



Less is more:

Improving profitability and the natural environment in hill and other marginal farming systems

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A note on terminology:

This report and the analysis on which it is based focuses on hill farming, but much of the report is applicable to other marginal, livestock-based farming systems. We have therefore referred in places to hill farms and 'other marginal farm types' such as those found at higher latitudes, in coastal areas and on remote islands, in the belief that many of the core concepts are of use in these places.

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Foreword

This report comes at a time when the future relationship between the United Kingdom and the European Union is intensely uncertain. Farmers and nature are on the front line of this turmoil. Brexit brings a range of challenges for the farming sector, from market access to uncertainty about future government support. These challenges come on top of existing headwinds: from impossibly tight profit margins and consumer demand for ultra-low food prices, to a climate crisis that increasingly confounds farmers' ability to plan and nature's capacity to adapt. The result is that many farmers are already beginning to change their underlying business model.

These challenges and trends are at their most acute in the uplands and other 'marginal' areas such as much of our coast and remote islands. As they are home to much of our wildlife and most valued landscapes, the future of farming in these places is tied to the prospects for the natural world. Rare and threatened species and habitats, such as curlew and hay meadows, are often dependent upon sensitive agricultural management. Further twin pressures of intensification and abandonment mean the future of this 'High Nature Value farming' (HNVf) is more precarious now than ever.

Our respective organisations have many years' experience of farming in these places and have built deep working relationships and connections with farmers and remote communities. This has led us each to believe that there is an urgent need to safeguard the future of such HNVf systems, and to chart a direction that is more profitable, more resilient, and nature-rich.

This report builds on a significant amount of previous work by the authors which aims to improve understanding of the underlying economics of hill farming and how these can be improved to both benefit the environment and increase the financial resilience of these businesses. The heart of the approach set out – a focus on margin over volume, on provenance over commodity production, and on cooperation over competition – forms not just the basis for a better future for farming in the uplands and other marginal areas, but also the basis of a brighter future for nature in these places. We believe this will also help to better position businesses to benefit from a 'public money for public goods' approach to future farm support, as is proposed in England and Wales.

As the country focuses on the choices ahead, the risks and opportunities for both farming and the environment are magnified. Without change, a conceivable future is one of fewer, larger farms in the uplands with little connection to place or community, that are dependent upon an intensive, high-input, nature-poor business model. This must be avoided. A more desirable outcome, as this report shows, is one that enables a lower input, more profitable, more biodiverse and, in places, a wilder future for hill farming. This report aims to inform a route to achieve such a result.

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Executive Summary

Upland farming faces a challenging economic situation and yet the UK's uplands, shaped over centuries by sheep and cattle grazing, can provide a range of ecosystem services that are valued by society. A large proportion of upland farms struggle to be profitable without financial support payments from government. A significant proportion of the income of upland farms consists of direct payments, with a smaller amount coming from environmental payments, such as those provided through agri-environment schemes. In Scotland, support through the Less Favoured Area Support Scheme also remains substantial. However, because these payments are generally included in the revenue line of the farm accounts, farmers are often not clear about the factors influencing the profitability of the farm business without public support. At the same time, many of the essential ecosystem services that the uplands can deliver are in poor condition, including the quality of water and soils and the condition of many habitats and species.

It is timely to look at ways of improving the profitability of upland farm businesses since, in England and Wales at least, direct payments in their current form are proposed to be phased out from 2021. Therefore, it is important that farms start to look at how they can become more resilient economically without direct payments.

With this in mind, during 2018 and 2019, Nethergill Associates carried out analysis for a range of clients, including the RSPB, the National Trust, The Wildlife Trusts and Nidderdale AONB (with funding from the Princes Countryside Trust) to investigate the financial sustainability of a selection of livestock farms (sheep and beef)¹ in the UK uplands and other marginal farming areas, and look at their profitability before and after support payments are taken into account. To do this, an approach to examining the farm accounts was developed to determine the level of output at which farms were the most economically sustainable (the 'Nethergill approach'). Looking at ways to enable upland and marginal farms to become more profitable is not something new. However, the Nethergill approach has sought to apply micro-economic theory to farm accounts in a way that farmers can relate to.

The approach has shown that on the upland and marginal livestock farms examined, **reducing output (and hence stock numbers) to a level where stock are grazed only on the farm's naturally available grass (i.e. without artificial fertilisers), increases profit (or reduces losses), through significant savings of variable costs²**. In turn this can generate environmental benefits by reducing some of the environmental pressure on the land, particularly where over-grazing is an issue. The findings challenge the approach often taken by upland farmers that greater profitability automatically ensues from increasing production. The results of the analysis were similar for all farms examined, whether managed by individuals, or environmental organisations, whether in protected landscapes or not and irrespective of their size.

Using the Nethergill approach, farm business incomes for these farms were examined both at current output levels and with output levels reduced to what was calculated to be the level of maximum economically sustainable output, under three scenarios: 1) all current support included; 2) only environmental support; and 3) no financial support. The results showed that moving to a situation where stock are grazed only on the naturally available grass improves the farm business income on all the farms

¹ Seven case studies, covering the accounts of 29 farm businesses were examined. In addition, an analysis of the Farm Business Survey data for 2016/17 for 17 SDA grazing farms in Yorkshire, Lancashire and Cheshire was carried out.

² This represents the point of what the Nethergill approach calls 'Maximum Sustainable Output' (MSO)

examined. However, with no support payments, farm business income was above zero in only one of the case studies. If environmental payments are included (at current levels), farm business income was above zero for two of the case studies. Therefore, to move the majority of case study farms to a profitable situation without direct payments would require some further combination of price increases, reductions in fixed costs, environmental payments and potentially diversification and additional income streams.

The findings also show that fixed costs (as treated in the farm accounts) are extremely high on the farms investigated as a proportion of output (from 67% to 290%) and that in some cases the farms assets (machinery, equipment) were not being worked as efficiently as they could be. The analysis shows that there is scope to reduce non-essential and lifestyle related fixed costs to boost profitability.

Examining the agricultural part of the farm business in isolation and by looking at the accounts before and after financial support has allowed a clearer economic picture to emerge about the factors influencing the profitability of marginal / hill farms. The insights provided are intended to help farm businesses to look afresh at their figures and consider the opportunities available to them to improve their viability and profit margins through a combination of the following:

- a) Reducing variable costs by reducing output to a level where stock are grazed only on the farm's naturally available grass
- b) Reducing unnecessary fixed costs to make fixed assets work harder for the business – e.g. through sharing machinery, cooperating and sharing resources with neighbouring farmers;
- c) Taking advantage of opportunities to improve the price received for meat produced, through adding value to the product;
- d) Making the protection and enhancement of the environment a more central element of the farm management system, rewarded both through the market (adding value to products) and through applying for public payments that are focused on the delivery of public goods;
- e) Considering the development of other diversification opportunities to add to the portfolio.

