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Measuring the impact of improved animal health practices on the economic efficiency of Irish dairy farms.

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Abstract

Cost and production efficiency gains must be achieved across herds if the Irish dairy sector is to prosper in a post-quota environment. As such, improvements in animal health are required and the costs of diseases such as mastitis must be reduced. Elevated levels of somatic cell count (SCC) found in milk are an indicator of the prevalence of clinical and subclinical mastitis in dairy herds. Given an EU regulatory limit of 400,000 (cells/mL) (Council Directive 92/46/EEC), the adverse effect of the disease on milk quality and the increasing practice of milk processors offering financial incentives for reduced cell count levels, the benefits of improved farm management practices resulting in lowered SCC are quantified here at the farm-level. Teagasc National Farm Survey data from over 300 nationally representative Irish dairy farms over a four year period (2008-2011) is utilised in the analysis. Preliminary regression results from a pooled OLS model indicate that a cell count reduction of 100,000 (cells/mL) results in an increase in gross margin of 6% or €87 per cow when all other pertinent factors are controlled for. The efficacy of herd management practices such as milk recording in improving animal health was also confirmed within the model. A cell count reduction of 17% was found as a result of milk recording within the herd, when all other variables were taken into account.

Keywords: Animal Health, Dairy Cost and Production Efficiency, Somatic Cell Count.

JEL code: Q1

Introduction

Ireland as a small open economy has benefited enormously from global export trade. Although Ireland is a relatively minor dairy producer in global terms, accounting for less than 1% of world dairy production, the Irish dairy industry has a global reach, with 80% of its dairy produce being exported.[1] As the European Union prepares for milk quota abolition in 2015 Irish agriculture will face increasing competitive challenges; an improvement therefore in the production efficiency and economic performance of Irish farms is vital. Superior animal health has an important role to play in ensuring such improved competiveness, meeting consumer demand and enhancing profitability (McCoy, 2012). Indeed improved animal health practices are of utmost importance to the economy given the value of highly risk sensitive markets such as infant milk formula in which, over the last two decades, Ireland has become one of the world's leading producers, supplying in excess of 15% of the international market.

Animal disease prevention and control has become a key element in the development of competitive livestock production systems and their associated value chains (Schwabenbauer, 2012) with disease at the farm level incurring substantial costs for societies worldwide (Bennett, 2003). Animal health economics provides a framework of concepts, procedures, and data to support the decision making process in optimizing animal health management (Huijps, 2009). Economic gains as a result of improved animal health (specifically with regard to mastitis) on Irish dairy farms are examined here; and are of particular relevance given the ambitious production targets (an increase of 50% by 2020) set out for the Irish dairy sector in the Food Harvest 2020 visionary document (Department of Agriculture, Fisheries and Food, 2010). More specifically, within this research, the key practices for animal health improvement with regard to mastitis in dairy cattle will be outlined and the costs, benefits and ultimate impact on profit quantified.

Elevated levels of somatic cell count (SCC) in milk are an indicator of the prevalence of clinical and subclinical mastitis within the dairy herd. Mastitis is the inflammation of the mammary gland caused by bacterial infection (Huijps, 2009) and remains a particular and costly challenge for the dairy industry. In addition, high levels of SCC adversely affect milk quality and processability.[2] According to European law (EEC 1992, Council Directive 92/46/EEC) SCC is

[1] Exports of Irish dairy products and ingredients were valued at some €2.66 billion in 2011, representing 30% of agri-food exports (Department of Agriculture, Food and the Marine (2012).

[2] The somatic cell count (SCC) is the number of cells present in milk (body cells as distinguished from invading bacterial cells). It is used as one indicator of udder infection. Somatic cells are made up of a combination of white blood cells and epithelial cells. White blood cells enter milk in response to inflammation, which may occur due to disease, or occasionally to injury. Epithelial cells are shed from the lining of the udder tissue. White blood cells make up the majority of the somatic cells, especially when the cell count is raised (Blowey et al. 2010).

required to be within certain thresholds, with a regulatory limit of 400,000 cells/mL. Elevated SCC levels in dairy herds result in reduced casein and fat levels in milk and is not desirable for processors due to a subsequent reduction in shelf life and yield (particularly in the manufacture of cheese). As a result, the value of milk to the dairy industry is a function of its composition and quality and as such the price received by producers is dependent on this. As milk processors increasingly apply incentives and penalties across a range of different milk quality parameters it is of utmost importance to producers to maintain low levels of SCC. Quality premiums offer them a competitive advantage and represent one of the few mechanisms to significantly impact on milk price (O'Brien et. al., 2008). Furthermore production efficiency gains can help insulate against milk price volatility, a particular phenomenon in recent years.

