April 2023

Engaging Nature for Business

Nethergill associates

www.nethergillassociates.co.uk

CONTENTS

1 - Executive summary

The principal focus of this study was to examine the factors affecting profitability for a group of farms in Wales and to identify ways in which that profitability might be improved whilst also encompassing improved environmental sustainability of the holding.

A central feature of the work was to establish for each farm its point of *maximum sustainable output (MSO). MSO* is the point at which profitability is maximised within the natural confines of the resources available on the holding, thus enabling space for improved environmental sustainability of the holding.

The level of profitability exhibited by all the farms in our analysis, and all the farms on a database of 120 farms in England and Wales, was dominated by three principal factors:

- The burden of its particular level of *corrective variable costs (CVCs)*
- The burden of its particular level of fixed costs
- The level of support payments received

Some key findings from this study of Welsh farms include:

- Farm profits is critically affected by its level of fixed costs. **Almost no farms are profitable before support payments if fixed costs exceed 40% of farm output**. Fixed costs ranged between 39.95% and 131.62% of farm output.
- ***CVCs* also drive down profitability on a farm**. These ranged from 17.86% of farm output to 83.54% by value.
- **Beyond the *MSO* point, when *CVCs* begin to be incurred, variable costs increase at a faster rate than revenues.** This is the reason why many farms become increasingly more unprofitable as the additional cost of *CVCs* needed to deliver an extra £1 of revenue increase. In the study farms this ranged from £2.15 per £ revenue to £13.63 per £ revenue.
- In the farm businesses that were analysed, a move to *MSO* levels of output would result in an average reduction in revenues of 12% - however, this would have been accompanied by an **increase of 42% in farm profitability.** This is because of a **greater focus on *margins* rather than maximising output volume.**

The concept of *MSO* rests on the discovery that variable costs in farming comprise two separate components; *productive variable costs* (*PVCs*), which are those associated with **working with nature**, and *corrective variable costs* (*CVCs*), which are those associated with **substituting for nature** when natural resources have been exhausted (or are unavailable). The consequence of this reality is that profitability is maximised at a different specific point on every farm, and that in most cases it occurs at output levels below those currently delivered. This specific point is *MSO* but it can vary year on year, so is not a permanent fixed point. In most cases profit will increase if overall production is aligned to a sustainable level that takes advantage of the natural productive carrying capacity of the land, and opposes the mainstream notion that intensification is the only way to improve farm business performance. Profitability is maximised at the *MSO* point but this point can only be reached when all *CVCs* are eliminated. It's important to note here that not all inputs are *CVCs*. For example, lime is a *PVC*, as it is part of historical management of the land, as is manure. But if manure is bought in, the transport costs of this are a *CVC*. It is the absence of *CVCs* at the *MSO* point that makes it possible to assert that nature at *MSO* is considerably less compromised as more natural processes are able to occur.

The phenomenon of non-linear variable costs in farming contrasts with wider industry where, invariably, its variable costs have a simpler linear relationship to output (Exhibit 1). Farming throughout Britain struggles to be profitable in a fully commercial sense. In an examination of over 120 British farms, by Nethergill Associates, it was found that 18% did not cover variable costs and only 20% were able to cover fixed and variable costs on revenues generated before support payments were added. This is indicative of a fundamental commercial crisis in the sector. With average farm sizes in Wales (at 46 Ha) smaller than the corresponding averages in England this underlying pattern of profitability is unlikely to be any better in Wales. While the farms selected for this study were all better performers than the norm they would not comprise a statistically significant sample.

Additionally, farming in Britain faces three other major challenges to its economic viability. Firstly, industrialised farming practices, based on the extensive use of fertilisers, pesticides, and herbicides, has degraded soil fertility and, in some cases, to dangerously low levels. Secondly, the nature and climate crises are focussing public attention on the farming sector and its associated environmental impacts, but in reality the sector has a huge opportunity to help address these issues. And, finally, there will be significant changes to the regime of support payments available from the Welsh Government as new domestic food and farming policies replace the European Union's Common Agricultural Policy .

This report addresses these challenges directly. The application of the principles behind *MSO* will not only improve profitability but will additionally reduce or even eliminate the negative effects caused by chemical additives and simultaneously reduce some of the impact of farming on climate change, habitat fragmentation and biodiversity loss. Additionally, an analytic understanding of the elements driving profitability in a farm business will provide a sharper perspective on the issues of *value-for-the-taxpayer* in the design of support payment schemes.

It is important to highlight that some of the information within this report refers to technical business and economics based terminology. This terminology is a critical aspect of the *MSO* concept and adapting to this as a business model. However, if this is the first time this terminology has been observed or you currently have limited understanding, more information can be sought through Nethergill Associates and organisations supportive of the *MSO* concept. There is also a glossary at the end of this report which contains further description of the text included as *italics* throughout the report.

2 - Introduction

Corrective Variable Costs

Corrective variable costs (CVCs) comprise items such as fertilisers, herbicides, pesticides, and over-prescribed veterinary pharmaceuticals. Farming has adopted the use of such items in the cause of ever-increasing outputs. However, these very items are, at the same time, major causes of unprofitability and serious despoilers of the natural environment. Whilst fertilisers for example, do provide nutrients over and above those available naturally, they offer a short term solution that comes at cost to the farmer and society.

All artificial additives are energy intensive and the energy consumption in manufacture comes at a real market cost. Only a small part of this energy will end up in food products and food prices are unlikely ever to recover the cost of the original energy content in artificial additives. For example, for every calorie of food that is produced in the United States, 10 calories of fossil fuel energy are put into the system to grow that food[1]. The use of such additives can certainly boost output but only at decreasing levels of profitability. Moreover, these artificial inputs disrupt natural processes, such as the exchange of nutrients between plant roots and soil microbes, meaning that crops become increasingly reliant on them. We have seen a dramatic increase in the price of inputs, particularly nitrogen fertilisers; however many farm businesses are forced to accept this because the typical farming system has become so dependent on external inputs. It is a vicious cycle which puts farmers at the mercy of external markets that are beyond their control.

Nethergill Associates have defined the *MSO* point on a farm as the situation when all the output resources of its natural capital are used primarily to produce food without depleting its stock of natural capital. The *MSO* point is also, simultaneously, the position of maximum profitability and the position of enhancing the sustainable management of natural resources. Reducing the reliance on *CVCs* is central to this.

Working at MSO levels of output, achieved through a programme to significantly reduce CVCs, is the best stratagem available to improve profitability on farms. When a farm can deliver whole site economical and environmental sustainability by eliminating outside inputs it will lead to an increase in farm profits. Some farms will remain unprofitable due to farm gate prices and this will require those farms to utilise public support and/or diversification where in many cases farms will have the ability to deliver wider societal and environmental benefits (e.g. flood mitigation, carbon storage, habitat) alongside the production of food at an MSO level.

Fixed Costs

The burden of *fixed costs* in farming exerts a very high leverage on profitability. Few farms are profitable when fixed costs exceed 40% of pre-support revenues. On the study farms fixed costs were an average of 72% of pre-support revenues.

Farms tend to be small business units and often lack the scale to recover fixed costs effectively. Farms under 500 Ha are particularly disadvantaged in this regard. Scale in farming can only come from increased levels of aggregation into larger units and this would have significant social consequences. Industrial-type solutions to the recovery of fixed costs would rely on increasing output volumes

[1] https://michaelpollan.com/articles-archive/how-to-feed-the-world/

through expansion but this approach is not sustainable for farm businesses; profitability will reduce when operating beyond the *MSO* point.

Farming is a capital-intensive business in terms of land and machinery. However, expensive machinery can only be cost-effective when it is capable of high levels of utilisation and the seasonal nature of farming essentially prevents this from happening (at least to the minimum levels that prevail in industry). In many places this situation has been exacerbated by the practice of purchasing machinery simply to offset a tax liability.

Reducing fixed costs aggressively will exert a high leverage on profits improvement.

A report by Hybu Cig Cymru/ Meat Promotion Wales on Red Meat Benchmarking draws similar conclusions and considerations. The report challenges the notion that as a business grows, financial performance will also increase due to economies of scale. It highlighted that the ability to keep costs down is universal amongst the financially top third performing enterprises. This key component of business success is true for all farm types and enterprises as top third performers have much lower variable and overhead costs than both the average and lower performing enterprises. The results highlight that farm businesses should fully evaluate their finances carefully before deciding to increase the size of their flocks or suckler cow herds[2].