This implies a shift away from a business model that focuses on production to one that focuses on profit margin. The case studies show the importance of exploring the full range of options available to improve the viability and profitability of farm businesses. This will require a greater focus on business planning, looking at the farm accounts in detail to ensure objective decisions can be made to assure the long-term viability of the business. The current system of support and its predecessors has effectively hidden the true financial situation of the agricultural activities taking place on farms in upland and other marginal areas, allowing farmers to avoid analysing the financial details of their operations. This needs to be addressed to prepare for the introduction of new systems of public support to agriculture across the UK in light of leaving the EU, particularly the planned removal of direct payments in England and Wales.

This transition to a new business model for upland farming will not take place overnight. It is also clear that there will remain situations where the economics of running a farm in upland and other marginal areas, focussing solely on agricultural production cannot be made to work. In these cases, decisions will have to be made about what course of action to take. However, the evidence from the farms examined makes a compelling case that upland farmers can both increase their underlying profitability and deliver more for the environment by reducing stocking levels, a situation which will also increase their resilience against future policy change, the urgent environmental and climate challenges faced, and provide the basis on which other diversified enterprises can be built.

Glossary of terms used

Term		Explanation
Accountant	Chartered	Looks after the balance sheet
	Management	Looks after the Profit & Loss account
Balance Sheet		A financial statement that reports a company's assets, liabilities and equity (i.e. financial position) at the end of a specified date. It is a snapshot of how much the business owns (its assets) and how much it owes (its liabilities). It aims to reflect its net worth.
Break-even point		The amount of sales required to cover total costs - both fixed and variable costs (excluding drawings and CAPEX) at a given level of output.
Break-back point		The point at which profitability moves back into loss, where variable costs start to exceed revenue as outputs increase.
CAPEX (Capital Expenditure)		Funds used to acquire, upgrade, and maintain physical assets such as property, buildings, technology or equipment
Contribution (to remaining cashflow)	1 st level	After variable costs deducted: failure to produce positive contribution at this point means that a business is losing cash (and consequently decapitalising) – equivalent to gross margin, but presented as actual costs, not as a percentage.
	2 nd level	After fixed costs are deducted: failure to produce a positive contribution at this point is unprofitable in an accounting sense (equivalent to profit/loss).
	3 rd level	After CAPEX is deducted
Fixed costs (FC)		Costs incurred even if no output is produced (e.g. rent, utilities, labour, machinery, bank interest & charges): however, FCs can fall into a number of different categories: <ol style="list-style-type: none"> 1. Essential and unavoidable (no business possible without these costs) 2. Mandatory (e.g. to adhere to regulations) 3. Intangible (balancing items such as reputation & goodwill). 4. Unnecessary costs (e.g. over specified equipment) 5. Lifestyle costs that support a lifestyle rather than farming
Gross margin	GM	Revenue (from farming activities) less the total (fixed & variable) costs associated with producing the goods sold (expressed as a % of sales)
Key Performance Indicators	KPIs	Measurable values that drive the business and indicate the size of the tasks involved (and unique to each businesses)
Marginal costs		If an enterprise produces x units of output, the marginal cost is the extra costs involved in producing $x + 1$ units. Its principal utility is in the <i>optimum allocation of resources</i> where costs have a linear relationship with volumes and output.
Marginal price		If an enterprise sells x units of output at a price p , the marginal price is the price achieved from the sale of an extra unit at an output of $x + 1$.
Maximum sustainable output (MSO)		Economically sustainable output - the volume of output that can be achieved before corrective variable costs cut in (linked to optimum stocking rates)

Naturally available grass		The grass that grows naturally without the application of artificial inputs (e.g. fertilisers or lime), but using the manure from the livestock grazed. This is essentially <i>free-issue</i> .
Productivity		Ratio of agricultural outputs to agricultural inputs
Profit		The surplus remaining after total costs (excluding drawings and CAPEX) are deducted from total revenue
Profit margin (gross/net)		The profit (gross/net) divided by turnover expressed as a percentage.
Profit and loss account		A company's revenue and expenses over a particular period of time. It represents the profitability of a business and its principal utility is in the computation of tax liabilities.
Turnover		Income from sales
Variable costs (VC)		Costs that vary depending on the level of production. In this report these are divided into:
	Productive (PVC)	Essential/unavoidable costs linked to livestock production but driven by activities that fully exploit the benefits of the naturally available grass and could include contract labour, seeds, home grown concentrates, bedding, contract labour, essential vet & med
	Corrective (CVC)	Avoidable / non-essential costs linked to livestock production which aim to increase production beyond what is feasible from the naturally available grass (e.g. bought in livestock feed, fertilisers, sprays)

1. Introduction and purpose

Upland farming faces a challenging economic situation and yet the UK's uplands, shaped over centuries by sheep and cattle grazing, can provide a range of ecosystem services that are valued by society – from the water that we drink, storing carbon from the atmosphere in soil and biomass, to being home to a wealth of wildlife and habitats and forming some of our most iconic landscapes. They are also home to rural communities with a long history of cultural linkages with the land and farming. However, many of these ecosystem services are in poor condition, including the quality of water and soils and the condition of many habitats and species.

A large proportion of upland farm businesses struggle to be profitable without financial support from government. The evidence shows that a significant proportion of the income of upland farms consists of direct payments, with a smaller amount coming from environmental payments, such as those provided through agri-environment schemes. In Scotland, support through the Less Favoured Area Support Scheme also remains substantial. However, because these payments are generally included in the revenue line of the farm accounts, it is not easy to get a clear understanding of what is influencing the profitability of the farm business without public support.

During 2018 and 2019, Nethergill Associates carried out detailed analyses for a range of clients³ to investigate the financial sustainability of a number of livestock farms in the UK uplands and other marginal areas and look at ways in which the agricultural parts of the farm enterprise might be made more profitable before support payments and other sources of revenue are taken into account. An approach to analysing the farm accounts (the 'Nethergill approach') was developed for this purpose and used to examine the farm accounts on 29 farms (included in the seven case studies in this report) and analyse the Farm Business Survey (FBS) upland grazing records for a further 17 farms.

