it has dropped every year since 1994/95. The rate of decline has varied though from -21% in some years to just -2% in others. Overall it averaged -11% per year during the 17-year period. The quota held by those in the 250-500K litre band has declined on average by -7% per year. For the 500K-1M category the average yearly drop was -2%. Interestingly, at the start of the period, this size category was growing but by the end it was in decline – indicating what might once have been considered a large dairy enterprise might no longer be considered to be one.

The 1M-2M band saw average growth of 5% and the largest category 13% average annual growth.

2.3 Geographical distribution

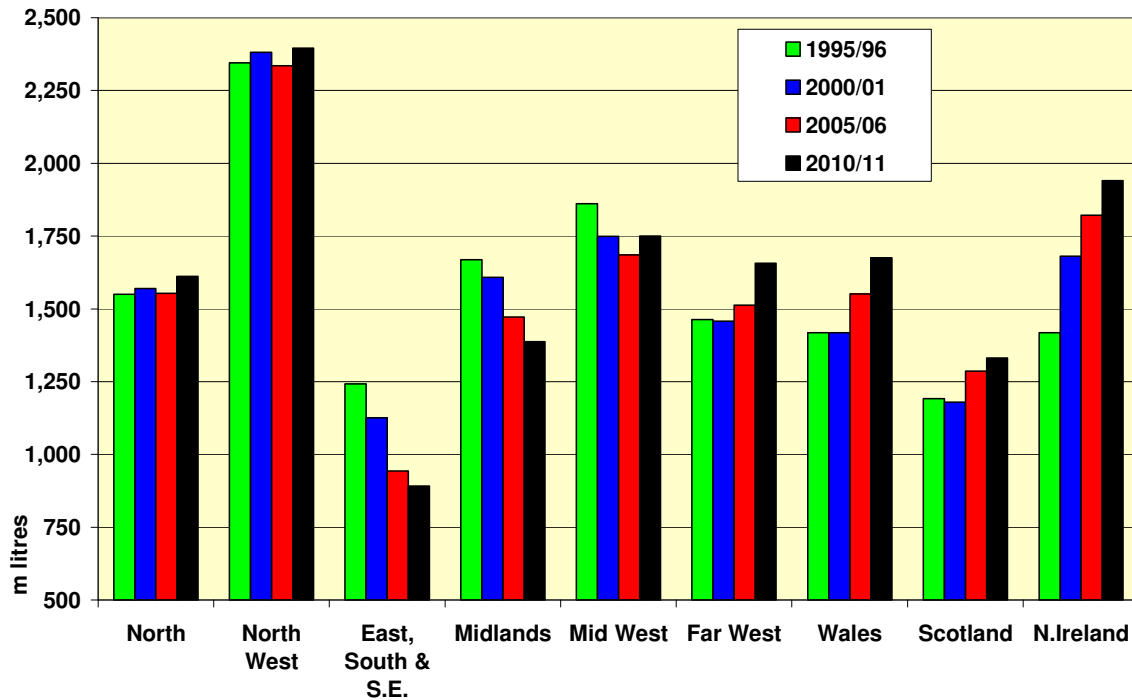
As well as shifts in the distribution of farm sizes, there have been geographical changes which are also hidden by the aggregate data. A significant pattern which has emerged over the last few years is a steady shift westwards of milk production in GB (and the UK). This can be tracked by where milk quota is held (but see footnote on previous page). This is illustrated on Figure 4 below.

In total, England has accounted for around 65% of total UK milk production in the two years 2009/10 and 2010/11 with Northern Ireland contributing 14%, Wales 11% and Scotland 10%. With the exception of England, all regions have significantly increased their respective overall quota holding since 1995/96.

The overall figure for England shows a decrease in quota holding, mostly as a result of considerable reductions in the East, South East and Midlands. Northern regions have seen only a very marginal increase, with the 'Far West' the only English region to have seen a significant rise.

There are likely to be two main factors driving these relative changes. Firstly, due to rainfall patterns, the west of the British Isles is favoured for grass growth. As a result, dairy farmers further west are likely to have a comparative advantage in that they are able to produce milk at a lower cost by utilising a higher proportion of forage.

Figure 4: Distribution of UK milk quota: 1995 to 2011



Source: DairyCo, Defra, RPA Note: 'Far West' is Devon and Cornwall, 'Mid West' is Avon, Dorset, Somerset, and Wiltshire. 'East, South and South East' comprise the area east of a line roughly from the Humber to the Solent. The total volume of UK is greater in latter years due to extra allocations under various reforms of the CAP.

Secondly, those farmers in the East and Midlands are likely to have a greater number of options when it comes to their business. Being closer to large centres of population brings greater 'diversification' opportunities, while land quality and climate make other farming enterprises, especially arable, a viable alternative to dairying. Agricultural land prices may also influence this shift, with development pressures from urban areas, 'lifestyle buyers' as well as alternative agricultural sectors increasing relative values in the South East and Midlands especially.

It is also possible that other factors specific to the devolved regions are playing a role, with regard to subsidy payments, legislative issues, markets supplied and relative importance of the industry to the 'region/economy'.

Lastly, many of the major milk buyers/processors are located along the major transport networks on the western side of the country. There are considerations of cause and effect, with milk processors for manufactured products particularly wishing to be located within extensive 'milk fields' to minimise transport costs. Once the plants are in place, however, they are a fixture and may, in turn, encourage greater milk production nearby.

2.4 Farmer age

It has been suggested that the age of dairy farmers is increasing and is representative of a lack of new entrants in the dairy sector. According to the 2010/11 Farm Business Survey (FBS), the average age of dairy farmers in England was 52.4 years². This is slightly younger than the average for all farm types in England of 55.5 years. Although the FBS only covers a sample of English producers, it is believed that this figure should be broadly applicable to the whole of the GB dairy sector. Figure 5 below shows the average age of dairy farmers at two-yearly intervals. It can be seen that, while the average age has been increasing in the last few years, this follows a period when it fell. It does not appear that the profile of the industry is becoming any 'older'. *Whether older farmers, in fact, exhibit any different attitudes to younger ones and, therefore, have different behaviours is looked at in more detail later in this report.*

Figure 5: Average ages of dairy farmers: 1996 to 2011

Year	1996/97	1998/99	2000/01	2002/03	2004/05	2006/07	2008/09	2010/11
Average Age	55.3	51.1	50.8	50.7	50.9	51.8	51.6	52.4

Source: Farm Business Survey

Key point: Despite the widespread perception of dairying as an aging industry, the data does not support this.

3. DRIVERS OF STRUCTURAL CHANGE

3.1 Analysis of data

The objective of the study is to examine the factors impacting on structural change in the industry. Without a complex farm level model, the analysis has concentrated on the factors which impact farmers' intentions to expand/contract and/or leave the industry. Data from the Farm Business Survey (FBS) and DairyCo data (primarily Farmer Intentions Survey (FIS) and Milkbench+ figures) was used for this analysis.

A linear model was developed to attempt to identify the factors which impacted on producers' decision-making. While the results of the study identified some factors which had a significant impact on decision making, the variation accounted for by the factors included in the model was very low. This suggests that many of the factors influencing decision making were not incorporated in the model. These may be specific to individuals such as 'ill-health' forcing retirement, TB pressures in specific areas or, indeed, development pressures from urban areas; factors which cannot be accounted for with data currently available.

None of the available data sets contained all of the factors identified entirely, with particular difficulty incorporating both economic and social aspects for producers within the same data

² The age figure from the Farm Business Survey (FBS) is not significantly different from that found in DairyCo surveys. The FBS data has been used as it provides a longer time series

set. The FBS data set incorporated the best combination of ‘economic’ and ‘social’ factors. However, the total number of observations was low, contributing to the low explanatory power of the model.

Key Point: To aid future analysis in the dairy sector it is suggested that more integration of the various surveys undertaken would be beneficial.

The FBS data set was split into two separate groups of producers based upon their dairy farming intentions with respect to milk production, in order to increase the explanatory power of the analysis. One group is classified as those producers that have indicated they plan to increase milk production by at least 10% in the next three years. The other group contains producers who have indicated no change in milk production levels, plan to reduce milk production or cease milk production.

While the overall variation in producer decision-making cannot be explained entirely from the analysis, several sources, including the DairyCo Farmer Intentions Survey (FIS), provide a good indication of the impact of the various individual factors either directly on intentions and/or measures of competitiveness such as profitability.

Historic trends in structural change were also analysed for correlation and, finally, data segmented on the basis of ‘behavioural values’, age and farm size are examined in order to identify how these different segments respond to the various factors identified.