Support Payments

Profitability in farming is almost entirely dependent upon *support payments*. Only one of the nine farms analysed delivered a contribution to profits after covering both its fixed and variable costs before support payments. The level of support at the study farms varied greatly but was equivalent, on average, to 28% of farm output values. This is low in comparison to an average of 55% experienced by the 120 farms that comprise previous Nethergill Associates studies.

The Welsh Government has proposed changes to the nature and structure of support payments through the Agriculture (Wales) Bill and the proposed Sustainable Farming Scheme. It is positive to see the proposed SFS state the need for farmers in Wales to manage and optimise farm performance through measuring and monitoring and further states "We believe encouraging farmers to adopt basic benchmarking using simple Key Performance Indicators (KPIs) could lead to a step change in farm performance, increasing a farms' ability to adapt to change and improve their impact on the environment…give farmers a starting point to understand how their business is performing, allowing them to drill down further if they want to and go on to improve their performance." Farmers ability to fulfil this action links strongly to the evidence laid out within the *MSO* concept; farming to within the natural carrying capacity of the land. We would implore the Welsh Government to use the SFS as a means for farmers in Wales to gather the benefits of working toward and at *MSO*. This will be an opportunity to revisit the objectives of support payment schemes.

It is often argued that support payments of some kind will be required if the true costs of food production are not to be passed on to the consumer. We know that for every £1 we spend at the checkout, we spend another £1 in hidden ways. These costs are not paid for by the food and farming businesses that cause them, nor are they included in the retail price of food. Instead, they are being

[2] https://meatpromotion.wales/images/general/Meat_Wales_-_Red_Meat_Benchmarking_-_Summary_ENG_WEB.pdf

passed on to the public through taxation, lost income due to ill health, and the price of mitigating and adapting to climate change and environmental degradation[3]. Two intrinsically linked objectives would seem to be essential; to reward practices that are deemed to be good for society, animal welfare, and the environment in general, and to cover the profitability gap for farms that are delivering these practices.

Balancing the perceived benefits from food production and farm profitability against a better environment is likely to be the principal future challenge for domestic support schemes.

More contentiously, a case could be made that support payment schemes in the future might preclude, or seriously reduce, payments over time, to farms that fail to cover variable costs before support payments (on the grounds that these businesses are intrinsically un-viable and drain cash from the economy). The same case could be argued for farms that significantly under-produce in relation to its *MSO*, citing greater gains for environmental outcomes and these farms can be a valuable public good resource, alongside producing food.

Linking support payments to encourage farms to operate at MSO levels of output would maximise farm profitability and optimise food outputs within essential constraints to protect the environment. However, some farms may wish to enable public goods through working below MSO and receive public support to provide their gap in income.

Working toward MSO

For most farms in Wales, working at *MSO* levels will mean reductions (short term in some instances) in activity and food output volumes. However, the wider Nethergill Associates database of 120 farms show that working at *MSO* levels will improve profitability on farms and this will be beneficial for the national economy . In the farm businesses that were analysed, a move to *MSO* levels of output would result in an average reduction in revenues of 12% - however, this would have been accompanied by an **increase of 42% in farm profitability.** This is because of a greater focus on *margins* rather than maximising output volume (Chart 7).

However, anecdotal evidence suggests there's now every reason to believe that as *CVCs* are cut, the fertility of the soil starts to increase again. This is because under normal conditions, there exists a symbiotic relationship between plant roots and soil microbes. This symbiotic relationship is based on nutrient exchange, where soil bacterial and fungal species find shelter inside the roots and get access to the sugars from photosynthesis, in exchange for providing nutrients and other services to the plant. This symbiotic process, known as root exudation, is disrupted if the plant receives nutrients from an external source (e.g. artificial fertiliser). This means that the plant is no longer reliant on the soil microbes for its nitrogen - so when a farmer then completely ceases to use artificial fertilisers, there is often a significant immediate reduction in grass/ crop yields. This is often described as land going into cold turkey. This is because it takes time for the natural processes in the soil to recover – it doesn't happen overnight. This reflects the effect that increased levels of artificial additives seem to be required year on year to maintain existing levels of output. However as soil fertility increases, yield increases as well, and over periods of three to six years output levels may well be restored to former levels.

[3] https://sustainablefoodtrust.org/our-work/true-cost-accounting/

Changing the whole farm system and completely eliminating *CVCs* overnight can be overwhelming and difficult, therefore we would encourage a transitional approach, over three to five years, to reducing reliance on inputs. An alternative approach is to introduce changes to a designated area of the farm, so that lessons are learned and experience gained.

Adopting MSO practices may initially reduce food production, but farm viability would be transformed immediately with the very real prospect of future MSO levels expanding to recover the lost production volumes. This stratagem would have considerable benefits to nature and patterns of biodiversity. This is because adopting MSO results in more space for nature and reducing CVCs halts the degradation of natural resources on the farm. In turn this helps to restore and maintain ecosystem resilience, which is not only good for nature but is required to produce food sustainably now and into the future[4].

3 - The MSO Concept

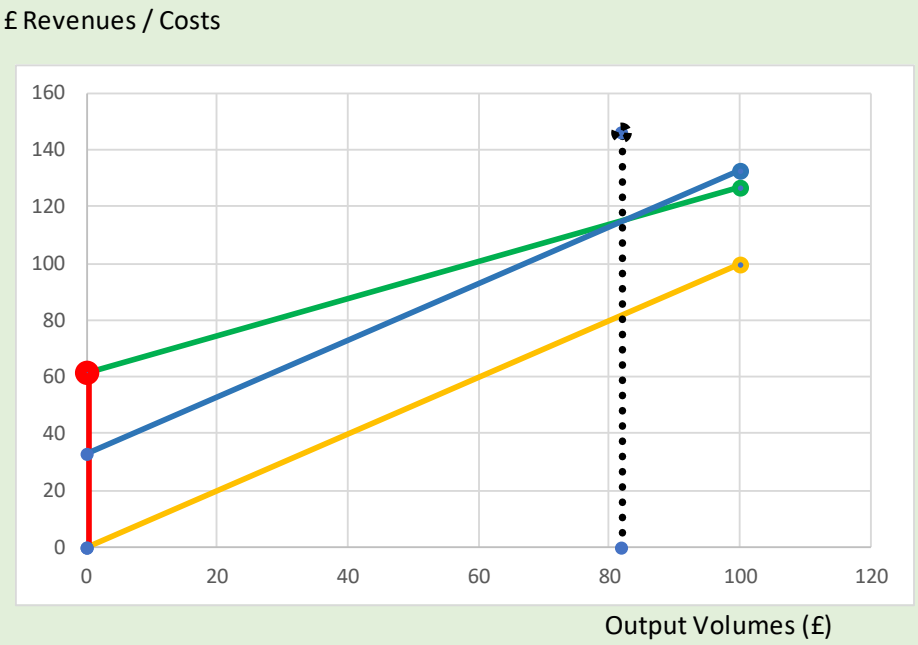
Maximum Sustainable Output (MSO)

Most simple business analyses are based on the *Standard Economic Model of The Firm*. The model has served other industries well and has been applied to farm businesses for some time. Exhibit 1 sets out the performance details of an actual farm (with the values indexed to preserve anonymity) and the application of the standard model. All data is indexed to 100 and in effect, these numbers illustrated in the exhibits and charts below, are percentages.

[4] United_Kingdom_Food_Security_Report_2021_19may2022.pdf (publishing.service.gov.uk)