The results reinforce the well-known fact that in a large proportion of cases, hill farms are operating at a loss without financial support, with fixed and variable costs far outweighing revenue. The findings demonstrate that, in an upland livestock situation, increasing production beyond what the naturally available grass can sustain in fact reduces profitability rather than increasing it. This is because where stocking rates increase beyond the naturally available grass⁴, the variable costs required to increase production are disproportionately higher than the value of the output (e.g. sales) produced. Therefore, as farms attempt to create more revenue, they are in fact losing more money in costs than they are gaining in income. The conclusions can be summed up as follows: **if there isn't enough naturally available grass, no amount of corrective economic action can make the farming any more profitable.**

This report summarises this research. It sets out the premise behind the Nethergill approach and shows how it works, using case studies based on the farm accounts of working farms in upland and marginal areas in England, Wales, Scotland and Northern Ireland. It is intended as a contribution to the discussions about the future of farming in upland and marginal areas. We hope it will broaden the conversation away from one that is predominantly production focused, towards a focus on profit margins alongside sustainable land management in which economic viability and the delivery of ecosystem services are

³ These included the RSPB, the National Trust, The Wildlife Trusts as well as several individual Wildlife Trusts in England, Nidderdale AONB and a number of private clients

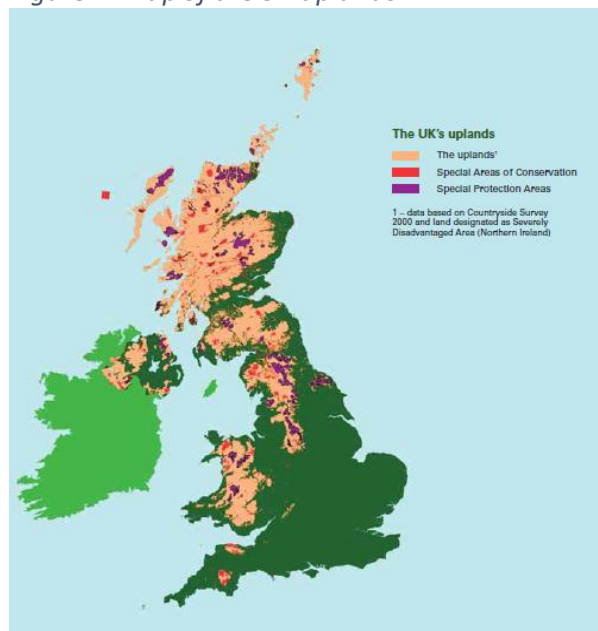
⁴ The grass that grows naturally without the application of artificial inputs (e.g. fertilisers or lime) but using the manure from the livestock grazed.

intrinsically linked, thereby improving the future resilience of these areas and providing benefits for society (including this and future generations) at large. This in turn has implications for agriculture and land management policy being developed in each of the four UK countries and the support provided to land managers as the UK leaves the EU.

2. What are upland farming systems and why are they important?

There is no formal definition of the 'uplands' in the UK. The term generally refers to areas above the upper limits of enclosed farmland where climatic conditions (such as high rainfall, low temperature, harsh weather, short crop season and low soil fertility) and/or altitude affect plant growth and which are characterized by dry and wet dwarf shrub heath species and rough grassland. In these areas farming is more difficult, generates lower yields and is where profitability is an issue. These areas also face supply chain inefficiencies due to greater distance to livestock markets, abattoirs and processors. However, they are also often areas of high value for the environment and climate, generating many ecosystem services for society. The provision of many of these ecosystem services are not optimised at present, in part due to current land management practice and policy.

Figure 1: Map of the UK uplands



Source: RSPB – The Uplands, Time to Change

The uplands cover about 40% of the UK land area and about 49% of the UK's agricultural area, using the Less Favoured Area (LFA) designation as a proxy for upland areas⁵. The most extensive upland areas are found in Scotland, northern England and Wales (see Table 1 and Figure 1 below). However, although LFAs in NI represent a relatively small area when compared to the rest of the UK they make up a significant proportion of farmed land there.

Table 1: Area in Less Favoured Areas in UK countries^{6,7}

	LFA (million ha)	Disadvantaged area (% of LFA)	Severely Disadvantaged area (% of LFA)	% UAA	Common land / common grazing (ha)
England	2.2	27.3%	72.7%	17%	306,000
Wales	1.7	29.5%	70.5%	79%	175,000
Scotland	6.9	1.4%	98.6%	88%	584,000
N. Ireland	0.9	33.3%	66.7%	67%	40,000

⁵ The LFAs are defined as areas where at least 60% of the area faces significant natural constraints, e.g. climate, poor soil productivity and steep slopes. These are divided into Disadvantaged and Severely Disadvantaged Areas.

⁶ Figure F1: Less Favoured Areas in the UK in Farm incomes in Wales, 2017-18, Statistical First Release, December 2018

⁷ Silcock P, Brunyee J and Pring J (2012) Changing livestock numbers in the UK Less Favoured Areas – an analysis of likely biodiversity implications

2.1 Nature of farming in the uplands

Farming has played a significant role shaping and maintaining the distinctive character of upland areas as we know them today. However, it has also been the cause of significant environment damage, particularly in the past 50 years, through attempts to improve the productive capacity of the land⁸, specialisation in favour of single species of livestock and overgrazing (see below). Historically farmers in the uplands have carried out management of these areas through livestock grazing, predominantly sheep but also cattle and this continues today. Sheep and cattle numbers increased after the Second World War, but have been declining steadily in many areas, particularly in the SDA, as a result of reductions in intervention prices for milk, beef and sheep and successive reforms of the CAP that have reduced the link between support and production, culminating in the introduction of decoupled payments in 2005⁹. However, despite this recent decline, overall stocking rates are still much higher than in the 1950s, with high numbers generally being reliant on bought in feedstuffs and the use of artificial fertilisers to improve the grass yield on the farm. Based on 2017/18 data, 28% of beef cows and 41% of breeding sheep are on LFA grazing farms in England¹⁰.

Typically, upland farms comprise an area of in-bye land (enclosed land), generally managed as pastures and meadows¹¹ as well as access to a larger area of unenclosed land, often common land, on which they have grazing rights. The size of upland farm businesses varies significantly, from the large estates of northern England and the central and east Highlands of Scotland to smaller holdings carried out by a mix of landowners and tenants. In the Highlands and Islands of Scotland, around 750,000 hectares of land (around 12% of the total agricultural area in Scotland) are managed as crofts (typically a small area of enclosed land with grazing rights to an area of larger common grazing)¹². On many of the larger estates and farms, the farming activity often sits alongside other land uses, such as driven grouse shooting, deer stalking and forestry. The average age of a farmers in the LFA in the different parts of the UK tends to be higher than in lowland areas.