3.2 Summary of results

A number of factors are commonly cited as influencing structural change and growth in dairy business size. These have been split broadly into ‘economic’ and ‘social’ factors. The economic factors focus on the business’s ability to provide an income to the proprietors. The financial results of the business are closely linked to technical performance so a number of production parameters have been included as well. The social factors are non-monetary issues and are more to do with the personal circumstances and outlook of the business owners.

A review of previous studies is included in the technical report, with the main findings being summarised below. Analysis was undertaken for this report of FBS and DairyCo data as set out in the previous section. Findings from this analysis are also shown. The economic drivers are summarised in Figure 6 below, alongside whether evidence for this was found in the current study and from the existing data sources specific to the UK.

Figure 6: ‘Economic’ drivers of change

Economic factors	Identified impact on structural change and decision-making	
	Evidence from existing studies elsewhere	Supported by analysis undertaken for this study
Business profitability	Yes	Yes
Milk price	Yes	Inconsistent
Cost levels	Yes	Yes
Support payments	Yes	No
Other income sources	Yes	No
Capital; Net worth and return	Yes	Insufficient evidence

Technical parameters:		
Yield levels	Yes	Yes
Input and labour use	Yes	Yes
Herd size – output level	Yes	Yes

The social drivers are summarised in Figure 7 and in the same way as for the economic drivers, the strength of evidence is assessed.

The following sections then go on to provide some evidence and analysis of the factors identified in Figures 6 and 7.

Figure 7: ‘Social’ drivers of change

	Identified impact on structural change and decision-making	
‘Internal’ social factors	Evidence from existing studies elsewhere	Supported by analysis undertaken for this study
Age of proprietor	Yes	Inconsistent
Business outlook; positive/negative	N/A	Yes
Education level	Yes	Limited evidence
Presence of a successor	Yes	Yes
‘External’ social factors		
‘Peer pressure’ influences	Yes	Insufficient evidence
Career opportunities outside agriculture	Yes	No
Bureaucracy/legislation	Yes	Yes
‘Situational’ factors		
Tenure	Yes	Limited
Availability of resources; labour/land <i>etc.</i>	Yes	Limited
Milk contract; supermarket aligned or not	N/A	Yes

3.3 Profitability

Most people would regard profitability as **the** key determinant of business change in the dairy sector. To some extent, this is supported by the analysis as summarised above. However, the situation is less clear-cut than might be expected. Firstly, some clarification of what is meant by profitability is required.

3.3.1 Profitability versus profits

The terms profitability and profit often tend to be used interchangeably but, in fact, mean somewhat different things. Profit is a simple financial measure of revenues less costs over a defined period. Profitability is a wider concept measuring how efficiently a farm generates these profits or ‘how much they make with what they’ve got’.

An illustration would be a business that made £1,000 profit for each of the last three years. In the first year, the business environment might have been benign, but then it turned very difficult by year two (eg prices down, cost up). While the *profit* was the same in both years, the *profitability* was better in year two because the same result was achieved in less favourable circumstances. Then, between years two and three, the business doubled the investment it had made. Again, profits were unchanged, but profitability was poorer as it was failing to turn the higher investment into better performance. In this example, profit has remained unchanged while profitability has altered considerably.

As profitability is harder to measure than straight 'profit', it is the latter that is often looked at in analyses. This is done in the section below but a discussion of profitability is returned to later.

3.3.2 Profits

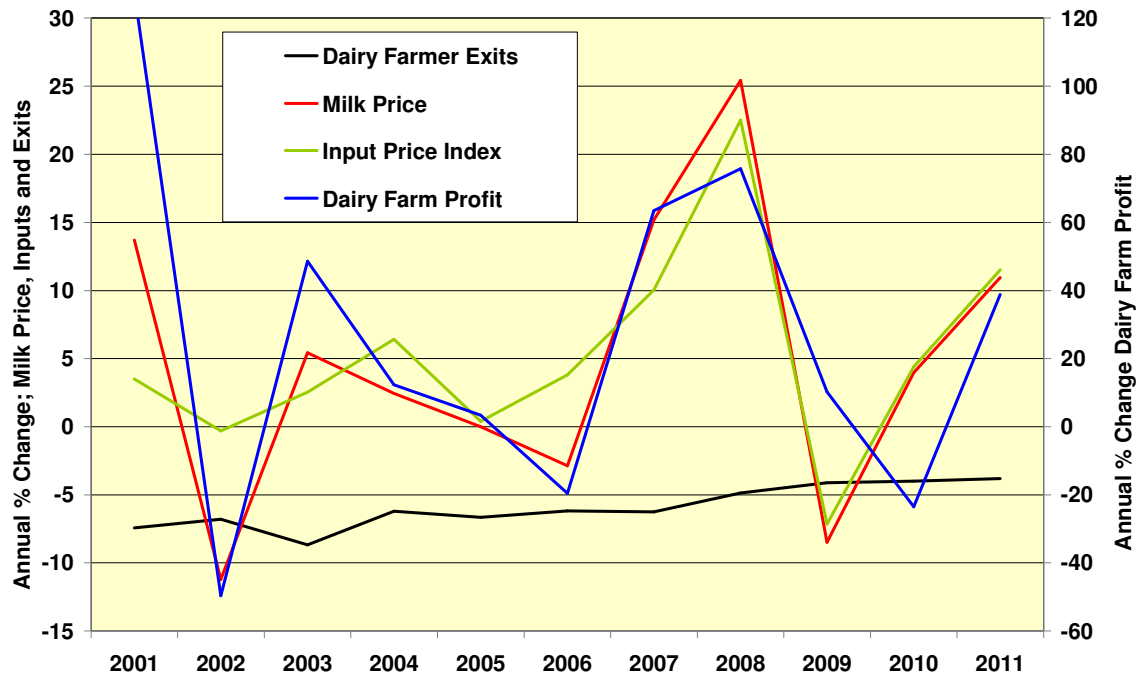
Simplistically, profit is revenue less costs. On the revenue side of the equation, milk prices are hugely important. Therefore, the analysis began by looking at profit plus the two key determinants: milk prices and costs.

Figure 8 shows the annual percentage change in the number of 'net' dairy farmer exits. This is calculated as the difference in dairy farmer numbers year-on-year; therefore, 'absolute exits' may be slightly higher than the figure stated if they are offset by 'new entrants'. This is plotted against average dairy farm profits (FBS annual data) and average milk and input prices (Defra) from 2001 to 2011. Firstly, it is evident that profits fluctuate hugely - as depicted from the separate right side axis, by up to 80% year-on-year. As might be expected, profits are very closely correlated with both milk price and input prices (left side axis).

Interestingly, milk price and input prices changes match very closely, especially in the last five years, this is likely to be as a result of volatility in the world markets where global commodities including dairy products and cereals or soya, for example, are readily traded and increasingly driven by 'global' (rather than 'national') supply and demand. Before this, the periods with the most dramatic changes in dairy farm profits were when input price inflation has exceeded milk price or vice versa as milk prices were primarily driven by intervention rates.

The trend in net dairy farmer exits appears to be relatively consistent, averaging at a rate of 6% over the period although the rate of decline in dairy producers is decreasing. In the early part of the decade, the rate of exit ranged between 9% and 6%, but had dropped to average approximately 4% during the last three years (2009, 2010, and 2011). Although this does not look dramatic on the graph above, this may represent a new degree of optimism among dairy farmers. The rapidly increased milk prices during 2007 and the ongoing expectation of growing global demand for dairy products, driven both by population growth and increasing affluence in Asia and South America, will have contributed towards this increased optimism.

Figure 8: Annual % change in dairy farmer exits, milk price, input price and profit



Source: Defra – Farm Business Survey (FBS)

In 2003, there was a significant increase in the rate of exit which appears to be correlated with a large decrease in dairy farm profits in 2002. Although dairy farm profits also fell sharply in 2006 and 2010, no apparent effect on dairy farmer ‘exits’ were observed. This may be due to the fact that, in 2007, rising milk prices rapidly counteracted this decline in profits and farmers will be making ‘long-term’ decisions based on future expectations which arguably are more optimistic than they were in 2003, a period when milk prices were determined by intervention rates rather than market supply and demand. The rate of dairy farmer exits slowed between 2007 and 2008 as profitability increased.

Key Point: This suggests that a significant decrease in dairy farm profits is needed to significantly affect the rate of exit in subsequent period; as one would expect according to economic theory.

Further analysis was performed examining the relationship between profits and farmers’ intentions regarding their future (ie to increase production, to decrease production or to exit the industry). Data from FBS and DairyCo FIS showed that, while farms with a higher total profit level are more likely to have the intention to increase their production and *vice versa*, this factor only has a small influence on changes to the rate of exit.