Exhibit 1

The Standard Economic Model of The Firm



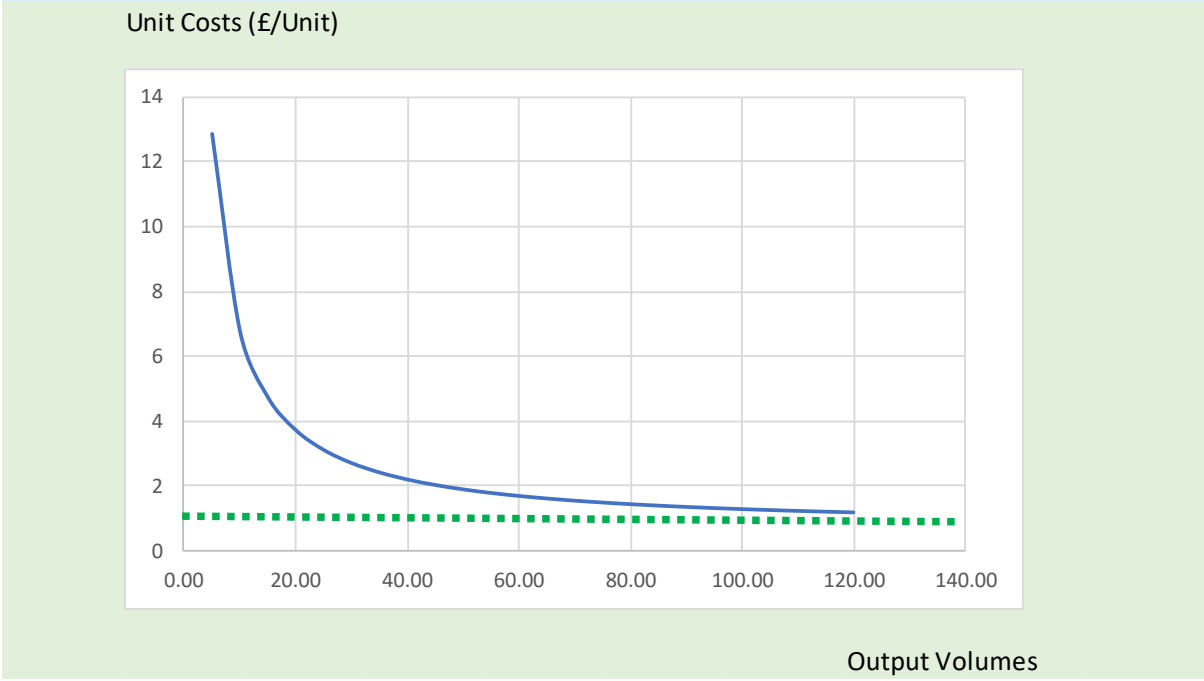
Data:		
	Revenues pre-Support	100
	Revenues post-Support	133
	Fixed Costs	61
	Variable Costs	66
	Break-even Point	82

On this model, which has been applied to one of the Welsh study farms, its *break-even point* is passed when output volumes exceed 82 and profits grow slowly thereafter. This model would suggest that at an output of 179 the farm will break-even on pre-support revenues. Its essential message is that, provided revenues grow faster than total variable costs, profitability is only a matter of expansion.

In industry, expansion of this form delivers more competitive unit costs, too. For a business with the financial characteristics of the farm in Exhibit 1 the unit cost behaviour is shown in Exhibit 2.

Exhibit 2

Unit Costs on the Standard Model



Unfortunately, the realities of farming invalidate the standard model in this form. The reason is that variable costs comprise two independent factors.

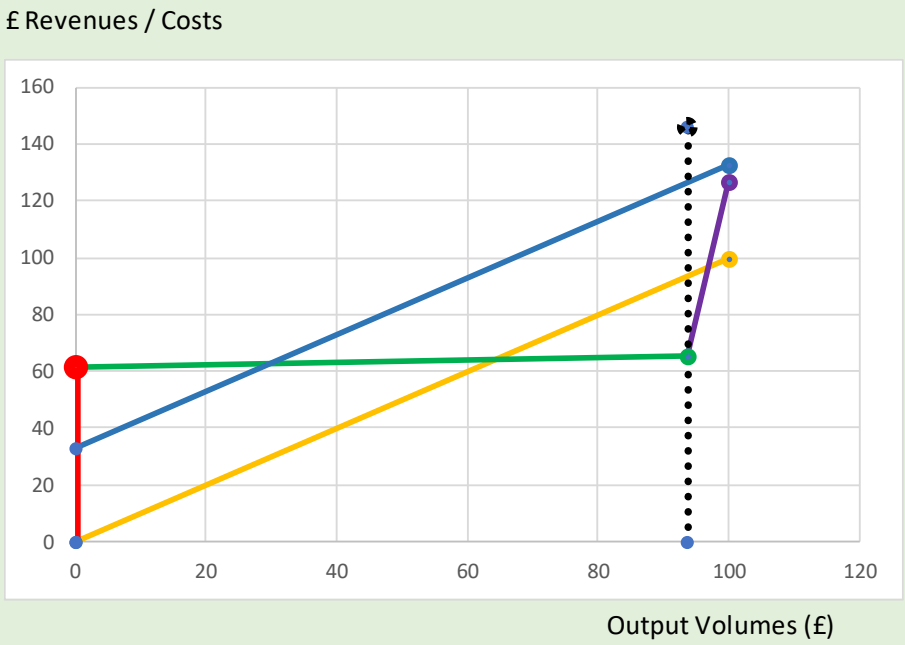
An important source of energy for farming is climate related. Energy from the sun, which is available on what industry would term as a "free-issue" basis, from the Solar Constant which is 1.38kWh per square metre, drives plant growth. With the right soils and adequate rainfall good quality grasses will grow, for example. However, there will be a physical limit on the quantity of grass that will become available for farming. Variable costs associated with managing natural resources in this way are the *PVCs*. These costs reflect **working with nature.**

At the point when the "grass runs out" a farmer has a choice. The farm business can live with these limitations or could seek to substitute for the absence of natural resources. From the early twentieth century farmers have had unrestricted access to industrial fertilisers, herbicides, and excessive veterinary pharmaceuticals. This new access coincided with the pressures to survive two world wars when governments promoted a policy of "output at any cost". Additionally, industry has produced concentrates as feed substitute for livestock so as to maintain high stock levels during winter months when natural feedstocks might be unavailable. The work associated with managing these activities are the *CVCs*. These costs reflect **substituting for nature**. The purchases of fertilisers and concentrates contain significant industrial energy costs and little of the energy content in these purchases will end up as usable energy in food products. This is a fundamental problem associated with industrial farming.

In summary, *PVCs* are incurred up to the point where natural resources are exhausted and *CVCs* are incurred thereafter. The consequence is a modified standard model for farming and this is illustrated in Exhibit 3 for the same farm business as in Exhibit 1.

Exhibit 3

The MSO Model for The Farm



Data:		
	Revenues pre-Support	100
	Revenues post-Support	133
	Fixed Costs	61
	Productive Variable Costs (PVCs)	6
	Corrective Variable Costs (CVCs)	61
	MSO Point	94

The point at which *PVCs* end and *CVCs* begin (the inflexion point in the variable costs equation) is the point of *MSO*. The farm businesses illustrated in Exhibits 1 and 3 end up at the same point but the pathways are vitally different. This has a dramatic impact.
The model in Exhibit 3 suggests that:

- There is a break-even point at an output of 32 on *post-support revenues* (82 on the standard model)
- There is a break-even point at an output of 65 on *pre-support revenues* (179 on the standard model)
- The *MSO* point is at an output of 94 (where profits are maximised)
- There is a *break-back point* on pre-support revenues at an output of 97

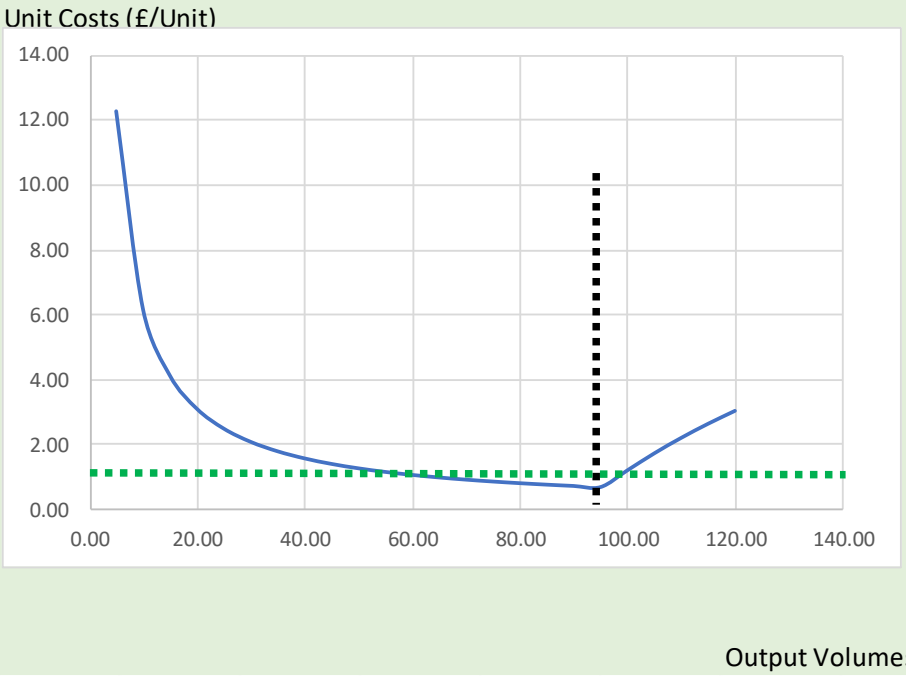
In summary, what happens beyond an output of 100 is very different as projected by the two models. The standard model, as illustrated in exhibit 1, projects growing profits and the *MSO* model the very opposite, as illustrated in exhibit 3. At an output of 100 the profit after support payments is just 5. However, at an output of 94 (*MSO*), and in the absence of *CVCs*, the profits were 27.

