A Review of the Financial Status of Irish Farms and Future Investment Requirements

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Foreword

It is generally recognised that growth in agriculture is fuelled by investment. This investment can come in numerous forms. It can arise in the form of additional human capital, improved genetic merit of animals, improved crop varieties and better quality machinery and buildings. Finally investment can also come in the form of additional investments. In this study we will focus on the latter category of farm investment.

It is evident from numerous international literature sources that farmers' ability to access scarce farm assets and to access financing has a major role in agricultural development. Hence, it is interesting to note that much of the focus of recent research and agricultural policy development concerning the Food Harvest 2020 expansion targets have not addressed the ability of farm units to balance net income flows and investment requirements.

In addition to income flow considerations, financing possibilities are bound by the leverage rates and collateral requirements of farms, which are often outside of farmers' control. Therefore, the current capital endowments, capital structures and financial leverage of farms are the critical underlying factors that finally determine the potential for future development patterns and the performance of the agricultural sector.

It was against this background that Teagasc initiated a research project to review the financial status of Irish farms and identify future investment requirements. Bank of Ireland generously agreed to part fund this initiative and the study was conducted in 2014.

Teagasc and Bank of Ireland would like to acknowledge the active involvement of a wide range of stakeholders who participated in the advisory group which was established at the outset of this study. Their helpful suggestions and critical comment during the course of the study were greatly appreciated. All errors and omissions remain the responsibility of the authors.

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Executive Summary

Background

- It is generally recognised that growth in agriculture is fuelled by investment.
- It is evident from numerous international literature sources that farmers' ability to access scarce farm assets and to access financing can play a major role in agricultural development.
- Hence, it is interesting to note that most interest in recent research and agricultural policymaking, concerning growth potential based on the recommendations from the Food Harvest 2020 document, have failed to document the ability of farm units to balance net income flows and investment requirements.
- It was against this background that Teagasc initiated a research project to review the financial status of Irish farms and identify future investment requirements. Bank of Ireland generously agreed to part fund this initiative and the study was conducted in 2014.

Summary of financial status of Irish farms

- Teagasc National Farm Survey (NFS) data has shown that the average level of debt on dairy and tillage farms was significantly higher than on livestock farms over the time period examined (2002-2012).
- The average level of debt on all farms (farms with and without debt) in 2013 was €24,000, with dairy farms recording the highest level of debt at an average of approximately €62,000 for all dairy farms, and an average of approximately €94,000 for the sub sample of dairy farms that have debt.
- With regard to farm loans in recent years, the majority of loans were used for buildings, land purchase and working capital.
- The closing balance of debt on all farms in 2013, as recorded by the Teagasc National Farm Survey, for the 80,000 commercial farms represented by the sample, was approx. €1.9 billion. This aggregate debt figure is not directly comparable with the total debt figures as recorded by the Central Bank for the sector as a whole. The NFS data do not include pig and poultry farms which, although small in number, are generally very large operations and may have significant debt levels. Data on debt recorded in the Teagasc National Farm Survey is confined strictly to farm related debt levels on commercial dairy, drystock and tillage farms. Furthermore, the NFS sample does not typically include farms that have a large-scale farm-related business such as agricultural contracting, food processing or agri-input supply. Such farms are likely to have considerable debt levels which would be reflected in the Central Bank figures but not in the Teagasc NFS data.

- The analysis of Teagasc NFS data indicates that despite the increase in liabilities recorded on farms in nominal terms in recent years, the historically low level of debt relative to assets and equity reaffirms the farm sector's strong financial position.
- In financial terms (and ensuing repayment capacity) the sector has remained relatively well insulated from the negative risks associated with commodity production (such as adverse weather), changing macroeconomic conditions in the world economy, as well as any fluctuations in farm asset values that may have occurred due to changing demand for agricultural assets.

Summary of the comparison of the financial structure of farming in the EU

- Given that Irish agriculture is now competing in an increasingly globalised market place, the financial stability from an inter country perspective (i.e. between competing countries) is very important.
- The financial indicators examined in the report using data from the European Commission Farm Accountancy Data Network (FADN) indicated that on average Irish farms have relatively low debt and high asset values relative to the EU average for all farms.
- Furthermore, looking at solvency, liquidity and financial efficiency indicators it is evident that Irish farms are in a very healthy position in EU terms.
- While previous work by Teagasc has shown that Ireland continues to exhibit a healthy position in terms of the competitiveness of its dairy sector (in EU and international markets), in a market which is increasingly exposed to market price volatility, the ability to demonstrate resilience will be equally important in the future. Given that this research has indicated that not only does Irish dairy farming enjoy a competitive advantage in cost terms within the EU, the level of debt and financial status of Irish dairy farms should also provide Irish farms with a relative advantage in resilience terms given that they are not servicing high debt levels in years of extreme market volatility.

Summary of the dynamics of investment

- Investment levels, typical characteristics and determinants of investment decisions are described and analysed using 2013 Teagasc NFS data.
- The analysis showed that Irish farms on average had net new investments of approximately €8,000 per farm in 2013, but this figure varied considerably between farm systems.
- Large dairy farms managed by farmers with higher family farm income and an off-farm income earned by the spouse demonstrated a higher probability of investment.

Summary of projected investment needs towards 2020 – Dairy

- Dairy farmers invested almost €2 billion (net of subsidies) in the 2007 to 2013 period. Just under half of this investment was in buildings, partly driven by grant incentives. Almost €70 million was invested in milk quota over that period.
- The average milk deliveries per farm increased by approximately 30 percent from 2007 to 2013 facilitated by this €2 billion investment.
- Results of a Teagasc NFS supplementary survey show that almost 40 percent of dairy farmers sought loan finance in 2013 with the vast majority of farmers seeking this finance from banks. Furthermore, the survey suggests that the vast majority of farmers, almost 80 percent, were successful in their bank loan application suggesting that access to finance may not be an issue for most farmers.
- It is estimated that a further €1.47 billion would need to be invested on dairy farms in the 2014 to 2020 period in order to achieve the Food Harvest 50 percent expansion target.
- At a milk price scenario of 32 cent per litre the current population of dairy farms could profitably increase milk production by 43 percent over the Food Harvest baseline of 2007 to 2009. This expansion would require an investment of €1.24 billion. About €400 million of this is for the acquisition of cows which may be funded out of internal resources rather than bank credit.
- To reach the Food Harvest 2020 target, approximately 500 new entrants would be required with a total start-up cost of €230 million.
- In addition to this investment associated with expansion, dairy farmers are also likely to undertake their "normal" investment in items such as machinery and in land improvements. In the 2007 to 2014 period investment in these items averaged €140 million per year.
- The results of a recent survey of farmers participating in the Teagasc National Farm Survey suggest that up to 60 percent of dairy farmers plan to expand milk production in the first 2 years following milk quota removal and almost 400 non-dairy farmers have engaged in some conversion to dairy planning. In aggregate it is expected that the national milk pool will increase by approximately 17 percent in the initial years following milk quota removal.
- Up to 70 percent of dairy farmers plan to use bank finance to fund this investment with the remaining 30 percent using internal sources of finance.
- It is important to note that farmers' expansion plans will be significantly influenced by the economic environment and milk price volatility may have a dampening effect on expansion plans.

Summary of the financials and investment needs towards 2020 - Pigs

- The Irish pig industry continues to improve its efficiency levels despite tight financial margins. The national average output has now increased to 25 pigs per sow per year and the sale weight has continued to rise to 105 kilograms (2013 figures).
- Under the Food Harvest 2020 report ambitious targets were set for the Irish pig sector to further expand and increase efficiency. If these targets are to be met then further capital investment will be required from financial institutions.
- The most immediate significant investment requirement identified by the industry is a reduction in the merchant feed credit which currently inflates feed prices and the cost of pig production. An elimination of merchant credit would decrease the cost of production and allow the Irish pig industry to become more internationally competitive.
- Investment in farm buildings is also a priority for the pig industry. An estimated €27.7million has been invested by the industry to comply with loose dry sow housing regulations. While this investment has ensured compliance with new welfare standards, it has not generated increased productivity but has increased the debt burden of units, and has been to the detriment of investment in other housing e.g. weaner/finisher housing that now requires refurbishment.
- An expansion of the Irish sow herd size to 200,000 sows was a key target of Food Harvest 2020. The additional 56,000 sows required to meet this target would require an investment of €280 million at current prices.
- A more likely and prudent scenario is for pig farms to maximise the output potential of their existing herd through an increase in the number of pigs produced per sow (to reach 27.2 pigs per sow per annum) and the achievement of higher sale weights (to reach 110 kilograms per finished pig where possible). The cost of this extra investment would equate to €539,000 for the average sized pig unit, but would lower the cost of production per kilogram by having the effect of diluting fixed costs across a larger output volume. In addition the national pigmeat output generated from this development would exceed the original forecasted Food Harvest 2020 output.

Scenario analysis

- In the context of milk quota elimination and the FH2020 target of expanding Irish milk production by 50 percent relative to the 2007-09 base period, the volatility of milk prices assumes greater importance. The scenario analysis carried out using the FAPRI-Ireland model highlighted the sensitivity of the profitability of milk production to the price of milk.
- Three milk price scenarios were used to assess the differing levels of profitability associated with milk production. It was found that the dairy farm level investment requirement could range from just over €1.5 billion euro to €2 billion euro depending on the price scenario.

- These findings illustrates the importance of market prospects in framing the extent to which Irish milk production might expand over the next 5 years and the associated investment that might be sought to bring this expansion about. Given that it is impossible to be certain about how international dairy markets will develop, it is reasonable to adopt a pragmatic approach in assessing the likely level of investment requirement that will emerge. In this context the investment figure of just under €1.5 billion estimated in the Steady scenario represents a reasonable estimate for planning purposes.
- It is important to note that total investment figures estimated in the report does not necessarily equate to credit demand. For example, over €400 million of this investment is for the acquisition of cows and it is probable that in many cases this would be funded out of the farmers' own resources.
- In conclusion while the total investment figure is close to €1.5 billion for the dairy sector at farm level the demand for bank credit is likely to be lower.

Concluding Remarks

- This report has shown that Irish farmers in general have a sound financial structure.
- Debt to asset levels are quite low by international standards and solvency, liquidity and financial efficiency indicators all compare favourably with our main competitors in Europe.
- Traditionally, dairy farmers have been the most active investors and this is a situation that is likely to continue given the impending removal of the milk quota.
- Significant investment and credit will be required if the farming sector is to achieve the targets as laid down in the Food Harvest 2020 report.
- However, sound financial planning on the part of farmers in conjunction with the banks will be critical to safeguarding farmers from financial stress. Given the current historically low interest rates in addition to the inevitability of output price volatility, it is prudent that all expansion plans are adequately stress tested.

Chapter 1
Introduction

1.1 Background

It is generally recognised that growth in agriculture is fuelled by investment. This investment can come in numerous forms. It can come in the form of human capital embodied in the farm operator, which can be acquired through education, training, experience and extension. It can also come in the form of improved genetic merit of animals, improved crop varieties and better quality machinery and buildings. Finally investment can also come in the form of additional buildings, machines, livestock and land, commonly referred to as fixed investment. In this study we will focus on the latter category of farm investment.

It is evident from numerous international literature sources that farmers' ability to access scarce farm assets, and their ability to access attractive terms of financing plays a major role in agricultural development. Hence, it is interesting to note that most of the recent research and associated agricultural policy development, concerning the Food Harvest 2020 targets, has not considered the ability of farm units to balance net income flows and investment requirements.

In addition to income flow considerations, financing possibilities are bound from above by the leverage rates and collateral requirements of farms, which are often exogenously fixed. Therefore, the current capital endowments, capital structures and financial leverage of farms are the critical underlying factors that finally determine the potential for future development patterns and the performance of the agricultural sector.

In order to address the aforementioned factors, the remaining sections of this report are divided into 7 further chapters.

Chapter 2 provides a context for the study by reviewing the financial status of Irish farms over the past decade using Irish Teagasc National Farm Survey (NFS) data.

Chapter 3 examines how the financial status of Irish farms has evolved through time, relative to competitor countries in the EU, with a particular focus on the period 2002 to 2012.

Chapter 4 examines the dynamics of investment within Irish agriculture. The analysis uses Teagasc National Farm Survey data to examine the determinants of investment

on all farms with a view to isolating the characteristics of potential investors as well as determination of the types of farms most likely to be able to fund future investment.

Chapter 5 outlines the investment required at the farm level if the Irish dairy sector is to meet the target of expanding milk production by 50 percent by 2020.

Chapter 6 summarizes the financial status of Irish pig farms and discusses their demand for external finance in the medium term. Although the sector is relatively small in terms of the number of herds, the scale and commercial nature of pig farmers makes this sector quite unique in Irish farming.

Chapter 7 examines a number of financial ratios which measure farmers' repayment capacities. These ratios are projected forward under different market assumptions. The objective of this chapter is to demonstrate the effect of input and output price volatility on farmers' repayment capacity.

Chapter 8 details some caveats that need to be considered and summarises the report's conclusions.

1.2 Short term economic outlook for Irish agriculture

Before the critical underlying factors that determine the potential for future development and investment patterns are evaluated in the following chapters, it is important that the current economic environment of the main sectors of agriculture are understood along with the short term economic environment that is likely to prevail.

To understand the current and short term outlook for agriculture, at the end of each year Teagasc economists estimate the economic outturn for each of the principal sectors of Irish agriculture in order to arrive at an overall estimate of agricultural income analogous to that measured in the Teagasc NFS. At the same time they assess likely developments in each sector over the short term, to arrive at a forecast average income level for the year ahead (Teagasc, 2014). Invariably there will be some unanticipated shocks to the system which mean that the forecast is imperfect, but in general these forecasts are a valuable tool for farmers, the food industry, policy makers and the banking sector.

Review of 2014

In terms of weather 2014 was one of the best years for grass growing conditions in Ireland in living memory and marked a contrast to the difficult operating environment

of 2012 and 2013. Lower grassland input expenditure in 2014 was driven by lower levels of feed and fertiliser usage and lower prices.

Market conditions for milk producers and beef finishers took a downturn in 2014 and the decrease in prices eroded the benefit of lower feed, fertiliser and fuel bills. Nevertheless, at 12 cent per litre the average dairy net margin in 2014 was unchanged on the previous year, as milk prices and production costs are estimated to both have fallen by 2 cent per litre. Beef finishers also experienced lower production costs, but the impact of lower costs did not fully offset the impact of lower finished cattle prices and gross margins declined by 9 percent in 2014.

While suckler farmers saw their average output prices fall, the estimated decrease in input expenditure meant that 2014 margins improved on levels earned in 2013. Sheep farmers saw their margins improve in 2014, as their production costs decreased, while lamb prices on average were higher than in 2013.

Irish cereal yields for major crops were above normal in 2014, but a large global harvest triggered a steep drop in international cereal prices. While cereal direct costs were down slightly, this was insufficient to negate the drop in output value. Consequently, cereal margins in Ireland were down for nearly all crops in 2014.

Irish pig producers experienced a decrease in pig prices in 2014, which was mainly due to the Russian embargo, but benefitted from declining feed prices through most of the year. Overall, their margins increased in 2014.

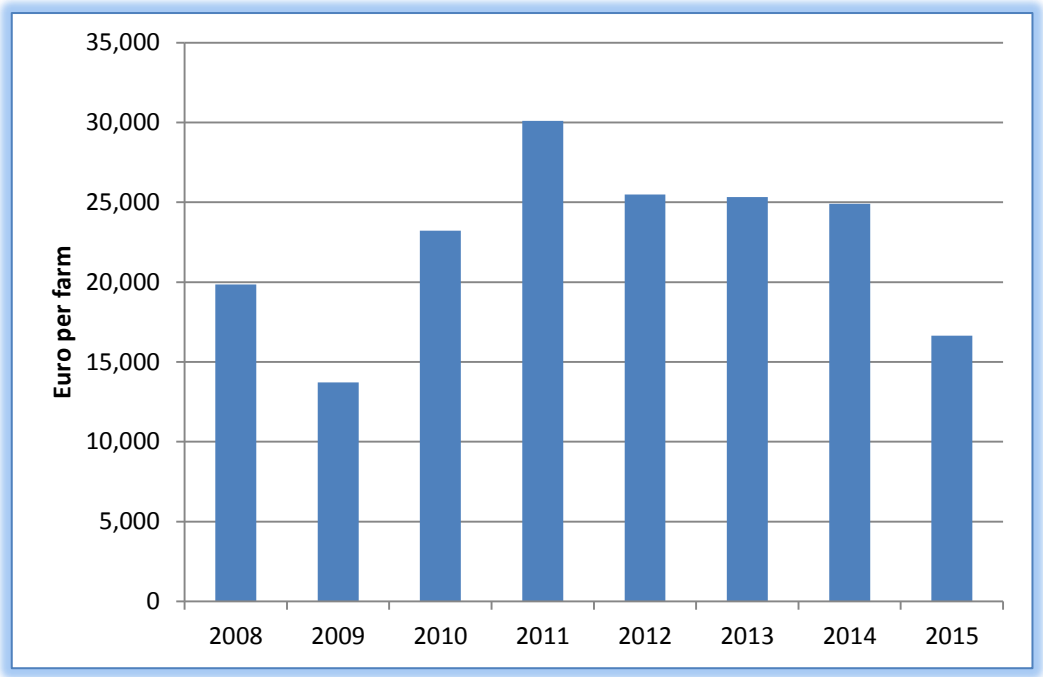
The overall level of subsidy payments to Irish agriculture decreased by9 percent in 2014, which had a negative impact on incomes. Overall, these changes in margin and subsidy payments at the sector level are indicative of a 3 percent drop in farm income in 2014, relative to 2013.

Outlook for 2015

In 2014 we saw a demand shock with the imposition of the Russian embargo and a supply shock due to a surge in global milk output, neither of which was anticipated in advance. Uncertainties of this kind may again emerge in 2015, making it challenging to forecast income in the year ahead.

Weather conditions can play a significant role in determining grassland and tillage sector incomes given the impact it can have on yields and production costs. Since it is not possible to forecast weather for the year ahead, we must assume that weather conditions reflect a long term average.

Figure 1.1 Teagasc NFS average farm income, with estimate for 2014 and forecast for 2015



Source: Teagasc (2014)

On this basis, feed usage levels in 2015 should be similar to those of 2014. Feed prices are likely to be lower in the first half of 2015 and higher in the second half, but on average feed bills for grassland systems in 2015 are forecast to be little changed on the 2014 level. Pig producers may experience a slight increase in their feed prices.

The euro is expected to be weaker against the US dollar in 2015 than it was in 2014. Allied with concern regarding the security of international fertiliser supplies, this means that fertiliser prices should be higher in 2015. With no anticipated change in fertiliser use in 2015, fertiliser expenditure will rise due to the effect of higher prices.

If the sudden and dramatic drop in oil prices in the latter stages of 2014 persists, then there will be considerable savings in fuel bills in 2015. Electricity prices reflect a mix of energy prices (coal, gas and oil) and significant capital costs, so the fall in oil prices may have little impact.

A substantial fall in farm gate milk prices in forecast for 2015. Global milk production growth in 2014 has outpaced the growth in demand for dairy products and a surplus has emerged which will depress prices for much of 2015. In Ireland the forecast reduction in milk prices for 2015 is 28 percent. This would take the annual average Irish milk price down to 27 cent per litre, a ten cent per litre drop on the estimated average figure for 2014.

Irish beef prices should improve in 2015 and with costs of production relatively unchanged, margins should be up for all systems. Sheep prices are expected to remain stable in 2015. A change to the Sheep Grassland payment will impact on margins, but will not affect incomes.

Stock levels on international grain markets remain at relatively low levels in spite of the large global harvest in 2014. Cereal prices in 2015 will therefore be highly dependent on growing conditions globally. For harvest 2015, Irish cereal prices are forecast to rise by 10 percent. If Irish yields revert to normal levels, then cereal margins in 2015 will be only very slightly improved on 2014 levels.

Pig meat prices are set to fall slightly in 2015 due to increased EU supplies, and marginally higher feed prices will also negatively impact on margins in 2015.

The inter-annual variation in Irish agricultural income is heavily associated with any changes in dairy margins. Much of the rest of Irish farm income is derived from the subsidy system and hence remains relatively stable. For the Irish dairy sector, 2015 is shaping up to be very much like 2009, with dairy incomes set to be more than halved. This will have a strong negative impact on income for the agriculture sector as a whole. Averaging across all of Irish agriculture, a decline in income of 25 percent is forecast in 2015. Using the narrower Teagasc NFS farm income definition, which excludes some enterprises and smaller farms, the forecast decrease is steeper, with an average decline of 30 percent in prospect.

Chapter 2

A Review of the Financial Status of Irish Farms 2002 to 2013: An Analysis of Teagasc National Farm Survey (NFS) Data

2.1 Introduction

This chapter provides some background context on a range of issues that create a focus for this study. A review of the performance of Irish farms in terms of key financial indicators since the year 2002 is provided. Based on a review of the literature the most often used indicators of farm financial performance are grouped into three broad categories: liquidity, solvency, and financial efficiency. It is important to keep in mind that monitoring these measures as a group is more important than focusing on only one measure at the exclusion of others. Before these frequently used indicators of financial performance are evaluated it is interesting to observe the historic and current situation regarding total liabilities and assets based on the balance sheets of Irish farm data.

2.2 Level of Indebtedness

Given the changes which occurred over the analysis period, in relation to the prevailing economic and political climate, it is interesting to observe average debt levels across time and system of production, to see if any discernible trends are evident. A review of total liabilities on farms is presented in Table 2.1 since the year 2002. Total debt include all current (<1 year, to include bank overdrafts and short term loans) and non-current liabilities (medium and long term loans, other debt).

Table 2.1: Average Farm Debt from Commercial[1] farms represented in the Teagasc, National Farm Survey (2002-2013)

Year	Dairy and Dairy Other[2]	Livestock	Tillage	Total
	€ per farm			
2002	33,500	7,343	26,767	16,942
2003	31,064	7,672	25,413	16,248
2004	31,954	7,733	21,906	16,391
2005	33,011	8,530	17,728	16,491
2006	32,546	12,463	16,436	18,742
2007	39,462	10,784	23,323	19,792
2008	54,490	11,919	30,201	24,264
2009	50,184	11,634	23,521	22,868
2010	54,014	9,595	41,175	23,277
2011	56,391	9,262	30,500	22,269
2012	63,052	10,061	27,257	23,843
2013	61,672	10,975	30,268	24,398

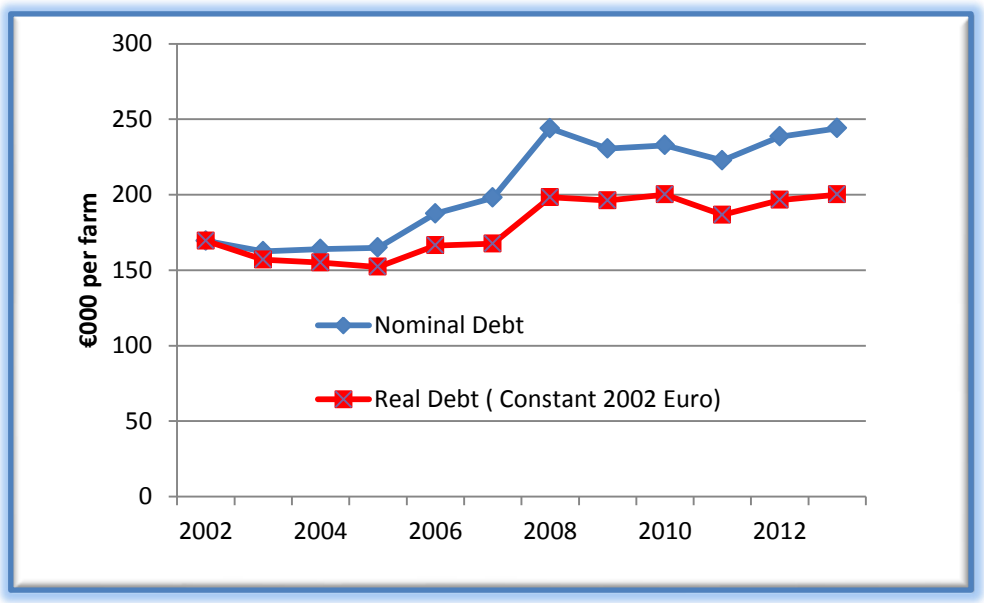
Source: Authors own analysis of Teagasc National Farm Survey data.

Table 2.1 shows that the level of debt has been highest on dairy farms over the recent past, followed by tillage farms. On the other hand the level of debt on beef and sheep farms was significantly less than that experienced on dairy and tillage farms.

There also appears to have been a marked increase in average investment levels over the time period examined. While the data presented in Table 2.1 above is in nominal terms, Figure 2.1 below shows the average investment levels across all sectors in real terms. These data shows that in real terms, the average investment level per farm increases but not at the same rate as indicated by the value in nominal terms.

[1] All commercial farms as represented in this chapter refer to all farms within the Teagasc, National Farm Survey with a Standard Output of greater than €8,000.
[2] Dairy and Dairy Other farms refer to Specialist Dairy farms in the Teagasc National Farm Survey in addition to 'Dairy and Other farms' defined pre 2011 and 'Mixed Livestock farms' as defined post 2011. See www.teagasc.ie/NFS for further detail on system classifications.

Figure 2.1: Average farm debt in nominal and real terms (2002-2013)



Source: Authors' analysis of Teagasc National Farm Survey data.

In addition to average debt levels across all farm sizes and systems, it is interesting to examine the proportion of farms within each system that have outstanding debt. Table 2.2 below shows that, on average over the time period examined, just under 6 out of every 10 farms do not have any outstanding debt levels at the end of each calendar year. It also appears that dairy farms have the highest number of farms with outstanding debts at the end of the calendar year, with about 7 out of every 10 dairy farms having outstanding debt at the end of the calendar year. About half of all tillage farms have outstanding debt and about one third of all livestock farms have outstanding debt, (at the end of the calendar year) across the period examined.