This paper is the first phase of a wider research project addressing four key questions, the first two of which are addressed here. These are:

- What is the cost-benefit of better animal health management?
- What are the key practises that improve animal health and by consequence profit?

The production and cost efficiency gains of reducing SCC levels across Irish farms are explored using Teagasc National Farm Survey (operated as part of the Farm Accountancy Data Network (FADN) of the EU) from 2008 to 2011. The resulting economic gain is quantified and the characteristics and herd management practices of those better performing farms (with lower SCC levels) are also examined. The second phase of the research is further outlined in the concluding section of this paper.

Epidemiology and economics

Animal health is one of the key factors affecting the economic efficiency of dairy herds (Young et. al. 1985, Esselmont 1993) and poor udder health is associated with higher costs of production through higher veterinary costs and higher labour costs (Evans & Berry (2005). As such, the economics of mastitis, the most prevalent production disease across dairy herds worldwide needs to be addressed at the farm level (Seegers, 2003). Mastitis is a costly disease, due to a consequent reduction of output and the additional inputs required to reduce the level of disease. Therefore, to assess the direct economic impact, costs, (i.e. extra resource use) and losses (i.e. reduced revenues) have to be aggregated (Hogeveen et. al., 2011). Published international estimates of the economic loss associated with mastitis range from €61 to €97 per cow, with large differences between farms, e.g. in The Netherlands, losses due to clinical and subclinical mastitis varied between €17 and €198 per cow per year (Hogeveen et. al., 2011). In an Irish context, mastitis cost estimates according to research by Teagasc, amount to €60 per cow for the average milk supplier, €300 for the average herd and €66 million for the dairy industry (O'Brien et. al. 2008).

SCC levels above 200,000 cells/mL are generally accepted as an indicator of the presence of a mastitis infection (International Dairy Federation, 1997). The focus of this paper therefore, in an attempt to quantify the value of reduced mastitis incidence across Irish dairy herds is to examine trends in SCC from 2008, to identify the costs associated with elevated SCC levels and to demonstrate the effect on farm profitability of their reduction. Earlier work by Berry et. al. (2006) found, using Irish processor data, that although SCC levels fell from 1994 to 2000 they began to rise again from 2000 to 2004. Further economic research conducted for Ireland by Geary et. al. (2012) found that as a result of elevated SCC levels (going from 100,000 to 400,000 cells/mL) net farm profit decreased by €19,504, due to milk production losses and culling costs. The authors found, in line with previous international research (including Hogeveen et. al., 2011, Dufour et. al., 2012) that mastitis related losses are often underestimated at the farm level due to reduced milk production, higher rates of culling, increased mortality and lower herd growth potential. Losses due to poorer compositional quality, shelf life and taste of milk resulting in reduced processability have also been previously highlighted by among others (Skrzypek et al 2004, Kelly, 2009, DeVliegher, 2012). Employing a methodology similar to that of Burton (1995) and Colman and Zhuang (2006) this paper examines the cost and production efficiency gains resulting from a reduction in SCC across herds and the consequential impact on profit.

A further element of this research explores the herd management factors associated with reduced SCC levels (and thus reduced prevalence of mastitis). Previous Irish research by Kelly et al. (2009) found an association between low SCC and the use of management practises such as dry cow therapy, participation in milk recording schemes and the use of teat disinfection post-milking. This follows a consistent association between good herd management practices and control of mastitis in the wider literature (Barkema et. al. 1998, 1999, Jansen et. al, 2009, Bytyqi, et. al., 2010 and Dufour et. al. 2010, 2011). The efficacy of such practices will again be assessed within the context of this research. Non-management factors are also of relevance and season of production, herd location and environment have all been previously highlighted as risk factors for subclinical mastitis (Skrzypek et al 2004, Fox, 2009, Sharma, et. al.2011, De Vliegher, 2012). As result these and other factors are also taken account of within the analysis.