This means that for a reduction of 6% in output, and the elimination of all CVCs, profits will improve by 22%. This pattern is common to all farms analysed using the MSO model.

When the MSO model is adopted the profile of unit costs is very different to the unit costs on the Standard Model (Exhibit 2). This is shown in Exhibit 4 which translates the performance pattern of the farm in Exhibit 3.

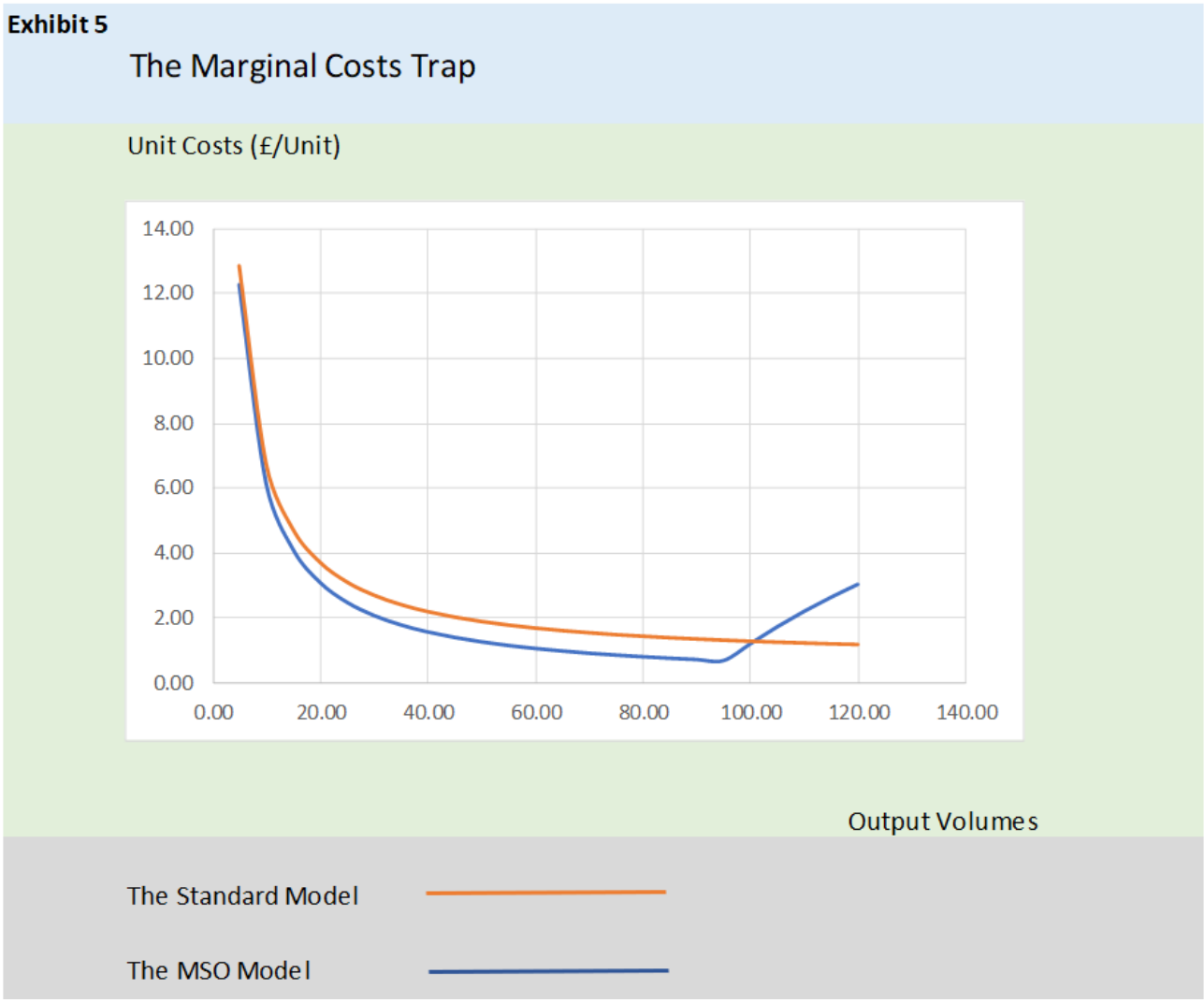
Exhibit 4

The Impact of MSO on Unit Costs



Unit costs now decline in a conventional manner to the MSO point and "kick-up" thereafter.
Unit costs lie behind the concept of *marginal costing* – a persistent favourite of economists. Comparing unit costs to unit prices at a given point of output will indicate the prospects for profits. However, making reference to the right profile is essential. Exhibit 5 compares the unit cost profiles delivered by the *standard model* with that delivered by the MSO model. The profiles offer diametrically opposed analyses. The standard model, by combining the underlying PVC and CVC components into a single parameter, cannot predict the total costs involved when one more unit is produced, whereas the *MSO* model can, as it predicts values at all points because it reflects the realities of splitting variable costs into their *PVC* and *CVC* components. . The standard model will only be accurate at one point in the business (in this case at an output of 100 – as indicated by the point at which the two curves coincide in Exhibit 5). This is the marginal costs trap inherent in the standard model when the variable costs profiles are split in two, or non-linear.

Exhibit 5



4 – The Results of the Study

The Study Farms

There were nine farms in the study group. This group is too small to be statistically significant. However, its diversity means it can play an indicative role when bench-marked against a larger database. For this study reference was made to a database of over 120 farm performance analyses. Appendix B outlines the methodology of the Nethergill Associates models and the accounting terms used.

In summary:

- The size of the farms ranged from 52Ha to 404Ha
- Elevations ranged from 50 m to 450 m
- Precipitation ranged from 1,000 mm pa to 2,000 mm pa
- Four farms were classified as upland mixed
- Three farms were lowland, with two mixed and the other sheep-only
- Two farms were dairy
- Four farms were tenanted
- Five farms were freehold with two also renting properties
- The tenanted farms had an average of £337,000 in assets employed in the business

- The freehold farms had an average of £1,997,000 in assets employed
- Four farms were in Mid-Wales (Ceredigion, Carmarthen, and Powys)
- Three farms were in lowland South-East Wales
- Two farms were in North Wales (Gwynedd and Clwyd)

Patterns of Profitability

Farm profits is critically affected by its level of fixed costs. Almost no farms are profitable before support payments if fixed costs exceed 40% of farm output.

On the Welsh case study farms, fixed costs ranged between 39.95% and 131.62% of farm output. The low ratio was returned by a dairy farm (with a *flying herd regime*) and the high ratio was returned by the farm undergoing restructuring. With these cases removed, fixed costs ranged between 58.99% and 129.17%. This compares with 65%+ on the database at Nethergill Associates, but it's entirely due to the small sample size of the Welsh study farms and the smaller average Welsh farm size.

CVCs also drive down profitability on a farm. These ranged from 17.86% of farm output to 83.54% by value. The low figure was returned by an organic farm and the high figure was returned by a farm with one of the highest elevations. CVCs have a negative leverage on overall profitability.

All nine farms were able to make a *positive 1st contribution* (revenue before support minus variable costs). On the database held at Nethergill Associates, comprising over 120 farms in England and Wales, 18% fail at this point.

However, only one farm (a dairy farm) made a *positive 2nd contribution* (revenue before support minus fixed and variable costs). Eight of the nine farms did make a *positive 3rd contribution* (revenue after support minus fixed and variable costs). Margins at this level ranged from -43% to 48% (average 12.62%) but it should be noted that the only farm to make a loss at this level was in the midst of a major restructuring programme. On the database held at Nethergill Associates only 80% of farms would be profitable (at the level of 3rd contribution).

- 1st Contribution = (Pre-support Revenues) – (all variable costs)
- 2nd Contribution = 1st Contribution – (Fixed Costs)
- 3rd contribution = 2nd Contribution + (Support Revenues)

Support payment as a % of farm output value ranged from 3.34% to 143.92% (average 28.4%). These support payments are critical to profitability. The dairy farms were awarded very much lower levels of support compared to the other farms.