Given that the majority of farms do not invest at all it is informative to look at average investment levels across systems just for those farms actually engaged in investment. Appendix 2.1 shows the average levels of investment for just those farms that invested, which is significantly higher than the figures presented in Table 2.1 above. For example, in 2013 the average closing balance on dairy and tillage farms that had liabilities was approx. €94,000 and €74,000. This leaves an average closing balance of approximately €62,000 on all farms that had debt (Appendix 2.1) compared to an average across all farms of just over €24,000 (Table 2.1).

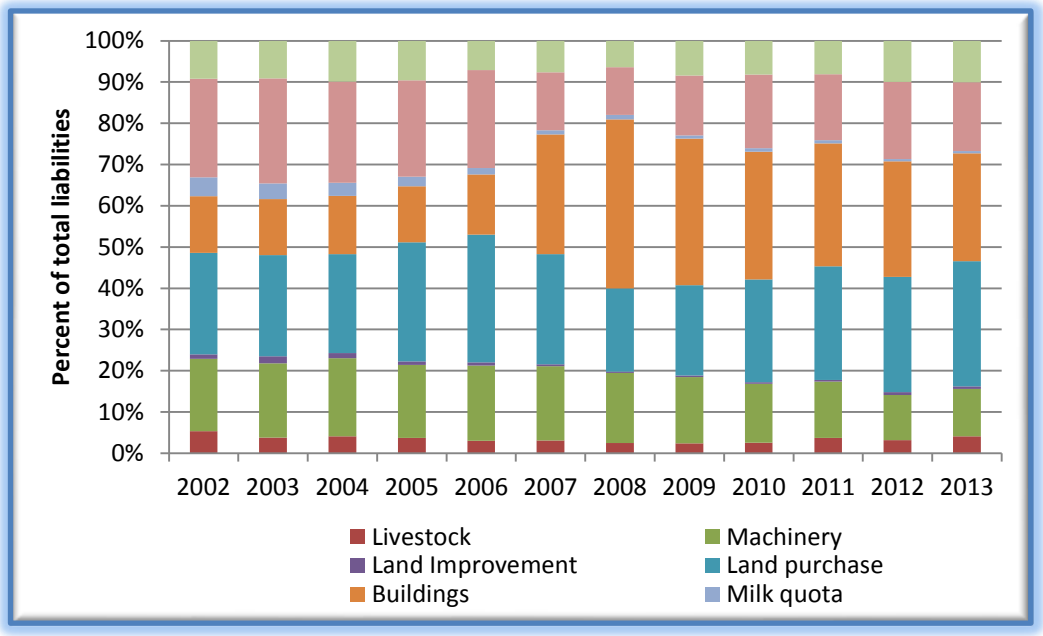
Table 2.2: Proportion of Farms with Outstanding Debt at Year End (2002-2013)

Year	Dairy[1]	Livestock	Tillage	Total
2002	71%	32%	50%	46%
2003	67%	30%	48%	43%
2004	62%	30%	42%	41%
2005	61%	30%	38%	40%
2006	61%	31%	44%	41%
2007	62%	28%	50%	39%
2008	65%	31%	47%	41%
2009	62%	32%	41%	41%
2010	67%	32%	42%	42%
2011	65%	32%	40%	40%
2012	66%	30%	40%	39%
2013	66%	30%	41%	40%

Source: Authors own analysis of Teagasc National Farm Survey data.

It is also worthwhile to note the purpose for which farm loans have been taken out in recent years. Figure 2.2 shows the proportion of liabilities per loan category over the past decade.

Figure 2.2 Investment purposes per loan category (2002-2013)



Source: Authors' analysis of Teagasc National Farm Survey data.

Figure 2.2 shows that the majority of farm loans have been used for buildings, land purchase and working capital in recent years. In the mid to late noughties loans for the purpose of buildings were the largest loan purpose category which is related to the availability of farm waste management grants for building improvements during this time period (to assist farmers meet new requirements under the European Communities (Good Agricultural Practice for Protection of Waters) Regulations 2005 (S.I. No. 788 of 2005) . It is also interesting to note the differences in loan purpose category by farm type (Appendix 2.1). For the majority of loan purpose categories, the narrative behind the figures is similar to what we have witnessed thus far, with the dairy sector experiencing the highest level of debt across all years, followed by tillage, with the livestock sector having significantly lower debt levels than the other sectors.

However, there are a number of noteworthy exceptions to this general finding. For example, the importance of working capital as a loan purpose category by farming system experienced shifts from year to year in the mid to late noughties as farm incomes fluctuated due to input and output price volatility. In particular, the role of working capital as a loan purpose category was highest for the tillage sector in 2010 which was on foot of a particularly bad income year in 2009 for the tillage sector. Likewise the relative importance of working capital as a loan purpose category was particularly noticeable for the dairy sector in 2012 which was probably related to the fodder crisis in that year.

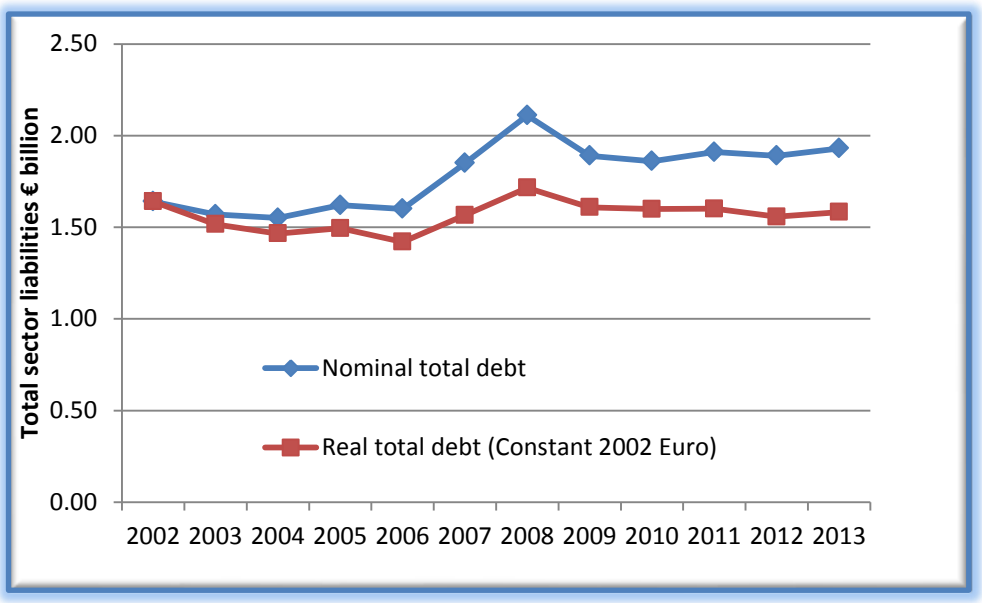
The relative importance of machinery as a loan purpose category is highest in the tillage system for all years, which is understandable given the mechanization levels evident on specialist tillage farms in Ireland. It is interesting to note that livestock as a loan purpose category is also highest in the tillage system despite the fact that the tillage system is defined by the proportion of output from crops produced, rather than livestock related output. One possible reason for this anomaly is that the dairy and livestock systems use the working capital as a loan purpose category to fund livestock related investment, whereas if livestock purchases do happen on tillage farms they tend to be lumpy investments which would not be funded from working capital and necessitate a specific purpose loan.

The investment in land purchases by system of farming over the time period examined is reflective of the lumpy nature of land purchase investments. However, the volatility in farm incomes in the late noughties does seem to have had an effect on the timing of some of these investments, with the dairy and tillage systems experiencing a large amount of fluctuation in this loan purpose category from 2007 onwards.

To summarize the trend in debt over the time period 2002 – 2013, it is informative to examine gross debt by the sector over the same time period (Figure 2.3). Gross debt

refers to the sum of the closing balance of all outstanding loans on all farms represented by the Teagasc NFS. This term is not to be confused with Net New Investment (NNI) which refers to all capital expenditure during the year less capital sales and grants. The cost of major repairs to farm buildings, plant and machinery as well as land improvements is also included. It does not include investments in land purchases.

Figure 2.3: Gross debt in nominal and real terms (2002- 2013)



Source: Author's analysis of Teagasc National Farm Survey data.

Figure 2.3 shows that in nominal terms gross debt held by the farming sector in Ireland increased from €1.6 billion in 2002 to just over €1.9 billion in 2013. However, when inflation is accounted for (using the CPI as the deflator), the total amount of debt has not increased to the same extent, and is actually quite flat in real terms.

2.3 Level of Farm Assets

Asset Value

Before any financial ratio analysis can be carried out it is important that a review of the asset value changes over the recent past be carried out. This section will focus on changes in asset value, which can be attributed to two reasons:

(i) first, the balance of total investments and depreciation to provide an indication of net investments, which defines whether capital accumulation or regress is happening and

(ii) Asset values can be re-evaluated to account for inflation and market price movements.

Both of these sources of asset value change over time and will be examined in the following section.

Total assets are the property of the agricultural holding and are calculated as the sum of current and fixed assets. Current assets in the NFS include non-breeding livestock, the stock of agricultural products and other circulating capital, holdings of agricultural shares, and amounts receivable in the short term or cash balances in hand or in the bank. Fixed assets are agricultural land, permanent crops, farm and other buildings, forest capital, machinery and equipment, and breeding livestock.

Table 2.3: Average total farm assets from commercial farms represented in the Teagasc, National Farm Survey (2002-2013)

Year	Dairy[1]	Livestock	Tillage	Total
	€ per farm			
2002	615,143	353,458	795,164	466,633
2003	654,909	384,324	974,537	508,331
2004	711,697	433,781	977,980	561,423
2005	894,858	583,865	1,593,753	749,579
2006	1,119,151	750,592	1,940,376	946,447
2007	1,273,142	813,139	1,920,591	1,011,596
2008	1,221,350	734,705	1,673,226	923,596
2009	1,127,313	674,334	1,365,678	845,883
2010	1,066,663	672,868	1,207,528	812,807
2011	1,193,826	686,597	1,150,125	847,335
2012	1,236,142	715,780	1,224,976	879,726
2013	1,250,496	725,120	1,286,688	894,637

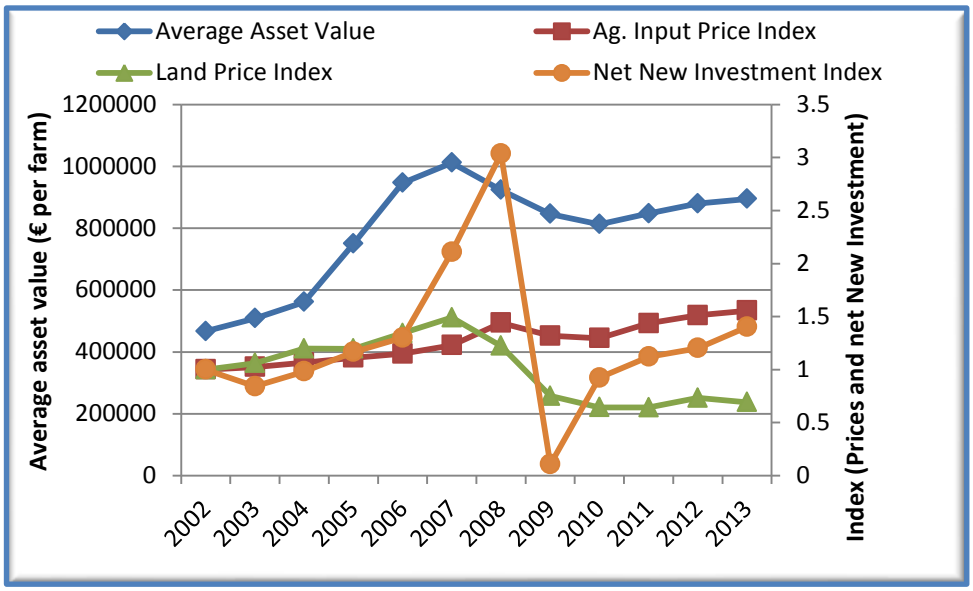
Source: Authors' analysis of Teagasc National Farm Survey data.

Table 2.3 shows that the tillage system has the highest level of assets across all years, which is related in part to farm size, with tillage farms having relatively large average farm size (tillage ~ 62.6 hectares in 2013 compared to an average farm size of 47.6hectares). Furthermore, there was a significant increase in total asset value across all systems over the period with asset values nearly doubling between 2002 and 2013.

There was also a very large spike in asset values between 2005 and 2007 on all farm systems, with the most significant rise in values occurring on tillage farms, followed by dairy farms.

To determine if this increase in value was associated with an increase in (i) capital formation or (ii) increases in inflation or market price movements, the trend in total asset value is compared to the trend in prices of key asset items (Figure 2.4).

Figure 2.4: Average total farm assets values compared to price indices for key asset items (2002-2013)



Source: Author's analysis of Teagasc National Farm Survey data; Donnellan, Hanrahan and O'Donovan (2014); C SO (various years)

Given that land values appreciated significantly during the Celtic Tiger period in Ireland it is reasonable to assume that the spike in the average asset value of farms in the mid to late noughties was related to land price movements. The land price index provides evidence that the spike in total assets in 2005 – 2007 does relate closely to land price movements. However what is interesting is that the subsequent decline in land prices shown in Figure 2.4 above shows that the subsequent fall in land prices was not mirrored as closely in total asset value. Hence, it appears reasonable to conclude that other price movements (as seen in the CSO agricultural input price index above) and volume movements have contributed to movements in the asset value over the recent past.

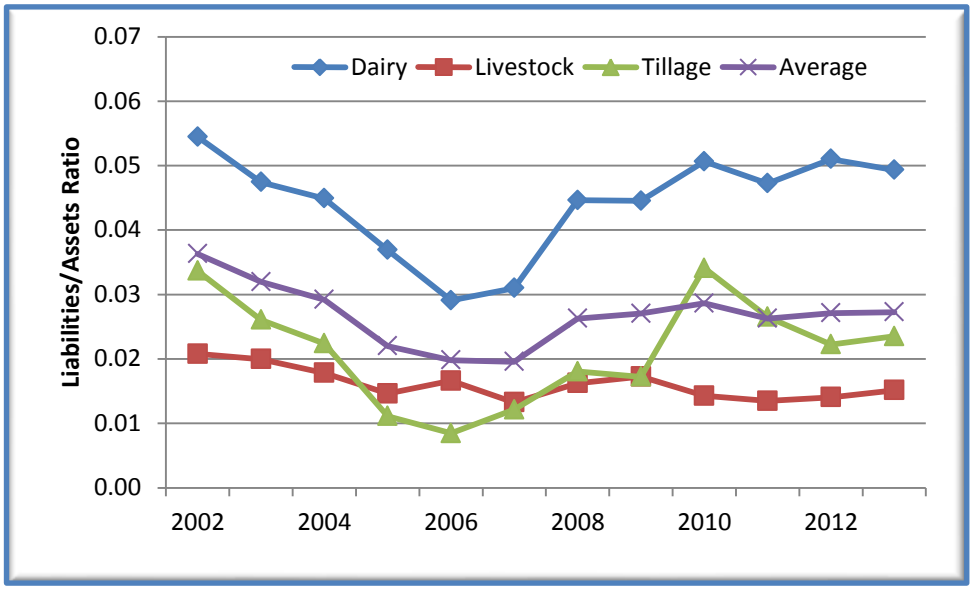
2.4 Solvency Levels

Reflecting on the trends shown in liabilities and assets above it is worthwhile to examine the trend in **Solvency** measures over the recent past on Irish farms. Solvency reflects on the amount of borrowed capital used by the business relative to the amount of owner's equity capital invested in the business. In other words, solvency measures provide an indication of the business' ability to repay all indebtedness if all of the assets were sold. Solvency measures also provide an indication of the business' ability to withstand risks by providing information about the farm's ability to continue operating after a major financial adversity. Unlike liquidity (which will be examined in further detail later in the report), solvency is concerned with long-term, as well as short-term, assets and liabilities.

Three widely used financial ratios to measure solvency are the debt-to-asset ratio, the equity-to-asset ratio and the debt-to-equity ratio. These three solvency ratios provide equivalent information, so the best choice is strictly a matter of personal preference. The debt-to-asset ratio expresses total farm liabilities as a proportion of total farm assets. The higher the ratio, the greater the risk exposure of the farm. The equity-to-asset ratio expresses the proportion of total assets financed by the owner's equity. The debt-to-equity ratio reflects the capital structure of the farm and the extent to which farm debt capital is being combined with farm equity capital. It is a measure of the degree to which a farmer is leveraging his equity.

The **debt-to-asset ratio** in Figure 2.5 provides a picture of the relative dependence of farm businesses on debt and their ability to use additional credit without impairing their risk-bearing ability. The lower the debt to asset ratio, the greater the overall financial solvency of the farm sector. The ratio shows that over the period 2002 to 2007, as assets increased in value quicker than debt levels, there was a decline in the debt to asset ratio across all systems, indicating an increasing rate of solvency. Subsequently, in the 2008 – 2010/2011 period, solvency levels decreased (apparent as an increase in the debt to asset ratio) as debt levels increased and asset values declined. In the later period, post 2011, solvency levels have reverted to the pre Celtic tiger levels for the majority of sectors, apart from the dairy sector where the solvency level is still lower than was historically the case (apparent as a higher debt to asset ratio). This trend is reflective of the trend in overall liabilities and also asset values to a lesser extent over the period, with liabilities in the dairy sector in particular increasing at a faster pace than other sectors.

Figure 2.5: Debt/ Asset Ratio by System (2002 – 2013)



Source: Teagasc National Farm Survey, various years and authors' own estimates.

The trend in relation to the equity to asset and debt to equity ratios is similar to the previous indicator of solvency (see Appendix 2.2), with solvency levels tending to be lowest on dairy farms, followed by tillage farms with livestock farms having the highest solvency rates. There is one additional observation which is interesting to note in relation to solvency, which is apparent from the equity to asset and debt to equity ratios, whereby dairy farms appear to be leveraging their own equity more so in recent years, with an increase in the debt to equity ratio evident on dairy farms from 2007 onwards. This trend is not as strongly evident in other production systems.

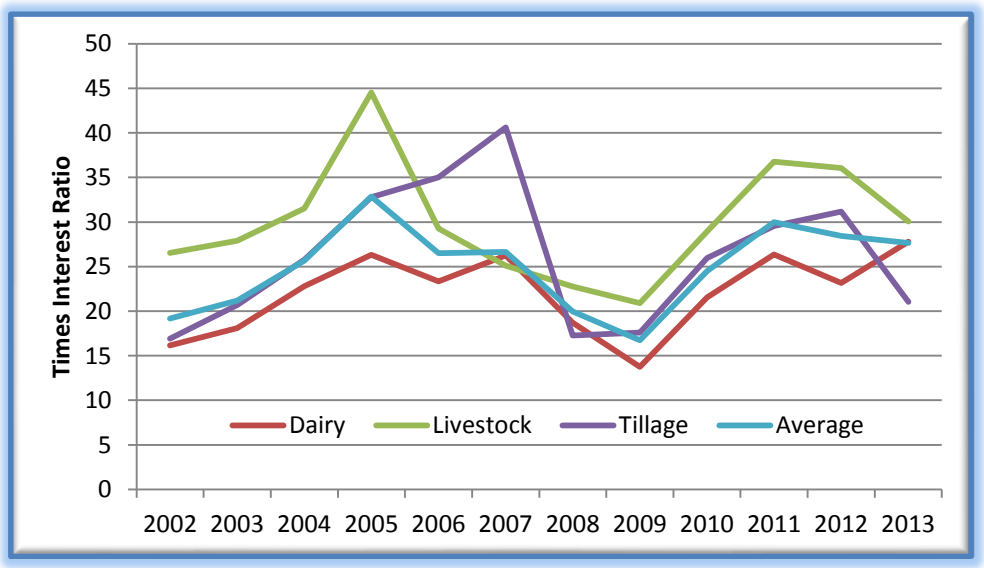
2.5 Liquidity Levels

As with any financial indicator, caution is needed when interpreting solvency indicators in isolation from other financial indicators in any business. It is not enough to look at the overall stability of the business, (which is the objective of solvency analysis) because the investigation of the short-term stability or liquidity of the business is also vital. Even if the gearing is healthy, as we have seen by examining the previous solvency indicators, shortage of cash for the purpose of essential materials and services, and loan repayments in particular, can force any business out of operation. The best guide to the availability of this cash, or 'working capital' is a cash flow budget. But given that the data we are using in this study is based on the Teagasc NFS, the balance sheet is the best unit of analysis available. Using available data from the balance sheet it is possible to examine indicators of **liquidity,** which measure the

ability of the farm business to meet financial obligations as they arise, without disrupting the normal, ongoing operations of the business.

A common indicator used in farm management literature to measure the liquidity of the farm business is the **times interest ratio** which measures the share of the farm business's net cash income before interest to service interest payments. Some other common indicators of liquidity are based on gross income relative to repayments, which are adequate in times of stable costs of production. But given that current financial pressure on Irish farms is based on pressures from the costs of production in addition to pressures on the value of output, it is worthwhile to examine an indicator which takes net income into account. Hence, the time interest ratio examined here is calculated as net cash farm income before interest divided by interest payments due. The lower the ratio the less liquidity there is on the farm.

Figure 2.6: Times Interest Ratio by System (2002 – 2013)



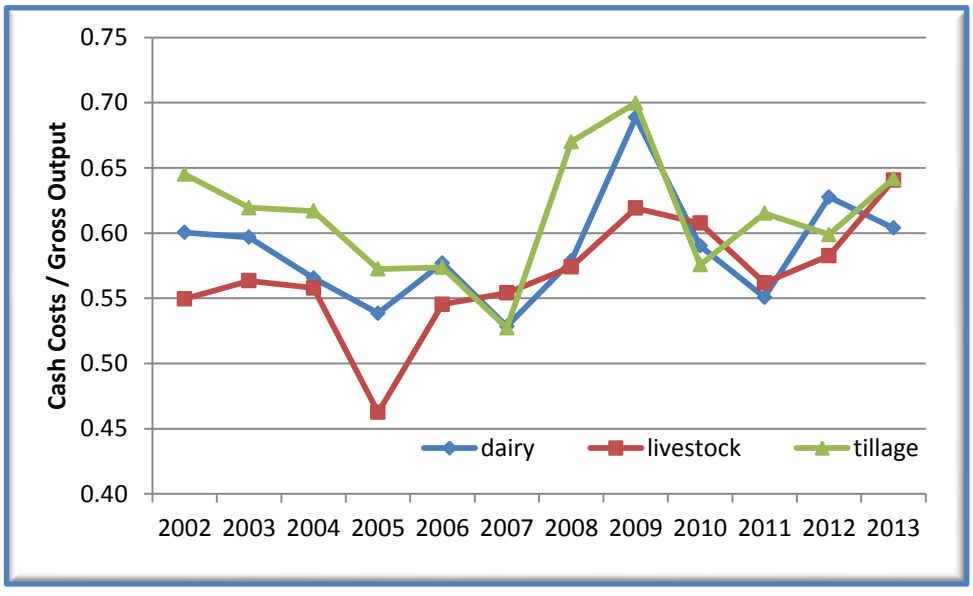
Source: Teagasc National Farm Survey, various years and authors' own estimates.

Figure 2.6 shows that over the period examined the experience of liquidity on Irish farms has been quite volatile, for the sectors where the majority of investment has taken place (dairy and tillage systems) the steepest decline in the ratio was experienced in the 2008 and 2009 period, indicating a decrease in liquidity. For the later years in the time period examined, again for dairy and tillage, the ratio has increased, with a slight decline again recorded in 2013 for the tillage sector. This decline in liquidity for the tillage sector in 2013 was driven by a slight increase in overall liabilities, coupled with a more severe decline in net cash farm income in the sector.

2.6 Financial Efficiency Levels

Another financial health check indicator often used in financial farm assessment is related to **Financial Efficiency.** Financial efficiency measures the degree of efficiency in using labor, management and capital. Efficiency analysis deals with the relationships between inputs and outputs. Because inputs can be measured in both physical and financial terms, a large number of efficiency measures in addition to financial measures can be derived. An interesting, and often used, indicator of financial efficiency on farms is the **gross efficiency ratio**. The gross efficiency ratio measures the proportion of gross output absorbed by cash operating expenses. Figure 2.7 shows that there was a large amount of volatility in absolute terms of the ratio since 2007 onwards, similar to the previous liquidity ratio. What is interesting to note in terms of this specific financial efficiency indicator is that there is no large consistent differential between the livestock systems and those systems which are considered to be the more profitable systems, dairy and tillage. Hence, this finding appears to be at odds with income and viability statistics recorded by the Teagasc NFS which would show a large disparity between dairy and tillage farms and all other livestock farms over the period examined, with much larger incomes and ensuing viability on dairy, followed by tillage farms compared to livestock farms. Reasons as to why this anomaly occurs could be attributed to reasons of scale and the failure of the selected financial efficiency ratio to capture total economic costs. In order to overcome these short-comings, it is worthwhile to investigate the trend in recent times of the economic viability of the various sectors.