Key Point: The level of business profit is only weakly associated with exits from the industry. Profit levels are not the key driver for people leaving the industry; other factors are likely to play an important contributory role in the decision to exit the industry.

No direct relationship between higher costs and intentions to remain in the industry was observed per se: However, higher costs in both fixed and variable categories was significantly

negatively correlated with profitability. This finding is comparable to Milkbench+ analysis which demonstrates total cost of production as the main determinant of profitability.

3.3.3 Milk prices

As outlined above, unsurprisingly, milk prices have an effect on profit levels and this in turn affects structural change in the industry (albeit weakly). However, it is worth looking at milk prices separately. This is because the milk price is such a ‘headline’ measure that it could influence farmer confidence and behaviour, independent of its actual effect on profit.

Milk prices set the background profitability environment for dairy farmers. Change in milk price over time has a significant effect on variation in overall annual profits of dairy farms. However, the ability to be profitable *relative to other dairy producers* at any given time is not determined by milk price but management and total cost of production, as documented in the recent Milkbench+ report -

(<http://www.dairyco.org.uk/resources-library/technical-information/milkbenchplus/milkbenchplus-report-2012/>).

Evidence from the FBS data shows there is no difference at all in milk price between the two intentions groups (expand/decline). Further justification is given by looking at absolute values for milk price; comparison between the four devolved regions shows a significant increase in milk production in Northern Ireland over the past 15 years, despite a more volatile price with lower troughs due to the higher exposure to the export market. Interestingly, the rate of dairy farmer exits in Northern Ireland is very similar to England, suggesting that lower dairy farm numbers need not necessarily lead to lower milk output.

Key Point: Milk production has increased in Northern Ireland, despite a decrease in dairy farmer numbers comparable to England and increased volatility in milk prices as a result of exposure to the world market. Both Wales and Scotland have increased milk output while having a very comparable milk price to England.

Larger dairy units can only directly affect the viability of smaller ones by changing the market environment in which the smaller producers operate. This might be through increasing milk output and thus creating excess supply which forces farmgate prices down or by reducing available outlets for smaller farms to sell their milk. Also, if larger producers have fundamentally lower costs of production, milk prices may find equilibrium based on these lower costs, rather than those of smaller producers. These issues are looked at in the following section.

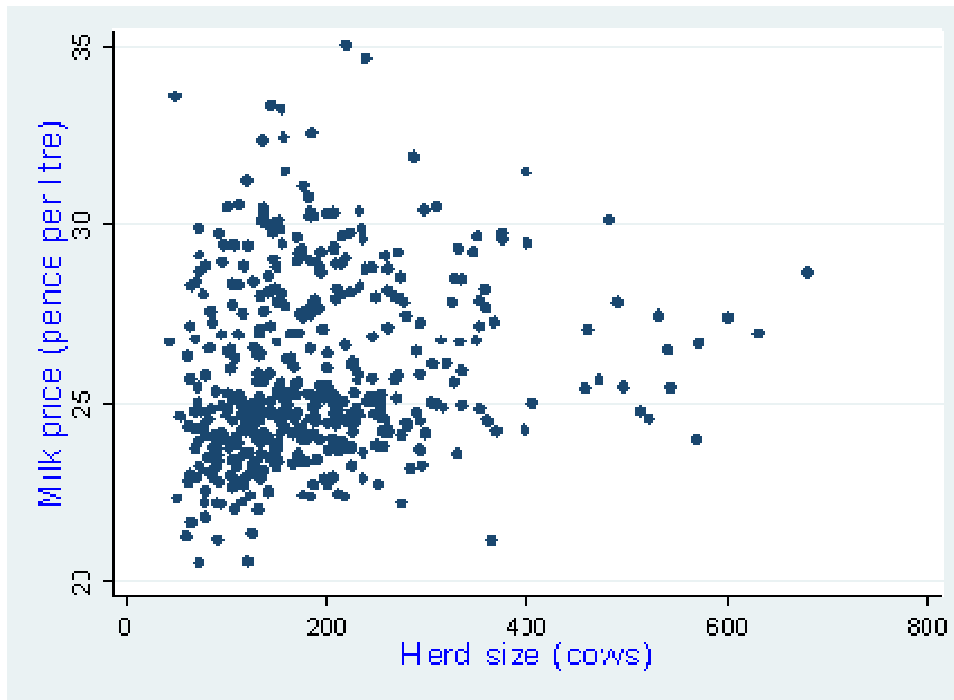
3.3.4 Herd size and milk price

On analysing the data, no correlation was found between average milk price and increasing average herd sizes in GB. It would be unlikely to see a relationship between these two factors given that milk price is fundamentally determined by supply and demand factors at both a national, EU and global basis³. However, although the overall *average* price may not be influenced by farm size, it is possible, that on certain contracts (particularly those for liquid

³ The milk price is also indirectly impacted by exchange rates and other macroeconomic factors.

milk), larger herds are able to achieve a higher price through favourable volume bonuses, potentially increasing profits and the ability to invest and/or expand (thereby achieving a competitive advantage in terms of cost and improving profitability). Milkbench+ figures were analysed to see if there was any relationship between herd size (expressed in terms of cow numbers) and milk price with the results shown in Figure 9. As can be seen, the farms achieving the higher prices are not those with the larger herds.

Figure 9: Herd size and milk price



Source: DairyCo Milkbench+ analysis (unpublished)

Key Point: There is no significant relationship between herd size and milk price.

3.3.5 Herd size and efficiency

While large herds do not, on average, achieve a higher milk price, it may be that they are more efficient and have lower costs per litre of milk produced, providing improved profitability. In this way, they would be more sustainable at a lower milk price than those businesses with higher per unit costs. Additionally, while existing larger herds may not, on average, achieve a higher price currently, they may be better able to attract a milk contract in certain geographical areas, by offering the advantages in logistics of more milk per collection and lower transport costs. There may be potential for 'newly created' large dairy farms to attract a preferential contract and thus create a price differential in the future.

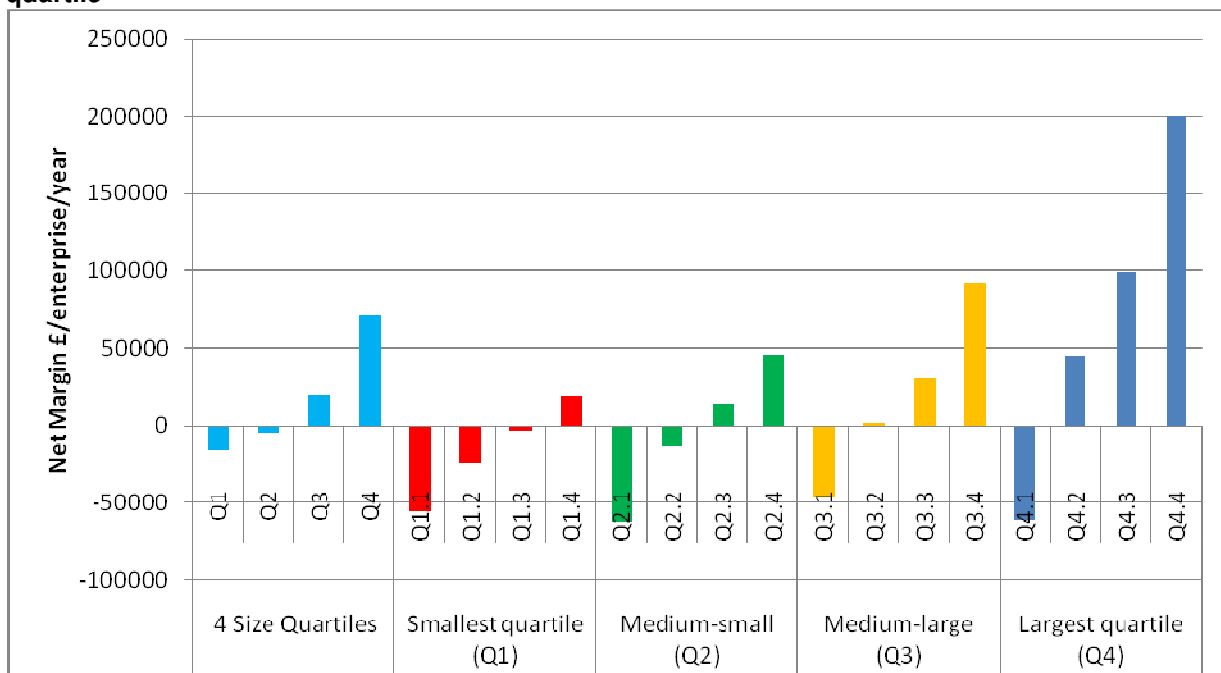
The following analysis aims to show the relationship between dairy farm size and dairy enterprise profits in detail using the comprehensive data from Milkbench+. Data was initially split into four size quartiles (based on volume of annual milk production). The average size of

each quartile is 600,000 litres (Q1), 1.05 million litres (Q2), 1.53 million litres (Q3) and 2.65 million litres (Q4).