2.2 Environmental, landscape, social and cultural value of the uplands

The UK's upland areas are a modified landscape and if left to nature would be predominantly tree covered. The introduction of farming has shaped the open landscapes we know today. They are characterised by hills, moors, valleys, mountains and ffridd¹³, which, if managed appropriately, can play an important role in providing ecosystem services for society – such as the production of food and timber, water supply and flood regulation, carbon capture and storage, renewable energy, biodiversity, recreation, physical and mental wellbeing, as well as containing a wealth of history and culture. However, farming practices in these areas – driven by the desire to improve incomes of those farming these areas through increasing

⁸ For example through the reseedling of grasslands, use of pesticides and artificial fertilisers, increased use of machinery, enlargement and levelling of fields, drainage of land, the switch from hay to silage production

⁹ Silcock P, Brunyee J and Pring J (2012) Changing livestock numbers in the UK Less Favoured Areas – an analysis of likely biodiversity implications

¹⁰ Harvey D and Scott C (2019) Hill farming in England 2017/18, Rural Business Research, Newcastle University

¹¹ Pastures are grazed but not cut, while meadows are cut for either hay or silage and may or may not be grazed

¹² Scottish Natural Heritage: <https://www.nature.scot/professional-advice/land-and-sea-management/managing-land/farming-and-crofting/types-farming/crofting> - accessed August 2019

¹³ sparsely wooded slopes between enclosed in-bye and open tops – see for example RSPB and NRW: Ffridd, a habitat on the edge http://www2.rspb.org.uk/Images/ffridd_tcm9-384432.pdf

productivity, supported by subsidies – has led to environmental damage and limited the extent to which these ecosystem services have been provided.

Much of the uplands is protected for its nationally significant landscape and biodiversity value. Eleven of the 15 national parks in England, Scotland and Wales are in hill farming areas, as are a number of the UK's Areas of Outstanding Natural Beauty and National Scenic Areas (Scotland). A third of England's ancient monuments are in the uplands¹⁴. 70% of the UK's drinking water is sourced from the uplands¹⁵ and upland peat soils and blanket bogs are the largest stores of carbon in the UK, storing 1,620 million tonnes of carbon in Scotland (56% of the total carbon in all Scottish soils)¹⁶ and around 138 million tonnes in England's uplands¹⁷. In addition, the largest remaining tracts of semi-natural habitats in the UK are found in the uplands. Upland areas contain many plant and animal communities that are only found in these areas. Most upland habitats have been subject to centuries of management by grazing, cutting, burning and drainage, changing the landscape from what was once predominately woodland and blanket bog, to the mixture of meadow, heathland, grassland and semi-natural woodland seen today. They are home to internationally important wildlife including iconic species like the mountain hare, atlantic salmon, freshwater pearl mussel and birds including golden eagle, hen harrier, curlew, lapwing, black grouse, ring ouzel and twite. Significant proportions of the uplands are also protected for their biodiversity value as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Sites of Special Scientific Interest (Areas of Special Scientific Interest in Northern Ireland) and National Nature Reserves. The landscape and biodiversity value of the uplands is also important in terms of attracting people to visit these, often remote, areas. For example, there are over 60 million visits to upland National Parks in the UK each year (2014 figures)¹⁸.

Appropriate grazing, lower use of certain inputs (e.g. of artificial fertilisers, pesticides, stocking densities and more efficient use of machinery) and lower yields per hectare are key to conserving many priority habitats such as limestone grassland and upland heath¹⁹. However, many areas of seminatural habitat within the National Parks have been lost or fragmented as a result of agricultural "improvements" such as the reseedling of grasslands, use of pesticides and artificial fertilisers, increased use of machinery, enlargement and levelling of fields, drainage of land, and the switch from hay to silage production. Mixed grazing systems (e.g. cattle, sheep, goats and ponies) have declined in preference for larger flocks of sheep. Inappropriate grazing (e.g. overgrazing and overwinter grazing) remains a significant concern, resulting in the loss of vegetation structure and the creation of short, heavily poached swards, and contributing to increases in soil erosion, run-off and flooding incidents downstream²⁰.

¹⁴ Written evidence submitted by English Heritage to the 2010/11 Efra Inquiry into Farming in the Uplands

¹⁵ M. Reed et al, "The Future of the Uplands" Land Use Policy, vol. 265, pp. 204-216, 2009

¹⁶ Chapman S, Bell J, Donnelly, D, Lilly A (2009) Carbon stocks in Scottish peatlands in *Soil Use and Management*, Volume 25, issue 2, pp 105-112

¹⁷ Alonso I, Weston K, Gregg R, Morecroft M (2012) *Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources*, Natural England Research Report NERR043

¹⁸ <https://nationalparks.uk/students/whatisanationalpark/factsandfigures>

¹⁹ Jones, G. 2014. High Nature Value Farming in the Northern Upland Chain

²⁰ Meyles, E. W., Williams, A. G., Ternan, J. L., Anderson, J. M., & Dowd, J. F. 2006. The influence of grazing on vegetation, soil properties and stream discharge in a small Dartmoor catchment, southwest England, UK. *Earth Surface Processes and Landforms* 31: 622–631 see: www.efncp.org/download/north-upl/Northern_Uplands_Chain_HNV_Farming_Report.pdf

In addition, many of the protected sites are in poor condition and many upland bird species are highlighted as being of conservation concern²¹. Figure 2 shows that less than 30% of sites protected for their biodiversity value (SSSIs) in upland National Parks (by area) are assessed as being in favourable condition, with figures as low as 11% in the North York Moors. The second *State of Nature* report, published in 2016²² revealed that 55 per cent of upland species assessed in the UK had declined over the long term, with a 36% of species showing strong or moderate declines. In addition, the report found that 15% of upland species are threatened with extinction from Great Britain and twelve of the 36 species of birds living in the uplands are now on the red list, meaning that they are of conservation concern. Agriculture (including in the uplands) is the cause of 30% of all water bodies not achieving good ecological status in England whilst the figure for Scotland is 18%. The main causes are: nutrient enrichment from excess phosphorus and nitrogen on agricultural land and farming practices; sediment loss caused by livestock poaching and river bank erosion by livestock; and diffuse pollution arising from farmyard runoff.