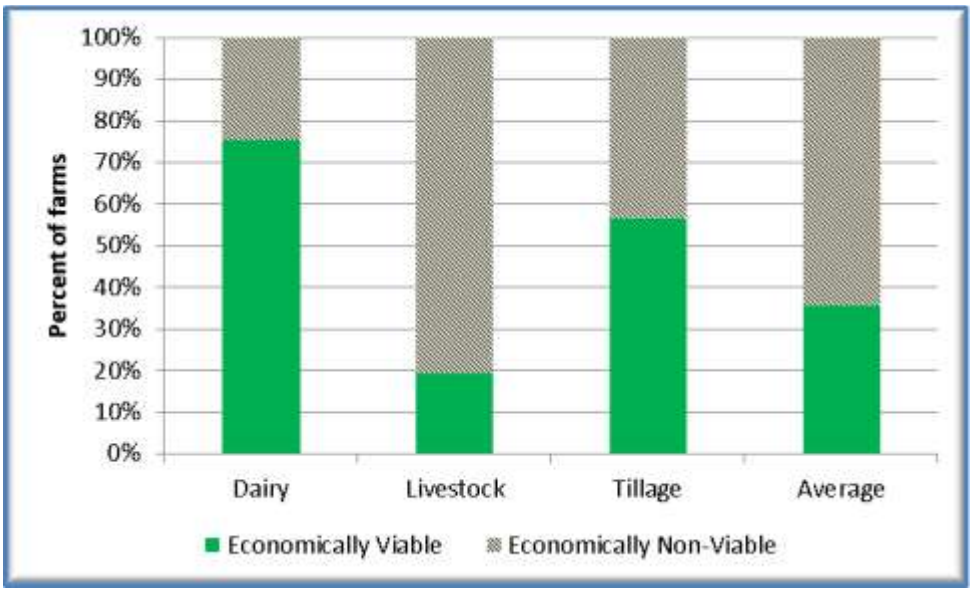
Figure 2.7: Financial Efficiency Ratio by System (2002 – 2013)



Source: Teagasc National Farm Survey, various years and authors own estimates

Figure 2.8 below shows the percent of farms, by system, which can be defined as economically viable, with economically viable farms defined as farms which can remunerate family labour at the minimum agricultural wage rate and also provide a 5 percent return on non-land capital. This additional indicator of financial efficiency, shows that the largest proportion of dairy farms could be considered economically viable in 2013 (75 percent), followed by tillage farms (56 percent) with only 19 percent of livestock farms being considered economically viable.

Figure 2.8: Financial Efficiency- Economic Viability Assessment by System (2013)



Source: Teagasc National Farm Survey, 2013 and authors own estimates

2.7 Concluding Comments

Despite the increase in liabilities recorded on farms in nominal terms in recent years, the historically low level of debt relative to assets and equity reaffirms the farm sector's strong financial position. As such, the sector has remained relatively well insulated from the risks associated with commodity production (such as adverse weather), changing macroeconomic conditions in the world economy, as well as any fluctuations in farm asset values that may occur due to changing demand for agricultural assets.

Teagasc NFS data utilised here indicates that across farm systems, the average level of debt on dairy and tillage farms was significantly higher than livestock farms over the time period examined (2002-2012). With regard to farm loan use in recent years, the majority of loans were used for buildings, land purchase and working capital.

A number of important farm financial indicators relating to the broad category areas of liquidity, solvency, and financial efficiency were reported on here. Taking each of these in turn, this analysis indicates that **solvency** levels in the dairy sector appear lower in recent years compared to historic levels, which could be attributed to higher leverage in the sub sector. In taking account of farm-level **liquidity** the data reveals a large degree of volatility in the relevant ratios across all sectors in recent years, with the livestock sector performing relatively better in this regard. Similarly, with regard to **financial efficiency**, for a number of years the livestock system could be considered to be relatively superior on first reflection, however it is important to take account of scale and total economic costs in any measurement. To this end it is worthwhile to examine **economic viability** across sectors. This additional indicator of financial efficiency shows that a larger proportion of dairy and tillage farms are considered viable compared to livestock farms, the majority of which are considered economically unviable.

Chapter 3

A Comparison of the Financial Structure of Farming in the EU: An Analysis of Data from the Farm Accountancy Data Network (FADN)

3. 1 Introduction

This chapter analyses the financial structure of agricultural holdings within the EU using data from the European Commission's Farm Accountancy Data Network (FADN) with reference to two main dimensions (country and farming type) using a number of financial indicators derived from farms' balance sheets. A narrative on the differences in the structure of farming across the respective countries is also provided by way of understanding the differences in financial indicators that are evident. For the most part data in this section is based on the latest available FADN data which relates to the accounting year 2012. The data is presented for the aggregate of the EU plus sub sets of regions which are typically different in both structure and longevity of EU membership. Where data is presented for additional years from the FADN dataset it is explicitly stated.

3.2 Total asset value

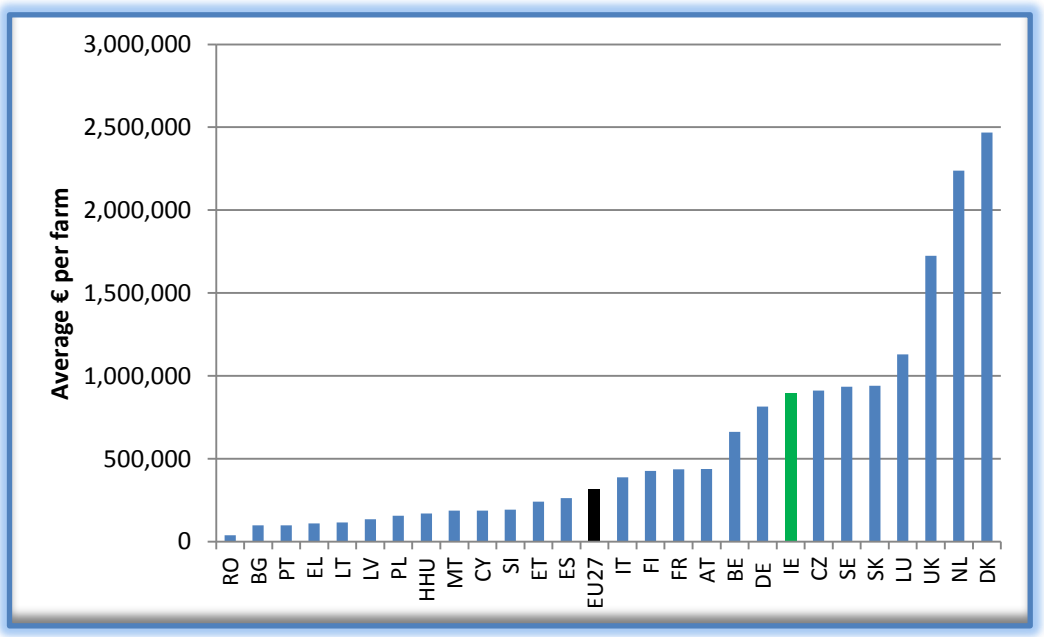
Total assets presented in this section relate to the property of the agricultural holding and are calculated as the sum of both current and fixed assets. Current assets in the FADN dataset include non-breeding livestock, stock of agricultural products and other circulating capital, holdings of agricultural shares, and amounts receivable in the short term or cash balances in hand or in the bank. Fixed assets are agricultural land, permanent crops, farm and other buildings, forest capital, machinery and equipment, and breeding livestock.

Figure 3.1 shows that the total value of assets of an average EU-27 farm was approximately € 316,792 in 2012[3], with average assets values for Irish farms almost three times this figure at €890,000. However, this average figure for EU farms masks sizeable variations across Member States (MS) due to differences in the structure of farming in individual countries. For example, total assets in Denmark and the Netherlands were on average much higher than other EU countries, (approximately €

[3] Average figure represents a weighted average of all farms in the EU.

2.46 million and €2.23 million respectively), due to very high land prices as well as the importance of types of farming which typically require large investments, such as milk, granivore and horticulture farming. By contrast, farms in Bulgaria and Romania had the lowest total assets (under € 100,000) as they are, on average, much smaller farms, mostly relatively less capital-intensive types of farming, and reflective of the lower general price level in EU-2 (Bulgaria and Romania).

Figure 3.1: Average total asset value € per farm by MS in 2012



Source: DG AGRI EU-FADN.

Further analysis of asset values across all farms within the EU (FADN, 2013) indicated that the value of total assets has been following an upward trend in both EU-15[4] and EU-10[5] over the recent past (1999 – 2009). In the period 1999 – 2009, total assets increased by over 50 per cent in nominal terms, and in the period 2004 – 2009, by nearly 80 per cent. This trend is similar to that experienced in Ireland as illustrated in chapter 2.

This same report referred to above indicated that dairy and granivore farms typically have the highest total assets within the EU, with approximately three times the assets of other permanent crop farms, which had the lowest value over a ten year period (1991- 2009). These disparities are primarily attributed to differences in the capital intensity of production processes across sectors. The average asset values by farming system in 2012 across all EU MS are presented in Appendix 3.1. These data shows that dairy and granivore farms continue to have the highest asset values of all farm

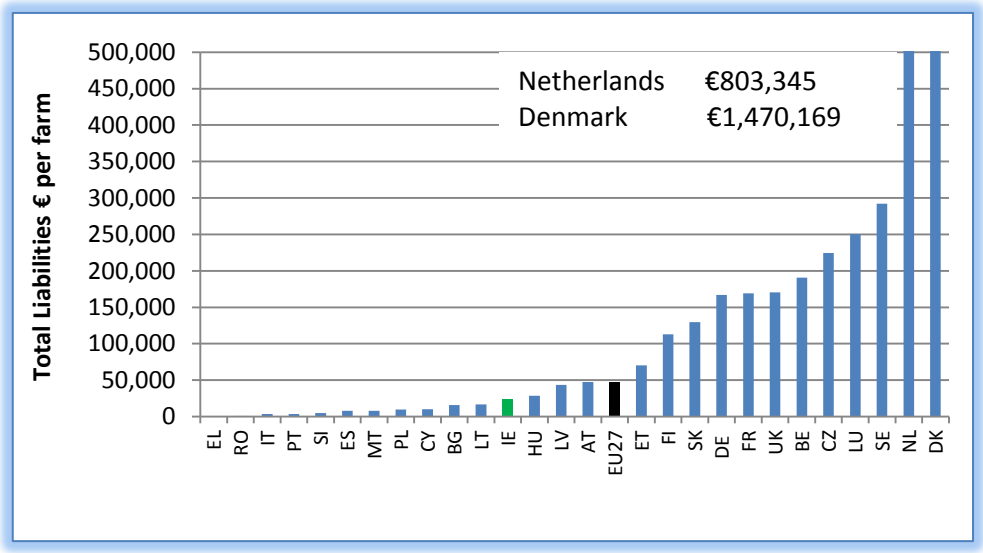
[4] Last adhered countries to EU
[5] Established EU Member States

systems. Furthermore, Irish dairy farms also have one of the highest asset values amongst all EU MS dairy farms examined, with only five MS's dairy farms reporting higher asset values.

3.3 Total liability value

Total liabilities presented in this section are the sum of the value at closing valuation of total (long- , medium- or short-term) loans still to be repaid (Figure 3.2).

Figure 3.2: Average total liability value € per farm by MS in 2012



Source: DG AGRI EU-FADN.

Figure 3.2 shows that the total value of liabilities per farm of an average EU-27 farm was approximately €48,000 in 2012, but it is evident from the figure that this varies considerably across MS. Total liabilities for the average farm in Ireland were reported at about half of the average of all farms in the EU, at just over €23,000. In absolute terms, total liabilities in Denmark and the Netherlands had, on average, the greatest total liabilities within the EU, at €1,470,169 and €803,345 respectively. By contrast, total liabilities per farm remained very low in many Mediterranean MS. Previous FADN reports (FADN, 2013) have indicated that low levels of liabilities in the afore mentioned MS's could be associated with credit access issues or different accounting practices, where liabilities are typically included in farmers' private rather than farm accounts.

In the recent past, farms have tended to rely mostly on short-term loans to finance their activities in Hungary, Portugal, Slovakia, the UK and Lithuania, (with short-term loans accounting, on average, for approximately half of total liabilities). By contrast,

medium- and long-term loans represented more than 90 % of total liabilities in Belgium, Italy, Slovenia, Cyprus, Denmark and Finland (FADN, 2013). Medium and long-term loans represented on average approx. 85% of total liabilities in Ireland in 2012.

FADN (2013) examined the differences in total liabilities across systems of production for the period 1999 – 2009. Granivore, horticulture and specialised dairy farms had, on average, the highest total liabilities (€ 139,500, € 117,700 and € 101,500 respectively), which is similar to the high total asset values observed in these farm types. Permanent crops, other than wine holdings, recorded the lowest liabilities in 2009 (€ 6,700). Regarding the composition of liabilities, wine holdings relied most on short-term loans to finance their activities, while the specialised dairy farms did so least.

The average liabilities by farming system in 2012 across all EU MS are presented in Appendix 3.2. These data shows that dairy and granivore farms continue to have the highest liability values of all farm systems. Furthermore, liabilities on Irish dairy farms are well below the average of all dairy farms examined in the EU, with total liabilities amounting to two thirds of the EU average (Ireland: €62,925 and EU average: €96,670).

In terms of how liabilities have evolved over the past for the average EU farm, FADN (2013) showed that in line with the general trend for total asset values, total liabilities have also increased over time in both EU-15 and EU-10, albeit at a slower pace than that witnessed for total assets. Furthermore, it is interesting to note that, on average, liabilities have tended to account for a small proportion of farms' funding sources. In this respect, while the 2004 and 2007 enlargements within the EU have affected the average level of total liabilities per farm, the impact has been substantially smaller than on total assets per farm.

3.4 Farm financial indicators

Solvency

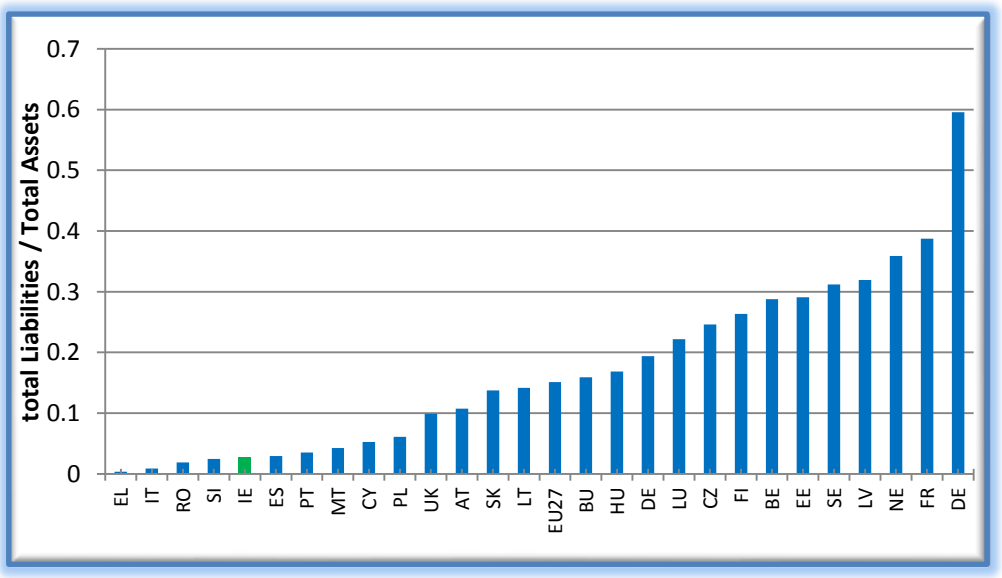
In the analysis presented in this section, solvency is measured by the liabilities-to-assets ratio. This gives an indication of a farm's ability to meet its obligations in the long-term (or its capacity to repay liabilities if all of the assets were sold). The results should be interpreted with caution as a high liabilities-to-assets ratio is not necessarily a sign of a financially vulnerable position. In fact, a high ratio could also be an indication of a farm's economic viability (i.e. its ability to access outside financing),

though there is certainly a threshold beyond which indebtedness will compromise a farm's financial health.

A high liabilities-to-assets ratio typically reflects a heavy recourse to outside financing (i.e. taking out loans). While the higher leverage (the amount of debt used to finance assets) helps a farm to invest and typically increase its profitability, it comes at greater risk as leveraging magnifies both gains (when investment generates the expected return) and losses (when investment moves against the investor).

Using the most recent FADN data for 2012, Figure 3.3 shows the liabilities-to-assets ratio across Member States. As indicated by the wide variation in ratios, solvency levels vary significantly across regions.

Figure 3.3 Average liabilities-to-assets ratio per farm by FADN region in 2012



Source: DG AGRI EU-FADN.

Figure 3.3 indicates that farms in Denmark, France and the Netherlands had the highest liabilities-to-assets ratio (at 60 %, 39 % and 36% respectively). The lowest average solvency levels (below 3 %) were observed in many Mediterranean MS. As has already been indicated, these very low levels of indebtedness, and by extension of solvency, could stem from the fact that in these Member States liabilities are typically not included in the farm accounts but in the private accounts of farmers. Furthermore, the liability/asset ratio on Irish farms was well below the average of all farms in the EU examined, with a ratio of less than 5% in 2012.

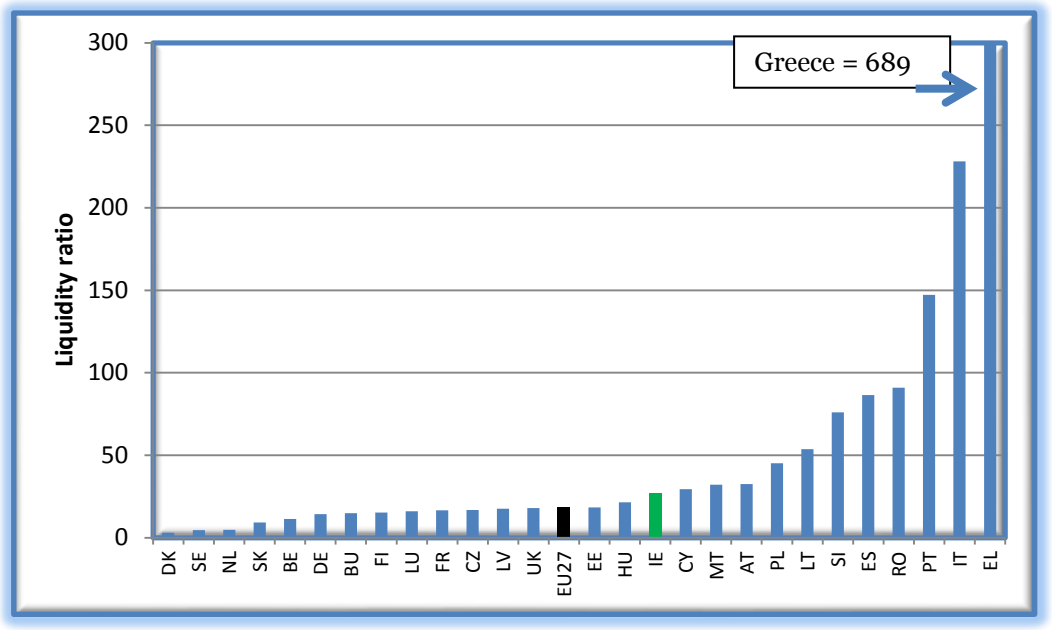
As depicted by Appendix 3.3 the level of solvency also varies across farm types, with granivore, horticulture and specialised dairy farms recording the highest liabilities-to-assets ratios, though in general the ratio remained at relatively low levels overall (below 50 %, which means that most farms' assets were financed through owners' equity). In terms of how Irish farms compared on a European basis in terms of solvency, it is not surprising that the liabilities to asset ratio was generally lower in Ireland than other EU countries, given the position in relation to assets and liabilities outlined previously. For example, Irish dairy farms had a solvency ratio of 5% while the EU average was 21%.

Liquidity

Using FADN data for the year 2012, liquidity is measured by the Times Interest ratio. This gives an indication of a farm's ability to meet its obligations in the short term. As was the case with the solvency ratio outlined previously, the results should be interpreted with caution as a low ratio is not necessarily a sign of a financially vulnerable position. In fact, a low ratio could also be an indication of a farm's economic viability (i.e. its ability to access outside financing).

A low liquidity ratio typically reflects heavy recourse to outside financing (i.e. taking out loans). While the higher leverage (the amount of debt used to finance assets) helps a farm to invest and typically increase its profitability, it comes at greater risk as leveraging magnifies both gains (when investment generates the expected return) and losses (when investment moves against the investor). Using the most recent FADN data for 2012, Figure 3.4 shows the liquidity ratio (Times Interest Ratio) across MS, which varies significantly across regions.

Figure 3.4 Liquidity (Times Interest ratio) per farm by FADN region in 2012



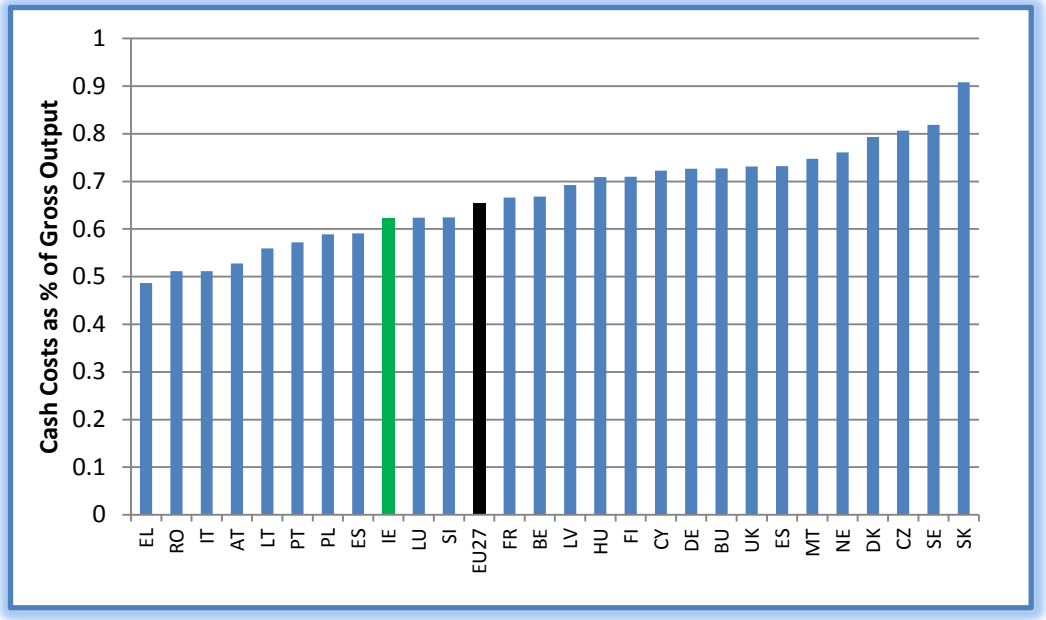
Source: DG AGRI EU-FADN.

Farms in Denmark, Sweden and the Netherlands had the lowest liquidity with a Times Interest ratio of less than 5. The highest average liquidity levels were observed in many Mediterranean MS (> 100). As has already been indicated, these very low levels of indebtedness, and by extension of liquidity (and solvency), could stem from the fact that in these MS liabilities are typically not included in the farm accounts but in the private accounts of farmers. Furthermore, liquidity levels on Irish farms were above the average of all farms, which is indicative of a more favourable liquidity position in the EU. Further details on the differences between systems of production across MS's are outlined in Appendix 3.4. This data shows that on average across the systems of production Irish farms had a much higher liquidity level than competing MS's. For example, in 2012, dairy farms in Ireland had a liquidity ratio almost double the EU average (Ireland: 22, EU average: 12).

Financial Efficiency

Using FADN data for the year 2012, *Financial Efficiency* is measured by the gross efficiency ratio which measures the proportion of gross cash farm output absorbed by cash operating expenses. Financial efficiency measures the degree of efficiency in using labour, management and capital. Figure 3.5 shows that financial efficiency varies significantly across regions.

Figure 3.5 Financial Efficiency per farm by FADN region in 2012



Source: DG AGRI EU-FADN.

Farms in Greece, Romania and Italy had the lowest ratio for costs as a percent of output indicating a positive situation in terms of financial efficiency levels, i.e. the highest amount of output left over after cash costs are met. The highest ratio and in turn the lowest average financial efficiency levels were observed in Slovakia, Sweden, Czech Republic and Denmark (with cash costs representing approx. 80 % of output or higher). On average farms in Ireland had cash costs as a percent of output of approximately 60 percent, which is lower than the average across all EU farms. In terms of the comparison of Irish farms with older EU MS (EU-15), against which Ireland often finds itself competing, the financial efficiency ratio for Ireland places Ireland in a significantly better position than the average. Further details on the differences between systems of production across MS's are outlined in Appendix 3.5. These data shows that on average across the systems of production, Irish farms had a lower ratio, hence indicating a better financial efficiency level than competing MS's. For example, in 2012, dairy farms in Ireland had a financial efficiency ratio of 6 percent lower than the EU average, indicating a superior performance in financial efficiency terms. When the ratio is examined for EU-15 countries, Ireland finds itself in a much improved position relative to the average.

3.5 Concluding Remarks

Given that Irish agriculture is now competing in a more globalised market place, the financial stability from an inter country perspective (i.e. between competing countries) is becoming increasingly important.

The financial indicators described in this chapter indicate that on average Irish farms have relatively low debt and high asset values relative to the EU average for all farms. Furthermore, solvency, liquidity and financial efficiency indicators also displayed Irish farms in a healthy position in EU terms. While previous work by Teagasc has shown that Irish dairy farms continues to exhibit a healthy position in terms of the competitiveness of our agricultural sector (in EU and international markets), in a market which is increasingly exposed to market price volatility, the ability to demonstrate resilience will be equally important in the future. Given that the findings from this chapter have indicated that not only does Ireland enjoy a competitive advantage in cost terms within the EU, the level of debt and financial status of Irish dairy farms should also these farms with a relative advantage in resilience terms given that they are not servicing high debt levels in years of extreme market volatility.

Chapter 4
The Dynamics of Investment

4.1 Introduction

This chapter provides an overview of investments within Irish agriculture. The analysis uses Teagasc National Farm Survey (NFS) data to analyse the determinants of investment on all farms with a view to identifying the characteristics of investors and determining the types of farms most likely to invest in the years ahead. To answer these research questions the analysis is outlined as follows: first, a descriptive analysis of the types of farms investing is conducted, followed by results of an econometric model that reveals what characterises the investment behaviour of Irish farmers.

4.2 Background

The factors affecting farm investment decisions have attracted considerable research interest and have previously been investigated using Teagasc NFS data. While this analysis provides a new and updated analysis based on 2013 data, the findings are set in context with previous results. Investment decisions were previously analysed by Hennessy and O'Brien (2007) using NFS data from 2004, and by Thorne et al., (2009) using NFS data from 2008. Hennessy and O'Brien showed that larger, more profitable dairy farms, with both a successor and a spouse with off-farm income present, had an increased probability of investment on the farm. When the issue was revisited using data from 2008 by Thorne et al., (2009) it was interesting to note that while size, system and identification of a successor remained significant in the investment decision, the presence of an off-farm job and the income level of the farm were not found to be statistically important in explaining farm investment decisions. Given that significant grant aid was available to farmers in the period following 2004 via the Farm Waste Management Scheme (FWMS) it is posited that that the availability of grant aid was likely to have been very important in explaining the investment decisions in the 2008 period, which possibly resulted in income (both on-farm and off-farm) not playing as important a role in the investment decision.