To determine if there is a significant difference in a farm’s ability to generate profits according to size, each size quartile was further subdivided into four performance quartiles ranked on dairy net margin (profit). With the exception of the 4th size quartile (largest producing farms), there is no significant difference in annual milk volume between the performance quartiles. For the larger farms, the variation in size between differently performing farms was larger. This may account for some of the increase in economic performance at an enterprise level for farms producing the largest volumes of milk.

Figure 10 shows the variation in net margin of each size quartile and each performance quartile within it. Net margin reflects full economic costs to the business, including unpaid labour, full land rental value and opportunity cost⁴ of capital. From the figure it can be seen that increasing herd size is associated with increased net margins, with the biggest jump occurring between the two larger subgroups. However, the lowest performing quartile in each size category is seemingly consistent across the observations. This suggests that, while increasing annual volume of output may enable higher profits to be achieved, management will determine whether this is achieved or not (i. whether the farm is profitable). Profit can be achieved at each level of output analysed.

Figure 10: Relationship between farm size and total dairy net margin ranked by performance quartile



Source: DairyCo Milkbench+

⁴ ‘Opportunity cost’ is the value of the next best choice that one gives up when making a decision. In the case of capital, it would be the return from other investments that could have been made with the funds used for investment in the dairy enterprise.

In order to provide further insight into the interaction between herd size, business performance and future intentions, data from the FBS (as outlined in section 3.1.) was examined. This highlighted the fact that, although businesses intending to expand had both slightly larger herd sizes and farmed area on-average, it was not a significant difference.

Key Point: Herd size and farmed area for those expanding was not significantly different to those looking to exit or decline.

In terms of business performance, results from the statistical analysis show a tendency towards a higher percentile performance rank for those intending to expand compared to those who do not (51.25 v 46.36) However, this again, is not statistically significant.

Key Point: This suggests that many producers who are not necessarily in a high 'economic performance' category are still intending to expand and grow their business, ultimately aiming for better economic performance in the future.

3.3.6 Profitability and key indicators

Analysis was undertaken of some key performance indicators behind the overall farm profit figures shown in Figure 10. A striking factor when looking at the 'competitiveness' of these farms segmented by size is the similarity across the *size quartiles* when comparing the performance parameters between the *economic quartiles*. Whatever the size of the farm, the better economically performing farms all used less labour per cow on average and less feed per litre (see full results in Technical Report). This implies that resources are used more efficiently compared to the less profitable farms of a similar size.

All size categories reported good levels of feed efficiency, with very little difference between the best economic quartile across size quartiles, suggesting this is more a factor of management than size. However, average labour hours per cow decreased with size, demonstrating that larger farms were able to achieve better labour efficiency: no doubt interacting with level of mechanisation and system operated.

As is to be expected, the larger farms tend to have a lower percentage of family labour. What is perhaps interesting is the fact that in the two smaller size quartiles the higher economic performing farms had a lower family labour share than those with lower net margins. The two larger size quartiles show a slightly different trend. The top earning farms in the two largest size categories had lower or average family labour levels compared to similar-sized farms. However, those farms with the second highest net margin figures, with the two largest size categories both showed a significantly larger share of family labour. The likely implications are that larger farms are more reliant on employed labour and, thus, more exposed to variation in the labour market, both in terms of availability of appropriate skills and costs. There is a suggestion that family labour can be an important beneficial input even at larger levels of output and this may be linked to finding the appropriate employed staff.

Most interesting, perhaps, is the relationship between average milk yield and economic quartile; the smallest herds showed a positive relationship between yield and farm net margin, where yield increases through the four performance quartiles. However, for the three remaining size quartiles the relationship is very different. In these, the average yield of the highest economic quartile is significantly less than that of the lowest economic quartile.

Firstly, this suggests that average yield per cow is a significant factor for only the smallest herd sizes in relation to farm net margin. This may be explained by the need to spread ‘fixed’ cost over more litres with a lower herd size because ‘fixed’ costs do not increase proportionally with cow numbers. For example, all herds require a milking parlour of sorts but a parlour capable of milking 200 cows does not necessarily cost twice as much as a parlour to milk 100 cows.

Larger herds exhibit a less straightforward relationship, suggesting that yield levels need to be examined in relation to inputs and where the additional costs are incurred (predominantly variable costs such as feed, but also so-called ‘fixed’ costs such as feeding/housing infrastructure, etc.). Targeting increased yield alone may not necessarily result in increased profits.

Analysis of the FBS intentions data was undertaken to supplement the Milkbench+ analysis. Within the FBS data both yields and the number of unpaid labour units (family labour) were observed to be higher and significantly different, for those intending to expand as opposed to those who are not.

Key Point: Those intending to expand their business had a higher proportion of ‘family labour’.

The observation of a higher number of family labour units in those expanding may well be driven by the need to create sufficient profit to accommodate additional family labour. At the same time, expansion is clearly not isolated to those farms which are already ‘large’.

3.4 Other economic factors

3.4.1 Support payments

Farmers in England intending to expand, exhibit a higher average subsidy receipt according to the analysis of FBS data. However, it is not a significant difference. There is considerable difference between the allocations of support payments between the four devolved regions leading some to suggest that this is a contributory factor in the differences in structural change.

Key Point: Analysis in this study found no evidence to support the suggestion that difference in allocation of support payments is a contributory factor in the differences in structural change between regions of the UK.

An examination of trends prior to the introduction of ‘decoupled’ support shows that the divergence was already evident, indicating that other factors are far more significant. If the distribution of support payments does have a direct effect, it is more likely to be psychologically, in terms of how different regions place different emphasis on production or the environment for example, and thus how farmers perceive their role and/or value as opposed to any direct economic effect.

One interesting finding in England is that each additional pound of SFP per hectare increased Management and Investment Income (MII) by £4.04 per hectare, indicating that the return to SFP payments per hectare (ie on those farms receiving greater per hectare payments) leads to a greater than expected return to financial measures. It is not clear exactly why this may be the

case, however, it is possible that higher subsidy receipts per hectare may increase confidence and/or the willingness to invest in new technology or to grow the business.

3.4.2 Other income sources (farming and non-farming)

Non-dairy income is not significantly different as a determinant of the decision to expand production or decline, although those which intend to increase production have a tendency towards higher values of non-dairy income overall. Added to this is the fact that non-dairy farm income contributes significantly towards total farm profitability. Although additional grazing livestock units (sheep/beef etc.) have a negative effect on profitability, suggesting that benefit from non-dairy income is not coming from these sources (therefore most likely non-farming or arable) and supporting previous work which shows a higher level of specialisation to positively affect profitability.

3.4.3 Net worth and return on capital

Similarly to previous results, although there is a tendency for those planning to expand to have a higher net worth, this is not statistically significant as a determinant of intentions.

Return on capital is not readily available for analysis in any of the available economic datasets and not widely used as a performance parameter in the UK. However, some studies elsewhere have shown an interaction between improved returns on capital and business prospects. This factor may benefit from closer attention in future.

3.5 Social factors

3.5.1 Age

FBS intentions data showed no difference at all in age, overall, for those expanding (50.8) compared to those who are not expanding or are leaving (51.8). The FIS does show some influence of age category on intentions with those 50 and over more likely to be exiting the industry, nevertheless, the proportion intending to expand, shows only a minor effect of age demographic, suggesting presence of a successor (below) may be more significant. Analysis of FBS data did show a negative economic effect of age with overall farm profitability decreasing by £6.81 per hectare for every additional year of age.

3.5.2 Education and alternative careers

Based on the analysis of FBS data, there is a tendency towards those who are intending to expand having a higher proportion of college/university qualifications than those who will exit/decline/stagnate. No data is available to effectively analyse how higher educational qualifications increase the likelihood of employment outside of agriculture or not. Nevertheless, none of the producers questioned for the FIS cite 'to pursue a career outside of agriculture' as a reason for exiting the industry. Thus, it can be assumed that this is not a significant factor.

3.5.3 Succession and the desire to pass the business on

Succession of some type (family or otherwise) is imperative to ensure business continuity. FIS data shows that those farms which already have a successor in place are far more likely (73% v 27%) to be intending to increase production. Conversely, those without a successor are far more likely to be intending to exit the industry. Furthermore, farms with a successor in place are more likely to have higher levels of milk output currently compared to those who don't. This is coherent with the points outlined in section 3.3.6 above suggesting that an important reason in farms growing in size is to support additional members of the family and that a significant proportion of farm business growth is driven by 'family farms' expanding.