Figure 2: Proportion of SSSI by area assessed as in favourable condition inside England's National Parks

Created from Natural England's SSSI condition data

National Park	Total area (ha)	Percentage of National Park designated as SSSI	Percentage of SSSI in favourable condition
Dartmoor	95,603	27%	16%
Exmoor	69,341	28%	15%
Lake District	236,568	18%	23%
New Forest	56,693	57%	52%
North York Moors	144,194	33%	11%
Northumberland	105,171	12%	32%
Peak District	143,889	35%	16%
South Downs	123,279	8%	47%
The Broads	30,130	24%	63%
Yorkshire Dales	218,642	23%	28%

Source: Cox et al, 2018²³

²¹ For example, the State of Birds in Wales, 2018 identifies the ongoing declines of farmland birds as a particular conservation concern including many upland species such as curlew, golden plover, black grouse and ring ouzel

²² Hayhow DB, Burns F, Eaton MA, Al Fulaij N, August TA, Babey L, Bacon L, Bingham C, Boswell J, Boughey KL, Brereton T, Brookman E, Brooks DR, Bullock DJ, Burke O, Collis M, Corbet L, Cornish N, De Massimi S, Densham J, Dunn E, Elliott S, Gent T, Godber J, Hamilton S, Havery S, Hawkins S, Henney J, Holmes K, Hutchinson N, Isaac NJB, Johns D, Macadam CR, Mathews F, Nicolet P, Noble DG, Outhwaite CL, Powney GD, Richardson P, Roy DB, Sims D, Smart S, Stevenson K, Stroud RA, Walker KJ, Webb JR, Webb TJ, Wynde R and Gregory RD (2016) State of Nature 2016. The State of Nature partnership.

²³ Cox, K., Groom, A. Jennings, K. and Mercer, I. (2018). National Parks or Natural Parks: how can we have both, British Wildlife, pp87-96

3. The current economic situation facing hill/upland farming systems

Upland farms face a challenging economic situation. They mainly operate in the commodity sector of the food market. Farm incomes remain low and the majority of farms are highly dependent on agricultural support payments and other sources of income, whether from diversification activities or off farm employment. Revenue from sales of livestock can be out of the control of the farmer, prices can be unpredictable and this year-on-year variation leads to a precarious economic situation for many upland farm businesses.

Therefore, while the Farm Business Income (FBI) figures and individual's farm accounts may show farm business incomes to be positive overall, this is usually because they include agricultural support, environmental payments and income from diversification in the figures (see Figure 3, Figure 4 and Box 1). In many cases, however when one strips out all the non-farming revenue, including support payments, the farming component of the business is making a loss and is economically unsustainable (see Chapter 4 for more details). It should also be noted that the FBI does not refer to the farm business balance sheet, just the annual business income of farms.

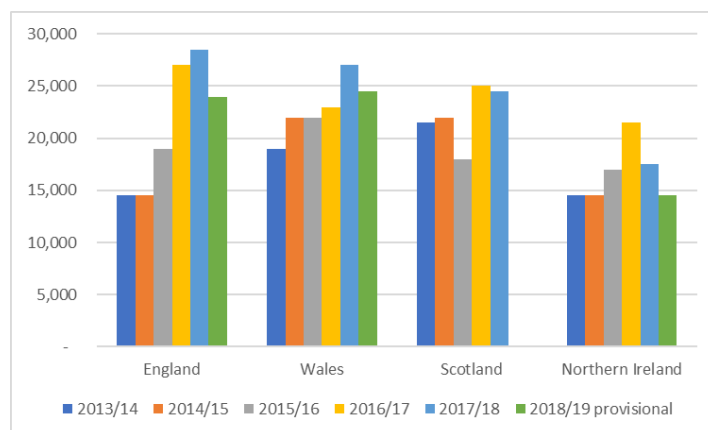


Figure 3: Average Farm Business Income per farm for grazing livestock (LFA) farms, including support payments

Source: Defra (2019) Agriculture in the United Kingdom 2018

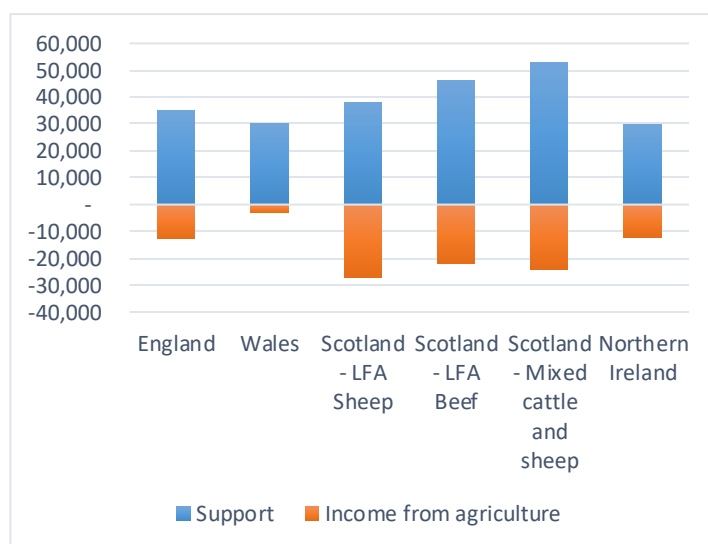


Figure 4: Average Farm Business Income per farm for grazing livestock (LFA) farms, showing contribution of support payments

NB: England: average figures for 2014/15 – 2016/17

Wales: figures for 2017/18

Scotland: average figures for 2015/16 – 2016/17

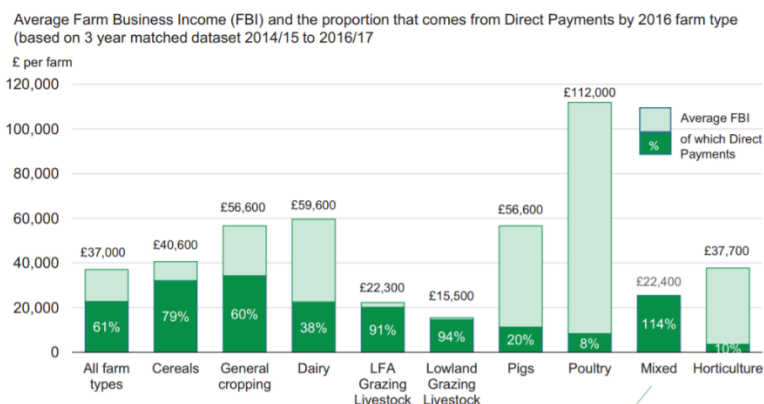
Northern Ireland: average figures for 2017/18