Methodology

Monthly data on Irish herd-level SCC is available on an annual basis from 2008 through the Teagasc National Farm Survey. This dataset contains over 300 nationally representative dairy farms each year and is utilised here to examine trends in SCC from 2008 to 2011. Farms are grouped across years by SCC thresholds (cells/mL) of ≤200,000, 200,001–300,000, 300,001–400,000, and >400,000. The return to lowered SCC is measured through production and cost efficiency gains and the characteristics of those better performing herds/farms are subsequently assessed.

A similar approach to that taken by Colman and Zhuang (2006) is followed, whereby farm level cost and production functions were estimated to quantify efficiency in milk production in England and Wales from 1997 to 2003. Productivity was further measured by them using estimated production functions, this is not undertaken here. The basic cost function specification employed is one originally used by Burton (1995) and has the important property of being U-shaped in terms of all major explanatory variables, which are (a) herd size (*cows*), (b) yield per cow (*yield*), and (c) stocking rate on the forage area (*cow/ha*). That is to say there are diseconomies of size for any herd beyond a size, which is specific to each herd depending on its initial herd size, yield and stocking rate (Colman and Zhuang, 2006).

As this work is preliminary in nature a pooled panel data model is employed, it is envisaged that further econometric panel data analysis will be undertaken during the next phase of the research.

Results

Table 1 below displays SCC (‘000 cells/mL) as a proportion of milk produced over the period 2008-2011. Based on weighted monthly deliveries computed for each dairy herd the annual average SCC (cells/mL) has continued to fall since 2009 with the 2011 figure standing at 242,835. Notably, the 2011 data shows an improvement in the proportion of herds (43 per cent) with herd a cell count under 200,000 cells/mL (the level at which the maximum milk price is paid by processors) compared to three years previously (25 per cent). The proportion of herds exceeding the EU regulatory limit (400,000 cells/mL) is also in decline but still stands for 3 percent of national production. The proportion of herds with a cell count below 200,000 cells/mL have continued to grow since 2009 with a reduction in the amount of milk being produced at higher SCC levels.

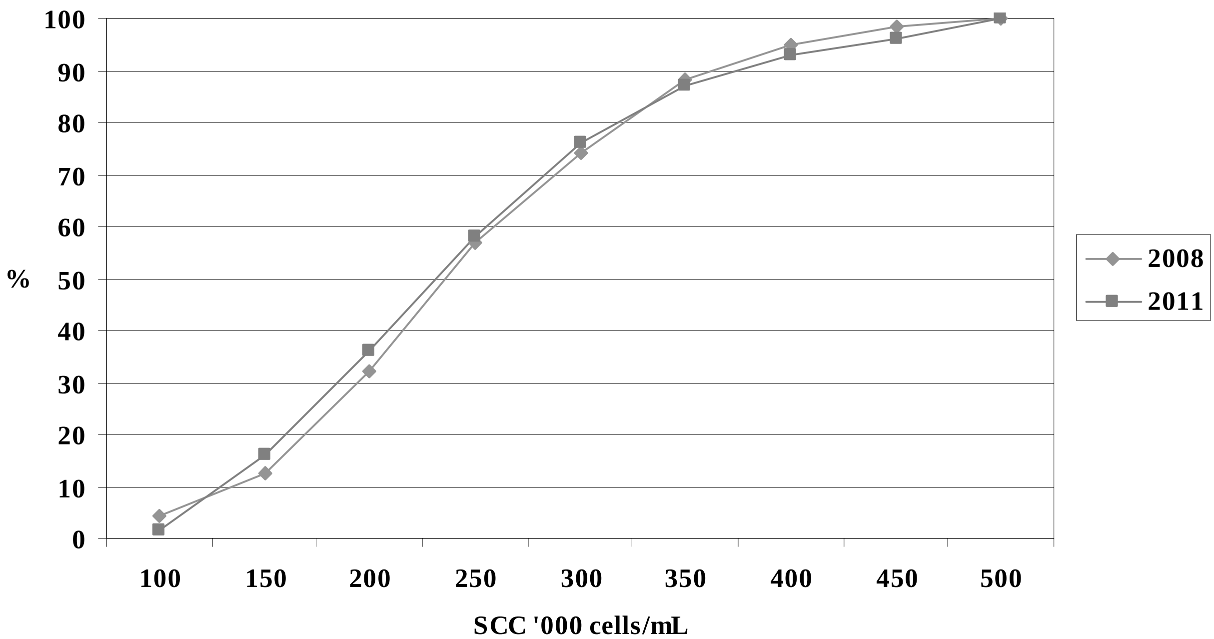
Table 1: SCC ('000 cells/mL) as a proportion of milk produced 2008-2011