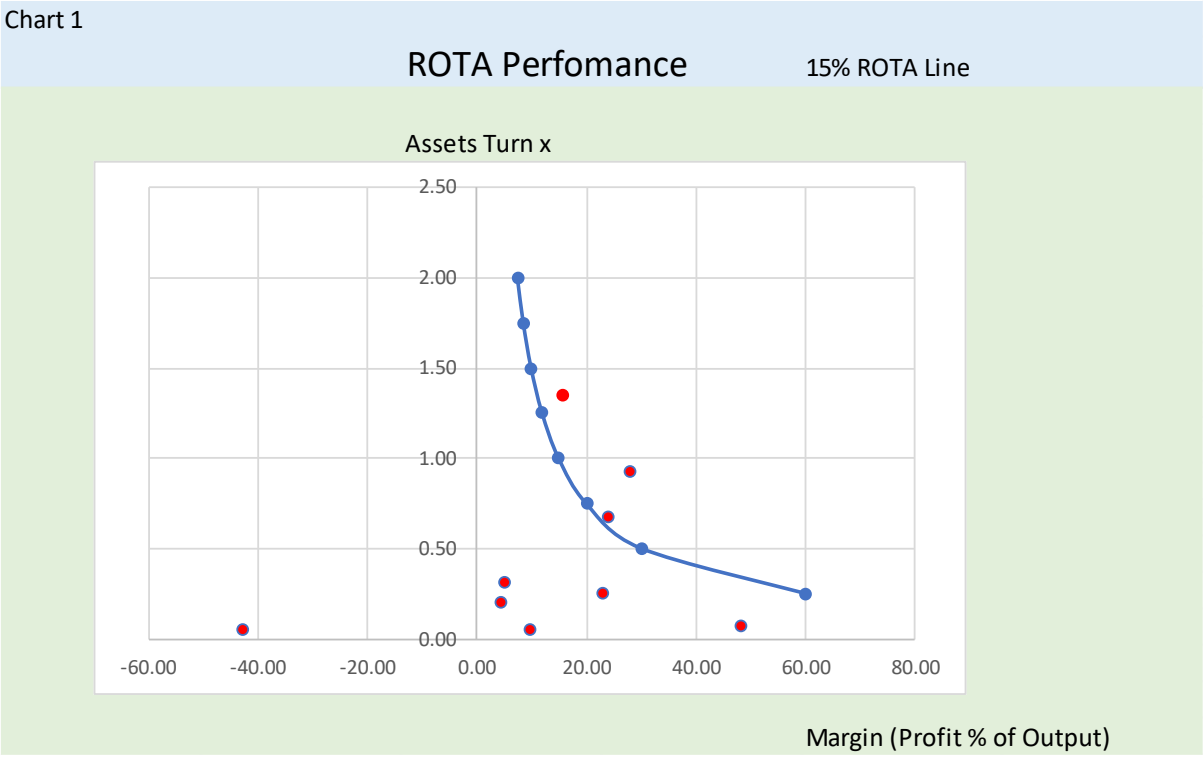
ROTA

The parameter *ROTA (return on total assets employed)*[5] is equivalent to a return on bank deposits (interest) and provides a means of comparison for different types of business. If interest rates at a building

[5] Money has two complementary characteristics. It has "amount" (in the form of a quantified value) and it has "term" (in the form of the limited time period it retains its value for its owner before it is exchanged in transactions). Amounts are accounted for on the profits & loss account and the term aspect is accounted for on the balance sheet.

society are 5% (and represent no risk) it would be reasonable to expect a business to better this return so as to compensate for the risks involved. If this *risk premium*[6] was valued at 10%, then a business should target a 15% ROTA as an objective. Three of the nine farms passed this test after support payments. The pattern of performance for all the farms is set out in Chart 1.

Chart 1



To improve ROTA performances farms will need to address:

1. *Margin improvements (Profit/Sales)* – through actions on the P&L account
2. *Assets turn (Sales/Assets employed)* – through actions on the balance sheet
3. NB: ROTA = Margins x Assets turn

In farming the bigger challenge will always be assets turn as farming, even for tenants, is assets intensive. Chart 1 exhibits a wide range of performances which is mostly indicative of the different business management skills of the respective farmers.

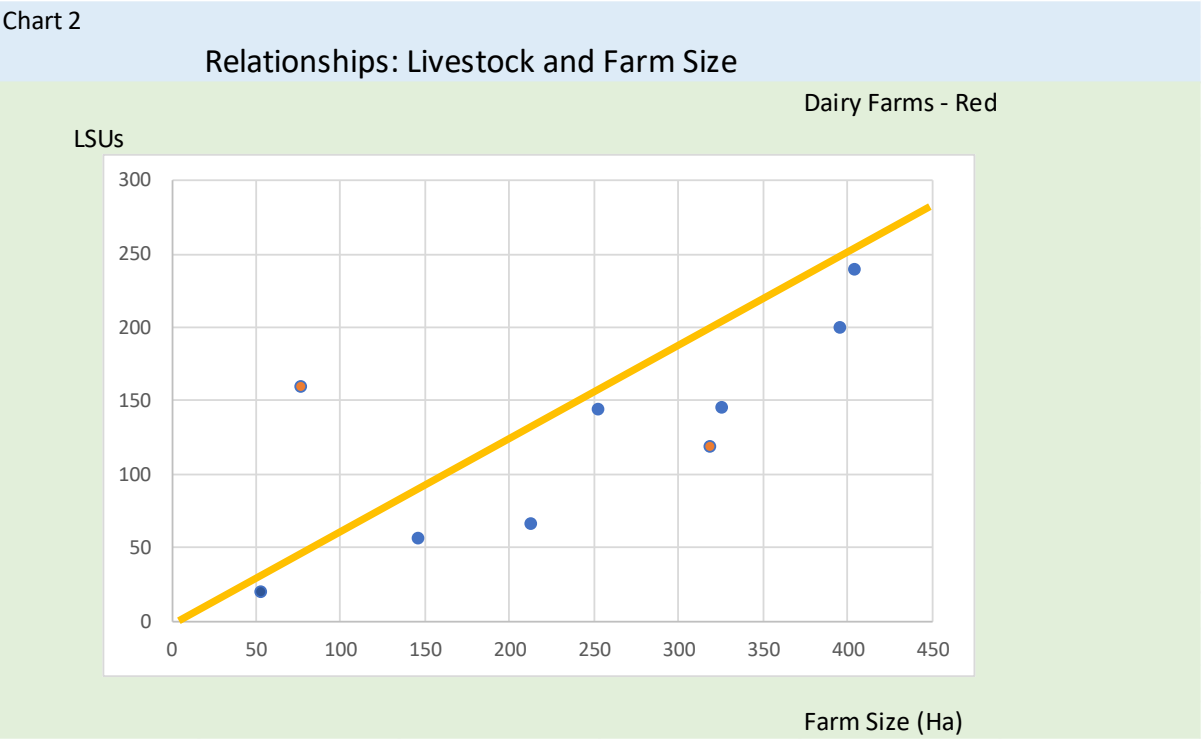
Underlying Relationships

Some key relationships have an impact on farm performances outside the competence of each farmer.

The first factor is the stocking rate (for livestock farms). As this factor increases, up to a point of saturation there should be an adequate increase in farm outputs. Chart 2 exhibits the pattern of stocking rates (LSUs/Ha) for the study farms.

[6] The risk on money deposited in a reputable bank or building society is regarded as the low datum point for financial risk. This datum is taken to be the prevailing interest rate on deposits. Money invested as capital in a business enterprise must acknowledge the risk of possible failure and should seek a premium over the datum as a return for carrying the greater risk. The premium is a matter of business judgment. If deposit rates are 5% then the premium being sought will be typically in the range from 5% to 15% depending on the collateral offered in the event of failure. The report takes the premium to be plus twice the deposit rate (to a total of 15% based on a 5% deposit rate).

Chart 2



The orange line in Chart 2 approximates to an all-beef-cattle farm. This chart demonstrates the underlying physical differences between the farms in the study group and these should be borne in mind when comparing business performances. Dairy farms exhibit a greater degree of variability from the average situation (as there are a wider variety of viable practice patterns on offer) and the dairy farm that resides well to the upper left of the orange line operates a *flying herd regime* which supports a significant increase in the apparent stocking rate. The plots for all the livestock farms, in being below the orange line, is indicative of the proportion of sheep in the livestock mix.

The second factor is the relationship between farm output and livestock numbers.