4.3 Empirical Model

The investment decision model used in this paper is similar to that used by Hennessy and O'Brien (2007) and Thorne et al., (2009). It is a binary choice Probit model which

estimates the probability of a farmer investing in farming activities given farm and demographic characteristics. The dependent variable is equal to one if the farmer invests in farming activities and zero otherwise. Further details on the specification of the model can be found in Appendix 4.1.

4.4 Data and Descriptive Analysis

NFS data for 2013, based on 911 observations representing a national population of 79,103 farms, were used for this analysis. While NFS farms are classified into six farming systems (dairy, cattle rearing, cattle other, sheep, tillage and mixed livestock), the categories dairy and mixed livestock[6] as well as both cattle systems are merged for the purpose of this analysis. This dataset is used to estimate the empirical model outlined that is used to investigate the factors influencing the on-farm investment decision. Table 4.1 of descriptive statistics provides a general overview of the investment levels of farms included in the 2013 NFS.

Table 4.1: Average Net New Investment – by Farm System – 2013

Net New Investment	Dairy other	Cattle	Sheep	Tillage	All farms
Average (€)	18,010	4,652	3,295	11,810	8,141
Average of investing farms (€)	23,514	8,849	6,899	20,663	18,406

Note: Net New Investment is equal to gross new investment in machinery, buildings, quota and land improvements (including forestry) minus sales and capital grants received during the year.
Source: Teagasc National Farm Survey, 2013

It can be seen that in 2013, average net new investment per farm was highest on dairy farms, followed by tillage farms. Average investment levels of beef and sheep farms were considerably lower.

Next, Table 4.2 provides variable descriptions and summary statistics of important characteristics that are used in the empirical analysis, based on the sample data on 911 farms when combined with the population weights associated with these farms means that the data reported is representative of 79,903 farms nationally. In 2013, almost 60 percent of all farms had positive net new investments. On average, Irish farms had 47 hectares of utilisable agricultural area with the farm holder being on average 57 years of age. Almost half of all farms had an off-farm income that was either gained by the farm holder (28 percent) and/or the spouse (35 percent). Access to credit is often cited in the literature as a variable that can have a significant impact on investment levels. However, for the current analysis, access to credit was not included in the model given that results from a recent Teagasc National Farm Survey analysis (reported in Chapter

[6]Mixed livestock farms generally have a significant dairy enterprise, but not as the dominant farm enterprise.

5) indicates that access to credit has not been an issue for the farm sector in the recent past.

Table 4.2: Descriptive Statistics and Variable Description

Variable	Definition	Population Weighted Sample Mean
Invested	= 1 if farm has a positive net new investment > 1; 0 otherwise	0.58
Dairy other	= 1 if farm is in dairy production; 0 otherwise	0.23
Cattle	= 1 if farm is in cattle production; 0 otherwise	0.52
Sheep	= 1 if farm is in sheep production; 0 otherwise	0.16
Tillage	= 1 if farm is in tillage production; 0 otherwise	0.08
Size	Total utilizable agricultural area in hectares	47.58
Job-farmer	= 1 if farm operator has off-farm employment; 0 otherwise	0.29
Job- spouse	= 1 if the spouse has off-farm employment; 0 otherwise	0.35
FFI	Family Farm Income in €000	25.40
Age	Farmer's age in years	57.17
No	Number living in farm household	2.98

Source: Teagasc National Farm, 2013

Table 4.3 shows a comparison of key descriptors for farms grouped by level of investment. This data shows that there are clear differences in the characteristics between farms that invest more than €25,000 and farms investing lower amounts. Specifically, the data indicate a correlation between family farm income levels and levels of farm investment. Furthermore, high investing farms also tend to have larger farms and are operated by younger farmers than their 'low-investing' counterparts.

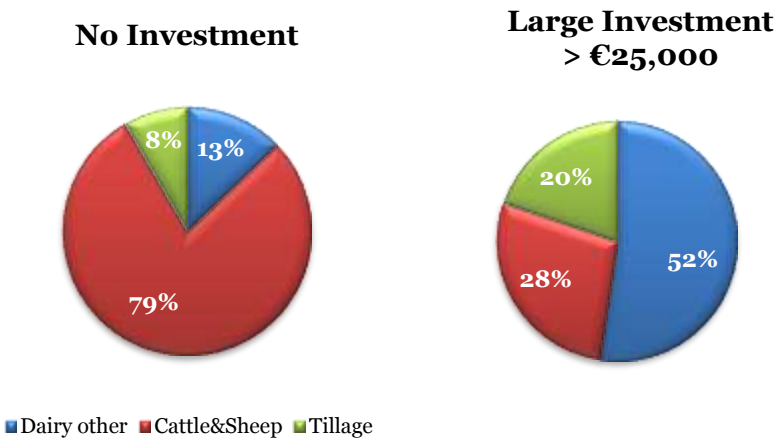
Table 4.3 Comparison of Farms Grouped by Level of Investment

Average level of investment (€)	Family farm income (€)	Market income (€)	Farm size (ha)	Farmer Age (years)	% of Total population
0	16,704	733	41.82	58.80	42.03
1-2,500	17,551	598	39.68	57.58	17.11
2,501-7,500	30,174	8,727	53.29	55.60	15.92
7,501-25,000	34,754	12,483	50.04	55.81	14.58
25,001 +	53,224	23,126	71.83	54.21	10.36
All	25,437	5,963	47.58	57.17	100

Source: Teagasc National Farm Survey, 2013

Detailed analysis of the individual investment level groups in Table 4.3 reveals that almost 80 percent of farms with no investments are cattle or sheep farmers, while the majority of 'high investing' farms are dairy farmers, see Figure 4.1.

Figure 4.1 Different Investment Levels grouped by Farm System[7]



Source: Teagasc National Farm Survey, 2013

4.5 Econometric Analysis of the Determinants of Investment

In the remainder of this chapter the results from an econometric model are presented to determine the factors affecting investment decisions.

[7] Please note that cattle and sheep farms are merged into one category for this analysis, due to small number of sheep farmers that invested more than €25,000 in 2013.

Table 4.4: Probit Model Results of the Decision to Invest

Variable	Marginal Effects
Cattle	-0.14 (0.05)**
Sheep	-0.17 (0.06)**
Tillage	-0.15 (0.07)**
Size	0.004 (0.0009)***
Size^2	-0.00009 (0.00)***
FFI	0.001 (0.006)**
Age	-0.02 (0.001)
Job farmer	0.03 (0.04)
Job spouse	0.07 (0.04)**
No	-0.0006 (0.01)
Pseudo R^2 = 0.095	
Likelihood Ratio Statistic: 112.86	

Significant at: *(p<0.1) **(p<0.05) ***(p<0.01), SD in parentheses

Based on NFS data from 2013 the model indicates that cattle, sheep and tillage farmers have a lower probability of investing on-farm compared to dairy farmers, while there is no significant difference in relation to investment probability among cattle, sheep and tillage farms. However, more detailed analysis of investment spending of farms who actually invested revealed that there is no significant difference between the amount invested across dairy and tillage systems, but the previously observed difference between drystock (i.e. cattle and sheep) and dairy systems remains.[8] In other words, investment does not differ between tillage and dairy farms, but these farms tend to invest significantly more than cattle and sheep systems, when they do invest.

In relation to farm characteristics, farm size has a significant positive effect on the investment decision, however, this effect diminishes as farm size increases (as indicated by the negative sign of the variable farm size squared[9]). Furthermore, as expected, family farm income has a positive effect on investment decisions. In this context, family farm income can be seen as important in accessing external funding sources. In relation to individual farmer characteristics, age and the number of household members do not significantly affect the investment decision. Finally, although whether or not the farm holder has an off-farm job does not significantly impact on the decision to invest, while when the spouse is engaged in off-farm work does have a positive significant effect on this decision.

[8] This analysis is based on a linear regression model that only includes farms with positive investments.

[9] Size^2 is a variable which measures the effect of economies of scale on the decision to invest.

4.6 Conclusions

This chapter provides an overview of investment spending on Irish farms using Teagasc National Farm Survey data from 2013. To summarise, Irish farms on average had net new investments of €8,140. There are significant differences in investment spending between different farm systems analysed, with dairy farmers having the highest average level of investment (€18,010). Farms with high levels of investment also tended to have higher family farm income, tended to be larger in size and be farmed by younger farmers than those farms with lower levels of investment. The findings from the econometric model confirmed that larger dairy farmers with higher family farm income and an off-farm income earned by the farmer's spouse have a higher probability of investment (see Table 4.5). This is in line with previous results from Hennessy and O'Brien (2007). While we have found a positive and statistically significant relationship between the investment decision of Irish farmers and the levels of farm income, it is probable that level of farm income is also determined by historical investment decisions and the level of investment in previous studies.

Overall, based on the empirical findings from this analysis and the impending policy change it can be concluded that future investment in the agricultural sector is likely to be conducted by larger dairy farmers with an opportunity to expand their business.

Table 4.5: Summary of Factors Affecting Investment

Impact on Investment	Variable
Positive	Dairy farming (in comparison to remaining farm systems), farms size, family farm income, off-farm income spouse
Negative	Cattle, sheep and tillage farming (in comparison to dairy), size squared
No significant impact	Age, size of household, off-farm job farm holder

Chapter 5
Investment Requirements of the Dairy Farm Sector to 2020

5.1 Introduction

The removal of the milk quota regime in April of 2015 will present the first substantive opportunity in over 30 years to expand Irish milk production at the national level. While it is difficult to predict with accuracy the extent to which milk production may increase in Ireland, there seems to be a broad consensus that the increase will be substantial. The target of a 50 percent expansion in milk output (by 2020 from the 2007 to 2009 base) that was set by the Food Harvest 2020 report now seems to be accepted as not only achievable but highly likely to be achieved. This ambitious expansion plan has been matched by private industry investment. Both Glanbia and Dairygold have embarked on major investment projects with a view to increasing their milk processing capacity. These significant investment plans give real grounds for optimism and provide commercial support for the Government's ambitious expansion plan.

The objective of this Chapter is to consider how Irish farmers are likely to react to milk quota removal, what expansion in production is likely to occur and most importantly, in the context of this study, what investment will be required at the farm level to facilitate this expansion. Some previous studies have considered the investment required to achieve the Food Harvest targets. The IFA for example have predicted that €1.5 billion will be invested at farm level by 2020, Kiersey and Bryan (2014). A study by Keane (2010) estimated that with an assumed 20 percent increase in yields by 2020 and a strong movement towards fewer and larger herds, an investment of €1.9 billion by 2020 would be required. A subsequent study assuming a more gradual movement towards larger herds resulted in an estimate of €1.3 billion to achieve the national target of 50% milk output growth by 2020, Keane (2011).

Here Teagasc National Farm Survey data are used to estimate the likely investment requirements of the dairy farm sector to 2020. In an era of considerable milk price volatility, it is difficult to forecast to what extent national milk production will increase following the removal of milk quotas. This difficulty is compounded at the farm-level by farm specific factors such as age, the presence of a successor and current farm infrastructure which are likely to have a significant influence on individual farm expansion plans. This Chapter does not attempt to forecast the future development of

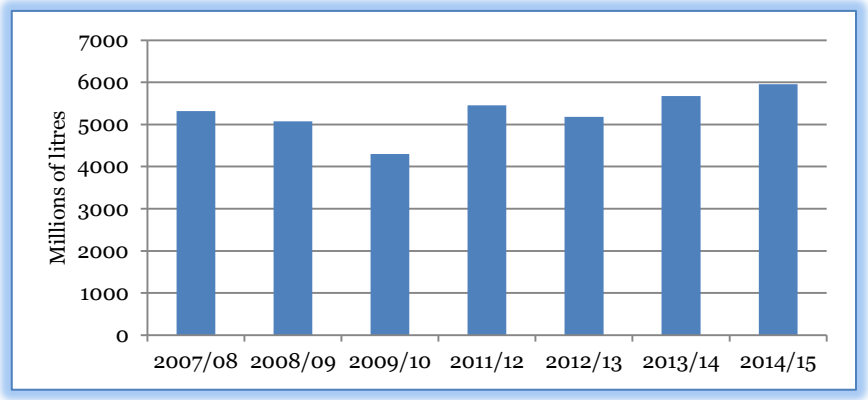
milk production in Ireland. Instead the analysis considers the investment that would be required to achieve the Food Harvest target of a 50 percent increase in milk output.

A model developed by Laepple and Hennessy (2012) is applied to Teagasc National Farm Survey data on existing dairy farms to estimate each farm's likely expansion path post quota removal and the associated required investment. Additionally, the investment required for a new start-up dairy business is also considered. Following this, a shorter term (next two years) estimate of investment requirements is produced by examining recent survey Teagasc National Farm Survey (NFS) data on farmers' short term milk expansion and farm investment plans.

5.2 Dairy Farm Sector Investment Requirements to 2020

The Food Harvest 2020 report set a target to increase milk production by 50 percent by 2020 from the 2007 to 2009 base. This represents an approximate 2.6 billion litres of additional milk production. It is important to note however, that some of this expansion in milk output has already occurred (Figure 5.1). In the 2013/2014 milk quota year, total milk deliveries had already increased by 480 million litres or a 9 percent increase over the 2007 to 2009 base. It is estimated that on the back of very good milk prices and excellent production conditions that milk deliveries increased further in the 2014/2015 quota year to 5.96 billion litres of milk or 14.6 percent above the Food Harvest Committee report base of 2007 to 2009.

Figure 5.1: Irish Milk Deliveries (fat adjusted) on a quota year basis

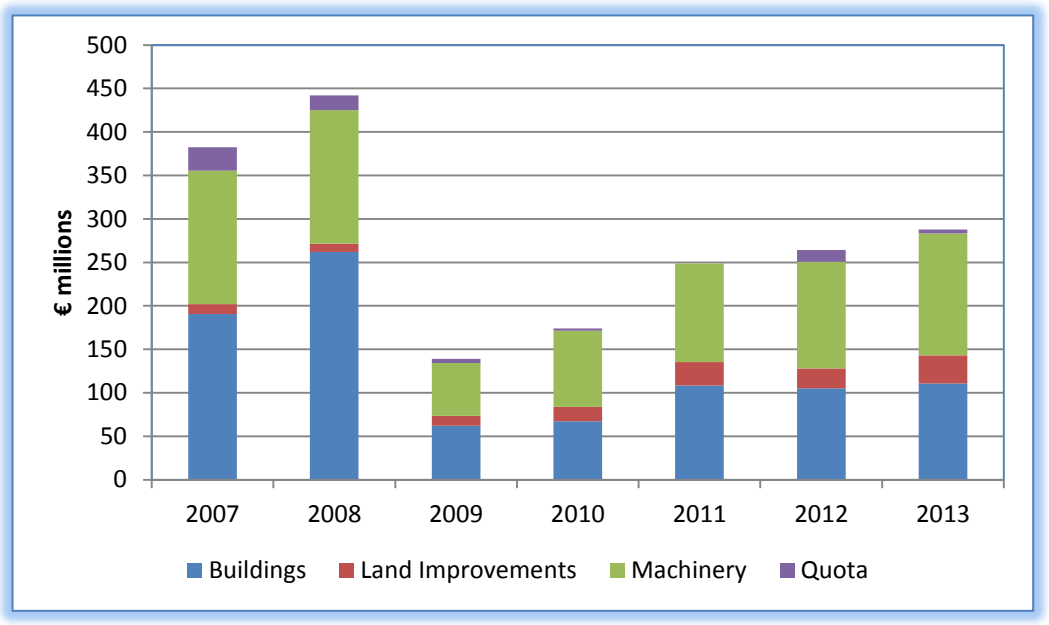


Source: Donnellan and Hanrahan. (2014)

Approximately 30 percent of the Food Harvest 2020 growth target of 50 percent has already occurred and over this period Irish dairy farmers have been investing. Figure 5.2 presents the aggregate net new investment undertaken by dairy farms in the 2007 to 2013 period. Net new investment is defined as investment (including both purchase and repair) in buildings, land improvements, machinery, and production quotas, less

all sales, grants and subsidies. The net new investment measure does not include land purchases.

Figure 5.2: Average Net New Investment on Irish Dairy Farms



Source: Teagasc National Farm Survey

Net new investment was particularly high on dairy farms in 2007 and 2008 and this was mostly driven by grants available through schemes, such as the Farm Waste Management and Dairy Farm Hygiene schemes. Investment declined in 2009 and 2010 in particular following the very difficult year in 2009 for dairy farmers. Investment has recovered since 2010 but has not returned to the 2007 and 2008 levels. In aggregate, net new investment on dairy farms has totalled €1.937 billion from 2007 to 2013. Investment in buildings has comprised 47 percent of all investment over the 7 year period but has varied from60 percent in 2008 to just 38 percent in 2013. Investment in machinery comprises 43 percent of all investment on dairy farms. Almost €70 million has been invested by dairy farmers in milk quota over the 7 years. This is an investment that will no longer be required from 2015 onwards.

Over this period the average deliveries per farm has increased from approximately 250,000 litres in 2007 to approximately 330,000 litres in 2013. This represents a 32 percent increase in production per farm. Although the milk quota system has been in place throughout this period, the total number of milk suppliers have fallen from around 21, 000 in 2007 to about 18,000 in 2013. The €1.9 billion invested in the 2007 to 2013 period has facilitated this growth in average farm size.

Although aggregate milk production has increased since the publication of the Food Harvest 2020 report, another 1.8 billion litres of milk is required to fully achieve the 50 percent target by 2020. Donnellan and Hanrahan (2014) used the FAPRI-Ireland model to simulate a scenario where the Irish dairy sector achieves the Food Harvest target of expanding milk production by 50 percent by 2020. In this simulation it is estimated that deliveries per cow increase by 18 percent from 2007-2009 to 2020. When considering expansion, many equate additional milk with cows, while this is true to a certain extent; the relationship between the two is not linear. Much of the additional milk that is expected to be delivered over the next five years is expected to come from productivity gains and greater deliveries per cow. Such expansion would come at a lower cost, requiring only additional operating capital due to higher feed costs and possibly some capital expenditure for investment in additional bulk tank capacity.

Based on productivity gains per cow of 18 percent, Donnellan and Hanrahan (2014) estimate that 1.499 million cows will be required to achieve the 50 percent expansion target and this would represent an increase of 450,000 cows in addition to the dairy cow population over the Food Harvest base period of 2007-2009.

A simple approach to estimating the investment required at the farm level would be to apply an investment per cow estimate, based perhaps on a land, housing and milking facility cost, to each additional cow to arrive at an aggregate investment figure. However, this approach would ignore many of the complexities of how dairy expansion is likely to occur at the farm level. First, the existing population of dairy farms is likely to continue to decline over the next 5 years thus leading to further consolidation in Irish milk production. This suggests that even in the absence of expansion in Irish milk output investment will be required to facilitate the normal on-going farm level restructuring that occurs in the sector. Second, some of the additional cows used to achieve the expansion target will be stocked on existing dairy farms, they will use the existing land and facilities and therefore the additional production associated with these cows will likely require very little capital investment. Third, some cows stocked on existing dairy farms may require more significant investment in, this more significant investment will occur where growth in the farm's cow numbers is such that additional investment in farm buildings and milking facilities is required. Finally, a proportion of these additional cows are likely to be stocked on new start-up dairy farms, either green-field sites and/or conversions of existing cattle farms. In both of these new business set-up environments, substantial capital investment will be required.

5.2.1 Phased expansion model

Laepple and Hennessy (2012) developed a simulation model of Irish dairy farming to estimate changes in national milk production in 2020 under three varying milk price scenarios. They used this model to estimate the extent to which the existing population of dairy farms could expand production. They also simulated structural change in the industry with a number of farms projected to exit production over the next 5 years. This means that many individual farms are expanding milk production even when the national milk pool is remaining static. Laepple and Hennessy estimated that despite the falling population of farmers, cow numbers and milk output are expected to expand over the period to 2020. They estimated that milk output would increase by between 20 and 40 percent relative to 2008 levels depending on the milk price considered, with a 32 percent increase in milk production being considered the most likely scenario. Under this scenario 850 new dairy business start-ups with an average herd size of 62 cows would be required to achieve the 50 percent expansion target.

For the purposes of this report, the Laepple and Hennessy analysis has been updated using more recent National Farm Survey data and also more up to date estimates of the investment costs associated with each expansion phase. The details of each expansion phase and the assumed investment requirements for each stage are outlined below.

Phase 1: the initial additional milk comes from the low cost approach of increasing deliveries per cow, an increase of 12 percent between 2013 and 2020 is assumed (little to no investment required)

Phase 2: the next phase is the medium cost approach of purchasing/rearing additional dairy cows on the existing land base, converting cattle housing and partially upgrading the existing milking parlour. According to Ryan et al. (2013) the guideline costs for constructing a cubicle bed in an existing straw bedded or slatted shed is €250 to €350 per cubicle, taken here as €300 per cow housing cost. The upgrading of dairy facilities is assumed to cost €400 per cow for the first additional 40 percent of cows, Hennessy et al. (2009). Although the vast majority of farmers are likely to breed their own replacements as well those required to expand their herd, in this case a cost of €1,300 for an in-calf heifer is assumed.[10] The replacement of a beef livestock unit with a dairy cow is assumed to result in a net increase in labour of 23 hours per cow, Hennessy et al. (2009). The cost of extra labour is €10 per hour.

Phase 3: is a higher cost approach where existing dairy farms purchase or rear additional dairy cows, stock them on the existing land but must extend cattle housing

[10] This is based on the average price paid for in-calf heifers by farmers in the NFS in the 2008 to 2013 period.

and build a new milking parlour if the total herd size is increasing by more than 40 percent. It is assumed that a new milking parlour is constructed at a cost of €9,500 per unit or €1,520 per cow for the full herd[11] (Ryan et al., 2013). All additional cows are housed in a new cubicle shed that is added to an existing slatted shed at a cost of €550 /cow place (Ryan et al., 2013). Again in-calf heifer costs are assumed to be €1,300 per animal and labour is assumed at 23 additional hours at €10 per hour.

Phase 4: the very high cost approach is where cattle and/or tillage farms convert to dairy farming and significant investment is required in housing, milking facilities, roadways etc. The investment associated with this stage of expansion is discussed below.

For all on-farm investment it is assumed that capital investment in housing and milking facilities is financed using a 10-year term loan at an interest rate of 5 per cent, with the investment in cows written off over a five year period. Labour costs are covered from working capital. In order to arrive at an estimate of the investment required to fund dairy expansion, it is necessary to consider the amount of additional milk that can be delivered in each of the four expansion phases outlined above and the associated investment required. The investment costs are annualised and only farms that can expand profitably at each expansion stage are expected to do so.

The analysis first considers the normal process of structural change in the dairy farm sector. Dairy farm numbers are estimated to decrease by approximately 1.75 percent per year between 2013 and 2020 leading to a reduction in total farms number of approximately 2,400 farms. These exiting farms account for 14 percent of the 2013 national milk pool. The first phase of expansion considered involves increasing deliveries per cow. It is assumed that deliveries per cow increase by 1.5 percent per year, with a 2 percent increase in 2015 and 2016 following the removal of milk quota. This amounts to a cumulative 12 percent increase in deliveries per cow between 2013 and 2020. It is assumed that this increase in output per cow will incur only minimal additional production costs as it will be achieved through improved breeding, herd and grassland management (Dillon *et al.,* 2010). The 12 percent increase in deliveries per cow is just sufficient to offset the milk production lost through the exit of farms from dairying, thus leaving aggregate milk production more or less unchanged.

The next stage of expansion involves increasing cow numbers on the existing land base. As in Laepple and Hennessy (2012) it is assumed that the stocking density on the dairy platform is increased in line with the objectives set out in the Teagasc roadmap for farms of varying soil type. A milk price scenario of 32 cent per litre is assumed as per the "Steady" scenario described in Chapter 7. At a price of 32 cent per litre,

[11] This is based on a 16 unit parlour used to milk 100 cows.

approximately 9,200 farms find it profitable to expand under Phase 2 (as described above) and another 2,900 find it profitable to expand under the more costly Phase 3. It is estimated that the combined expansion achieved under Phases 1, 2 and 3 on the remaining 15,700 farms is 37 percent over and above the 2013 national milk pool, or 43 percent over the Food Harvest 2007 to 2009 base. The total number of dairy cows in this scenario is 1.316 million, a 12 percent increase on the 2013 level. However given that the number of dairy farms has reduced, the total number of new cows requiring new housing, milking facilities and labour is 282,000.

The total investment required to achieve this expansion is presented in Table 5.1. The cost of acquiring the additional 282,000 cows is estimated to be €401 million. This is based on a cost of €1,300 per cow borrowed and repaid over 5 years. It is estimated that approximately 2,900 farms will expand cow numbers by 40 percent or more and therefore will require a new milking parlour. Up to 350,000 cows will be milked in new parlours at an investment cost of €649 million. The remaining investment is associated with converting and extending existing animal housing and upgrading of milking facilities on farms that are not erecting new milking parlours.

Table 5.1: Investment requirements for existing dairy farms

	Total Investment €million
Acquisition of dairy cows	401
New Milking Parlour (on 2,900 farms)	649
Conversion of beef housing to dairy (for 176,000 cows)	76
Upgrading of existing milking facilities (on 8,000 farms)	63
Extension to existing housing (for 60,000 cows)	53
Total Investment	**1,241**

The total investment required by existing dairy farms to increase the national milk pool by 43 percent from the 2007 to 2009 base up to 2020 is €1,241 million.