	<200	201-300	301-400	>400
2008	36.4%	42.4%	18.0%	3.2%
2009	25.5%	48.5%	21.4%	4.6%
2010	27.4%	43.7%	25.3%	3.6%
2011	43.0%	41.5%	12.5%	3.0%

Analysis using Teagasc National Farm Survey data.

Figure 1 below further presents the distribution of annual average SCC across total milk production in 2011 compared to 2008 and illustrates an increase in the proportion of milk produced with a cell count of 200,000 or below and a decline in the proportion produced with an SCC above the regulatory limit of 400,000 cells/mL. That is to say an improvement is being made overall with a lower share of milk with elevated SCC levels being produced.

Fig. 1: Irish Milk Production (%) across SCC thresholds (2008-2011)



The main objective of this paper is to assess the economic benefits of improved animal health practices in relation to mastitis control. To this end, two key research questions are addressed here. Firstly, what is the economic benefit of reduced SCC at the farm level and secondly what are the characteristics of those herds/farms with lower SCC. The objective of the latter is to gain a better understanding of how farmers improve their animal health performance with a view to encouraging sector wide enhanced performance. Each research question will be dealt with in turn in the following section. The data utilised in the analysis is Teagasc National Farm Survey data from 2008 to 2011. Data is weighted and nationally representative.

What is the economic benefit of reduced SCC?

The economic return due to lower SCC levels in 2011 is illustrated through a number of key indicators in table 2 below. Dairy herds/farms are grouped by SCC threshold with the largest proportion of herds (39%) falling into the 201,000-300,000 grouping. Positively, 75% of herds have an SCC of 300,000 cells/mL or below. Results indicate a clear incentive to keep SCC low as output and margin decrease as SCC increases. The positive impact of reduced SCC on milk yield per cow and milk price is also clear across SCC thresholds.

Table 2: Economic indicators (average values) across SCC thresholds (cells/mL) 2011

	<200,000	**201,000-300,000**	**301,000-400,000**	**> 40,000**	**All Farms**
Number of Farms	6,690	7,307	3,238	1,272	18,507
Percentage	36%	39%	17%	7%	100%
Dairy Gross Output	€137,106	€121,704	€85,782	€54,276	€116,353
Dairy Gross Margin	€91,595	€77,204	€54,969	€31,694	€75,388
Net Margin	€53,130	€40,509	€25,963	€14,585	€40,745
Net Margin per cow	€745	€672	€516	€275	€644
Net Margin cent per litre	0.159	0.143	0.127	0.060	0.141
Milk Yield per cow (litres)	5,376	5,322	4,826	4,306	5,185
Milk Price cent per litre	35.39	35.04	34.97	34.66	35.13

Analysis using Teagasc National Farm Survey data.

Similarly, table 3 below displaying the same indicators over the four year period to 2011 confirm the economic benefit of reduced SCC over a longer timeframe. Again farms/herds are grouped by SCC threshold and output, margin, yield and price all found to decline as SCC rises. Indeed the differential between the indicators is particularly marked for those herds in the lower versus higher thresholds (less than 200,000 and more than 400,000) on average with dairy gross margin for the former standing at €66,394 and the latter at €20,745. A large differential between milk yield and price per litre is also found.