This may indicate that the uncertainty involved with being a tenant farmer, or the need to pay a rental, thus reducing profitability, is discouraging the next generation.

It is hypothesised that, if time series data could be analysed regarding farmers' reasoning for exiting the industry historically, then absence of a successor would be a significant factor as suggested by comparative research elsewhere.

Key Point: There is a significantly higher proportion of farm businesses with a successor in place for those that are owner-occupiers compared to tenants.

3.5.4 Tenure

No statistical difference of tenure type was observed from the FBS or FIS data with regard to direct future intentions.

4. SEGMENTATION OF FARMS

Analysis of the economic and social factors which would be expected to influence farmers' intentions for remaining in the industry has identified the main drivers behind structural change. However, there are some results which have been inconclusive or inconsistent to what we may expect (ie profits are not a significant impact although farmer perceptions would show they are). It is hypothesised that not all farmers will react in the same way to these drivers. For example, reactions to the different drivers are likely to vary according to farm size, age of the farmer or long-term objectives of the farmer. Simply looking at aggregated results may hide variations in farmer responses to changes in the key drivers behind structural change. To improve understanding of what drives farmers' decision-making regarding their dairy businesses, dairy farmers have been segmented and analysed.

4.1 Behavioural Segmentation

There have been numerous academic studies on farmer behaviours, values and attitudes, both in the UK and abroad. The concept that individuals act purely on the basis of rational monetary based self-interest does not adequately explain real-world behaviour; farmer decision-making is driven not simply by economic pressures.

Attitudinal differences between business owners will affect both how various economic factors influence them and how they manage the business independently of economic factors. Attitudes and behaviours change according to life-stage, interactions with partners/successors within the business and the influence of social peers outside the business.

In recent years, there has been work undertaken by both Defra within the Farm Business Survey and DairyCo from data on its levy payers, to group farmers by certain behavioural characteristics. This can be imprecise with farms often fitting into multiple categories (or none), or moving between categories over time, however, it remains a useful method for interpreting the reasoning behind farmers’ decision-making rather than simply according to the size of the business, for example.

Figure 11 below attempts to graphically compare the DairyCo Segmentation Study and Defra/FBS Segmentation models. In some cases, the categories overlap with, for example, a Defra category comprising elements of more than one DairyCo grouping. However, the overall similarity between the two provides good justification of the validity of the DairyCo model for use in further analysis in this report.

Figure 11: Comparison of segmentation analysis

DairyCo Segmentation Model	Defra Segmentation Model
DIVERSIFY Pessimistic about dairy farming and seeking to exploit farm assets to obtain a superior return.	LIFESTYLE CHOICE (6%) Farming is not the main source of income. Farm in a traditional style and for pleasure.
MONETISE Exploiting techniques from a variety of businesses and dairy industry sources to maximise returns from their milk business.	PRAGMATISTS (22%) Balanced approach. Emotional connection with farming but recognises need to focus on business.
LEGACY Building a family dairy legacy through continual improvement	MODERN FAMILY BUSINESSES (41%) Family success and income. Financial planning important.
SETTLED Feeling left behind by a changing dairy industry, exacerbated by perceptions of an indifferent public.	CUSTODIANS (23%) Farming is a way of life. Pride in farming, heritage and the environment.
EXIT An increasingly hostile environment has left them feeling they have had enough.	CHALLENGED ENTERPRISES (7%) Farming is a burden and a struggle. Isolated and pessimistic for the future.

Source: DairyCo (2011) / Defra/Andersons *Note: percentages in brackets denote the proportion of the total population that falls into each category.*

One point to note is that, a previous study analysing the Defra segmentation model has shown that, in relation to other agricultural sectors (arable, beef, etc.), dairy enterprises are more likely to associate themselves with either ‘modern family businesses’ or ‘challenged enterprises’ suggesting there is considerable divergence between the different sectors in terms of behaviours.

4.2 Behavioural traits

The following Figure 11 presents a summary of the different segments in the DairyCo Segmentation study; their physical characteristics, confidence and the factors most likely to affect their decision-making

By far the most cited factor likely to affect producers’ decision-making and, therefore, affect potential structural change, evidenced by this segmentation study, is the milk price. This is supported by the fact that all segments except the ‘diversify’ segment have cited it as the most important obstacle to achieving their goals; it is also seen as the biggest threat to all segments. Input costs were also identified as a significant obstacle and threat throughout the analysis. However, while both these ‘headline variables’ were viewed to be very important, ‘profitability’ was not, with less than 5% of the total sample citing it as the most important obstacle to achieving their goals, compared to 33% of the sample citing milk price.

Figure 11: DairyCo segmentation model summary results

Segment	Physical characteristics	Confidence in future	Factors important in driving structural change
Legacy	Similar to overall sample average; slightly larger herd sizes and slightly younger age.	The most optimistic segment for the dairy industry and their ‘own farm’.	The milk price is by far the biggest obstacle to achieving their goals and thus likely to have most effect on their decision-making, and any structural change.
Monetise	Younger with larger herd sizes than the average, more likely to be specialist dairy producers. Frequent internet users.	Relatively confident in both their ‘own farm’ and the dairy industry.	Again, milk price is very important, along with input costs and land availability. Supermarket power is viewed as a significant obstacle compared to the sample average.
Settled	Lower herd size and older than the average. More mixed enterprises and less internet use.	Predominantly neutral; slightly lower confidence overall than the average.	Milk price still the biggest factor but bureaucracy is also viewed as an important obstacle as well as access to labour.
Diversify	Smaller herds, largely in the ‘middle age’ segment. More mixed enterprises.	Very low confidence in the dairy industry, but slightly higher for their ‘own farm’.	Access to capital is by far the largest factor, followed by bureaucracy. Whereas, milk price is not at all significant.
Exit	Older than the average with lower herd sizes. Very low internet use.	Extremely pessimistic in both the dairy industry and their ‘own farm’.	The most important obstacles to achieving their goals are ‘animal/health and welfare’, ‘nothing’ and knowing what to do next, suggesting this segment has already decided to exit the industry. Milk price, bovine TB and regulation of costs may have been important factors driving this decision as these are cited as areas for DairyCo action.

There are several possible reasons for this; firstly, either producers simply do not rank profitability as very important to them or perhaps do not have a good knowledge of their relative profitability. It may also be that some respondents feel that, by identifying milk price and input costs as the most significant determinant of their sustainability (profitability), they feel no need to also cite profitability. Respondents may also feel that they can influence their profitability through managing inputs and technical farm performance but cannot influence costs or milk price received directly. Whatever the reasoning, it cannot be ignored that, when asked, milk price is viewed by producers as the most important factor affecting decision-making, and whether to stay in the industry or not. Input costs, bureaucracy, supermarket power, land and labour availability, as well as animal health and welfare issues such as bovine TB also have a significant impact at different levels according to segment.

Subsequent to the analysis carried out in this report, a further 'benchmarking survey' in 2012, again investigated the factors important to the segments outlined above. This study shows that influencing factors are substantially different in certain segments year-on-year. Specifically in 2012, the 'legacy', 'monetise', 'settled' and 'exit' category, input prices were seen as the biggest obstacle to achieving their goals as opposed to milk price. This suggests that such influences are dynamic and dependent on the most pertinent issue at the point of survey. In 2012, input price rises have had a dramatic effect due to poor weather increasing the requirement for purchased feeds, while at the same time reducing supply and thus driving price increases. It is likely that this factor was at the forefront of producer minds at the point of survey.

4.3 Segmentation by age

A simple perception would assume that 'older' farmers are more likely to be exiting the industry or 'winding' down. However, the results outlined previously would suggest that this is not necessarily the case. This could be because, although the survey respondent may be in an 'older' age category and may indeed be moving towards retirement at a personal level, the business may nevertheless have a successor in place and be aiming to expand for the next generation, whether it be within the family or not.

In order to gain a greater understanding of how different age categories affect decision-making, data from the DairyCo Segmentation Study was analysed in relation to age segment. When asked to identify their 'number one priority', there is a significant difference in response against age group. In particular, younger farmers (under 40 years of age) demonstrate lower proportions who wish to leave dairying and, additionally, a greater proportion who wish to maximise financial returns by exploiting technology/finding new ways of working or expanding the business. The oldest group (60 years +) demonstrates a higher percentage that wish to leave dairy, albeit 24% of this age group are seeking to maximise returns as their number one priority.

There is also a significant difference across the age groups with respect to their ranking of prospects for their own farm (1 = poor prospects, 5 = very good prospects), with farmers over 50 more likely to cite scores at the lower end of the scale than farmers under 50 years old. Additionally, those under 40 years of age are more positive about the future for their own farm, with 64% of this age group citing scores of 4 or 5. These figures are consistent with the survey conducted in 2012.