The remaining 383 million litres of milk (i.e. the additional milk required to achieve the Food Harvest 2020 production target) will be supplied by new entrants. Assuming an average delivery of 5,750 per cow in 2020, then approximately 66,500 additional dairy cows will be required to further expand the milk pool to a level 50 percent above the 2007-2009 base. It is difficult to predict how many new dairy farm businesses will be established over the next 5 years, but in order to achieve the Food Harvest target (and assuming an average herd size for new entrants of 130 cows) it is estimated that approximately 500 new entrants are required. This milk will be delivered under the most expensive stage, i.e. Phase 4 and again it is difficult to predict the costs

associated with a new business start-up or conversion to dairying as it will very much depend on the existing infrastructure on the farm. The Teagasc Greenfield dairy project provides some insights. Shalloo et al. (2011) have provided an estimate of start-up costs for this 295 cow operation. They estimate stock acquisition costs to be €1,300 per cow, infrastructure costs including stand-off pads, roadways, yarding, etc. to be €1,105 per cow, parlour costs €772 per cow, fencing and water provision €160 per cow, reseeding and land preparation €166 per cow. For the purpose of this analysis any other operating costs, such as the normal direct costs of production, are not considered. This brings the total start-up costs to €3,500 per cow or an approximate €233 million to produce the additional 383 million litres of milk.

Combining the investment requirements of existing dairy farms with those starting a dairy new business brings the total investment requirement of the dairy farm sector to **€1.47 billion** between 2013 and 2020. It is important to note that this investment is associated with the expansion in milk production. It is probable that there will be additional "normal" investment undertaken by dairy farmers. While the €1.47 billion figure is likely to encompass all investment in buildings and machinery associated with milking parlours, it is likely that there would be additional investment in other machinery and/or land improvements. Investment in these items averaged €140 million per year over the 2007 to 2013 period. Assuming a continuation of this investment, this could mean another approximate €800 million investment in the 6 year period from 2015 to 2020.

It is important to note that this figure cannot be strictly interpreted as an estimate of the demand for additional credit from banking institutions, since some of the €1.47 billion is likely to be financed out of working capital. Further detail on how farmers intend to fund future investment is presented in section 5.4 below.

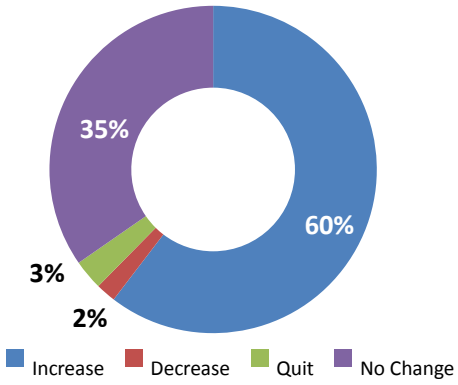
5.3 Short-term expansion and investment plans

The preceding section considers the investment requirements of the dairy farming sector from 2013 to 2020 assuming that the Food Harvest target of a 50 percent expansion in milk output is achieved. This section of the Chapter takes a shorter term view and considers dairy farmers' actual expansion and investment plans in the next two to three years.

A special supplementary survey of the Teagasc National Farm Survey farms was conducted in the second half of 2013. A representative sample of existing Irish dairy farmers was questioned about their production plans from the point of quota elimination in 2015 through to the end of 2017. The aggregated results of the survey shown in Figure 5.3 indicate that almost two-thirds of dairy farmers, or 11,000 farmers, plan to expand milk production in the 2015 to 2017 period. A further one-

third of farmers plan to maintain their current production level, while a small proportion, 5 percent, plan to either decrease or exit milk production. These figures are broadly consistent with the findings of the expansion model outlined above. The average current herd size of those planning to increase production is 79 cows, while those planning no change in production have an average herd size of 51 cows at present.

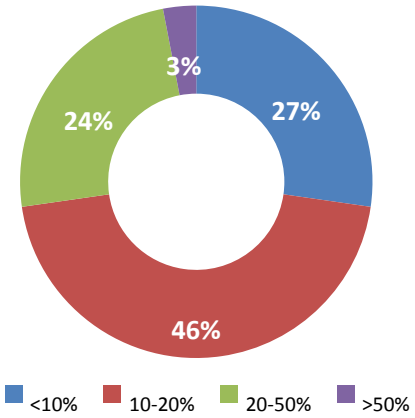
Figure 5.3: Existing Dairy Farmers' Production plans to 2017



Source: Teagasc National Farm Survey Data

Figure 5.4 illustrates that almost three-quarters of the 11,000 farmers planning to expand production in the 2015 to 2017 period plan to expand by less than 20 percent relative to their existing level of production. Only 3 percent of farmers plan to expand production by 50 percent or more during the period 2015-2017.

Figure 5.4: Planned Milk Production increase to 2017 for expanding Dairy Farmers



Source: Teagasc National Farm Survey Data 2013

Taking existing production levels, as recorded by the Teagasc NFS in 2013 and applying each farmer's stated production plans for the 2015 to 2017 period, it is

possible to estimate the change in aggregate planned production that would result. If farmers follow through on their stated plans to increase, exit or maintain production levels, the total milk production of this group of farmers would increase by 14 percent in this two year period over the level produced in 2013.

In order to arrive at some estimate of the number of new entrants to dairy farming, non-dairy farmers were also questioned in the same survey about their intentions to enter dairy farming. Just 902 farms or 1 percent of the non-dairy farms represented by the Teagasc NFS expressed an interest in entering dairy farming in the 2015 to 2017 period. However, only 40 percent of those with intentions of entering dairying had engaged in active planning by discussing their dairy start-up plan with a bank manager and only 25 percent had completed a business plan. It is therefore likely that the number of new entrants in the 2015 to 2017 period will be closer to 360 than the 902 that had expressed an interest. Again this is in keeping with the estimate of 500 new entrants in the five year period of 2015 to 2020. The 360 non-dairy farmers that are estimated to have discussed a dairy business start-up plan with their bank manager collectively plan to stock 40,000 cows or an average herd of 130 cows, almost double the current national average herd size. Assuming these cows produce the average national milk yield, the milk production of these new entrants add a further 3 percent to the Irish national milk pool.

Combining the additional production of existing farmers with the production from new entrants would lead to a 17 percent increase in national milk production in the 2015 to 2017 period over the 2013 level. Again this figure can be considered to be consistent with the expansion model which predicted a 37 percent increase in production by this group over the longer five year period relative to 2013 levels. With 17 percent expansion achieved in the first 2 years following milk quota removal, the further 20 percent would need to be delivered between 2017 and 2020.

The investment plans of both the existing and new entrant dairy farms were also garnered from the survey. As can be seen the existing group of dairy farms are planning significant expansion with almost 4,000 farmers planning investment in milking facilities and a further almost 6,000 planning investment in animal housing. The magnitude of this investment however was not recorded by the survey. While the vast majority of new entrants will engage in farm investment, given the relatively small number of new entrants (approximately 360) the overall value of the investment is likely to be small.

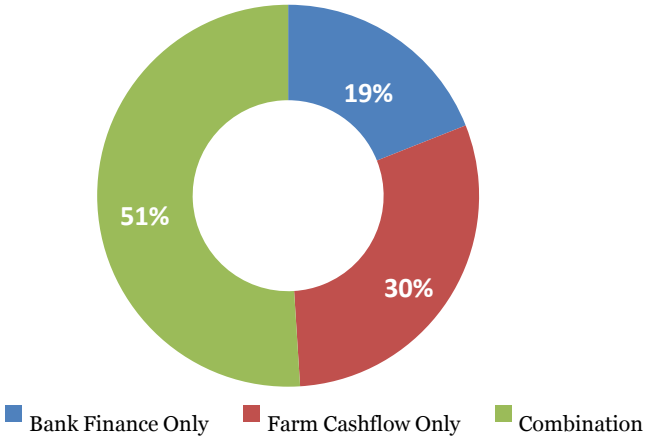
Table 5.2: Short-term investment plans of dairy and new entrant farms 2015-2017

Investment Requirements	Dairy Farmers		New Entrants	
	%	No.	%	No.
Milking Parlour	20	3,600	71	257
Animal Housing	33	5,900	68	245
Additional Land	14	2,520	6	22
Additional Labour	7	1,200	30	100
Purchase Co-op Shareholding	6	1,080	65	234

Source: Teagasc National Farm Survey Data

In a 2014 supplementary questionnaire to the Teagasc National Farm Survey dairy farmers were asked how they planned to fund their future investment. Almost one third of farmers (30 percent) do not plan to use any bank finance for their investment, using only farm cash flow to fund investment. A further 19 percent intend to use only bank finance, while the remaining 51 percent intend to use a combination of the two.

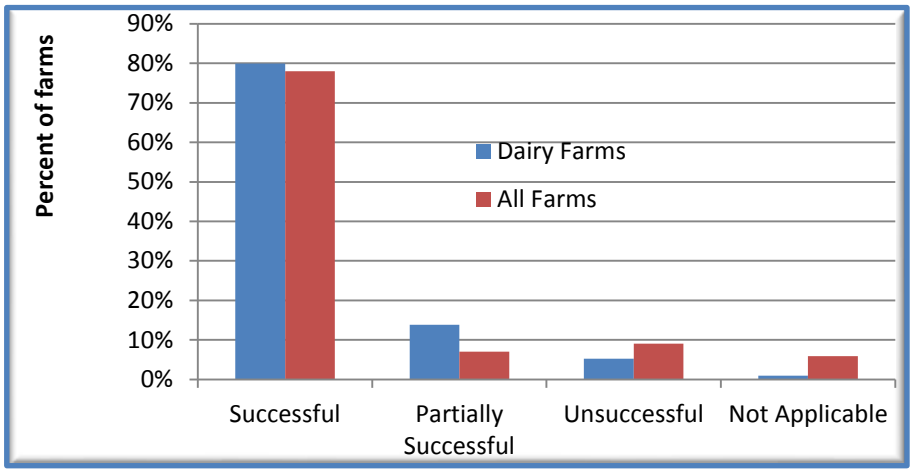
Figure 5.5: Dairy Farmers' Planned Use of Finance



Source: Teagasc National Farm Survey Data

Within the same supplementary survey, farmers were asked whether they had experienced any difficulties in accessing bank finance in 2013. The results indicated that 39 percent of dairy farmers had sought loan finance with the vast majority, over 90 percent, seeking this finance from banks. Farmers were also asked about the success or otherwise of their credit applications (Figure 5.6).

Figure 5.6: Success of bank loan finance applications



Source: Teagasc National Farm Survey Data

The vast majority of farms, almost 80 percent, were successful in their bank loan application, with only 9 percent of all farms being unsuccessful and only 5 percent of dairy farms. It is possible that the results may be slightly biased in that farmers expecting to be rejected may not submit an application and therefore are not reflected in the unsuccessful figures. These results indicate that access to credit has not been a major issue in recent times. This is an important finding given the level of investment needed to fuel growth in the dairy sector highlighted earlier in the chapter.

5.4 Conclusions

Dairy farmers have invested almost €2 billion euros in the last seven years, i.e. from 2007 to 2013. The bulk of this investment has been in buildings and machinery although it should be noted that much of this investment was driven by the significant incentives for investment in buildings in the 2007 to 2008 period. While the milk quota system has been in place over this period, attrition from the sector has meant that the average deliveries per farm have increased by the order of 30 percent. It may therefore be interpreted that the €2 billion euro investment has facilitated output growth of 30 percent on the current population of dairy farms.

More recently, the results of a Teagasc NFS supplementary survey show that almost 40 percent of dairy farmers sought loan finance in 2013 with the vast majority of farmers seeking this finance from banks. Furthermore, the survey suggests that the vast majority of farmers, almost 80 percent, were successful in their bank loan application suggesting that access to finance may not be an issue for most farmers.

The Food Harvest 2020 report set the target to increase national milk output by 50 percent by 2020 from the 2007 - 2009 base level. This chapter considers the farm-level investment required to meet this expansion target. The analysis concludes that

the vast majority of this additional milk production will be delivered by existing dairy farms, with only about 500 new entrants required to meet the target. While some of this additional output will be delivered by cow productivity gains, which will be achieved at no additional capital costs, the vast majority of farms will need to acquire additional cows, convert existing housing and milking facilities and/or erect new facilities. It is estimated that the existing population of dairy farmers will invest €1.24 billion in the 2014 to 2020 period with a further €230 million being invested by new entrants. This brings the total farm sector investment to €1.47 billion. The results of a recent survey of farmers participating in the Teagasc National Farm Survey support these results. Up to 60 percent of dairy farmers plan to expand milk production in the first 2 years following milk quota removal and almost 400 non-dairy farmers have engaged in some conversion to dairy planning. In aggregate it is expected that the national milk pool will increase by approximately 17 percent in the initial years following milk quota removal. Up to 70 percent of dairy farmers plan to use bank finance to fund this investment with the remaining 30 percent using internal sources of finance.

As discussed about the €1.47 billion investment estimate does not include the "normal" investment undertaken by dairy farmers, while it is likely to encompass all investment in buildings and machinery associated with milking parlours, it is likely that there would be additional investment in other machinery and/or land improvements. It is estimated that this investment may run to approximately €140 million per year, assuming past trends continue.

Finally, the analysis presented in this Chapter presents quite an optimistic outlook for the Irish dairy farm sector, with substantial expansion and investment planned. However it is very important to note that any expansion will be predicated on the economic environment. Milk price volatility will be an inevitable feature of dairy markets in the coming years and Irish dairy farmers may be exposed to extreme price swings. However, the general trend in milk prices is upwards and an expansion of the sector is likely to occur but the pace and magnitude of that expansion will be influenced by price movements. This issue is explored further in Chapter 7.

Chapter 6
Current Financial Situation and Investment requirements of the Pig Sector by 2020

6.1 Introduction

Pig production constitutes a significant segment of the agricultural economy of Ireland. Ranking third in importance after milk and beef, pig meat amounts to 7% of Gross Agricultural Output (GAO). The value of pig meat exports in 2014 was estimated at €476m. Despite a number of setbacks for European exports (including the Russian ban on EU imports) Irish pig meat exports to third countries increased by 9% for January-October 2014 (. The pig sector is a significant employer, accounting for at least 1,300 labour units on farms and a further 7,000 employed in associated sectors such as pig meat processing, feed manufacture, haulage and services. It is a sector which survives on tight margins, without the aid of any form of subsidy or protection from market forces, by achieving improved efficiencies at farm level.

6.2 Food Harvest 2020

Food Harvest 2020 (DAFM 2010) sets out formidable targets for Irish pig meat production, which can be summarised as follows:

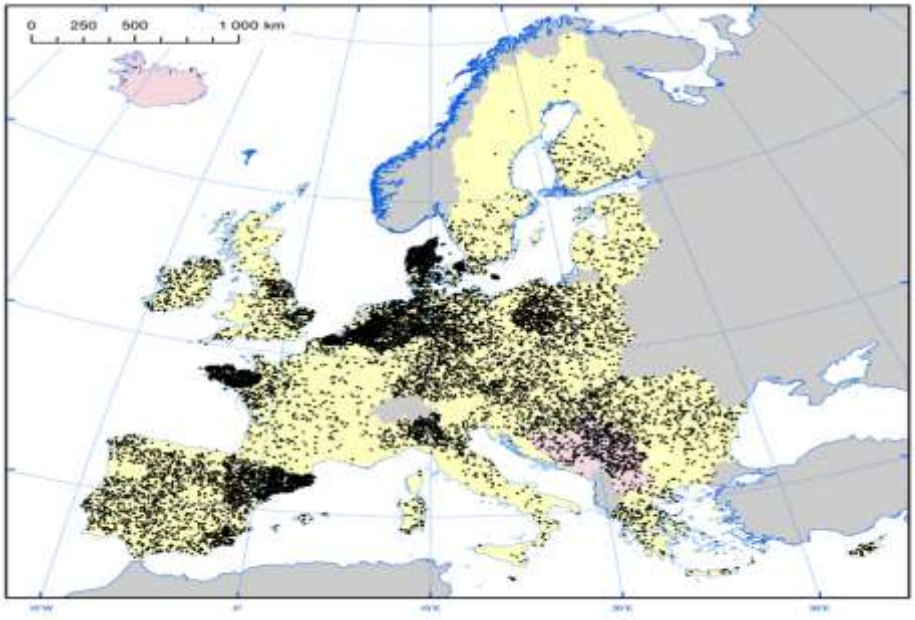
1. Address the profitability gap: Reduce costs of production and maximise pig price.
2. Increase the output value of the sector by 50%
3. Increase the average number of pigs produced per sow per year from 21.0 (average 2005-09) to 24.
4. Increase the national sow herd by 56,000 sows to 200,000 sows.

Food Harvest 2020 identifies the need to address the profitability gap in the sector as a prelude to further expansion in the national sow herd. Specifically, a reduction in feed costs per kg of pig meat has to be achieved thereby reducing the gap between Ireland and many of the main pig meat producing countries in the European Union. The profitability and credit crisis in Irish pig production since the 2010 Irish cereal harvest continues to place many pig producers under substantial financial pressure. The accumulated debt from this period, profitability in the medium term and future access to bank finance will dictate whether the industry can achieve its expansion target of 200,000 sows by 2020.

6.3 Industry Structure

The Irish sow herd size is small by EU comparison at 1.2% of EU total with a low density. The overall density of pig production, expressed as the agricultural area used (AAU) per sow, in Ireland (25.7ha/sow) is low when compared to the Netherlands (1.9ha), Denmark (2.0ha) and Belgium (2.2ha), Figure 6.1.

Figure 6.1: European Pig Density



Source: Eurostat 2013.

Although the Irish industry is small by total sow population, the average Irish farm size (600 sows) is among the highest in Europe. Since Ireland is a net importer of feed ingredients and a net exporter of product, located on the periphery of Europe, the scale of production is important. The large farm size and resultant 'economies of scale', in conjunction with the support of the Irish feed mills have been critical in maintaining the national sow herd numbers despite the lower sector profitability over the last 5 years. The EU28 sow herd has fallen by 19.8% since 2005 with the Irish herd decrease marginally lower at 17.4% (See Appendix 6.1 for further details).

6.4 Current Pig Sector Profitability

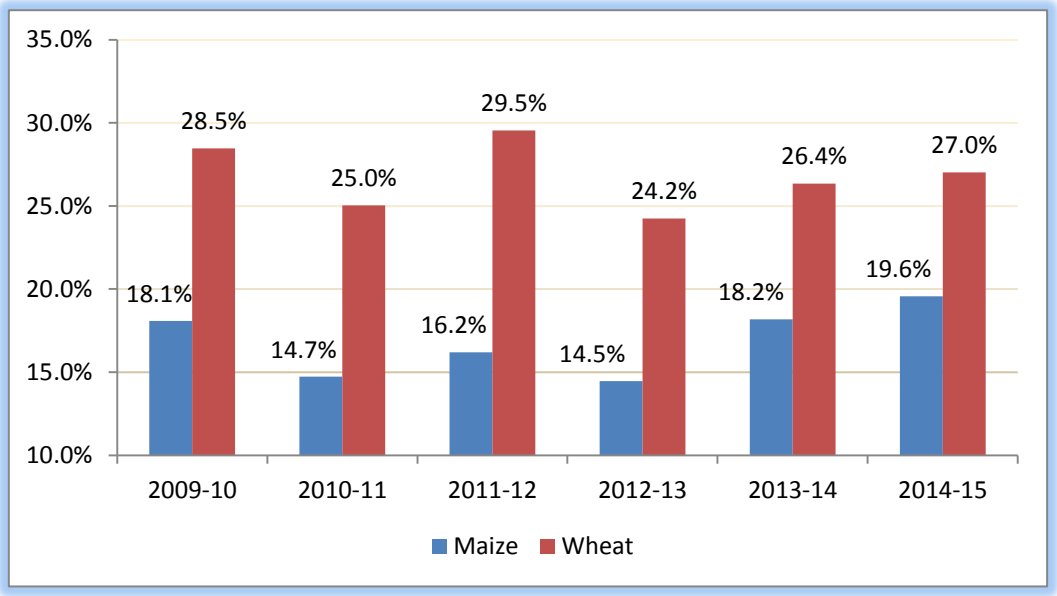
The pig sector profitability is largely determined by input and output prices.

6.4.1 Input Costs

The largest single input cost in pig production is the cost of pig feed which constitutes 70-73% of the total cost of production. The profitability of the industry is therefore significantly influenced by the fluctuations in world cereal prices. The industry is further exposed to price fluctuations by the necessity to import considerable volume of

ingredients not grown domestically e.g. soya beans. Significant increased demand by new (bioethanol) and existing (Chinese) markets has resulted in increased global volatility, see Figure 6.2.

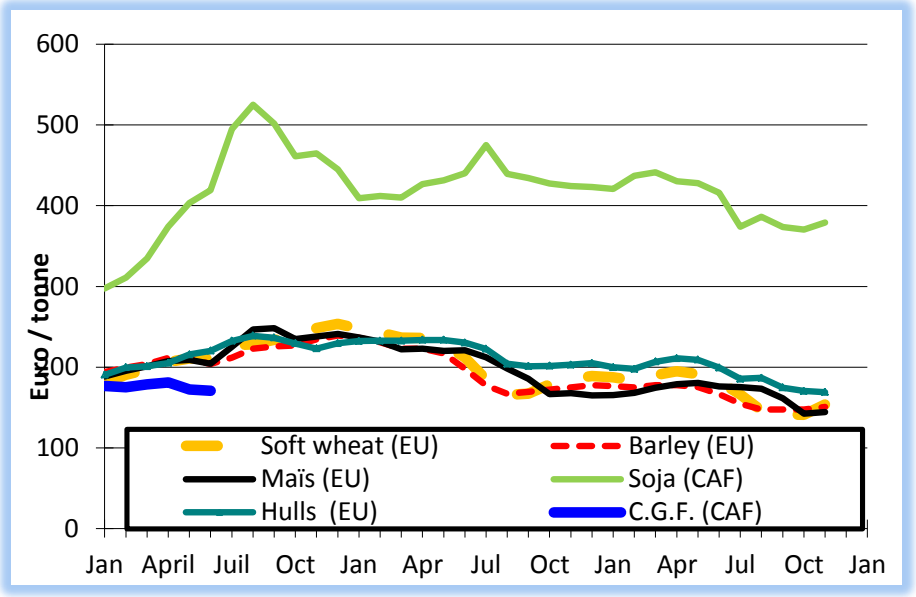
Figure 6.2: World Wheat & Maize Demand: Closing Stock as % of Total Production in the Year



Source: USDA 2014

This supply-demand volatility has resulted in increased ingredient price fluctuations in recent years associated with maize closing stocks as a percent of total production ranging from 14% to 19.6% and wheat from 24% to 29.5%, Figure 6.3.

Figure 6.3: Prices of feed ingredients (€/tonne)



Source: DG AGRI 2014

These feed ingredient price variations has translated into the Irish compound pig feed price ranging from a low €208 / tonne in 2005 to a high of €356 in 2013, an increase of 71%.

Table 6.1: Irish Compound Pig Feed Price (€/tonne)

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
226	208	214	254	293	252	247	305	332	356

Source: Teagasc 2014a

When the compound feed cost increase is translated into a pig meat 'Cost per kg deadweight', using the average Teagasc e-Profit Monitor (ePM) National Herd Performance (Teagasc, 2014b) for each respective year, the variation is reduced to 61%. This is due to the effect of increased production efficiencies and output defraying some of the increased feed cost per tonne.

Table 6.2: Feed Cost (cent / kg deadweight)

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
86	80	84	97	113	94	93	112.3	123	132

Source: Teagasc 2014a

Non-Feed Costs

The non –feed costs excluding financials have been relatively steady over the last number of years reflecting the emphasis on cost control by farmers due to the recent tight profit margins.

Table 6.3: Common Cost (cent/kg dwt)

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
32.8	38.4	36.8	37.8	37	33.2	34.5	33.9	29.8	34.6

Source: Teagasc 2014b

Financial Costs

The pig industry is a high capital intensive industry which requires high on-going capital re-investment due to the significant level of depreciation in internal building fixtures and fittings. The advantage of the industry in comparison to some other farming enterprises, such as beef and tillage, is that it has a relatively constant incoming revenue stream each week throughout the year.

The repayment 'cost per kg dead weight' has remained relatively constant over the last five years. This masks the actual increased repayments per herd during this period as a result of structural changes required by welfare legislation. The variation within the

ePM Pig database is quite large reflecting some pig units with small repayments (3-4 cent/kg dwt) as a result of a stable herd size or minimal re-investment and other units with larger repayments (12-14 cent/kg dwt) reflecting rapid herd expansion in recent years or poor performance due to health issues etc.

Table 6.4: Financial Repayments (Principle & Interest)

Repayments	2010	2011	2012	2013	2013
Repayments (c/kg dwt)	8.4	8	8.6	7.5	7.9
Repayments Per Sow €	153	151	162	146	160
Repayments Per Herd €	84,241	98,660	113,582	104,622	113,284

Source: Teagasc ePM

On the basis of these calculations the net repayments of the entire Irish pig farming sector can be estimated at €23 million in 2013. The low profitability in the industry in recent years has resulted in the true capital re-investment required by the industry been underestimated. The investment that has taken place, primarily under grant aid, has been in the form of new/refurbished loose sow housing to the detriment of other housing e.g. weaner/finisher that now requires refurbishment. While this investment has ensured compliance with new welfare standards it has not generated increased productivity but has increased the debt burden of units.

Capital Investment

A significant amount of capital investment in recent years has been grant aided primarily for new sow welfare housing under TAMS funding which has resulted in 126 applicants receiving funding since 2006. On the basis of applicants receiving the full 40% grant funding allocation this indicates that the industry has invested €27.7 million in sow housing grant aid since 2006.

Table 6.5: Capital investment funding under Welfare Housing Grant schemes

2006	2007	2008	2009	2010	2011	2012	2013	2014*	2006-2014
€0.47	€0.69	€2.27	€1.58	€0.68	€0.55	€0.71	€4.53	€6.40	€11.09

Source: DAFM 2014 **Jan-Sept.*

6.4.2 Output Prices

The pig industry traditionally followed a five year pig price cycle. When pig prices were high, production would expand, leading to an increased supply of pig meat thereby forcing pig meat prices downwards. When this downward phase eventually became loss making, producers would reduce their herd size or exit the industry, thereby leading to a shortage of pig meat with a resultant rise in pig prices. In the last 10

years, due to the increased globalisation of trade, dominance of supermarkets etc. this cycle has become less evident and the pig price appears to be increasingly associated with the pig feed cost.