Table 3: Economic indicators (average values) across SCC thresholds (cells/mL) 2008-2011

	< 200,000	201,000-300,000	301,000-400,000	> 400,000	All Farms
Number of farms	21,845	29,507	16,748	6,530	74,630
Percentage	29%	40%	22%	9%	100%
Dairy Gross Output	€103,859	€93,618	€76,699	€39,864	€88,115
Dairy Gross Margin	€66,394	€56,133	€45,432	€20,745	€53,638
Net Margin	€32,963	€24,004	€16,566	€5,023	€23,296
Net Margin per Cow	€518	€392	€301	€86	€382
Net Margin cent per litre	0.1125	0.0897	0.0316	0.0314	0.0782
Milk Yield per cow (litres)	5,176	5,000	4,642	4,021	4,885
Milk Price cent per litre	31.92	30.68	30.25	28.41	0.75

Analysis using Teagasc National Farm Survey data.

Similar to the approach utilised by Colman and Zhuang (2006) in examining cost efficiency in milk production in England and Wales, the cost efficiency gains and ultimate impact on gross margin resultant from a reduction in SCC can be further explored and estimated using the farm survey data available to us. The relationship between for example SCC, milk price, direct costs and gross margin is thus quantified below for illustrative purposes, using 2011 data. Three regression models are estimated where price, direct costs per litre and margin per cow are the dependent variables and the effect of SCC on those variables is estimated in a univariate context. The results are displayed in table 4 below.

Regression results indicate that SCC (measured in thousands of cells) has a significant effect on milk price and explains 1.9% of its variation. The relationship is significant and negative suggesting that a 100,000 (cells/mL) increase in SCC results in a reduction in milk price by 0.2 cent per litre. The relationship between SCC and dairying direct costs per litre is significant and positive indicating that a 100,000 (cells/mL) increase in cell count marginally increases direct cost per litre of milk produced.

Table 4: Relationship between SCC & Milk Price, Direct Costs per Litre & Margin per Cow 2011

Dependent Variable	Milk Price Cent per Litre		Dairy Direct Costs per Litre		Gross Margin per Cow	
	Co-eff	t-Stat	Co-eff	t-Stat	Co-eff	t-Stat
Constant	35.71		0.122		1495.73	
SCC (‘000, cells/mL)	-0.002*	-2.41	6.587E-5*	1.99	-1.233*	-6.45
R^2	0.019		0.013		0.123	
F-Statistic	5.796*		3.976*		41.65*	

n=298 ** significant at the 99% confidence level*

Taking both milk price received and costs incurred into account the relationship between gross margin per cow and SCC is negative and significant with the effect of a 100,000 increase in cell count resulting in a decrease of in gross margin per cow of €123 i.e. resulting in an 8% reduction in gross margin per cow.

Taking other pertinent factors into account the relationship between SCC, gross margin and dairying direct costs per cow are further explored over the period 2008-2011 using pooled ordinary least squares regression.

Relationship between SCC and Gross Margin per Cow

The relationship between gross margin per cow and a number of key explanatory variables is outlined in table 5 below. Regression results indicate that as expected when all other pertinent factors are controlled for a rise in SCC results in a reduction in gross margin. A 100,000 rise in cell count reduces gross margin by €87 per cow. Likewise, as SCC falls from 400,000 to 300,000 gross margin per cow goes from €1,481 to €1,568 all things being equal. The analysis indicates that the degree of specialisation of the farm is also of significance with those systems more specialised in dairying seeing an improvement in gross margin per cow when other factors are held constant. Similarly, a longer grazing period (i.e. more days at grass) is also positively related to gross margin. In addition, a regional effect is apparent from this analysis with those herds located in designated disadvantaged areas likely to experience a reduction in gross margin when all factors are taken into account. On the other hand, gross margin will be higher for those herds located in regions of superior soil quality. Those farmers in contact with an advisory service are also likely to have a higher gross margin per cow, when other variables are controlled for.