Analysis of prospects for the entire dairy industry (as opposed to their own farm) against age groupings follows a very similar pattern; producers of 50 years and over are more likely to display lower prospect rankings than those less than 50 years of age. It is informative to note that the rankings for 'prospects for your own farm' ranks more positively than prospects for the dairy industry. This seems to suggest that individuals believe they can outperform the 'average'.

There is no significant correlation between herd size and producer age.

Producer rankings of prospects for both the industry and their own farm have a significant effect on their desire to either 'exit' or 'remain' in the industry and, indeed, whether to 'remain' or 'grow'.

Analysis was also undertaken as to whether the presence of a supermarket contract had an effect on behaviour. There is a significant difference across the supermarket aligned groups with respect to their ranking of prospects for their own farm, with farmers on aligned contracts more frequently citing scores of four or five than farmers who are operating without a supermarket aligned contract.

It is perhaps unsurprising to note that while a significant relationship was found with respect to presence or absence of a supermarket contract for prospects for own farm, no significant relationship is observed with respect to prospects for the dairy industry as a whole.

On the whole it demonstrates that younger producers are predominantly positive with regard to the future and their intentions for developing their businesses. However, it is not clear as to whether the evolution towards lower confidence with increasing age is simply a result of inherent psychological factors associated with aging and life stage, ie resistance to change and pessimism or whether this is a result of other factors/problems specific to the dairy sector.

4.4 Segmentation by herd size

Although farm size is only a crude way of segmenting the dairy farm population, it was considered worthy of analysis as there has been much discussion in recent times around the issue of whether the trend towards more large farms drives smaller units out of business.

There is a significant difference between herd size categories and which factor was stated as the number one priority similar to that in the 'age' section above. With a far higher proportion in the smallest herd size category (20-80 cows), identifying their intention to leave dairy (17.3%) compared to only 9.5% in the 151-250 cow category and 1.9% in the 251-400 cow category. Correspondingly smaller herd sizes are more likely to state 'settled' or 'diversify' as their number one priority. Conversely the larger herd size categories contained a higher proportion of 'monetise' and 'legacy'. However, there is a considerable difference between the two largest herd size categories whereby the 251-400 cows have 46% in the legacy segment and 31% 'monetise', whereas 401+ cows are predominantly monetise (50%) as opposed to legacy (36%). This may suggest that, for the largest herd sizes, business aims extend beyond the 'family businesses' predominance.

A similar picture is apparent with regard to the ranking of prospects for both their own farm and the dairy industry with larger herd sizes proportionally more optimistic than those representing smaller herd sizes. The difference is more pronounced for 'own farm' compared to the dairy industry in general. This suggests that larger herds are comparatively more confident in their

own future than smaller herds are. However, it is not explicitly clear as to the cause and effect here; are larger herds bigger because they are more confident in the future or are they more confident because they are bigger?

4.5 Segmentation conclusions

Segmentation highlights some important variations in characteristics between business 'behaviours' and their subsequent likely future intentions. Clearly, behavioural characteristics associated with the 'monetise' and 'legacy' segments indicate a more positive future for dairy production. It is not conclusively clear as to why certain businesses belong to one segment or another; a certain element will no doubt come down to individual psychology, or physical constraints on the business, however, it is likely that the overall industry 'well-being' or 'prospects' are important in determining how individual businesses view their goals.

5. SCENARIOS

5.1 Background

Many of the arguments around larger farms assume the GB milk market is static. The assumption is that extra output from a large farm must, by definition, displace a number of smaller producers. With market constraints (such as quotas), this hypothesis may be true but could be questioned in the current market. The milk market is actually dynamic and four plausible scenarios have been selected for analysis. By looking at some scenarios for the wider industry, it is possible to consider how certain developments may affect the pace of industry restructuring and farmer exits, and what 'type' of businesses may be most affected by these changes. The scenarios are;

- Abolition of Quotas
- Increased GB Participation in EU and World Markets
- Increase in GB Processing Capacity
- Decrease in GB Processing Capacity

Within all of the scenarios modelled above, it was assumed that the demand for milk and milk products within the domestic market will remain unchanged. Thus, the focus will be on changing trade flows of milk products.

This is by no means a complete list of scenarios and many others could have been considered. The Dairy 2020 report considers some of these issues in more detail.

5.2 Abolition of quotas

5.2.1 What would change?

It is proposed that the current EU milk quota system will end on 31 March 2015. Quotas are an artificial constraint on production. With their abolition, output across Europe should rise. In line with economic theory, greater output will lead to lower prices. While lower prices will, in turn,

create greater demand, the market equilibrium is likely to settle at a lower price level in the absence of new markets or increasing demand.

The European Commission financed a study by the *Institut d'Economie Industrielle* in Toulouse called Economic Analysis of the Effects of the Expiry of the EU Milk Quota System, which was published in spring 2008⁵.

This study forecasts that, with the removal of quotas, EU milk production would increase by 5.0% with a corresponding 10.3% decrease in the farm milk price by 2015/16. *However, this predicted fall in the milk price was made from the 'baseline' scenario which assumed milk prices would increase by around 1% per year from 2008/09. Translated to the current situation this would indicate a reduction of around 6% from today's 2012/13 values.*

Like all models, the outputs depend on how the model is constructed and the variables used. A number of other studies have also attempted to model the end of milk quotas. More recent studies tend to have a smaller milk price decrease. This is largely due to the better world market situation that has existed since 2007 with higher overall prices seen. This allows the additional EU milk production generated by quota removal to be sold on world markets rather than be sold at intervention values.

The GB price effect of quota abolition will operate via the single European market for manufactured milk products. British farmers are unlikely to increase output simply because quota is removed. The UK (and thus GB) has been around 10% below the national quota for the last four years. If it was economically rational to increase production, GB farmers could have already done it without concern about quota. Quota has not been an effective production constraint in the GB dairy sector for a number of years.

However, some EU Member States with large dairy industries are still above quota (eg Denmark, Netherlands). Our closest competitor (geographically and climatically), Ireland, was only 0.4% below national quota in 2010/11. The country has a national target for a 50% increase in milk production by 2020. This would see a growth in milk deliveries from an average of 5.1 billion litres over the 2007 to 2009 period, to 7.7 billion litres in 2020. Even if these plans are not fully realised, it can be seen that total milk output in the EU is likely to increase.

Output increases and price falls will impact on GB prices through the world/EU commodity milk market. It may be argued that price determination for parts of the GB milk sector, such as liquid milk and high value-added products, occurs outside of the global commodity market. Evidence shows that this is not the case (see recent DairyCo study – 'Asymmetric Price Transmission in Dairy Supply Chains' – <http://www.dairyco.org.uk/resources-library/market-information/apt-reports/apt-report-2011/>). Because milk is 'substitutable', price changes for commodity milk products spill over into other markets. For example, if the value of raw milk for manufacturing products exceeds the 'liquid' price, supply will move into this market. Liquid buyers would have to raise prices to secure supply.

⁵ This can be found via http://ec.europa.eu/agriculture/analysis/external/milk/index_en.htm

5.2.2 Effect on GB dairy farmers

There may be some residual fear of overproduction and superlevy and, thus, the removal of quotas may encourage more progressive producers ('Maximise Returns' or 'Legacy') to expand faster, to a greater extent, than otherwise. However, it is thought that this effect would be marginal as these types of producers are generally well informed with regard to the quota situation.

The effects of quota removal may be more psychological, in that it would clearly signal a more 'free market' approach across the EU. Progressive businesses would see this as an opportunity, while other businesses ('Exit' or 'No Change') may feel they are being 'abandoned to the market'. This may encourage the latter to exit the sector.

It is worth noting that milk purchasers are likely to be more proactive in managing their milk supply in a post-quota world. Quotas effectively set an upper limit on what farmers would deliver and, therefore, processors could be reasonably confident of what milk they would receive. With quotas becoming increasingly irrelevant in Great Britain, many milk buyers have already moved to managing the quantities of milk farmers can deliver. This is likely to become the norm after 2015 as processors seek to match milk inputs with outputs. Therefore, it may not be the case that progressive producers can simply increase output at will – they will have to find a processor willing to take the extra output.

Some producers may have regarded quota as a 'pension' – an asset to be sold when ceasing dairying to fund retirement. The ending of quotas would see the disappearance of this asset. This could make exits from the industry less likely. However, quota values have now been low for a number of years and are no longer an important driver of the decision to exit dairying. This is evidenced by the fact that they were not mentioned by any of the respondents to the Intentions Survey.