Table 6.6: Irish Farm Pig meat Prices (c/kg)

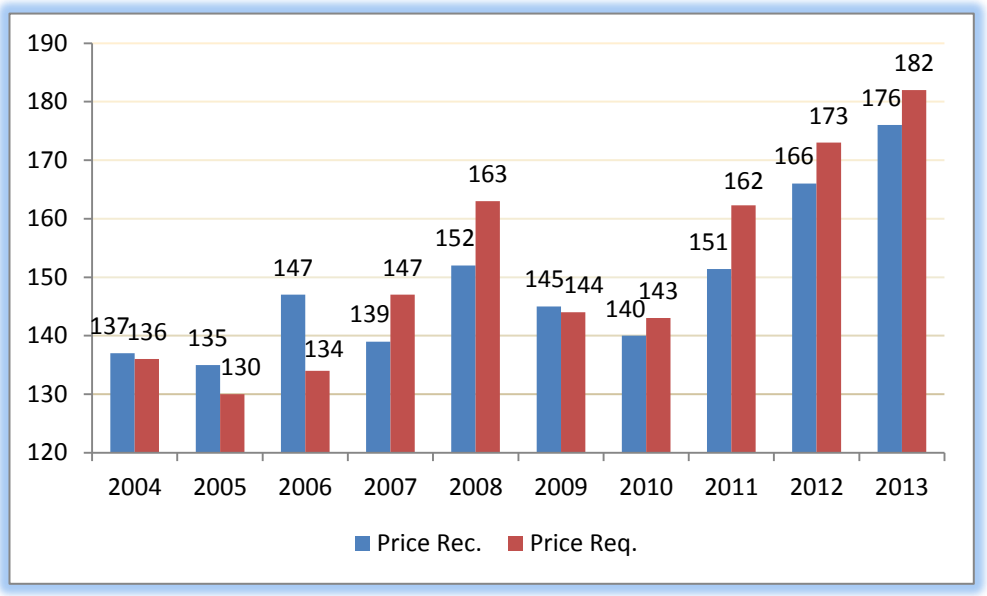
2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
137	135	147	139	152	145	140	151	166	176

Source: Teagasc Pig Dept.

6.4.3 Trend in Profitability

The 'Margin over Feed' required by pig producers to return a profit (including financial & drawings) is 50 cent per kilogram above the feed cost. The trend over the last 10 years illustrates that this has not been achieved, especially since 2010. The average annual 'Margin over Feed' since 2004 is 48 cent.

Figure 6.4: Margin Over Feed Required and Received (c/kg dwt)



Source: Teagasc 2014c

6.5 *Financial investment requirements until 2020*

Under the targets for Food Harvest 2020 the pig industry has already achieved the prolificacy target of 24 pigs produced per sow per year as the 2013 National ePM Performance report details 25.2 pigs produced per sow per year.

The targets of a) reducing the cost of production and b) expanding the national herd to 200,000 sows will require investment by the industry.

6.5.1 Reducing Cost of Production

As previously outlined the principle input cost in pig production is feed, therefore this presents the greatest area of opportunity to reduce costs of production. Analysis by Interpig (Table 6.7) indicates that our compound pig feed price is more expensive than our main competitors. This is due to a number of factors including; feed credit, energy system used, ingredient importation cost. Of these items, feed credit is the largest single cost factor.

Table 6.7: Comparison of compound pig feed prices 2013 (€/tonne)

Ireland	Germany	Denmark	Netherlands
356	305	287	317

Source: Interpig 2014

Traditionally the Irish pig industry used feed credit as a cheap form of finance, particularly during the 1970's and 1980's when loan interest rates were very high. Feed mills would grant temporary extra feed credit which allowed pig units to expand. The good profitability of the industry during this period allowed this extra credit to be repaid when the increased volume of pig sales materialised. Generally three months was recognised as the standard credit period for compound pig feed.

Unfortunately in 2011/2012 the high feed cost, poor profitability and restricted access to bank finance resulted in many pig units having to access extra feed credit from millers. The Irish millers recognised the strong underlying viability of the pig industry, low bad-debt risk and the importance for the mill's own efficiencies. This resulted in the average industry feed credit been extended to 4.5 months (Teagasc, 2012). In the interim it is estimated (Teagasc Pig Dept.) that this credit has been reduced by a margin of three weeks leaving the average for the industry at 3.75 months.

This feed credit is an extra cost that must be borne by the pig feed mills and ultimately passed back to their pig feed customers through higher feed prices. This is an extra cost that is <u>not</u> borne by pig producers in our chief export rivals e.g. Netherlands, Denmark, as their feed credit is on average 7-14 days. In addition to resulting in higher feed prices, the extent of the credit also results in pig farmers been effectively 'locked in' to a mill and reduces their options if they wish to retire or sell their pig unit, leading to poor industry mobility. This poor mobility will restrict the entry of young people as owners into the industry with consequential detrimental effects on the future levels of innovation and up-skilling.

6.5.1.1 Feed Credit Elimination

Dialogue at pig producer discussion groups has highlighted the reduction in feed credit as the most pressing financial investment required by the Irish pig sector in the short term. A previous study (Teagasc, 2011) highlighted how bank finance utilised to reduce feed credit terms could result in the process being self-financing through lower compound feed prices, Table 6.8 and 6.9.

The current cost of merchant credit for 3.75 months at an annual charge of 18% equates to an extra feed cost per kg deadweight of six cent, which places the Irish pig industry at a serious international competitive disadvantage. An elimination of this debt using a five year term loan at 5.5 % interest combined with a €5 per tonne compound feed price reduction would ensure that this process was a) cost neutral for pig producers and b) reduce the risk burden for feed mills. If the pig sector does not tackle the feed credit reduction in an industry structured format then the time frame required for this debt elimination will be much longer. This will place continued financial pressure on producers, millers and a longer term loss of our international competitive position.

The net cost of the introduction of this term loan is based on the following assumptions in Table 6.8.

Table 6.8: Finance Required For Feed Credit Elimination- Assumptions

Variable	**Assumption**
National Average herd size (sows)	550
Average Number Pigs Produced / Sow (head)	25
Carcass Weight(kg)	79.8
Kill Out %	0.76
Live weight (kg)	105
Monthly Feed Usage (tonnes)	320.8
Total Annual Feed Usage (tonnes)	3,850
Annual Feed Usage Per Sow (tonnes)	1.37
Weaner - Sale FCE	2.55
Composite feed price/ tonne (€)	320
Monthly Finisher sales (head)	1146
Cost of Annual Feed (€)	102,656
Merchant Credit Annual Interest Rate %	18

Table 6.9: Finance for Feed Credit Elimination

Calculation:

Months	Feed Credit	Annual merchant credit at 18% **(A)**	Annual Repayments Required to clear feed credit at 5.5% over 5 year s **(B)**	Difference per year **(B-A)**	Feed price reduction required to cover differential	Merchant credit Cent Per Kg dwt C
1	€102,656	€18,478	€23,508	€5,030	€1.31	1.6
2	€205,312	€36,956	€47,016	€10,060	€2.61	3.3
3	€307,968	€55,434	€70,524	€15,090	€3.92	4.9
4	€410,624	€73,912	€94,033	€20,121	€5.23	6.6
5	€513,280	€92,390	€117,541	€25,151	€6.53	8.2
6	€615,936	€110,868	€141,049	€30,181	€7.84	9.82

Estimate of funding needed for scheme

	Sow Herd Size	Total Pigs Produced	Annual Total feed tonnage	One month Tonnage	One Month feed credit	Ave. 3.75 mth feed credit
National Herd	144,000	3,600,000	1,008,000	84,000	€26,880,000	-
Home compounders	43,200	1,080,000	302,400	25,200	€8,064,000	-
Compound Buyers	100,800	2,520,000	705,600	58,800	€18,816,000	€70,560,000

At a 50% uptake of scheme and 3.75 months credit reduction the funding required is **€35,280,000**

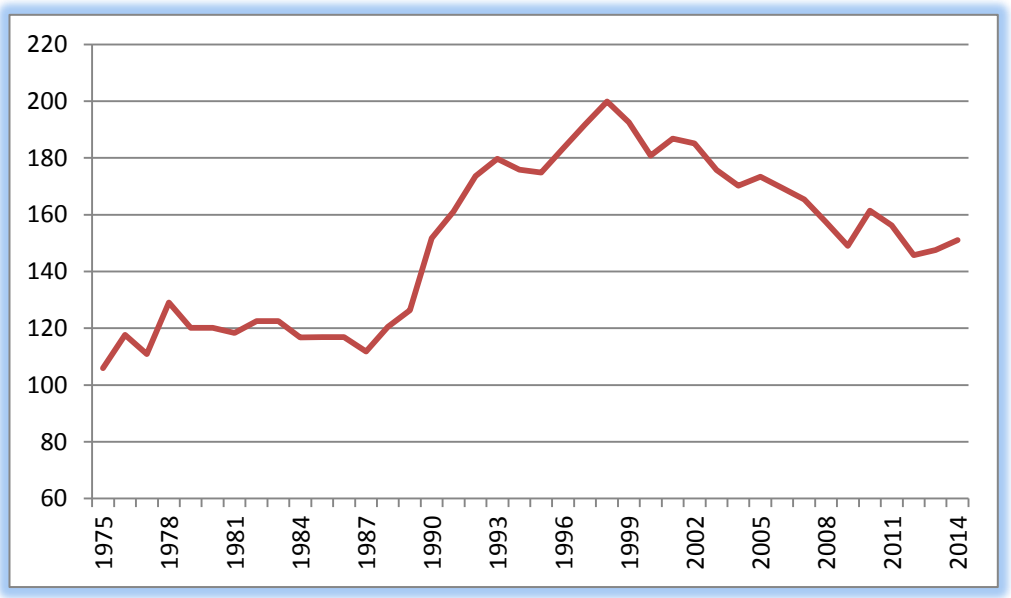
At a 75% uptake of scheme and 3.75 months credit reduction the funding required is **€52,920,000**

The calculation illustrates the average feed credit owed by pig producers purchasing compound feed – home compounders purchasing ingredients are excluded as these have 14 days feed credit

6.5.2 Expanding the National Herd

A major Food Harvest 2020 target for the Irish pig herd is to expand the sow herd population from the current level of 144,000 sows to 200,000 sows. This is a very ambitious target that would require considerable external financing for achievement. The Irish herd previously reached a peak 200,000 sows in 1999 before poor profitability initiated a decline.

Figure 6.5: Irish Sow Population 1975 – 2014 (000's)



Source: CSO 2014b

In order to achieve this target of 200,000 sows the industry will require financing for building infrastructure and working capital. The current capital investment required for building infrastructure on a green-field site is approximately €5,500 per integrated sow place, while a herd expansion on an existing unit is estimated at €4,500 per integrated sow. Based on these assumptions the capital funding required for building infrastructure to expand the national herd by 56,000 sows will be €280 million. In addition the short term working capital funding required for incurred extra feed etc. will be €30.8 million (€550/sow).

The 'TAMS 2' grant scheme will provide some opportunity to defray some of the cost, but the substantive funding required will still have to be supplied by financial institutions. Traditionally building infrastructure funding has been financed over a 10-12 year time frame but due to the sector's increased volatility in the recent years the expectation is for the repayment window to be increased to 15 years for future investments. However, sow herd expansion without optimising the current potential in terms of slaughter weight and 'pig meat produced per sow' would not be the most prudent use of available capital.

6.5.2.1 Maximising Pig meat Output

A more likely and prudent scenario is for the national sow herd size to be maintained at current levels but output increased through higher prolificacy and sale weight. The Food Harvest 2020 target used the reference years of 2005-2009 as the baseline years for its pig sector targets. During this period the average 'Pig meat Produced per Sow per Year' was 1,600 kilograms. On the basis of 144,000 sows this produced a national pig meat output of 230,400 tonnes. If the national herd was increased to 200,000 sows then (based on the baseline assumptions) the national pig meat output would have increased to 320,000 tonnes.

Current 'Pig meat Produced per Sow per Year' is 2,031 kilograms based on 25.2 pigs sold per sow per year and a dead weight of 80.6 kilograms (Teagasc 2014b). If the national sow herd size remained at 144,000, the number of 'pigs sold per sow' increased to 27.2 and the sale weight increased by a further 3.5 kilograms (84.1), as appears more likely and processor acceptable, then the national pig meat output would be 329,402 tonnes of pig meat. This output would exceed the original target Food target of 200,000 sows.

Pig farms will require capital investment for additional housing to achieve this higher output. On a per sow basis this would cost €980 per sow which would equate to €539,000 for an average pig farm (550 sows) and €141 million on a national basis. In this scenario (see Appendix 6.2 &6.3) the total cost per kilogram of pig meat produced would be reduced by 2 cent (despite repayments cost increasing) due to the fixed costs dilution effect arising from the greater output.

This indicates that an output increase based on the existing national sow herd size may be the most readily achievable and preferential investment option in the coming years rather than a substantial increase in the national sow herd size.

6.6 Conclusions

The Irish pig industry continues to improve its efficiency levels despite tight financial margins. The national output has now increased to 25 'Pigs per Sow per Year' and the sale weight has continued to rise to 105 kilograms. Under the Food Harvest 2020 report ambitious targets were set for the Irish pig sector to further expand and increase efficiency. If these targets are to be met then further capital investment will be required from financial institutions. The most immediate significant investment requirement identified by the industry is a reduction in the feed credit terms which is increasing the cost of production. An elimination of this issue would decrease the cost of production and allow the Irish industry and specifically Irish pigmeat to become more internationally competitive.

An expansion of the Irish sow herd size to 200,000 sows was another key target of 'Harvest 2020'. The additional 56,000 sows required to meet this target would require an investment of €280 million at current prices. A more likely and prudent scenario is for pig farms to maximise the output potential of their existing herd through an increase in pigs produced (27.2) and higher sale weights to 110 kilograms. The cost of this extra investment would equate to €539,000 per average pig unit but would lower the 'Cost of Production per Kilogram' through a dilution effect of fixed costs. In addition the national pigmeat output generated from this development would exceed the original forecasted Food Harvest 2020 output.

The future of Irish pig production is bright but the sector must continue to increase its level of efficiency and output, thereby improving the competitiveness of Irish pigmeat in the global market.

Chapter 7
Scenario Analysis

7.1 Introduction

Earlier chapters in this report have shown that over the short to medium term that the majority of new net investment in Irish agriculture is likely to occur on Irish dairy farms. Since 1984 the presence of the milk quota has limited the growth of Irish milk output. From April 2015, with the ending of the EU milk quota regime, Irish farmers will be able to produce milk on the basis of the economic signals they receive from the market place. Where farmers expect that additional production will be profitable they will be free, in the post-quota era, to expand their volume of production in line with their expectations with regard to future output prices, input costs and margins.

On many farms the expansion of milk production will require additional investment in animals, buildings, milking parlours and storage facilities, farm infrastructure, and agricultural land. The magnitude of the investment needs will vary from farm to farm reflecting the level of existing facilities and resources and the planned level of production expansion. In planning investment, Irish dairy farmers face uncertainty with regard to the future level of input and output prices and consequently with respect to margin per litre of milk produced. The experience of the last 10 years, with both historically high (2013) and historically low levels of profit (2009), has taught the Irish dairy industry that volatility in prices and incomes will be a feature of the new dairy industry that Irish farmers will need to have the capacity to manage and withstand.

No one can predict with perfect foresight when price and income shocks will occur, how severe such shocks will be, or how long these shocks will persist. To assess the vulnerability of Irish dairy farm incomes to price and income shocks in this chapter we use the FAPRI-Ireland aggregate sector and farm level models to examine three scenarios that are based on contrasting visions of how international demand for dairy products could evolve over the near to medium term.

- Under the first scenario international demand for dairy commodities grows steadily and underpins relatively **stable Irish milk prices** over the period 2015 to 2020.
- Under the second scenario analysed, stronger growth in the international economy leads to strong growth in the demand for dairy commodities. Strong growth in the global demand for dairy commodities leads to **an increase in**

the milk prices received by Irish farmers (effectively a positive output price shock).

- Under the third scenario analysed weak growth in the global economy leads to weak growth in the demand for dairy commodities from the global dairy market place. This weaker growth in demand is reflected in **low dairy prices over the period 2015 to 2020.**

The FAPRI-Ireland aggregate sector model is used to analyse the impact of these three contrasting output price paths on the aggregate supply of milk by the Irish dairy sector. The output and input price projections associated with the three contrasting international dairy demand scenarios are used by the FAPRI-Ireland farm level models to analyse the impact of the positive and negative output price shocks on farm level incomes and repayment capacity from milk production.

The volatility in dairy output prices, input prices and incomes over the last 10 years has occurred within a market environment where supply within the EU has been controlled by the milk quota. With the ending of the milk quota regime it is probable that volatility that has characterised EU dairy markets will persist and that the influence of international dairy market developments on Irish and EU dairy prices will persist and in all likelihood may increase. Already we have a situation where production from some of the main milk exporting regions (Oceania and the USA) is subject to considerable annual variability (due to market or production shocks). Heretofore the dairy export capacity of the EU has been comparatively stable, given that milk production continued to be bound by milk quotas in the more competitive EU member states. The presence of the EU milk quota therefore limited the EU dairy market's supply response to variations in global dairy market conditions. With the removal of the EU milk quota that stabilising influence will come to an end. This means that EU milk production will potentially be subject to greater inter-annual variability, contributing to the overall volatility in global dairy export volumes and associated world dairy prices.

The three scenarios set out in this chapter are not predictive in the sense of forecasting when an output price shock will occur or how severe it will be or how long it will persist. Instead the purpose of the three scenarios examined is to examine the sensitivity of Irish milk production and dairy farm incomes to output price volatility and to use this information to assess the risks faced by those Irish dairy farmers who will over the next 5 years invest resources in expanding their milk production at the farm level.

In the next section we provide the detail on the projected paths of milk prices and milk production in Ireland under the Steady Growth, Strong Growth, and Weak Growth in

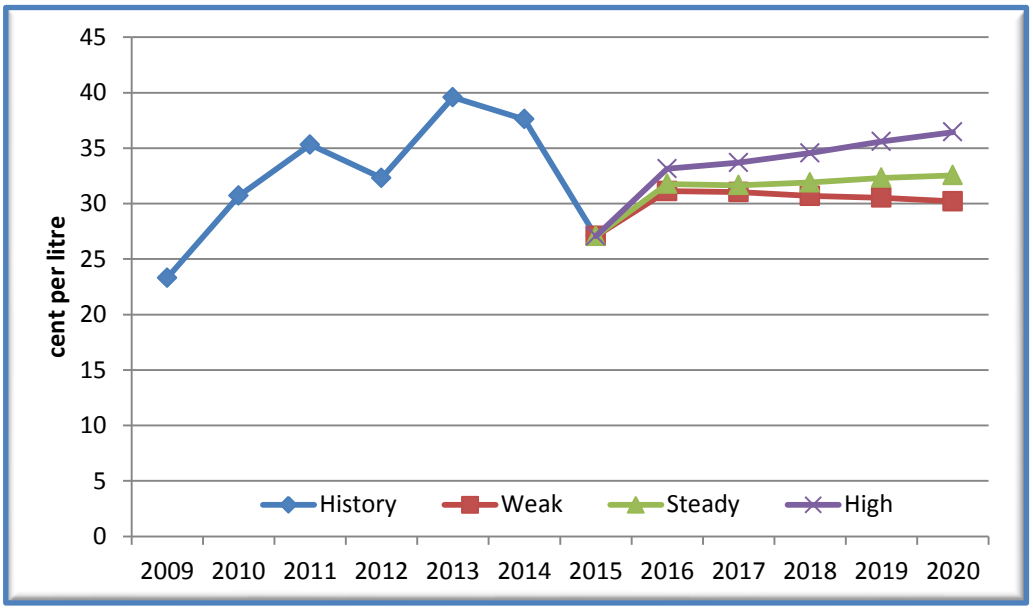
international dairy demand generated using the FAPRI-Ireland aggregate sector model. In the subsequent sections the impact of these projected price and output developments on farm level profitability are assessed using the FAPRI-Ireland farm level model.

7.2 FAPRI-Ireland Aggregate Sector Scenario Analysis

As outlined in the previous section, three price paths for milk prices are examined for the period to 2020. As is always the case with economic projections we can be more certain about short term developments than about medium and long term developments. All three milk price scenarios reflect uniform short term developments, with milk prices in 2015 sharply below the prices levels of 2013 or 2014. The basis for this short term outlook has already been outlined in Chapter 1.

Beyond 2015, milk prices recover from the low of 2015, but the milk price path for the three scenarios differs in subsequent years so that by 2020 the milk price ranges from about 30 cent per litre in the low scenario to over 36 cent per litre in the high scenario. The low scenario would see projected milk prices below the medium term historical average. The Steady scenario would see projected milk prices similar to the medium term historical average and the strong Scenarios would see prices surpass the medium term historical average.

Figure 7.1: Historical Irish Milk Prices and three projected milk price scenarios to 2020



Source: FAPRI Ireland Model

Recent experience has demonstrated that production costs such as feed, fertiliser and energy prices can vary considerably. However, for simplicity in all three scenarios developments in production costs are uniform. Little change on overall production costs in projected in the period to 2020. Therefore the three scenarios have significant implications of the projected margin achieved from milk production for the average milk producer.

Under the Weak and Steady Scenarios, the FH2020 production is not achieved, whereas under the Strong Scenario the Fh2020 expansion target is achieved. In the next section the implications of the three scenarios for farm level expansion and the associated investment requirement are explored.

7.3 FAPRI-Ireland Farm Sector Scenario Analysis

The impact of the three milk price scenarios on milk production levels, farm investment and farm income in Ireland is examined using the farm model outlined in Chapter 5. Table 7.1 presents data on milk production levels and investment under the three scenarios. The total milk supplied by existing dairy farms is higher in the Steady Scenario in comparison with the Weak Scenario as the milk price in the Steady Scenario is higher. Likewise in the Strong Scenario the milk price is higher than in the Steady Scenario and consequently the Strong Scenario results in a higher level of milk production. Therefore the number of new entrants required to meet the Food Harvest target is highest in the Weak Scenario.

Under the Weak Scenario, it is estimated that the pre-existing population of dairy farms could increase milk production by 31 percent relative to the 2007-2009 base against which FH 2020 expansion in measured. It is estimated that an investment of just over €1 billion at the farm level would be required to achieve this level of milk expansion. However, under this scenario, up to 1,300 new entrants would also be required to achieve the Food Harvest expansion target, bringing the estimated total farm investment requirement to €1.67 billion.

Under the Steady Scenario the higher milk price means that more of the additional milk is supplied from pre-existing farms (43 percent) at a lower investment requirement and hence less is supplied from the more capital intensive business start-ups in order to reach the 50 percent expansion target. Existing farms require an investment of just over €1.2 billion with a further €232 million in investment required by new entrants to reach the 50% target bringing total investment to €1.47 billion.

It is expected that at a milk price scenario of 36 cent per litre in 2020, the Strong Scenario, the Food Harvest targets would be exceeded by the existing farms alone and

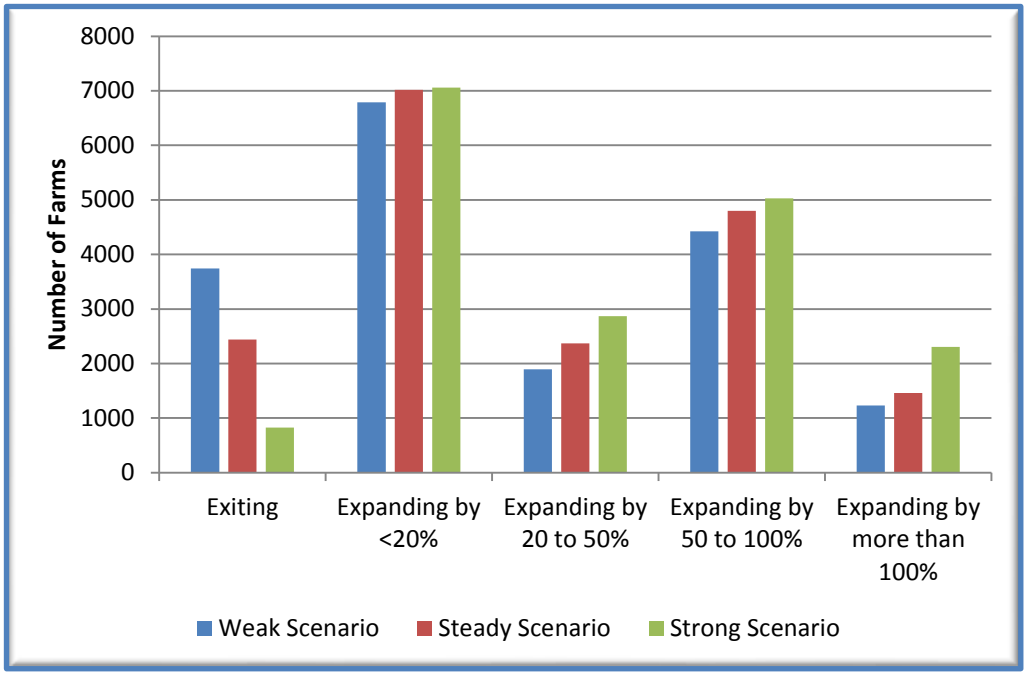
total milk production would increase by 65 percent before any new entrants are considered. The total investment associated with this level of expansion is almost €2 billion. However, it is important to note that this investment figure is not directly comparable with the investment required in the other two scenarios since it results in a level of production beyond the FH2020 target.