Chart 3

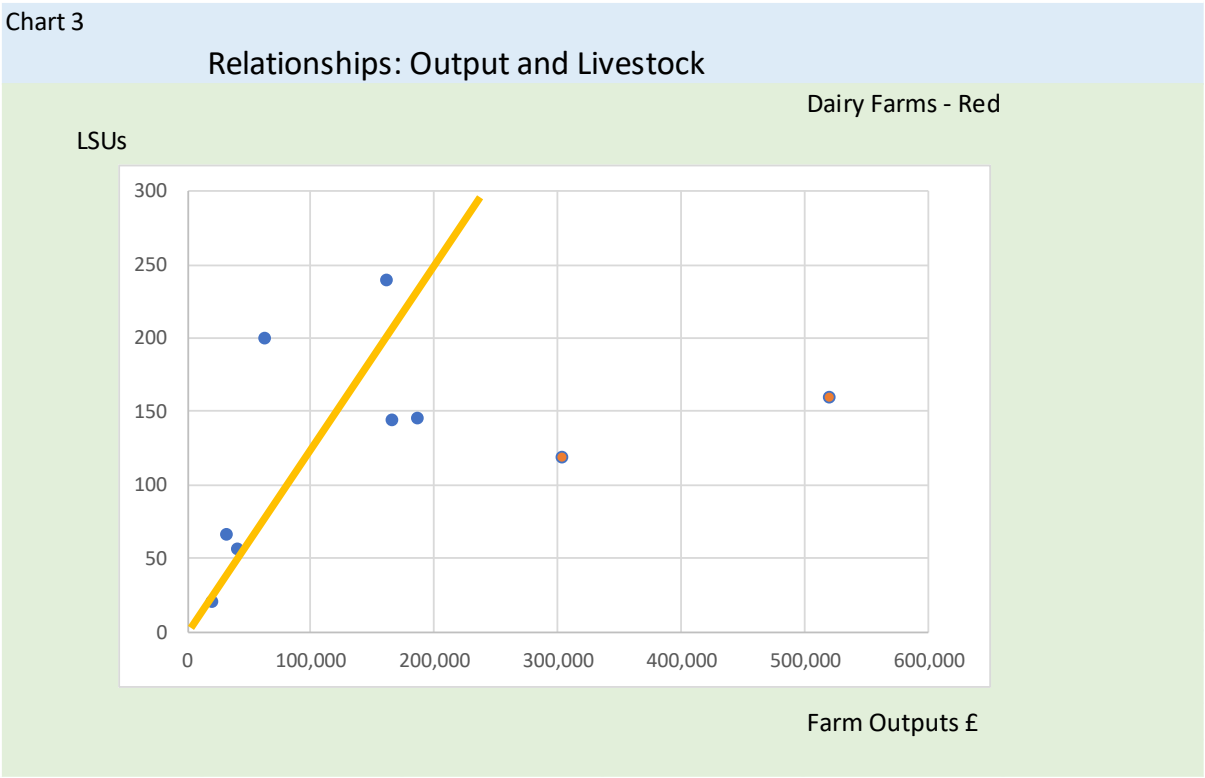
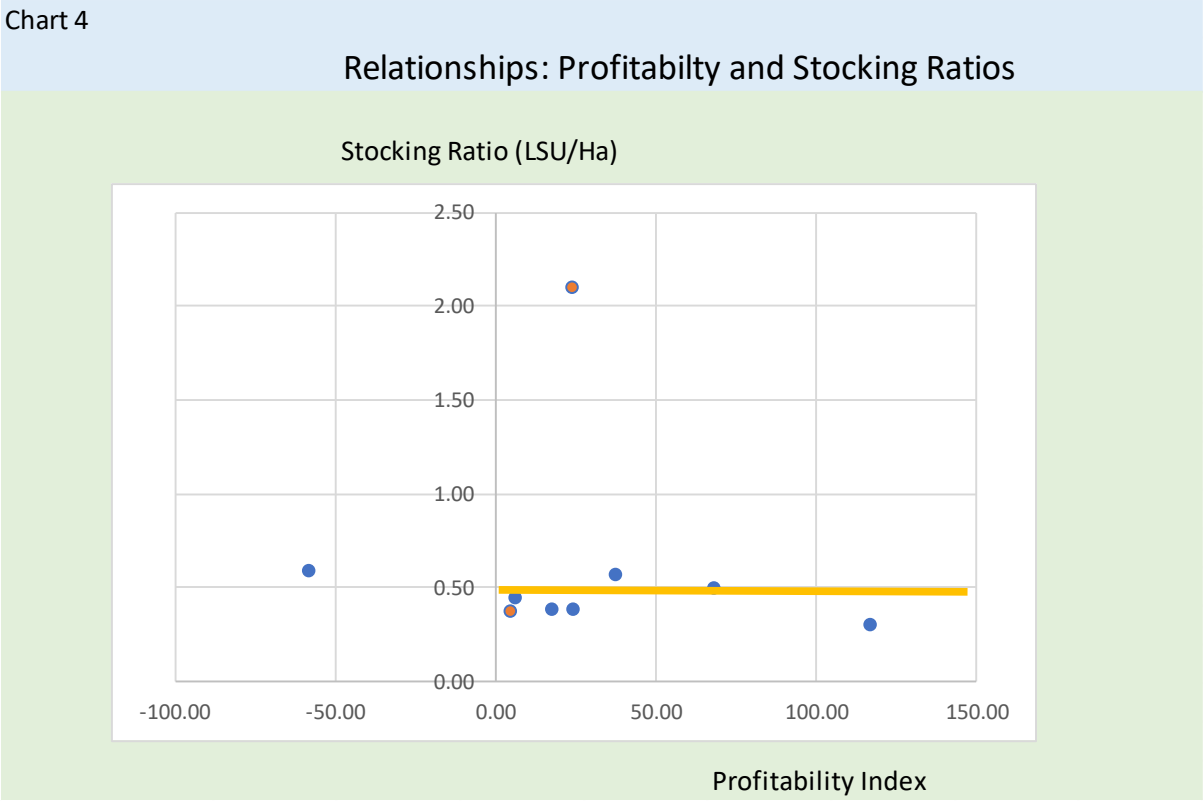


Chart 3 clearly shows the differences between dairy farms and other livestock farms. This is a simple reflection of the higher value of annual outputs delivered by dairy operations. The livestock farms (unsurprisingly) have a fairly simple linear relationship between numbers and outputs.

The impact of differences in farmers' *business-competence* is exhibited in Chart 4. Stocking rates on the study farms are generally consistent at around 0.50 LSUs/Ha. The exception, once again, is the *flying-herd* dairy farm. At this farm all the animals are in productive mode – all the other farms carry the burden of non-productive animals during rearing. It is quite noticeable, given the farms are operating at roughly the same intensity, there is a considerable variation in consequent profitability.