Box 1: Income figures for LFA grazing livestock farms in England, Scotland, Wales and Northern Ireland

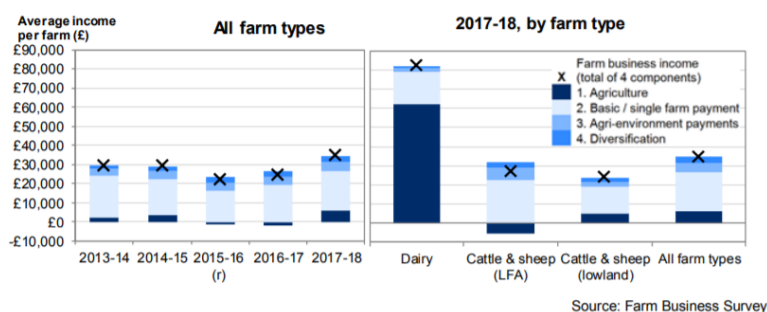
Figures from **England** show that between 2014/15 and 2016/17 the average annual farm business income (FBI) on LFA grazing livestock farms (including CAP support) was £22,300, the least financially rewarding of all farm types. Even with support, 14% of LFA grazing livestock farms made a loss and 24% showed FBI of between £0 and £10,000 per year.

Without direct payments, 46% would have made a loss. On average CAP support payments per farm were £35,000 over this period (of which a round £20,000 was direct payments), offsetting approximately £12,000 of losses from the agricultural side of the business.

Looking at costs, LFA grazing livestock farms would have had to reduce their costs (variable and fixed) by a bout 18% on average to break even without direct payments (this ranges from 2-59% for 90% of farms or 9-26% for 50% of farms).



In **Wales**, 2017/18 figures indicate that the average income (including CAP support) for cattle and sheep farms in the LFA was £26,900. Just over 60 per cent of LFA cattle and sheep farms either make a loss or would have made a loss without support.



In **Scotland**, between 2015/16 and 2016/17 the average farm business income for LFA livestock grazing farms (including support) was as follows:

- LFA sheep: £11,052 (of which the average support was £38,124)
- LFA beef: £24,378 (of which the average support was £46,268)
- LFA mixed cattle and sheep: £28,820 (of which the average support was £53,058)

The agricultural contribution to average farm business income on LFA farms in 2017/18 was negative at -19% and just over 60% of LFA grazing livestock farms in Scotland would have made a loss without CAP payments (16% made a loss even with CAP support).

In **Northern Ireland**, in 2017/18, the average farm business income for LFA cattle and sheep farms was £17,725 (based on a sample of identical farms) of which the average direct payments were £29,883. Without direct payments, therefore, the average farm business income would have been negative at -£12,158.

Sources:

Defra (2018) Health and Harmony Evidence compendium

Wales: 2017/18 Farm Business Survey, Welsh Government, Farm incomes in Wales, 2017-18, 20 December 2018 SFR 121/2018

Scotland: <https://www.gov.scot/publications/agriculture-facts-figures-2018/pages/3/>

Northern Ireland: DAERA (2019) Policy Economics and Statistics Division, Farm Incomes in Northern Ireland 2017/18

Despite this situation, in 2016/17, less than one in five LFA grazing farms in England regularly managed farm performance, such as producing budgets, gross margins, cashflows or analysing their profits and losses²⁴. Figures show that more profitable farms were more likely to be those that actively engaged with the business management side of their enterprise²⁵. For all farm types, the top 25% of farm performers were 2.5 times more likely to undertake business management practices such as looking at their profit and loss account compared to the bottom 25% of performers.

The importance of understanding farm accounts, and in particular the profitability or otherwise of the agricultural business itself (before income from support payments or income from non-farming activities) will only become more important as the UK leaves the EU and new support systems are introduced in the four UK countries.

3.1 Public support available to farmers in upland areas

The availability of support to upland farmers and those in marginal areas differs in the four countries of the UK. There have been significant changes to agricultural policy and the nature of support provided to farmers in the uplands over the years and this in turn has heavily influenced the response of farmers, both in terms of stocking levels and in the way the land has been managed²⁶. Indeed, the post war drive for production, stimulated through agricultural output subsidies, resulted in agriculture becoming more of a full-time occupation in the uplands than had been the case previously, when farming was one element of the economic activities carried out on the farm within much more diverse rural economies. Indeed, even today many farms have a portfolio of enterprises operating from the farm.

To provide some context to the current economic situation facing upland farms, the current (2019) system of support operating under the EU's Common Agricultural Policy (CAP), includes:

- Direct payments, providing payments per hectare of farmland - all four countries provide direct payments, although the payment per hectare varies (see Table 2).
- Additional payments to farmers within Less Favoured areas (formally now known as Areas of Natural Constraints) – only Scotland provides these payments from 2019.
- Payments are also available in all four countries for environmental management under agri-environment schemes as well as for organic farming, including support for the costs of conversion.

In addition, all farms, whether or not they are in the uplands, must also comply with a basic set of rules and standards to receive CAP support – known as cross-compliance. These include standards relating to: public, animal and plant health; environment, climate change and good agricultural condition of land; and animal welfare. In addition, requirements under the Pillar 1 'greening' measures, *inter alia* limit changes in the extent of permanent grassland (as a proportion of total agricultural area) to 5%.

²⁴ Defra (2018) Health and Harmony Evidence Compendium

²⁵ In England, for all farm types, the top 25% of farm performers were 2.5 times more likely to undertake business management practices such as looking at their profit and loss account compared to the bottom 25% of performers (Defra, 2018, Health and Harmony Evidence Compendium).

²⁶ Condliffe, I. 2009. Policy change in the uplands. In Bonn, A., Allott, T., Hubacek, K. & Stewart, J. (eds) *Drivers of Environmental Change in Uplands*: 59-89. London. Routledge

Table 2: Direct payment rates in the UK

UK (England)	Three regions. The 2018 rate, including the greening element: <ul style="list-style-type: none"> - Non-SDA land: €259.52/ha - Upland SDA, other than moorland: €257.53/ha - Upland SDA moorland: €70.23/ha
UK (Northern Ireland)	One region: Approximately €229/ha, including the Greening payment and capped at €150,000
UK (Scotland)	Three regions. Including the greening payments, the payment rates for 2019 are: <ul style="list-style-type: none"> - Region 1: €165.63/ha (~1.8m ha): better quality agricultural land, typically used for arable cropping, temporary grass and permanent grass. - Region 2: €36.16/ha (~1m ha): better quality rough grazing designated as Less Favoured Areas (LFA) grazing categories B, C, D and non-LFA. - Region 3: €10.48/ha (~2m ha): poorest quality rough grazing designated as LFA grazing category A
UK (Wales)	One region. 2019 rates are: €125/ha, with an additional redistributive payment of €120/ha on the first 54ha.