Table 7.1: Milk production and investment under the three price scenarios

	Weak Scenario	Steady Scenario	Strong Scenario
Pre-Existing Dairy Farms			
Production increase on existing farms in 2020 relative to 2007-09 level (%)	31	43	65
Investment Required (€million)	1,066	1,241	1,942
Food Harvest 2020 shortfall (%)	19	7	-
Food Harvest excess (%)	-	-	15
New Entrants			
Number Required	1,346	511	n/a
Investment Required (€million)	612	232	n/a
Increase in National Milk Production by	**50**	**50**	**65**
Total Investment	**1,678**	**1,474**	**1,942**

Figure 7.2 presents the number of farms expanding milk production under the three milk price scenarios. As expected the number of farmers exiting milk production declines in the higher milk price scenarios. Furthermore, the number of farms that can expand profitably increases in scenarios where the milk price is projected to be higher. About 5,500 farms could expand milk production by 50 percent or more, relative to the 2013 level, under the Weak scenario. This number increases to almost 7,500 under the Strong scenario.

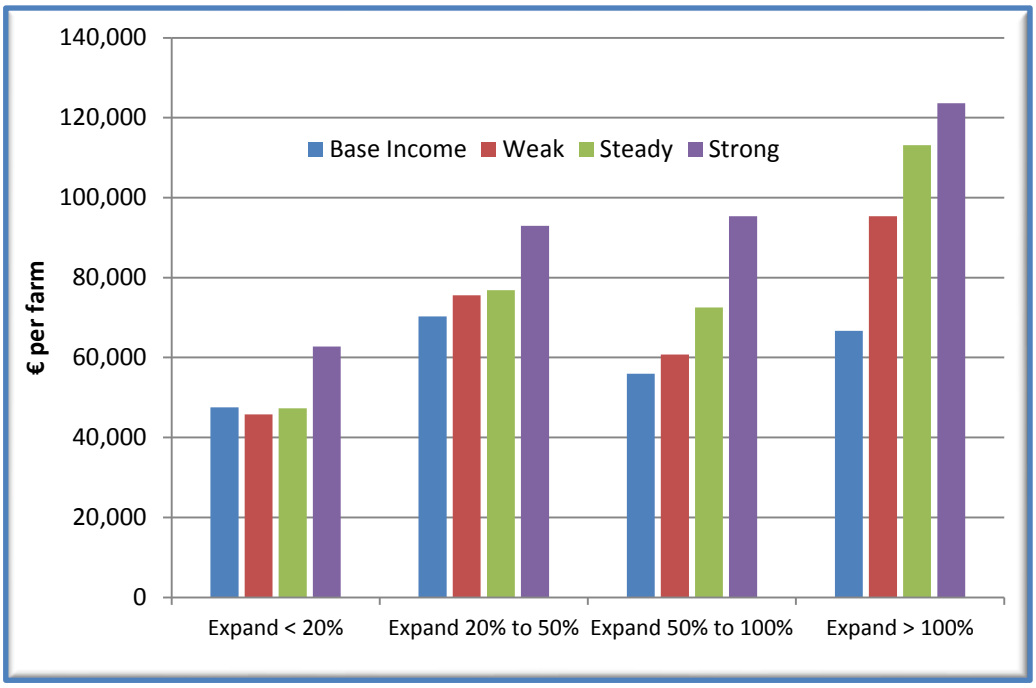
Figure 7.2: Number of Farms Expanding Milk Production under Three Milk Price Scenarios



The results presented in Table 7.1 are based on the assumption that farmers will expand production if the marginal revenue associated with the additional unit of production is greater than the marginal cost, even by only a fraction of a cent. Figure 7.3 presents estimates of farm income under the three milk price scenarios for farm groups expanding by varying degrees. The income estimates are compared to a base income level which is a five year farm income average from 2009 to 2013.

As can be seen in Figure 7.3, farmers expanding milk production by less than 20 percent can only maintain their base income level in the Strong scenario. Farmers expanding by more than 20 percent can increase their farm income under all three price scenarios. Farmers doubling their milk production levels can also double their income levels under the Strong scenario and can increase farm income by up to 48 percent even under the Weak scenario. It should be noted that while these figures allow for the additional labour required to produce this additional milk and the income foregone from other livestock enterprises, they do not allow for the interest on capital invested or the repayment of the principal. Furthermore, the additional production does not attract support payments. However, the relatively positive income results suggest that dairy farmers should be in a good position to undertake the required investment especially in the Steady and Strong scenarios.

Figure 7.3: Historical Farm Income and Projected Income under Three Milk Price Scenarios



7.3 Conclusions

In this section of the study we have highlighted the sensitivity of the profitability of milk production to the price of milk. While the implications of milk price volatility have already been felt over the last decade, this has been in the context of a milk quota regime with limited opportunities for individual producers to expand milk production in Ireland. In the context of milk quota elimination and the FH2020 target of expanding Irish milk production by 50 percent relative to the 2007-09 base period, the volatility of milk prices assumes greater importance and the impact of low milk prices may be particularly severe on farms with significant borrowings.

Three milk price scenarios were used to assess the differing levels of profitability associated with milk production. Following from this it was possible to assess the extent of the expansion that could be profitably achieved by the existing cohort of dairy farmers and additionally the number of new entrants that would be required to assure that the FH2020 milk production expansion target is achieved. Given that existing producers and new entrants are assumed to have differing investment requirements, it was possible to ascertain the potential range of total farm level investment that would be required. It was found that the dairy farm level investment requirement could range from just over €1.5 billion euro to €2 billion euro depending on the price scenario. Under the more optimistic Strong scenario, it is expected that the Food Harvest targets could be exceeded by the current cohort of farmers and hence the investment requirement would also be higher.

These findings illustrates the importance of market prospects in framing the extent to which Irish milk production might expand over the next 5 years and the associated investment that might be sought to bring this expansion about. Given that it is impossible to be certain about how international dairy markets will develop, it is reasonable to adopt a pragmatic approach in assessing the likely level of investment requirement that will emerge. In this context the investment figure of just under €1.5 billion estimated in the Steady scenario represents a reasonable estimate for planning purposes. It is important to note that this is a total investment figure and does not necessarily equate to credit demand. For example, over €400 million of this investment is for the acquisition of cows and it is probable that in many cases this would be funded out of the farmers' own resources. Furthermore, farmer intentions survey data presented in Chapter 5 suggest that 30 percent of farmers plan to fund investment out of own resources. In conclusion while the total investment figure is close to €1.5 billion the demand for bank credit is likely to be lower.

Chapter 8
Conclusions

8.1 Introduction

In terms of the financial situation and investment requirements of Irish agriculture, 2015 is likely to be the dawn of a new era for dairy farmers in particular. While the short-term outlook for milk price in 2015 is negative, in general milk prices are on an upward trajectory and the prospects for dairy product markets are favourable. The expansion of the Irish dairy sector has been long anticipated, however, significant investment will be required at both the farm and food processing levels to facilitate this growth. Access to finance under favourable terms and farmers' ability to balance net income flows and service debt will be critical to the future successful development of the sector. In this context the publication of this report is both timely and relevant given the imminent removal of the milk quota system.

8.2 Main Conclusions

The results of this study indicate that despite the increase in liabilities recorded on farms in nominal terms in recent years, the historically low level of debt relative to assets and equity reaffirms the farm sector's strong financial position (Chapter 2). As such, the sector has remained relatively well insulated from the risks associated with commodity production (such as adverse weather and price volatility), changing macroeconomic conditions in the world economy and fluctuations in farm asset values. Furthermore, Teagasc NFS data show that the average level of debt on dairy and tillage farms was significantly higher than livestock farms over the time period examined (2002-2012). With regard to farm loan use in recent years, the majority of loans were used for buildings, land purchase and working capital.

Given that Irish agriculture is now competing in an ever increasing global market place the financial stability from an inter country perspective (i.e. between competing countries) is as important as the intra country perspective (i.e. within the country). The financial indicators described in chapter 3 suggest that, on average, Irish farms have relatively low debt and high asset values relative to the EU average for all farms. Furthermore, solvency, liquidity and financial efficiency indicators also provide evidence of Ireland's healthy financial position in EU terms. While previous work by Teagasc has shown that Ireland continues to exhibit a healthy position in terms of the competitiveness of our agricultural sector (in EU and international markets), in a market which is increasingly exposed to price volatility, the ability to demonstrate resilience will be equally important in the future. Given that this research has indicated that not only does Ireland enjoy a competitive advantage in cost terms

within the EU, the level of debt and financial status of Irish farms should also provide Irish farms with a relative advantage in resilience terms given that they are not servicing high debt levels in years of low output or high input prices.

Chapter 4 of the report sets the scene for identifying the determinants of investment on all farms with a view to isolating the characteristics of investors and determining the types of farms most likely to invest in the years ahead. This analysis shows that Irish farms on average had net new investments of approximately €8,000 in 2013, with larger, younger, dairy farmers with higher family farm income and an off-farm income earned by the spouse having a higher probability of investment.

Chapter 5 considers how dairy farmers are likely to react to milk quota removal, what expansion in production is likely to occur and most importantly, what investment will be required at the farm level to facilitate expansion. The results indicate that total investment required to meet FH2020 targets between 2014 and 2020 is likely to be in the region of €1.47 billion. It is important to note however that this investment figure is not directly akin to a demand for credit figure given that some of the investment is likely to be funded from own resources. This fact was highlighted by the supplementary survey from the Teagasc National Farm Survey in late 2014 when approximately 30 percent of farmers said that they planned to use non loan finance to fund investment in 2015 alone.

Chapter 6 considers the recent financial situation of pig farms in Ireland showing that the Irish pig industry continues to improve its efficiency levels despite tight financial margins. Under the Food Harvest 2020 report ambitious targets were set for the Irish pig sector to further expand and increase efficiency. If these targets are to be achieved, then further capital investment will be required. The most immediate significant investment requirement identified by the industry is a reduction in the merchant feed credit which currently inflates feed prices and the cost of pig production. An expansion of the Irish sow herd size to 200,000 sows was also a key target of Food Harvest 2020. The additional sows required to meet this target would require an investment of €280 million at current prices. However, a more likely and prudent scenario is for pig farms to maximise the output potential of their existing herd through an increase in the number of pigs produced per sow and the achievement of higher sale weights. The cost of this extra investment would equate to €539,000 for the average pig unit, but would lower the cost of production per kilogram by having the effect of diluting fixed costs across a larger output volume. In addition, the national pig meat output generated from this development would exceed the original forecasted Food Harvest 2020 output.

Given that earlier chapters in the report show that over the short to medium term that the majority of new net investment in Irish agriculture is likely to occur on Irish dairy farms, chapter 7 focuses on identifying milk price scenarios to illustrate the vulnerability of Irish dairy farm incomes to price and income shocks. Three milk price scenarios were used and it was found that the dairy farm level investment requirement could range from just over €1.5 billion euro to €2 billion euro depending on the price scenario. These findings illustrates the importance of market prospects in framing the extent to which Irish milk production might expand over the next 5 years and the associated investment that might be sought to bring this expansion about.

Finally, in the context of projecting how investment requirements might change in the future, there are very many issues which may affect future investment levels that have not been assessed in this report. While they have not been addressed in the analysis, they are explored and discussed below.

8.3 Other issues to consider

Based on the findings from chapter 5 it is evident that the removal of the milk quota will present new opportunities for expansion of the dairy sector in Ireland at farm level and for the dairy sector in aggregate. While the elimination of the quota system in 2015 will remove the constraints on production, it is plausible that other constraints may be imposed (directly or indirectly) in the medium term. Environmental measures, for example, may restrict production. For example, the need to reduce greenhouse gas emissions from agriculture is one of the grand challenges currently facing the sector. Any such environmental constraints may hinder expansion and as such negatively affect investment levels.

Policy issues such as CAP reform and Trade agreements may also impact on investment and demand for credit. While the most recent reform of the CAP has not substantially changed the direct payment system, the overall national envelope will decline in the coming years and some redistribution of payments from more intensive to less intensive farms will occur. The changing value of direct payments to farmers may affect investment decisions, albeit the impact is likely to be small.

Progress in the WTO negotiations has been very slow in recent years. However, this does not mean that negotiations aimed at liberalised trade have been abandoned. Lack of progress through the WTO mechanism has seen an increase in bilateral negotiations concerning trade. In the content of the next 5 to ten years it is not possible to rule out reductions in trade barriers between the EU and third countries which could open up the EU dairy sector in particular to greater competition on its home markets. The Irish dairy sector is highly exported focused. In some product areas this export focus places the Irish dairy sector in the position of being a residual supplier to dairy deficit

markets. These characteristics distinguish the Irish dairy sector from some of our competitors in the EU who are much less reliant on export markets. Hence, trade agreements could have a negative impact on Irish dairy product markets and Irish producer milk prices, with adverse consequences for the repayment ability of the Irish dairy sector.

Finally, in planning investment Irish farmers face uncertainty with regard to the future level of input and output prices and consequently with respect to margin per hectare. The experience of the last 10 years, with both historically high (2013) and historically low levels of profit (2009), has taught Irish farmers and dairy farmers in particular, that volatility in prices and incomes will be a common feature of modern farming. Irish farmers will need to establish a capacity to withstand such volatility. Hence, income volatility and the capacity to manage income flow considerations will be a key factor in determining investment levels in the medium term.

8.4 Concluding Comments

Finally, it can be concluded that Irish farmers in general have a sound financial structure. Debt to asset levels are quite low by international standards and solvency, liquidity and financial efficiency indicators all compare favourably with our main competitors in Europe. Traditionally, dairy farmers have been the most active investors and this is a situation that is likely to continue given the impending removal of the milk quota. Significant investment and credit will be required if the farming sector is to achieve the targets as identified in the Food Harvest 2020 report. However, sound financial planning on the part of farmers in conjunction with the banks will be critical to safeguarding farmers from financial stress. Given the current historically low interest rates in addition to the inevitability of output price volatility, it is prudent that all expansion plans are adequately stress tested.

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Appendices

Appendix 2.1 – Average Liabilities per farm* (2002-2013)

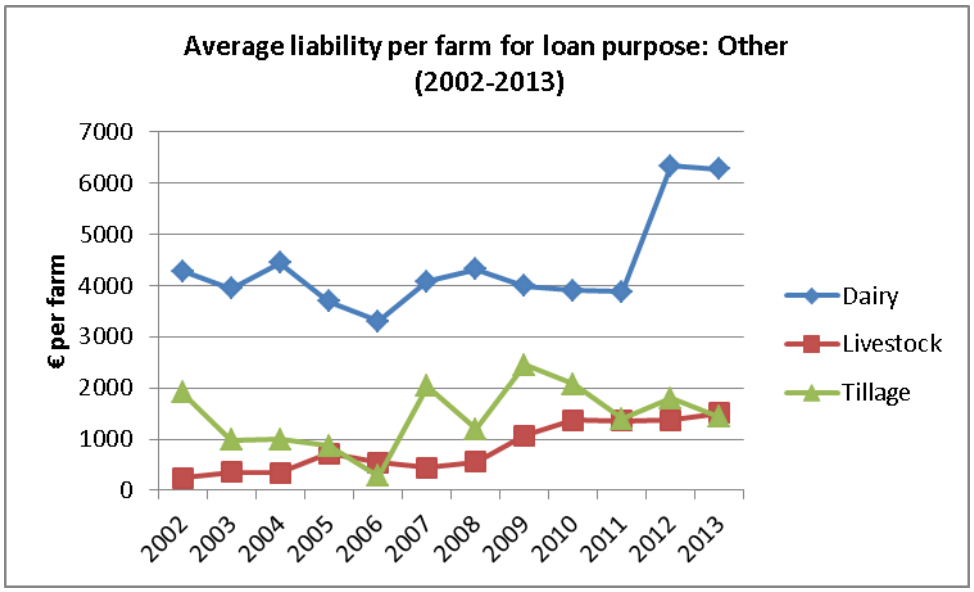
Year	Dairy	Livestock	Tillage	Total
	€ per farm			
2002	46892	22864	53857	37038
2003	46556	25228	53454	37740
2004	51430	25623	51650	39860
2005	54292	28745	46840	41704
2006	53314	40295	37416	45876
2007	63783	37854	46945	50781
2008	84143	38225	64893	59246
2009	81383	36246	57426	56194
2010	80850	29685	97559	55589
2011	86780	29055	75652	55065
2012	95856	33009	68358	60381
2013	93778	36059	73870	61698

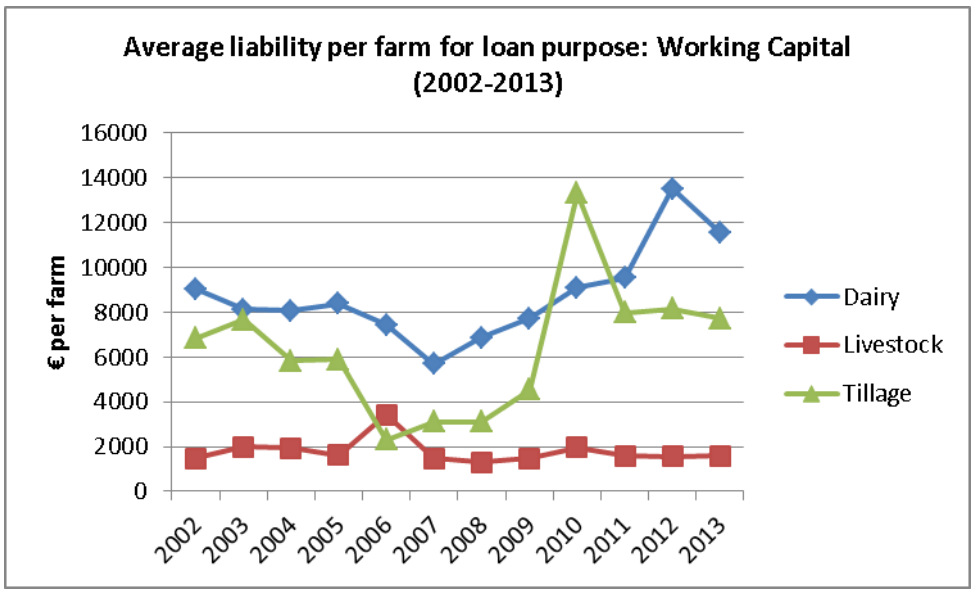
Source: Teagasc, National Farm Survey

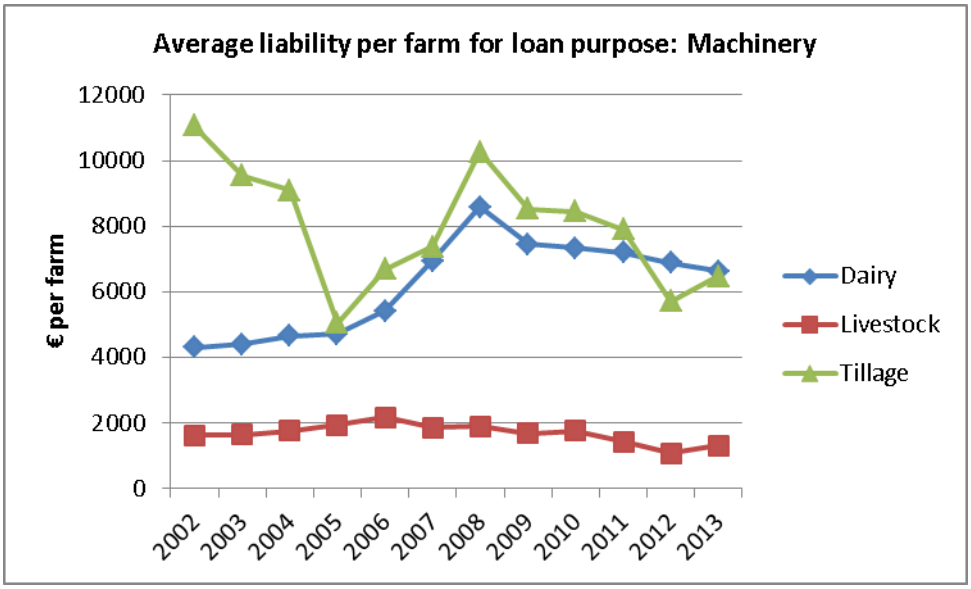
** Only farms with liabilities included.*

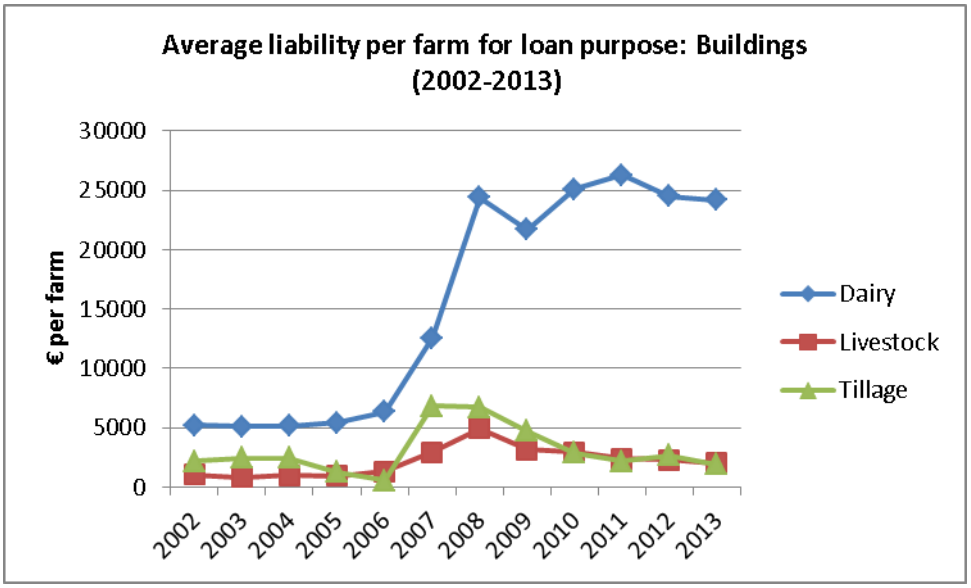
Appendix 2.2

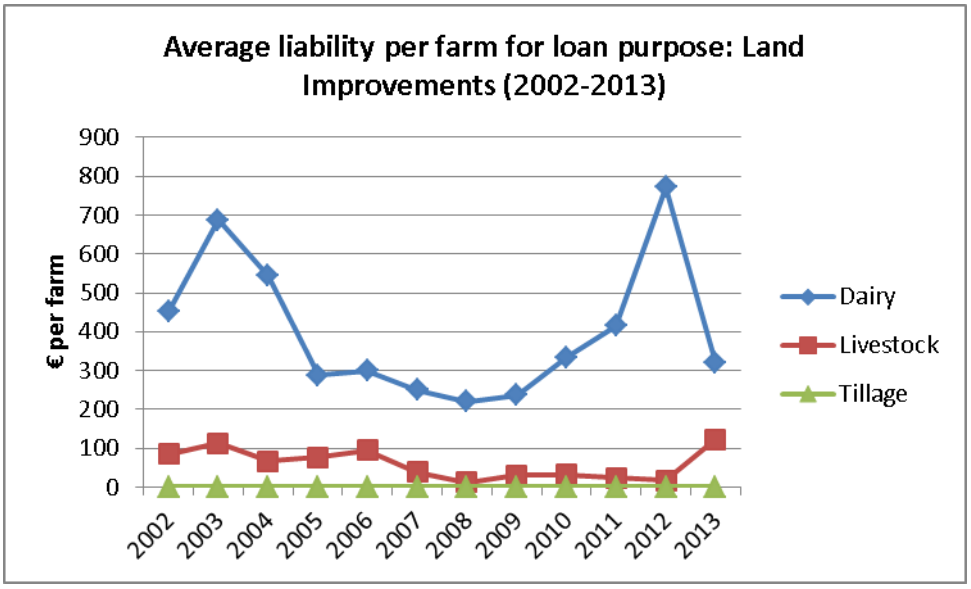
Average farm liabilities per loan purpose category, by farm system (2002-2013)

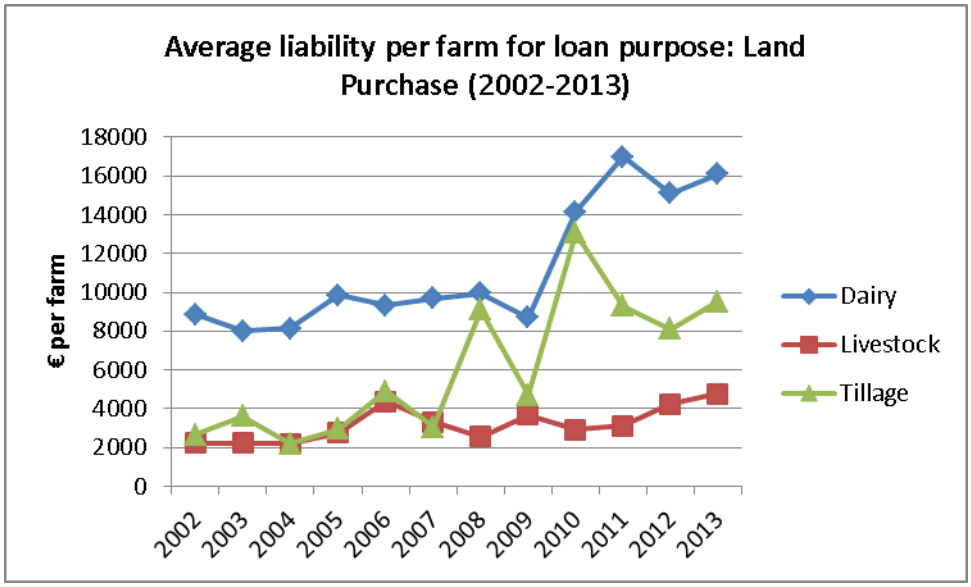


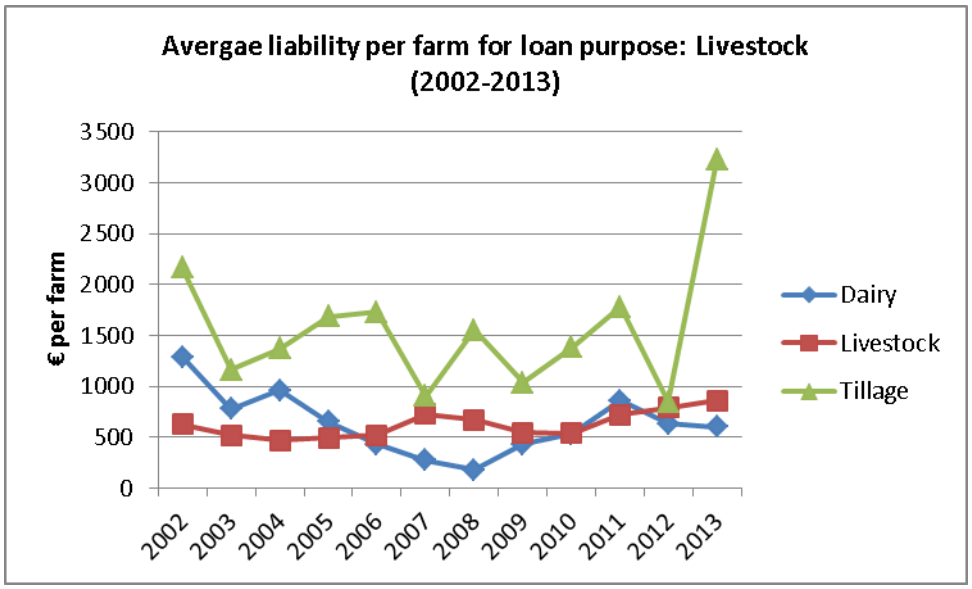



Average liability per farm for loan purpose: Machinery
€ per farm
12000
10000
8000
6000
4000
2000
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Dairy
Livestock
Tillage