Table 5: Impact on Gross Margin per Cow

	B	t	Sig.
(Constant)	699.775	8.981	.000
SCC ('000, cells/mL)	-0.872	-10.188	.000
Dairy specialisation	437.794	7.072	.000
Days at grass	0.331	2.624	.009
Region (Disadvantaged area)	-103.763	-6.595	.000
Good soil	76.954	2.45	.014
Advisory Contact	70.84	3.643	.000
Stocking Rate	-46.779	-2.651	.008
Herd Size	6.146	6.277	.000
Herd Size^2	-0.034	-5.553	.000
Milk Yield per cow	0.06	4.477	.000
Winter forage cost per cow	-0.683	-4.932	.000
Concentrates cost per cow	0.21	6.963	.000
Seasonality (Spring calving)	-0.335	-0.868	.386
Year 2009	-441.364	-20.993	.000
Year 2010	-73.35	-3.625	.000
Year 2011	95.784	4.734	.000

Dependent Variable: Gross_Margin_per_cow

Results from the model indicate economies of scale with regard to herd size. That is to say the coefficients on herd and herd^2 indicate that as herd size increases gross margin per cow increases however the relationship is an inverted U-shape and declines when herd size goes beyond the optimum point. That is to say improvements in gross margin through herd expansion will only occur to a point.

The spring calving variable is a measure of summer milk production and was included in the model as there is an increased incidence of clinical mastitis during the summer months (Skrzypek et al 2004). However, this seasonality variable was found not to be significant here when all of the other variables are included in the analysis. Dummy year variables are included in the model with 2008 the reference year. 2009 and 2010 were not as successful for the dairy industry with recovery evident in 2011.

It should be noted that further analysis using a fixed effects panel model is next envisaged. As a result we might then expect the impact of lowering herd cell count on gross margin and profit to be less as such models allow for the unobserved characteristics of the farmer (i.e. simply that he is a better manager) to be explored. With the pooled panel data model run her more may be attributed to the SCC variable than should perhaps be the case. However the hypothesis remains the same, i.e. the relationship between SCC and gross margin per cow is negative. Efficiency gains can be made at the farm level by a reduction in cell count.

Relationship between SCC and Dairying Direct Costs per Cow

A similar approach is then taken in the examination of dairying direct costs per cow. The relationship between direct costs per cow and a number of key variables is summarised in table 6 below. As with the work of Colman and Zhuang (2006) in estimating an average cost function (pence per litre) for milk production in England and Wales diseconomies of scale with regard to herd size and milk yield per cow are evident here. That is to say the coefficients on herd and $herd^2$ and yield and $yield^2$ indicate that cost savings per cow are made as herd size and milk yield increase however a point is reached whereby this is no longer the case.

Table 6: Impact on Dairying Direct Costs per Cow

	B	**T**	**Sig.**
(Constant)	851.498	9.123	.000
SCC ('000, cells/mL)	.165	2.516	.012
Concentrates cost per cow	1.365	62.467	.000
Pasture cost per cow	1.528	10.136	.000
Winter forage cost per cow	.842	8.133	.000
Herd Size	-4.034	-5.862	.000
Herd Size^2	.021	4.727	.000
Milk Yield per cow	-.169	-4.644	.000
Milk Yield per cow^2	1.785E-5	4.897	.000

Dependent Variable: Dairying Direct Costs per Cow

Average direct cost per cow is specified here as a function of cell count, herd size, milk yield, and feed costs and the impact of a 100,000 reduction in SCC for the average farm results in a relatively small reduction in direct costs of 1.5% or €17 per cow. This model indicates that at the farm level, dairy direct costs per cow can be reduced from €1,273 to €1,257 when SCC falls from 400,000 cells/mL to 300,000 cells/mL when the other variables included in the model are taken account of. As the cost saving would appear quite low further investigation with regard to the inclusion of other explanatory variables is required.

Characteristics of farms with reduced SCC

The categorisation of those farmers with reduced SCC levels is important if the goal of improved animal health across herds is to be achieved. The farm level economic gains have already been outlined, the question remains what types of farmers are achieving these gains and perhaps more importantly, who is not? A first attempt at answering these questions is contained in table 7 below. The model indicates that those farmers participating in milk recording schemes involving the monitoring of milk quality for each cow in the herd and contact with an agricultural advisor are likely to have reduced SCC, other things being equal. Likewise, more specialist diary farmers are likely to have lower SCC levels when other factors are controlled for.