The nature of support available to farmers will change in the four countries of the UK in the coming years, when the UK leaves the EU. Each UK country is in the process of developing their new systems of support which will start to take effect from 2021. In the case of England and Wales, the current proposals are that this will involve the removal of direct payments, but that support will be available to pay farmers for providing environmental public goods, amongst other things. In Scotland, under 'Stability and Simplicity' proposals, existing support payments are set to continue up to 2024 with a new rural policy likely to be introduced after that. The nature of this new policy is yet to be determined. In Northern Ireland, without a functioning Assembly and Minister for Agriculture and the Environment, the future policy direction remains unclear, but current support arrangements are expected to continue until at least 2021.

4. Making marginal farming systems more profitable: the Nethergill approach

The severity of the economic challenges facing hill farming, coupled with the evidence of the ongoing issues facing the environment in upland areas drove Chris Clark, an upland farmer and business adviser, to join forces with Brian Scanlon, business adviser, to investigate how to improve the profitability of upland farming²⁷. Their approach has been to examine the accounts of individual upland farms to seek to understand the fundamental economics of the farming aspects of the business, before support payments and other income from non-farming activities are taken into account, and to provide insights into how this might be improved. Seeking to find ways to enable upland and marginal farms to become more profitable is not something new. However, the Nethergill approach has sought to apply micro-economic theory to farm accounts in a way that farmers can relate to.

Their impetus for doing this is a vision for the future of the uplands in which the 'uplands will be a **balance** between food, farming, nature and the communities that are settled there' and where the uplands naturally provide:

²⁷ Nethergill Associates is a business consultancy aimed at helping farmers and SMEs develop and improve the resilience of their businesses to deal with the realities of leaving the EU.

- A foundation for people and communities to live and work;
- High quality beef and lamb, for people to eat (albeit at reduced quantities compared with now);
- Landscape and nature for people to step off their world and revive; and
- Natural services that are essential to the well-being of society: clean water; carbon storage and biodiversity.

Extensive mixed cattle and sheep systems can help maintain the quality and quantity of the ecosystem services that these marginal areas can provide. However, to enable extensively managed hill farms to survive into the future, ways need to be found to make them profitable. To do this, farm businesses need to be well budgeted and planned, and to understand the fundamentals of their income and expenditure from different income streams (livestock, diversification, off-farm income, public support) to enable them to make informed business decisions.

4.1 The realities of hill farming

Farming at Nethergill Farm in the Yorkshire Dales, Chris Clark understands the realities of hill farming. From a purely commercial perspective, the main objective *is to turn grass, through grazing livestock, into meat products in a way that is profitable*. At the most basic level, it is often assumed that as the size of a flock/herd increases so does the consumption of grass and that if the revenues generated by a farm increase faster than the costs incurred, then as its output grows, profits will inevitably result at some point, provided there is enough grass.

The disadvantages that hill farmers face from high elevation, precipitation, poorer soils and, for some, the additional disadvantages of a northerly latitude, result in less grass per hectare than their counterparts in lowland areas. Increasingly, farmers have sought to correct these natural deficiencies of the uplands through additional expenditure, such as the purchase of artificial fertilisers to increase the availability of grass and/or the purchase of either winter grazing or feed. This has enabled farmers to increase the number of livestock to levels well above what the naturally available grass can sustain and to generate significant additional revenue, often using breeds which may not be suited to upland environments and require more inputs, such as grain feed. The logic has been that, by increasing production, output also increases and that this must therefore equate to increased profitability.

But in fact, this study suggests that this is a false assumption. Instead, what has been found on all the farms analysed is that, in taking this approach the underlying profitability of the business does not improve beyond a particular point and then declines. This is because the extra costs incurred over and above the availability of naturally available grass, increases at a faster rate than revenues from the meat produced to the extent that profitability is reversed. As a result, by increasing stocking rates, greater losses are incurred. At the same time these decisions can lead to collateral damage to the environment – for example, water run-off from fields treated with excess fertilisers pollutes river courses and increases the costs to water companies of water purification.

Therefore, what these case studies have shown is that farming beyond the limits of what is possible using the grass the land can produce naturally (i.e. without artificial inputs), is not only less profitable to individual farm businesses, but also becomes more intrinsically unprofitable in the wider economy once the wider environmental impacts are taken into account.

Agricultural policy has perpetuated this uneconomic situation. While direct payments provide a valuable safety net for farmers, at the same time they allow farmers to put off examining the underlying business

model they are operating. LFA (in Scotland) and environmental payments also provide an important income stream for some farmers in upland areas but are voluntary and often not seen as an intrinsic part of the farm business model. As such they have not to date been sufficient to spark a fundamental change of approach to farming in upland and other marginal areas.

4.2 Reducing output to improve profitability

The profit of any farm is the surplus that remains after all costs are deducted from revenues received. However, many farm accounts generally include a range of types of income in the revenue line. This not only includes revenue from farming activities (e.g. the income from sales of livestock), but also agricultural support payments, environmental payments, as well as revenue from other income streams, such as diversification activities. As found in the farms examined, this leads to a situation where many farmers only look at the overall revenue line against costs.

However, including CAP support payments and treating non-farming activities as if they were part of the farming business can simply mask the true economic situation of the farming activities alone (which is often unprofitable) and avoids decisions being made about how to improve the underlying profitability of the farming business itself.

Under the Nethergill approach, the farm accounts are examined first to include only revenue and the fixed and variable costs associated with the farming activities to understand the underlying dynamics of the business and to inform decisions about how to improve profitability. Only once this has been done are other streams of revenue taken into account. Taking the public support element out of the initial analysis of the farm accounts allows a clearer picture to emerge about the factors influencing the profitability of marginal / hill farms.

The crux of the Nethergill approach is the identification of the point of maximum profitability for the farm business. This they have called the **Maximum Sustainable Output (MSO)**. The steps taken to analyse the accounts and identify the maximum level of farm output that is economically sustainable under the Nethergill approach are set out in Annex 1 and the rationale for taking this approach is set out below.