It will be the price effects of the abolition of quotas that will be by far the most important factor in industry change. As output increases, are more likely to occur outside the GB market, then the greatest price effect within GB will be seen on tradable 'commodity' milk products. Therefore, farmers supplying commodity markets are likely to face prices which increasingly converge with global and EU markets. In the short-run, this may result in price reductions if output increases in the EU are combined with static demand on EU markets. Only those producers who could supply the market profitably at the lower price would survive – i. the most efficient.

As set out in the previous section, other market segments will not escape the price pressure due to the linkages between markets. However, they may take longer to manifest and may, depending on supply and demand conditions within that particular market segment, be at a different rate. This pre-supposes that there are no major changes in the GB milk supply chain such as the growing prevalence of 'ring-fenced' cost of production contracts.

Previous analysis within this report shows that farm size is not a determinant of farm profitability – there are efficient businesses at all scales of production. It also found that milk price and thus profits were only loosely connected to dairy farm exits (at least in the short-term).

The implication is that abolition of quota and a consequent fall in milk prices would not, *per se*, lead to an acceleration in the rate of dairy farm exits. Nor would the effects be particularly focused on any particular size category. A caveat to this may be small dairy farms. Although they may be efficient on a unit-of-production basis, their small size may make them unable to

generate enough *aggregate* return to support the proprietors. A drop in milk price (and revenue) may exacerbate this problem and lead to greater exits.

Over the longer-term, lower milk prices would make it more difficult for dairy farmers to cover their long-run costs (including non-cash costs like depreciation). This will lead to a gradual accumulation of pressure on the poorest performing businesses. A greater number may take the decision to exit the industry than would have been the case without quota abolition. The extent of this is difficult to predict as the level of price drops, and farmers' reactions to mitigate their effects are unknown. As analysis shows that profitability is less of a driver of business change than is often believed, the effect may be relatively small – the businesses exiting dairying after 2015 may well have done so anyway.

Any additional pressure for business change will be felt at all size levels. It will be the least efficient businesses, whether large or small, which will face the most difficulties. It would, therefore be expected that businesses of all sizes will exit the industry. *One point to note is that there are proportionally more small and medium-sized businesses in British dairying than large or very large businesses. If, for example, the bottom 15% performers in each size category leave the industry, then, in terms of numbers, more small and medium producers would leave. This would give the impression that certain size categories are being disproportionately impacted.*

5.3 Increased GB participation in global dairy markets

5.3.1 What would change?

This scenario would see the GB dairy industry export a greater volume of dairy products into EU and world markets. The focus would be on exports of manufactured milk products as liquid milk is a product that is not easily transportable (or stored), and is less in demand abroad than in the Great Britain.

DairyCo (in collaboration with the NFU) is currently undertaking research looking into export market opportunities for British milk and dairy products. This will have a particular focus on small and medium-sized dairy enterprises.

A number of scenarios of how the GB industry could become more involved in markets are possible.

Firstly, and simplistically, the industry improves its products and/or marketing and sells a greater volume of dairy goods abroad. Assuming domestic demand for milk products remains unchanged, then GB dairy processors would require greater volumes of raw milk to produce the products to satisfy the new markets. The type of exports would have an influence on how GB milk prices react.

If the exports are of commoditised products, then average farmgate prices would align themselves more closely to the world market as the market segment becomes a more important component of the GB industry.

Key Point: For GB to compete in global commodity milk markets the price of raw milk must be internationally competitive

An alternative is for the GB industry to grow exports of added-value dairy products. In this case, the price of the raw material (farmgate milk) is less important as product sales are not determined solely by price. As processors required more milk to satisfy the growing export demand and they could afford to pay for it due to reasonable margins, the farmgate price should rise.

This is static analysis and does not include any dynamic changes that might result from the farmgate price change. Higher GB farmgate prices are likely to encourage greater milk output, thus pushing prices back down. In addition, higher prices due to increased exports may decrease an element of domestic consumption of milk products. It is beyond the scope of this report to fully model such changes in the milk market. For simplicity, it is assumed that, under the scenario described, GB milk output would settle at a new higher equilibrium with a slight higher price level.

An alternative scenario is that the product mix being supplied by GB processors changes. This could be simple import substitution where imports of (high value) dairy products are replaced by domestically sourced products. This would not, technically, involve greater participation in global dairy markets; in fact, the opposite would be the case as GB milk is diverted to greater domestic use. However, the greater value being derived from the raw milk could deliver a higher milk price assuming that the higher returns find their way down the supply chain to farmers.

A third scenario is growth in total trade. This would see dairy exports to the rest of the world growing *at the same time* as an increase in imports. This could come about if the GB industry was successful in developing markets for high value products (eg Stilton and other territorial) while at the same time there was greater import penetration at the 'bottom end' of the market (unbranded butter, Cheddar, etc.) from efficient commodity producers such as Ireland and New Zealand. This would see the *value* in the GB dairy supply chain rise but the *volume* of raw milk demanded may not increase.

The British dairy industry has been a 'late starter' in developing international dairy brands. A shift up the value chain would take a concerted effort and is likely to be a long-term undertaking. Thus, any changes would take some years to be felt by GB dairy farmers.

5.3.2 Effect on GB dairy producers

It is difficult to predict whether there would be benefit to British dairy farmers under the scenarios where the supply chain creates more added-value products. It might be assumed that some element of the extra revenue gained would flow down to the producer level as processors become less reliant on commodity markets and potentially receive a 'premium' price. There may also be less volatility in such markets. However, it seems naive to believe that this would necessarily be the result. Expense might be incurred in marketing and promotion to increase sales of value-added products. The processors would wish to recover these costs (and additional profit) before providing higher prices to producers.

However, if processors are producing a higher-value product, there is less chance of it being substituted. This is particularly true of a branded product. Continuity of supply is less of an issue with true commodity products as the buyer is always able to purchase elsewhere (and may go elsewhere anyway simply due to price). Processors supplying added-value markets will wish to guarantee milk supply, so are likely to offer an element of price premium. Thus, there

would be benefits to GB producers. It might be thought that higher farmgate prices would encourage output increases but the processors are likely to manage milk supply carefully to match demand for their products. Higher output may not automatically follow.

Processors in value-added markets may be looking for quite specific requirements in terms of milk composition and seasonality. This may offer an opportunity for smaller producers to achieve premium milk prices. This is not to say that large producers could not meet stringent buyers' requirements but that smaller producers may have an advantage in terms of flexibility and attention to detail.

It is difficult to make generalisations about the effect of all this on farmer exits, as the effect is likely to be localised. A processor that cultivates added-value markets is likely to offer attractive returns. There would be a greater economic incentive to stay in dairying. There may also be greater 'emotional' desire to continue as part of a growing, internationally successful element of the GB dairy industry. But such a processor will be looking for supplying farmers within a geographically defined region. Farmers in similar circumstances may face very different business choices simply because one is located close to a successful exporting company, while another is not.

If the participation in exports markets was simply greater export volumes of milk products, then, as described above, there would be greater demand for GB milk and output would increase. There would be greater opportunities for expansion-minded dairy farmers to increase volumes delivered.

If exports were of commodity milk products, the greatest growth in demand would be in those geographic areas that already have the manufacturing capacity for such products. This tends to be the west of Great Britain. It is not inconceivable that new plants could be built (see section below), but upgrades of existing sites would seem more likely. Producers close to such sites would be best placed to meet the extra demand.

This does not mean that regions without manufacturing capacity would not benefit. Greater demand in one area would pull up prices in surrounding locations as milk was brokered to where its value could be maximised. Transport costs mean that this effect becomes weaker with distance.

Processors exporting commodity products would be seeking contracts with individuals or groups of individuals able to supply large volumes of raw milk within a geographically defined region. The impact of greater export of dairy products will therefore be observed at the lower-end of the milk price range, whereby producers are focused upon volume first and foremost. This may favour large-scale producers focused on efficient production of relatively low value milk.

5.4 Increase or decrease in GB processing capacity

5.4.1 Introduction

The scenarios of an increase or decrease in dairy processing capacity in Great Britain will be looked at together as they are two sides of the same coin.

In recent years, there has been significant investment in processing capacity in the GB dairy industry. Major examples in the last decade include:

- Arla – Stoughton and Aylesbury
- Wiseman – Droitwich and Bridgwater
- Westbury
- Dairy Crest – Derbyshire (originally Amelca).

There have also been significant upgrades to existing dairy processing plants made in the last decade.

There has also been rationalisation in dairy processing. This especially occurred when Dairy Farmers of Britain became insolvent. A number of its facilities failed to find a buyer and were closed. Recently, Dairy Crest has announced the closure of its Fenstanton and Aintree liquid milk plants and the Crudgington spreads plant.