Average liability per farm for loan purpose: Buildings (2002-2013)
€ per farm
30000
25000
20000
15000
10000
5000
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Dairy
Livestock
Tillage


Average liability per farm for loan purpose: Land Improvements (2002-2013)
€ per farm
900
800
700
600
500
400
300
200
100
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Dairy
Livestock
Tillage



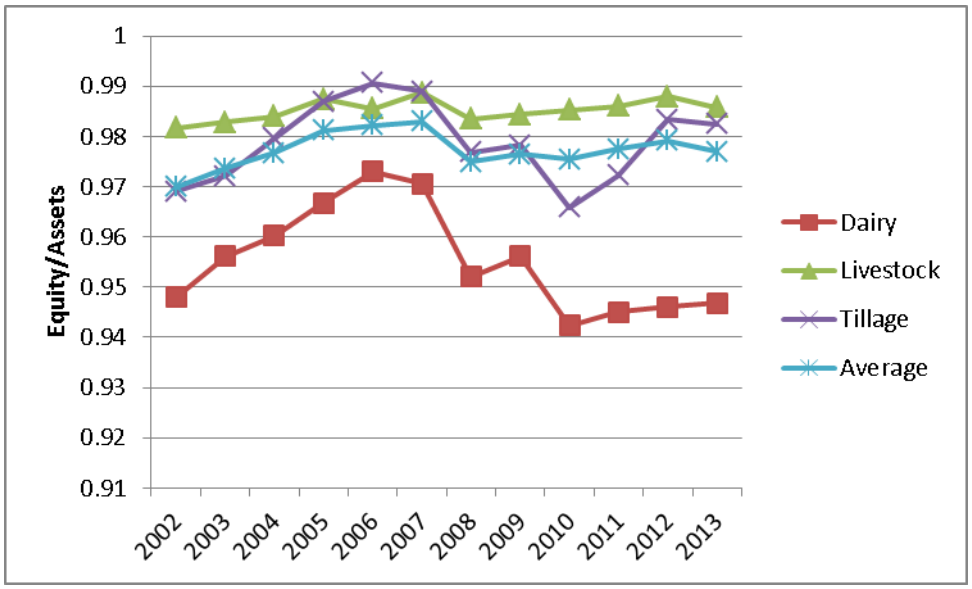


Source: Teagasc National Farm Survey, various years and authors' own estimates

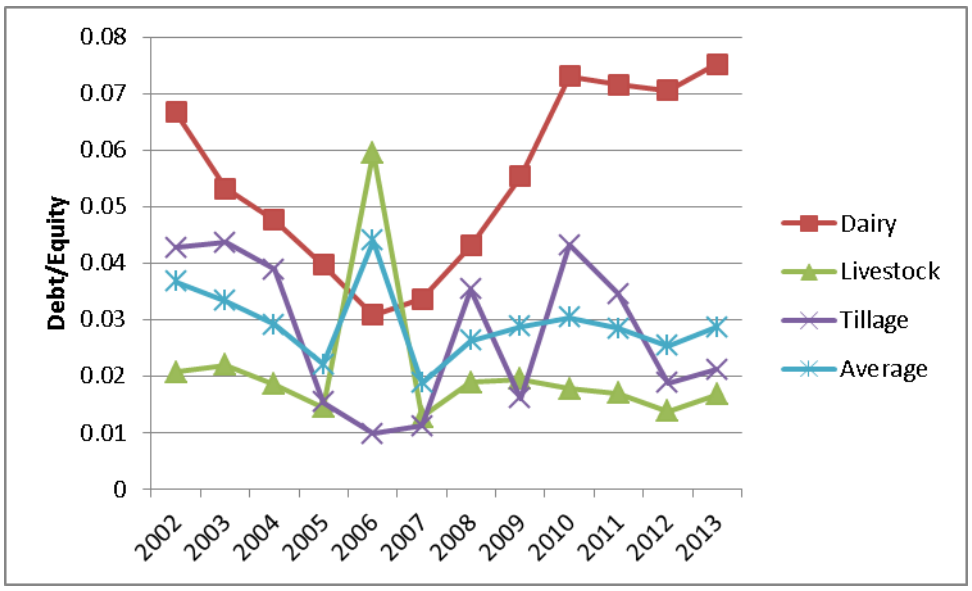
Appendix 2.3 – Solvency Ratios

Average Equity/Asset and Debt/Equity ratios per loan purpose category, by farm system (2002-2013)

Equity / Asset Ratio (2002 – 2013)



Debt / Equity Ratio (2002 – 2013)



Source: Teagasc National Farm Survey, various years and authors' own estimates

Appendix 3.1 – Asset Value by Farm System and By Member State (2012)

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Average Asses Value per farm €							
2012	Belgium	531648	626665	-	669143	626258	554491	899885	825092
2012	Bulgaria	161963	288544	325683	59280	38732	28889	192590	29633
2012	Cyprus	218831	-	105898	108640	-	205851	-	73202
2012	Czech Republic	616102	243895	224711	211595	1388798	401871	1428486	2006512
2012	Denmark	2068239	1379429	-	1367490	3754704	866801	5283379	2199727
2012	Germany	926609	390853	544405	614120	804791	631333	1005960	888609
2012	Greece	110494	117401	92946	107725	-	105213	-	101319
2012	Spain	283130	305273	233272	210378	444494	275986	383764	292955
2012	Estonia	236792	86139	-	-	477699	120548	1007741	159268
2012	France	400053	241934	594522	314051	425294	378022	469564	502915
2012	Hungary	193424	132305	253268	99558	289734	150085	154280	137100
2012	Ireland	1253372	-	-	-	1271406	753372	-	1258116
2012	Italy	412473	410674	350010	236862	1013688	406744	1572644	435869
2012	Lithuania	186671	122047	-	105514	90269	93406	766203	89997
2012	Luxembourg	-	-	835292	-	1252134	1043159	-	1238895
2012	Latvia	207750	254728	-	70664	83080	139269	1348865	82914
2012	Malta	132168	98580	-	-	1071044	148649	596537	169597

Appendix 3.1 – Asset Value by Farm System and By Member State (2012) cont.

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Average Asses Value per farm €							
2012	Netherlands	3081010	1816155	-	1285818	2720904	1231653	1713649	2656886
2012	Austria	387828	-	286415	325500	468524	445765	602095	436137
2012	Poland	171331	130395	-	161608	199388	133007	274184	125273
2012	Portugal	91196	77147	155093	86244	126339	80930	222004	90000
2012	Romania	76706	114339	93678	61671	27378	36558	113727	29120
2012	Finland	310876	615245	-	-	516751	459274	844672	615870
2012	Sweden	1090206	463198	-	-	1175032	521620	1641368	1402277
2012	Slovakia	653610	-	-	-	1640383	544832	-	2215767
2012	Slovenia	155895	-	207305	112310	276629	198431	413254	150756
2012	United Kingdom	2561185	919353	-	1521558	1711794	1207998	1278687	2086146
2012	Total	390102	347867	346187	196667	468837	302322	629675	178405

Source: European Commission, FADN (2013)

Appendix 3.2 – Liabilities by Farm System and By Member State (2012)

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Average Liabilities per farm €							
2012	Belgium	108419	243942	-	185370	187986	126262	331473	225551
2012	Bulgaria	40886	13798	104871	7231	7831	1649	62330	2796
2012	Cyprus	11591	-	10410	3574	-	3928	-	13786
2012	Czech Republic	129828	68548	44423	62293	428742	77293	415525	516078
2012	Denmark	958276	753842	-	652214	2826214	434077	3828245	1163558
2012	Germany	152191	164553	86903	102906	151508	104764	244544	189469
2012	Greece	376	986	8	261	-	608	-	940
2012	Spain	8047	15164	5011	2612	13526	8111	43349	7117
2012	Estonia	53032	11828	-	-	187713	25366	376845	36625
2012	France	151538	139988	185383	143439	182104	122195	284908	211980
2012	Hungary	27066	33932	25784	10083	61529	15057	55033	21687
2012	Ireland	35717	-	-	-	62925	11787	-	20922
2012	Italy	1241	5240	7973	1144	9827	3692	23746	2639
2012	Lithuania	33042	20103	-	24893	10548	8237	220144	9452
2012	Luxembourg	-	-	142684	-	288055	200774	-	303502
2012	Latvia	79294	115175	-	15665	16818	25404	677858	18812
2012	Malta	0	4713	-	-	63392	312	35470	7652
2012	Netherlands	692019	1031925	-	432149	862547	459889	900406	821516

Appendix 3.2 – Liabilities by Farm System and By Member State (2012) cont.

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Average Liabilities Value per farm €							
2012	Austria	32867	-	53919	47840	48447	46648	68428	42502
2012	Poland	13635	17424	-	7302	10958	5272	27299	4719
2012	Portugal	2682	4220	4312	1559	8556	1586	44980	455
2012	Romania	4265	160	3116	411	94	84	9195	30
2012	Finland	51707	378237	-	-	149300	130895	262189	135741
2012	Sweden	276745	174834	-	-	471253	102786	926852	514040
2012	Slovakia	81844	-	-	-	293923	84466	-	258228
2012	Slovenia	5415	-	9812	1908	7748	3071	12681	3869
2012	United Kingdom	216121	212970	-	214181	257126	84152	356283	202309
2012	Total	48250	91146	39379	7505	96670	30379	206021	28346

Source: European Commission, FADN (2013)

Appendix 3.3 – Solvency Levels by Farm System and By Member State (2012)

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Liabilities / Assets							
2012	Belgium	0.20	0.39	-	0.28	0.30	0.23	0.37	0.27
2012	Bulgaria	0.25	0.05	0.32	0.12	0.20	0.06	0.32	0.09
2012	Cyprus	0.05	-	0.10	0.03	-	0.02	-	0.19
2012	Czech Republic	0.21	0.28	0.20	0.29	0.31	0.19	0.29	0.26
2012	Denmark	0.46	0.55	-	0.48	0.75	0.50	0.72	0.53
2012	Germany	0.16	0.42	0.16	0.17	0.19	0.17	0.24	0.21
2012	Greece	0.00	0.01	0.00	0.00	-	0.01	-	0.01
2012	Spain	0.03	0.05	0.02	0.01	0.03	0.03	0.11	0.02
2012	Estonia	0.22	0.14	-	-	0.39	0.21	0.37	0.23
2012	France	0.38	0.58	0.31	0.46	0.43	0.32	0.61	0.42
2012	Hungary	0.14	0.26	0.10	0.10	0.21	0.10	0.36	0.16
2012	Ireland	0.03	-	-	-	0.05	0.02	-	0.02
2012	Italy	0.00	0.01	0.02	0.00	0.01	0.01	0.02	0.01
2012	Lithuania	0.18	0.16	-	0.24	0.12	0.09	0.29	0.11
2012	Luxembourg	-	-	0.17	-	0.23	0.19	-	0.24
2012	Latvia	0.38	0.45	-	0.22	0.20	0.18	0.50	0.23
2012	Malta	-	0.05	-	-	0.06	0.00	0.06	0.05
2012	Netherlands	0.22	0.57	-	0.34	0.32	0.37	0.53	0.31

Appendix 3.3 – Solvency Levels by Farm System and By Member State (2012) cont.

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Liabilities/Assets							
2012	Austria	0.08	-	0.19	0.15	0.10	0.10	0.11	0.10
2012	Poland	0.08	0.13	-	0.05	0.05	0.04	0.10	0.04
2012	Portugal	0.03	0.05	0.03	0.02	0.07	0.02	0.20	0.01
2012	Romania	0.06	0.00	0.03	0.01	0.00	0.00	0.08	0.00
2012	Finland	0.17	0.61	-	-	0.29	0.29	0.31	0.22
2012	Sweden	0.25	0.38	-	-	0.40	0.20	0.56	0.37
2012	Slovakia	0.13	-	-	-	0.18	0.16	-	0.12
2012	Slovenia	0.03	-	0.05	0.02	0.03	0.02	0.03	0.03
2012	United Kingdom	0.08	0.23	-	0.14	0.15	0.07	0.28	0.10
2012	Total	0.12	0.26	0.11	0.04	0.21	0.10	0.33	0.16

Source: European Commission, FADN (2013)

Appendix 3.4 – Liquidity Levels by Farm System and By Member State (2012)

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Times Interest Ratio							
2012	Belgium	18.45	13.22	-	24.43	8.95	8.82	9.15	11.29
2012	Bulgaria	15.86	7.90	3.98	14.10	16.55	72.79	4.79	31.35
2012	Cyprus	24.71	-	80.22	195.45	-	67.67	-	129.13
2012	Czech Republic	20.32	83.51	17.29	19.05	11.70	19.67	37.43	14.16
2012	Denmark	4.73	4.05	-	4.00	1.87	1.48	2.82	2.68
2012	Germany	19.63	11.45	21.20	23.29	13.59	10.93	11.61	12.55
2012	Greece	625.39	735.12	-	963.85	-	702.03	-	306.33
2012	Spain	88.49	62.01	142.72	166.59	68.92	73.40	38.60	101.18
2012	Estonia	25.59	68.46	-	-	11.74	21.18	11.55	26.97
2012	France	24.01	18.71	17.13	21.08	12.63	13.86	10.61	14.78
2012	Hungary	25.25	29.55	44.88	60.84	11.69	43.09	10.77	19.63
2012	Ireland	23.11	-	-	-	21.89	33.21	-	40.37
2012	Italy	319.26	100.74	218.95	277.35	205.33	220.75	245.62	361.15
2012	Lithuania	61.57	66.08	-	16.41	47.70	73.57	33.75	55.10
2012	Luxembourg	-	-	20.18	-	17.20	15.15	-	16.68
2012	Latvia	17.34	8.48	-	33.88	25.74	33.29	5.50	27.48
2012	Malta	-	54.36	-	-	19.40	194.39	3.42	60.25
2012	Netherlands	7.50	5.51	-	7.90	4.00	3.34	4.62	4.51

Appendix 3.4 – Liquidity Levels by Farm System and By Member State (2012) cont.

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Times Interest Ratio							
2012	Austria	57.53	-	21.69	31.42	34.90	22.00	40.19	37.53
2012	Poland	41.07	29.21	-	70.57	44.32	46.31	38.15	57.88
2012	Portugal	319.23	80.50	329.77	381.24	72.15	415.43	13.00	476.92
2012	Romania	69.59	4.16	87.71	371.00	447.82	710.60	25.51	300.29
2012	Finland	16.46	11.13	-	-	19.81	10.98	12.17	15.25
2012	Sweden	5.48	10.52	-	-	4.33	6.40	3.25	3.05
2012	Slovakia	18.18	-	-	-	2.33	6.38	-	5.55
2012	Slovenia	97.94	-	86.84	147.95	71.02	105.03	26.12	82.07
2012	United Kingdom	22.73	28.58	-	8.33	13.99	18.55	11.43	17.22
2012	Total	23.51	13.33	34.79	68.36	11.90	20.70	10.26	17.86

Source: European Commission, FADN (2013)

Appendix 3.5 – Financial Efficiency Levels by Farm System and By Member State (2012)

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Cash Costs / Output							
2012	Belgium	0.52	0.68	-	0.49	0.64	0.68	0.78	0.65
2012	Bulgaria	0.72	0.79	0.72	0.62	0.73	0.56	0.92	0.61
2012	Cyprus	0.67	-	0.55	0.55	-	0.74	-	0.63
2012	Czech Republic	0.75	0.77	0.63	0.69	0.83	0.70	0.92	0.84
2012	Denmark	0.63	0.89	-	0.65	0.89	0.93	0.84	0.82
2012	Germany	0.65	0.80	0.57	0.60	0.71	0.74	0.80	0.78
2012	Greece	0.55	0.51	0.32	0.36	-	0.52	-	0.48
2012	Spain	0.57	0.63	0.40	0.48	0.73	0.63	0.74	0.63
2012	Estonia	0.61	0.64	-	-	0.83	0.65	0.89	0.71
2012	France	0.58	0.77	0.67	0.71	0.68	0.68	0.80	0.67
2012	Hungary	0.64	0.67	0.56	0.57	0.79	0.60	0.88	0.75
2012	Ireland	0.65	-	-	-	0.64	0.60	-	0.60
2012	Italy	0.52	0.58	0.42	0.43	0.57	0.49	0.60	0.51
2012	Lithuania	0.50	0.50	-	0.35	0.56	0.51	0.79	0.64
2012	Luxembourg	-	-	0.59	-	0.61	0.62	-	0.64
2012	Latvia	0.64	0.89	-	0.61	0.72	0.64	0.82	0.69
2012	Malta	0.48	0.59	-	-	0.84	0.76	0.99	0.73
2012	Netherlands	0.59	0.81	-	0.64	0.70	0.80	0.84	0.76

Appendix 3.5 – Financial Efficiency Levels by Farm System and By Member State (2012) cont.

		System of Production							
		Fieldcrops	**Horticulture**	**Wine**	**Other permanent crops**	**Milk**	**Other grazing livestock**	**Granivores**	**Mixed**
		Cash Costs /Output							
2012	Austria	0.50	-	0.52	0.53	0.50	0.51	0.61	0.53
2012	Poland	0.53	0.66	-	0.43	0.52	0.54	0.72	0.62
2012	Portugal	0.55	0.55	0.53	0.41	0.70	0.46	0.88	0.48
2012	Romania	0.57	0.64	0.61	0.44	0.44	0.48	0.53	0.47
2012	Finland	0.65	0.82	-	-	0.67	0.74	0.76	0.71
2012	Sweden	0.76	0.85	-	-	0.84	0.82	0.84	0.86
2012	Slovakia	0.83	-	-	-	0.98	0.95	-	0.96
2012	Slovenia	0.56	-	0.43	0.61	0.64	0.60	0.70	0.68
2012	United Kingdom	0.65	0.86	-	0.84	0.78	0.73	0.82	0.74
2012	Total	0.60	0.73	0.55	0.48	0.69	0.64	0.77	0.69

Source: European Commission, FADN (2013)

Appendix 4.1 – Econometric Specification of Model to Determine the Investment Decision at Farm Level

The investment decision model used is binary, and estimates the probability of each farmer investing in farming activities given the farm and demographic characteristics. It is a binary choice model where the dependent variable investment is equal to one if the farmer invests in farming activities and equals zero otherwise. We assume;

$$E[I = 1|x] = F(x\beta)$$

where F is some normal distribution function bound by the [0,1] interval, i.e. $0 \sim F(x_i\beta) \sim 1$ to satisfy the probability properties. If we assume F to be a probability distribution then equation 1 can be estimated using a Probit model. The Probit model is estimated using the maximum likelihood procedure. Where the effect (β) of a vector of explanatory variables, x, on the probability of investment (I) is estimated. The estimated coefficient corresponding to an explanatory variable measures its influence on the probability of investment. However, coefficient estimates cannot be interpreted directly, therefore marginal effects are presented in Table 4.4. Please refer to Wooldridge (2012) for a more detailed description of Probit models.

Wooldridge, J. (2012). *Introductory Econometrics: A Modern Approach*, 5th Ed. Cengage Learning, US.

Appendix 6.1 - Selected EU Member State Sow Populations (000's)

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2005-13
EU 28	15,591	15,708	15,049	14,050	14,005	13,682	13,255	12,737	12,503	-19.8%
Denmark	1,340	1,414	1,353	1,289	1,346	1,286	1,239	1,229	1,258	-6.1%
Germany	2,504	2,467	2,418	2,296	2,236	2,233	2,194	2,118	2,054	-18.0%
Ireland	175	167	159	151	158	149	146	144	144	-17.4%
Spain	2,593	2,689	2,663	2,542	2,440	2,408	2,404	2,250	2,253	-13.1%
France	1,274	1,264	1,234	1,200	1,185	1,116	1,103	1,076	1,043	-18.1%
Italy	722	772	754	756	746	717	709	621	590	-18.2%
Netherlands	1,100	1,050	1,060	1,025	1,100	1,098	1,106	1,081	1,095	-0.5%
Poland	1,808	1,786	1,587	1,279	1,361	1,328	1,125	1,012	955	-47.2%
UK	505	524	498	487	481	491	484	494	482	-4.5%

Source: Eurostat 2014.

Appendix 6.2 - Assumptions for Increased Sow Herd Output

			CURRENT HERD	*EXPANDED HERD*
NO.SOWS			550	550
NO.GILTS			60	60
NO.BOARS			3	3
NO.PIGS PRODUCED/SOW/YEAR.			25	27.2
AVERAGE WEANING AGE		Days	26	26
AVERAGE WEANING WEIGHT		Kg	7	7
FEED PER SOW PER YEAR		Tonnes	1.35	1.35
CREEP FEED/WEANER		Kg	3.5	3.5
LINK FEED/WEANER		Kg	5.5	5.5
WEANER FEED CONVERSION.			1.92	1.92
WEANER WEIGHT TRANSFER .		Kg	35	35
WEANER WEIGHT AT SALE		Kg	35	35
WEANER AVERAGE DAILY GAIN		g	460	460
FINISHER SALE LIVEWEIGHT		Kg	105	110
KILL OUT		%	76	76
LEAN MEAT		%	54	54
FINISHER FEED CONVERSION			2.8	2.8
FINISHER AVERAGE DAILY GAIN		g	820	820
SOW CULLING RATE PER YEAR		%	45	45
SOW MORTALITY PER YEAR		%	6	6
BOAR REPLACEMNT RATE/YEAR		%	33	33
PURCHASED GILTS SERVED		%	95	95
FEED PRICE	DRY SOW	€/tonne	274	274
	LACTATING SOW	€/tonne	319	319
	CREEP	€/tonne	930	930
	LINK	€/tonne	650	650
	WEANER	€/tonne	360	360
	FINISHER	€/tonne	301	301
COST OF GILTS PER HEAD		€	105	105
COST OF BOARS PER HEAD		€	105	105
HEALTHCARE COSTS PER PIG		€	5.19	5.19
HEAT/POWER/LIGHT PER PIG		€	3.51	3.51
TRANSPORT COST PER PIG		€	1.2	1.2
AI COST PER DOUBLE DOSE		€	16	16
A.I.COSTS PER WEEK		€	457	457
MANURE HANDLING PER YEAR		€	7681	7681
MISCELLANEOUS COSTS/YEAR		€	17556	17556
GROSS ANNUAL LABOUR COSTS		€	127281	127281
REPAIRS+MAINTENANCE/YEAR		€	26334	26334
ADMIN/ACCOUNTANCY PER YEAR			6584	6584
LOAN REPAYMENTS / MONTH		€	7200	11458
AVERAGE INTEREST PAID / MONTH		€	1700	2700

		CURRENT HERD	*EXPANDED HERD*
INSURANCE COSTS/YEAR €	€	8778	8778
BUILDING DEPRECIATION / YEAR	€	0	0
FINISHERS- PIG SALES(W+F)	%	100	100
FINISHER BASE PRICE	c /Kg	150	150
WEANER PRICE/HEAD	€	55	55
CULL SOW PRICE	€	80	80
CULL BOAR PRICE	€	80	80
CULL GILT PRICE	€	80	80

Appendix 6.3 -Financial implication from Increased Sow Herd Output

PERFORMANCE SUMMARY		Current Herd	Expanded Herd
NO PIGS PRODUCED		13750	14960
TOTAL FINISHER LIVEWEIGHT SOLD KG		1443750	1645600
TOTAL FEED USED TONNES		4177.25	4688.95
AVERAGE FEED PRICE PER TONNE €		320.82	320.4
WEANING TO SALE	FCE	2.55	2.56
	ADG g	670	676
	DAYS	146	152
COST PER KG DEADWEIGHT cent			
AVERAGE DEADWEIGHT	Kg	79.8	83.6
FEED	c	122.2	120.1
NON-FEED			
HEALTHCARE		6.5	6.2
HEAT/POWER/LIGHT		4.4	4.2
TRANSPORT		1.5	1.4
A.I.		2.2	1.9
MANURE HANDLING		0.7	0.6
MISCELLANEOUS		1.6	1.4
LABOUR		11.6	10.2
REPAIRS/MAINTENANCE		2.4	2.1
ADMIN / ACCOUNTANCY		0.6	0.5
LOAN REPAYMENTS		7.9	11
LEASE CHARGES		0	0
INTEREST PAID		1.9	2.6
ENVIRONMENT COSTS		0	0
PERS. DRAWINGS/MANAGEMENT		0	0
INSURANCE		0.8	0.7
BUILDING DEPRECIATION		0	0
STOCK DEPRECIATION		0.9	0.8
	TOTAL	35.1	32.7
CASH PAYMENT PER KG DEADWEIGHT		163.2	161.2
(including full bank repayments but excluding building depreciation)			