Table 7: Impact of herd management and other factors on SCC

	B	t	Sig
(Constant)	467.92	15.273	0.000
Participate in Milk Recording	-29.994	-5.657	0.000
Advisory Contact	-22.059	-3.42	0.001
Stocking Rate	-124.439	-4.358	0.000
Stocking Rate^2	28.297	4.006	0.000
Dairy specialisation	-39.573	-2.17	0.030
Spring calving	-0.346	-2.814	0.005
Days at grass	-0.135	-3.261	0.001
Herd Size	0.065	0.533	0.594
Region (Disadvantaged area)	8.093	1.548	0.122
Good Soil	14.27	1.348	0.178

Dependent Variable: SCC ('000)

Previous research has highlighted the effectiveness of herd management factors such as milk recording in improving herd health, our model indicates that herd management factors and not for example physical factors such as soil type, region or herd size are significant here and are influential in SCC reduction, when all variables are taken into account. Examining the effectiveness of milk recording, results from the model indicate that its use leads to a 17% reduction in cell count. Controlling for all other variables SCC can be reduced from 175,000 to 145,000 when such recording practices are utilised. If then, herd management practices such as this are proven worthwhile and cost-effective, why do some farmers choose not to adopt such them? The next phase of this research aims to explore this question further. In addition supplementary data (also collected through the national farm survey in 2009) on the utilisation and effectiveness of other herd management practises such as teat disinfection and dry cow therapy will be further examined.

Further questions remain, for example the model indicates that a longer grazing season (days at grass variable) is negatively related to SCC when other variables are controlled for however more investigation is required to elicit the reasoning behind this i.e. whether or not this is because the soil is better or the manager superior. Again, it is anticipated that further econometric analysis using a fixed effects model will provide further explanation on such matters.

Interestingly, within the model contact with an agricultural advisor was one of the key factors affecting SCC level, (i.e. contact with an advisor leads to a reduction of SCC of over 33,000 cells/mL) but a recent survey conducted by Teagasc (representative of almost 17,000 farmers) indicated that 59% of are most likely to take mastitis related advice from a veterinary surgeon first and foremost. Their next point of contact was their co-op milk quality adviser (25%) with only three percent of those surveyed first contacting an advisor or speaking at a dairy discussion group. How best to engage with farmers with the ultimate goal of improved animal health is an area which also needs further examiniation. Interestingly, all of the dairy farmers surveyed encountered mastitis within the herd with the average number of cases being eleven. Further analysis of this data relating to mastitis incidence and treatment will also be undertaken during the next research stage.

Conclusion

Improved animal health and management of milk quality at the herd level will prove progressively more important for the future of the Irish dairy industry post-quota with consumers demanding high quality products in an increasingly competitive market. At the farm level, cost efficiency and productivity gains can be made through the use of improved herd management practices. The sentiment is well put by Stott (2011) who stated that *"…economics is both carrot and stick to improve udder health."*

In a more general sense, animal health improvements have implications far beyond the farm level, increasingly so with regard to the competitiveness and marketability of agricultural output. As such the general objectives of this research are set out below. Initial analysis with regard to the first two objectives has been outlined in this paper. The remaining two objectives will be dealt with during the next phase of the research.

- what is the cost-benefit of better animal health management;
- what are the key practises that improve animal health and by consequence profit;
- are farmers aware of the relevant practises and if so why are they not adopting them;
- and what might help influence farmer behaviour to improve animal health practises.

Following some preliminary analysis of farm-level Irish data the cost-benefit with regard to mastitis related management is apparent with improvements in milk yield, cost reduction and gross margin found over the four year period for which data is available (2008 to 2011). Regression results from a pooled OLS panel model indicate that gross margin per cow improves by 6% or €87 when SCC is reduced by 100,000 (cells/mL) and other variables are controlled for.

The categorisation of those better performing farmers is important if the goal of improved animal health across herds is to be achieved. In line with previous research, the effectiveness of herd management practices such as milk recording has been confirmed with results indicating that its use reduces SCC by 17% when all other pertinent factors are controlled for. Our model indicates that herd management factors and not for example physical factors such as soil type, region or herd size are significant in reducing cell count when all variables are taken into account. Further analysis will next be undertaken using a fixed effects panel data model which should prove more insightful for our purposes.

The next stage of this research will explore why some farmers are reluctant to adopt certain herd management practices despite them being proven as both effective and cost efficient. Furthermore, how farmer attitudes and behaviours towards such practices can be modified will be explored. If the longer-term goal of improved animal health is to be achieved the widespread adoption of such practices and a change in mindset (where necessary) is vital.

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