Chart 4



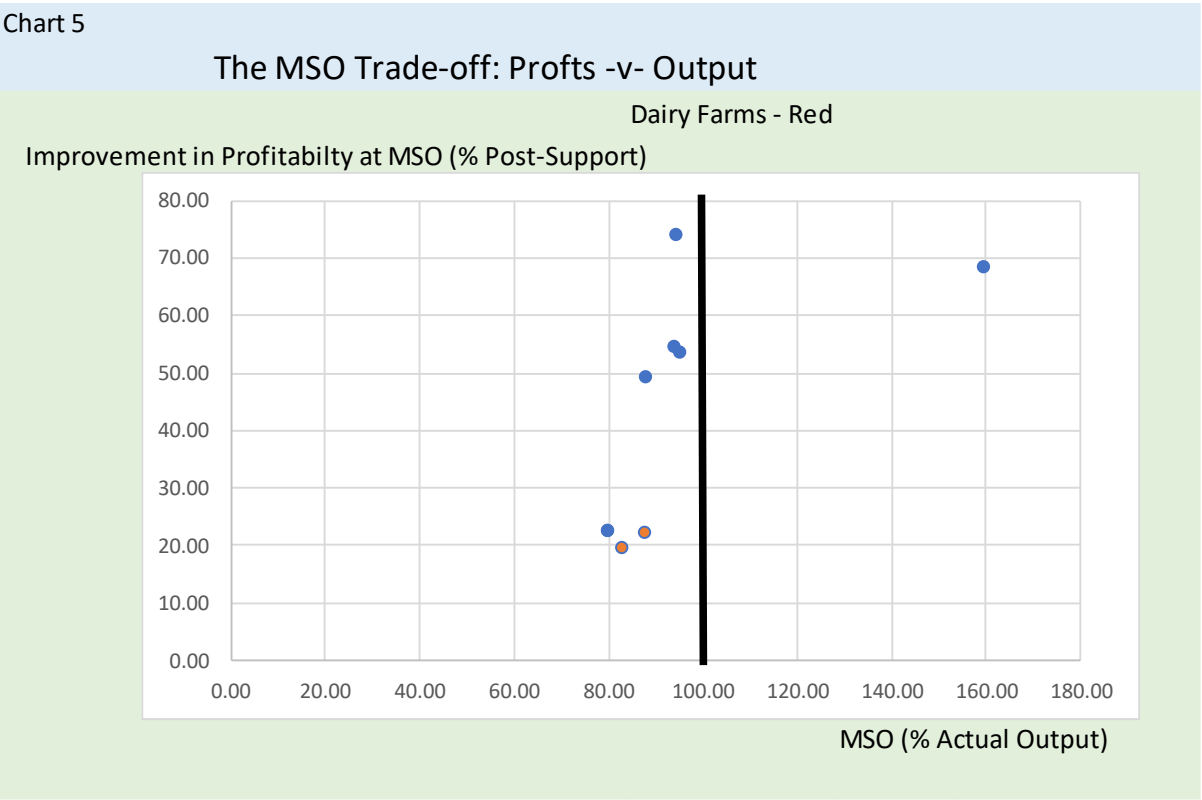
Operations At MSO

Farms operate at *MSO* when all the *naturally available resources*, such as grass, are consumed and no *CVCs* are incurred. The *MSO* point is also characterised by other key attributes:

- It is the point of maximum profitability (without exception when measured as a margin and almost invariably when measured in absolute terms (£) too).
- When the "free-issue" energy resources of nature are taken into account, the MSO point will coincide with the minimum cost of "non-free" energy consumption on the farm.
- As, by definition, there will be a total absence of *CVCs* at the *MSO* point, it coincides with a point where most poor farming practices are removed and an outstanding starting point to farm more sustainably now and into the future. Most farms in the United Kingdom will be operating above its *MSO* point. For these farms, operations at *MSO* means downsizing. However, one of the benefits of moving to *MSO* is that profitability will increase and will more than compensate for the downsizing. It is interesting to note in this regard that as *CVCs* are reduced it is likely that the *MSO* level of output will increase of its own accord as the recovery of natural fertility takes place.

Chart 5 shows the trade-off situation for the study farms.

Chart 5

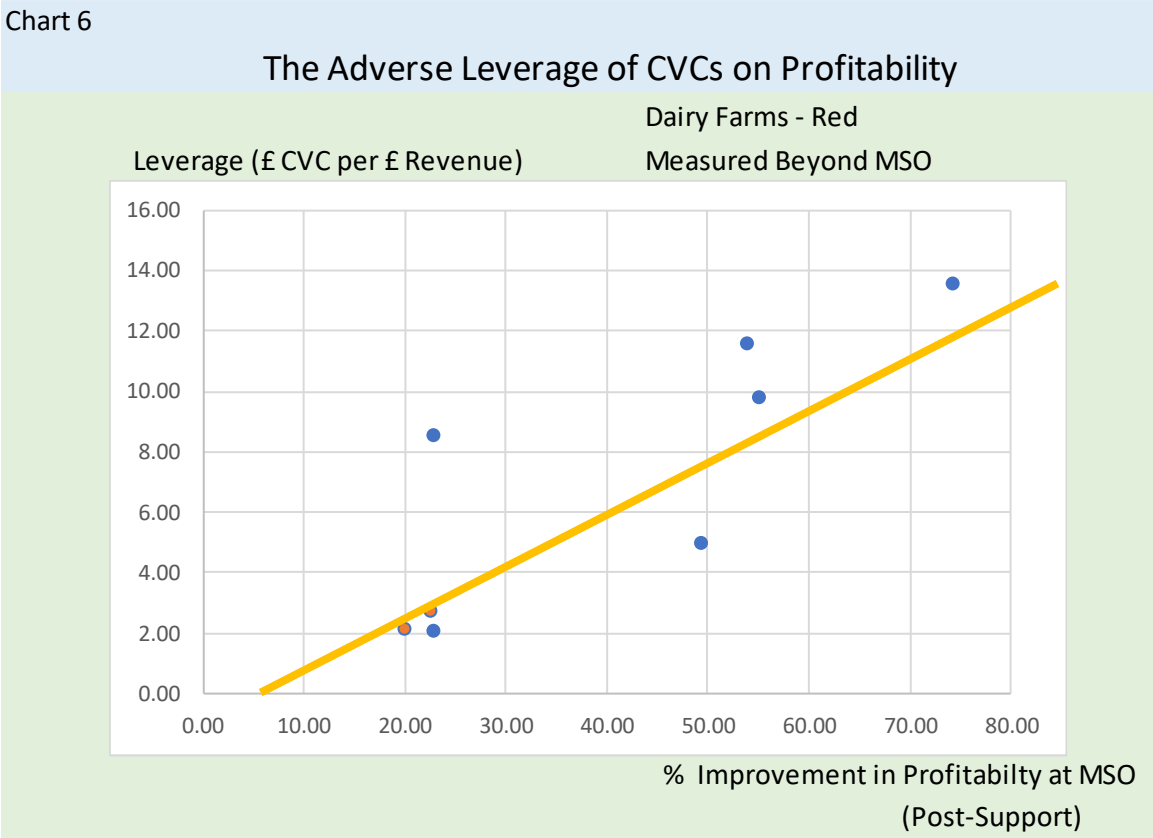


All the farms improve profitability at *MSO* by improvements to its 3rd contributions, ranging between 19% and 74% despite the decreases in absolute output values. In Chart 5 the black line divides those farms operating above *MSO* (to the left) from the one farm operating below *MSO* (to the right). The dairy farms have lower expectations for profit improvement as a consequence of the greater added-value in the product but 20% improvement potential is still significant. The farm operating below *MSO* has enabled the farm to allocate land to agri-environmental schemes and earn income via government support and aligns with policy direction in Wales, where farmers will be financially supported to produce food but also provide benefits to the environment through providing goods such as healthy habitat, soils and water. . This might well be a legitimate social/environmental objective but whilst it should not end up as an unintended default position it does represent an opportunity to diversify income beyond just food production.

Beyond the *MSO* point, when *CVCs* begin to be incurred, variable costs (almost without exception) increase at a faster rate than revenues. This is the reason why many farms become increasingly more unprofitable as outputs grow indefinitely. This is the phenomenon of adverse leverage which is measured by the additional cost of *CVCs* needed to deliver an extra £1 of revenue. In the study farms this ranged from £2.15 per £ revenue to £13.63 per £ revenue. This is a consequence of the impact of "industrial energy" in the components of CVCs.

The situation is set out in Chart 6. In general, as the adverse leverage increases so the scope for profits improvement grows. Only eight farms are shown in this chart. The farm working below *MSO* has been omitted because the *CVCs* are incurred unnecessarily as not all the available natural grass was consumed. In this case, the *CVCs* still represented over 14% of pre-support revenues.

Chart 6



Individual Case Studies

A break-even analysis has been produced for each farm in the study group. This analysis best characterises the performance of each farm. To respect confidentiality, these charts have been re-produced for this report with the data indexed. Pre-support revenues at each farm is taken as 100. This indexation also has the useful property of making comparisons between the different farm businesses a simple proposition.
A bespoke report has been prepared for each of the study farms. These reports comprise:

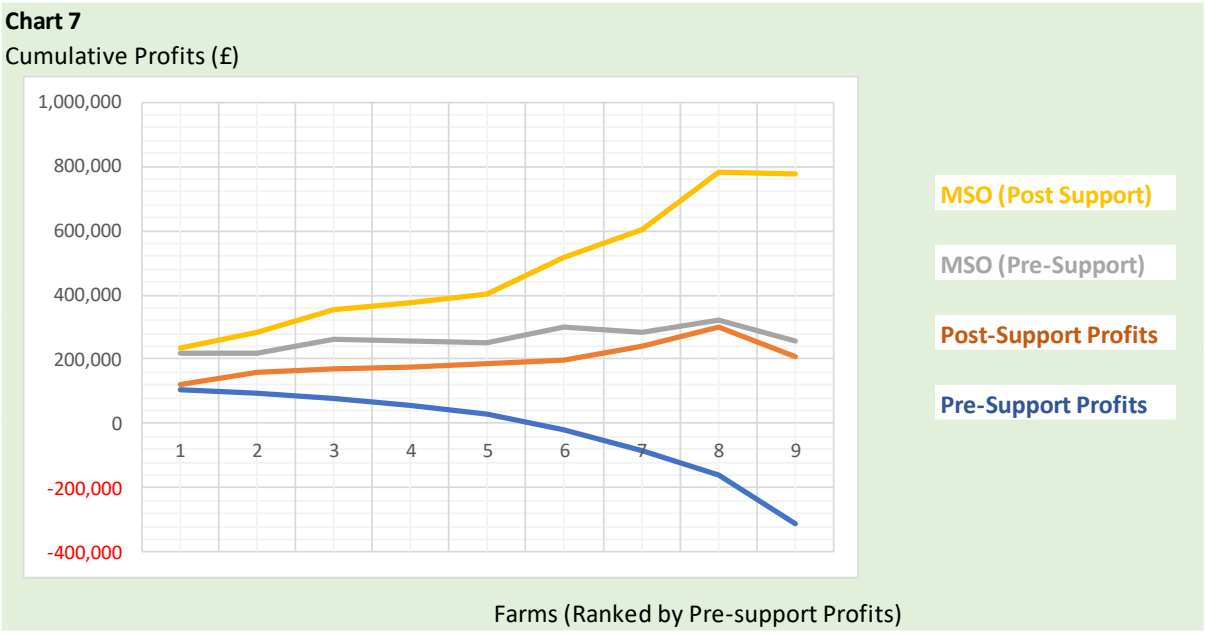
- A set of management accounts based on actual returns. Appendix B shows the management accounting format and hierarchy.
- A set of comparable management accounts cast at *MSO* levels of output
- A break-even analysis based on actual returns
- A *ROTA* performance analysis cast at pre-support revenues, post-support revenues, and *MSO* level operations
- A leverage analysis to serve as a basis for a profitability improvement programme.
- A set of key performance indicators (KPIs)

These reports have been or will be provided to each participating farm in the study when authorised.

The individual break-even charts (indexed) for each of the study farms can be obtained by Appendix A.

The Community Effect

Despite the wide variations in the locations of the study farms, it is interesting to consider the group as a community. Together, the nine farms would run at a loss of £311,000 on a pre-support basis. When support payments are added-in the farms make or receive £206,000. This is the consequence of £517,000 of support. If the study farms were to operate at MSO levels of output, before support payments, the farms would generate £255,000. After support payments this would rise to £744,000. In summary, the impact of support payments and working at MSO appears to improve the economic performance of the farms by £1,055,000 (this is illustrated in Chart 7 as the difference between the yellow and blue line).



5 – General Conclusions

The three most important factors affecting the profitability of the study farms are:

- The support payments from government
- The ability to operate at *MSO* levels of output (i.e. reducing or eliminating *CVCs*) (within a 5% band)
- The general level of fixed costs which need to be reduced dramatically

Two of the study farms were very different from the norms for mixed livestock farming, in one case, and dairy farming in the other.

The exceptional mixed farm was operating well below its *MSO* level of output. This was a direct result of the prescriptions attached to some of its environmental support payments. The farmers concerned were, naturally, anxious to both maintain the integrity of its environmental status and follow the prescriptions strictly. The farm was profitable after support and the farmers were happy with the arrangements and the contribution they were making to environmentally-responsible farming. The farm could work at *MSO* and fulfil its full commercial potential and maximise its capacity as a food producer. If the farm was to operate at *MSO* and not incur *CVCs*, the environment could continue to be uncompromised.

The dairy farm operating the *flying-herd* system provides a case of a farmer consciously structuring operations to place critical aspects of commercial risk on other farm businesses willing to supply animals as and when needed to maintain milk supplies. It is a perfectly legitimate stratagem and it could be a useful model for many others with one caveat – in the absence of other farmers willing to participate in the supply of animals it falls down. This is in fact an abdication of responsibility to the management of the environment to other farmers in the supply chain. Whilst this can make business sense now, future changes in the behaviour of other participants in the supply chain will, in time, eliminate this possibility.

It should be accepted that all farm businesses adopt the practice of business performance analyses, alongside farm performance analyses, in order to exercise greater control and make better informed business decisions.

6 – Glossary

Term		Explanation
Break-even point		The point at which all fixed costs are recovered
Break-back point		The volume at which profitability is reversed
Fixed costs (FC)		Unavoidable costs: (rent, utilities, bank interest & charges)
Free Issue		In farming, grass is provided effectively on a "free-issue" basis (courtesy of nature) and this grass, by virtue of the costs-avoided in purchasing a substitute, makes a significant contribution to farm profitability.
MSO	Maximum Sustainable Output	The point on a farm when all the output resources of its natural capital are primarily used to produce food without depleting its stock of natural capital
Productivity		The gain over and above what is put into the business in effort & cost
Variable costs (VC)	Productive (PVC)	Valuable activities: measured per animal (e.g. home grown feed, essential vet & med)
	Corrective (CVC)	Unwanted activities: measured per animal (e.g. livestock feed, fertiliser, vet & med)
Support payment		All extra income over and above that generated the sale of livestock or produce. Typically, support payment come as grants or payments for public goods/services (such as the maintenance of limestone walls for the community).
Margins		The difference between revenues and costs expressed as a percentage of revenues.
Standard Economic Model of the Firm		The model used by economists to quantify the business performance of an enterprise. Its distinctive assumption is that variable costs in businesses are linearly proportional to output volumes. The term was coined by Johnson 1963.

Pre-support revenues		All farm revenues associated with the sale of livestock or other produce, not including any grants or government support.
Post-support revenues		The gross revenue of a farm business for all sources.
Marginal Costing		An accounting concept. The cost of the next unit of output when the previous unit costs is defined as: = (Total costs of output)/ (Total volume of output) NB: Its historical use implies a linear variable cost relationship with output volumes. This is its fundamental flaw in farming.
Positive 1st Contribution		=(Pre-support Revenues) - (Variable Costs). NB: When negative, a farm business loses cash on every transaction
Positive 2nd Contribution		= 1st Contribution – (Fixed Costs)
Positive 3rd Contribution		= 2nd Contribution + (Support Payments)
Flying herd		Applicable to dairy operations where all animals are milk producers. I.e. there is no investment in animal breeding.
ROTA	Return on Total Assets	= (Margin)/(Total assets employed) expressed as a %. NB: It is business equivalent of an interest rate on deposits.
Risk		The datum for financial risk is the prevailing rate of interest on deposits. In the report this has been taken to be 5%.
Risk premium		The premium over the datum justified by the extra risks involved in running a commercial enterprise. In the report this premium has been taken to be twice the datum (at 10%) making the objective ROTA 15%.
Margin improvement		The change in Profit/sales as a % that results from a change of farming practices.
Assets turn		= (Sales Revenues)/ (Total assets employed). NB: the relationship 365/ (assets turn) gives the parameter "days-of-sales equivalent"
Business competence		The ability of a business owner to make sound and successful decisions about the business aspect. The may not confirm always with conventional wisdom on farming aspects (although it should never compromise animal welfare).
Productive mode		Committed to profitability as a main driver.
Naturally available resources		Any useful resources that are available on a farm as a consequence of sunlight, weather, elevation and latitude.

7 – Appendix A – available upon request from Nethergill Associates.

8 – Appendix B

Nethergill Associates **MSO Accounting Models: Technical Notes**

Accounts

1. Re-ordered from standard accounting format (the objective of which is to assess tax liability)

2. New Order is:
    a. Revenues (without Support Payments)
    b. Productive Variable Costs
    c. Corrective Variable Costs
    d. Fixed Costs
    e. Drawings
    f. Miscellaneous (non-Farming Income)
    g. Support Payments
    h. Net Capital Expenditure
    i. Net Cash Flow
    j. Assets
    k. Liabilities
    l. Net Assets

3. New Order allows the hierarchical calculations:
    a. Calculate the position of MSO (Maximum Sustainable Output). At this point profitability, expressed as (revenues – costs) as a % of sales, is maximised.
    b. Before Support
        i. Contributions after Variable Costs
        ii. Contributions after All Costs
    c. After Support
        i. Contributions after Variable Costs
        ii. Contributions after All Costs (= Profits before Tax)

Analyses

1. All analyses will produce a ***Parameter*** or a ***Key Performance Indicator (KPI)***
    a. These are algebraic and absolute in relation to the data in the Accounts
    b. The Parameters and KPIs all need interpretation to deliver the full benefits from exploiting implications
    c. All farmers should aspire to being able to interpret the Parameters and KPIs

2. Most farms do not analyse assets and liabilities in a Balance Sheet (B/S)
    a. Proving a Balance Sheet allows a Return on Total Assets (ROTA) to be carried out
        b. ROTA is a vital tool in producing **Performance Improvement Plans**