It is the **net** increase or decrease in dairy processing capacity which is the important factor in determining the market for dairy farmers. For example, Arla's new 1bn litre facility near Aylesbury is widely expected to lead to closures of the firm's Hatfield Peverel, Oakthorpe and Ashby plants – resulting in only a minor net increase in capacity.

It will be noted that most of the recent investments have been in the liquid milk sector. This has historically been seen as the 'premium' market by processors – one where profits should be high and investments are worthwhile. The economies of scale of 'superdairies' are also attractive to processors. However, squeezed margins in the liquid market have almost certainly made this part of the marketplace less attractive to processors. Any further major investments in the near future might well be considered unlikely.

5.4.2 What would change?

In common with most large-scale production systems, dairy processing plants are most efficient when running at or near capacity. The cost of land, buildings and plant are 'sunk' at the point of construction. Other costs such as labour are relatively fixed in the short-term. Thus, a large proportion of total costs are committed whether the plant operates or not. As plant throughput increases, the cost per unit of production falls as costs are spread over a progressively large number of units. This means that dairy processors have a strong incentive to maximise factory throughputs in their facilities.

An increase in net GB processing capacity through new factories or upgrades to existing facilities would increase the competition for milk as processors sought to maximise throughputs. This puts upwards pressure on milk prices as greater competition for raw milk bids up prices.

This analysis is based on the assumption that there is sufficient market demand for the products any new factory is producing. This would either have to be growth in the domestic market or increased export activity (as discussed in the previous chapter). If new dairies were constructed on a 'speculative' basis and not in response to market demand, this would lead to excess capacity in the industry. Without full utilisation then inefficiencies will be greater and costs higher. The processors may offer low prices to their customers (retailers and foodservice companies) simply to boost market share. This could exert pressure on margins which might be passed back to farmers, as has recently been seen in the liquid milk market.

In the long-run, the overcapacity would be unsustainable and the least efficient factories would go out of business. In this way, the industry may reach a position of having a more modern and efficient processing sector, but face a period of considerable 'pain' in getting there. The 'long-run' might also turn out to be an extended period as processors 'hang-on' in the hope that competitors reduce capacity first.

The issue of keeping dairies at maximum throughput is also more complex than the simplistic analysis above suggests. In many parts of the world (eg New Zealand), milk supply is very seasonal and processing plants are operated to match this. Some facilities are actually closed down for part of the year. This also happens in other parts of agriculture – eg the sugar beet industry. This is possible largely because of a more integrated approach through the supply chain. Rather than focusing solely on internal production efficiencies, the processors look at what is the cheapest way overall of producing the product. Effectively, if seasonal milk production systems allow the processor to access raw milk at cheaper prices, they can afford to run factories at less than optimum efficiency by varying throughput during the year. This happens to some extent in Great Britain (eg Westbury), but there is still a very prevalent 'level production' mind-set. Thus, it is not only a question of the capacity of the GB processing sector, but also how it is operated.

5.4.3 Effect on GB dairy producers

For the purpose of this scenario, it will be assumed that the increase in GB processing capacity has been demand-led and does not result in overcapacity. In this case, there should be increased competition between milk buyers for raw milk and prices would rise. This, in turn, would be a signal for progressive producers to expand production. Economic theory would suggest that the milk market would find equilibrium at higher output levels with only marginal or no price increases.

This scenario needs to be considered in the following context:

- Producers need the ability to be able to switch between milk buyers relatively easily for the benefits of milk buyer competition to be felt at the farm level. This has not always been the case in the past (see DairyCo report <http://www.dairyco.org.uk/library/market-information/apt-reports/apt-report-2011.aspx>). The subject of milk contracts and notice periods is a live issue at present but is beyond the scope of this report to consider in detail
- The location of dairy processing plants is important - dairy farmers tend to benefit from buyer competition *in their localities* (as outlined in the previous section). Due to transport costs the trend has been to build commodity milk product manufacturing facilities close to

milk fields (lessening transport distance for raw milk). Liquid milk is processed closer to consumers as the end product is equally (or more) bulky than the raw milk.

A situation of static prices, but a greater opportunity to increase output, will favour those expansion-minded producers. They will see a chance to expand output to increase the total revenue (and profit) of their business, even if the 'per litre' profit is not greatly changed. A larger business could be more efficient on a unit cost of production basis but the analysis within this report shows that economies of scale in dairy production are marginal at best.

Businesses that are not expansion-minded are likely to face a broadly similar business environment whether processing capacity increases or not. The price level will not alter greatly due to output increases matching extra demand. Therefore, trends in business exits and restructuring will be broadly unaffected.

There may be a slightly different outcome if there is a contraction in processing capacity. If there is less demand and competition for raw milk from processors then the price will fall. Economic theory would suggest that producers would reduce production in response to this, in the same way production increases when prices rise. In fact, this does not always occur:

- Producers may target a certain level of *revenue* (eg what is required to fund family drawings etc.). When prices fall, there may be an increase in output as farmers try to offset income falls by producing more
- Higher milk prices encourage the 'expansion-minded' to expand. But lower milk prices may not cause them to reduce precisely because they have an expansion mindset
- Lower demand, reduced milk prices and falling profitability should put pressure on the least efficient businesses to exit. However, we have seen that milk prices and profitability are only weakly correlated with industry restructuring. These less efficient business decisions may not be greatly altered in the short-term.

For these reasons, the market adjustment to a fall in processing capacity may be much slower than to an increase. It could result in an 'over-supply' of raw milk for some time and thus lower prices. This may not greatly affect the pace of structural change but would make the business conditions for all dairy farms less favourable.

One final point concerning a reduction in processing capacity is the effect on smaller producers. An oversupply of milk may allow processors to 'pick-and-choose' their farmer suppliers. As it is more expensive to collect milk from a large number of small farmers than a small number of large ones, then those with fewer cows may be adversely affected. At worst, some buyers may simply not offer very small producers contracts under any circumstances. It is more likely that they would be penalised with higher charges/lower milk price, putting them at a competitive disadvantage to larger herds. This may accelerate structural change in this segment of the production base.

6. CONCLUSIONS

A number of conclusions can be drawn from this work:

- The decline in dairy farmer numbers is not a new phenomenon, nor is it exclusive to the UK. In fact, the rate of annual decrease in dairy producer numbers has been falling for some time. Similarly, the increase in average herd size has been a long-term trend but again the rate of increase is falling
- There is However, considerable disparity in production trends in different regions/countries with some areas growing considerably despite declining producer numbers overall; this appears to be because certain regions are able to exploit competitive or comparative advantage, e.g. western parts of the UK are able to grow grass more cheaply, while climatic conditions and topography may make the same area less suited to alternative agricultural sectors
- When analysed, the economic drivers of change appear to be less influential in determining dairy farmers' decisions than might be widely believed
- This suggests that decisions are rather more driven by the personal 'social' factors that producers face. This, however, is difficult to prove empirically; attempts to 'model' the inclination of producers within the industry, based on both economic and social variables available only explains a very small proportion of the variation in producers intentions . This is firstly because a number of these measures is so subjective. Secondly, even when data could be gathered in a robust way, the current information is lacking. This could be an area for future work
- It is likely that individual producer circumstances are more important in determining future intentions, which is likely to include variables which cannot be encapsulated in any broad industry dataset, for example, individual exposure to bovine TB, personal health issues or development pressure from urban areas and industry
- Categorising farms by the proprietor(s) attitudes and goals seems a useful counterpoint to merely thinking about business size. However, it must be acknowledged that this is an imprecise activity; additional studies show that many businesses associate 'across' segments (rather than fitting one precisely), furthermore businesses evolve in such 'behavioural segmentation' according to business 'cycle stage' and maturity. Further work may be able to refine this and produce additional data for analysis
- Segmenting farms by size shows that there is no 'correct' size for dairy production. Both large and small farms can be profitable or loss-making. Equally, farms of all sizes can be efficient, progressive businesses. However, larger farms/higher milk output gives the potential for higher total levels of profit; achieving this (or not) is dependent on the management of each individual business
- There is no evidence that large dairy farms make the business environment more challenging for smaller units and thus contribute to their exit
- It is not possible to state whether all producers have 'perfect knowledge' with regard to their own production costs, however, producers that regularly benchmark are observed to have higher profitability indicating improved future sustainability as a result of this

- To achieve any significant reversal in the current trends of industry would require an increase in the desire of new entrants in the industry, to do this would require a 'sea change' in two aspects: firstly, the signals regarding the prospects and future profitability within the industry will need to improve and much of this will depend on the outcome of the important future scenarios outlined above. Secondly, there will need to be much greater understanding and awareness of potential routes for new entrants into the industry, which reduces the barriers to entry due to the high capital requirements.

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