Since one of the main issues facing upland farm businesses is creating a positive profit margin from the farm enterprise alone, the investigation of the farm accounts focusses first on the variable costs associated with the business and how these relate to volume of outputs. Only then are fixed costs taken into account. This is the opposite to the sequence taken by accountants who seek to recover unavoidable fixed costs as a first priority. The Nethergill approach reverses the sequence to establish the primary cash flow in the business, as if this is not positive a business will lose cash (and hence decapitalise). In such cases it must be questioned whether a business can ever be shaped to be viable.

4.2.1 Investigating variable costs

In seeking to understand the relationship between the volume of output from the farm and its variable costs, the critical discovery is that variable costs have to be separated into two categories and the inflection point between the two identified in order to make sense of what is going on. These two categories have been differentiated as follows:

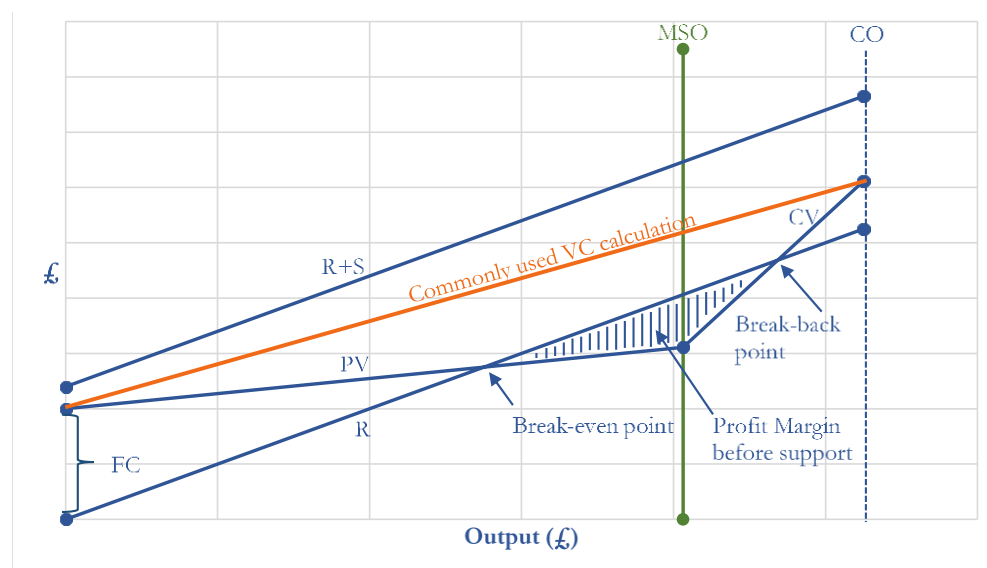
- *Productive variable costs*: essential /unavoidable costs linked to livestock production (e.g. seeds, home grown concentrates, bedding, contract labour, essential vet & med costs); and
- *Corrective variable costs*: Avoidable / non-essential costs linked to livestock production associated with production above the natural carrying capacity of the grass (e.g. bought in livestock feed, fertilisers, sprays).

What the Nethergill approach showed was that the variable costs were non-linear in nature²⁸ (i.e. that there was an inflexion point in two separate linear costs lines). However, discussions with farmers in the case studies indicated that farmers were making business decisions based on the assumption that their total variable costs were linear. This meant that increasing production to achieve economies of size was leading to a reduction in profitability rather than an increase. This can be explained as follows:

- Many farmers were assuming that their variable costs were linear. By doing so, the assumption was that output (and therefore income per unit of output) would increase in proportion to increases in variable costs – so the more one puts into the system, the more one gets out. If one operates on this logic, once revenue exceeds variable and fixed costs, then breakeven point is reached and the business starts to make a profit. If either variable or fixed costs can be reduced, then the breakeven point can be reached at lower volume of output and therefore profits can be increased.
- In farming however, the reality is that variable costs are not linear. Instead there is a point at which the costs per unit of output start to increase at a faster rate – i.e. it starts to cost more to produce an additional unit of output. This is in keeping with the economic explanation of how costs behave. The Nethergill approach, using a geometric approach (see Annex 1), has calculated that this is the point at which it is no longer possible to generate the volume of output on the basis of 'free issue inputs' (naturally available grass, rain etc) and productive variable costs (e.g., home grown feed concentrates, seeds, bedding, machinery costs etc) – see point of inflection on the variable costs line in Figure 5 below. At this point, to generate more volume, one needs to add additional inputs/costs (corrective variable costs (e.g. fertilisers, vet & med, feed concentrates, winter fodder, auction fees, off-wintering costs, haulage etc). However, the additional costs increase at a faster rate than the volume of output it is possible to generate. Therefore, any additional output produced using corrective variable costs becomes more expensive per unit of output than that produced using only productive variable costs.
- The result of this is that if one continues to assume variable costs are linear (i.e. apply a volume driven logic to the farm business) past the point where corrective variable costs kick in) then before long the costs exceed the revenue and the farm business moves from making a profit, to making a loss (see Figure 5). This means that beyond a certain point, the business cannot continue to make a profit by volume increases alone. Put another way, **if there isn't enough natural grass, no amount of corrective economic action can make farming any more profitable.**

²⁸ To note that in this approach actual costs are used rather than marginal costs.

Figure 5: Principles of non-linear variable costs – an illustrative situation facing a hill farm



Legend:

FC	Fixed Costs
R	Revenue without Support
R+S	Revenue with Support (BPS + environmental payments)
PV	Productive Variable Costs
CV	Corrective Variable Costs
MSO	Maximum Sustainable Output
CO	Current Output

Once it is accepted that variable costs are non-linear, this changes the way decisions relating to the farm business are made. Followed to its logical conclusion, the volume of output should only be increased to the point at which the costs associated with production remain less than the revenue it is possible to generate from sales. Knowing when this point is reached requires farmers to actively engage with their accounts.

This point is what is termed '**Maximum Sustainable Output**' in the Nethergill approach. It is the point of maximum profitability at current levels of fixed costs and is the point at which the naturally available grass runs out. In the Nethergill analysis, output has been measured in terms of pounds sterling as a surrogate for physical livestock numbers. Beyond this point, a farm's intrinsic profitability declines, and ultimately reverses, with any further attempt to produce additional revenue via increased output leading to financial losses. It should also be noted that the stocking rates at the MSO level should equate to those that can be sustained by the naturally available grass (irrespective of breed of livestock). This means that the pressures on the environment, e.g. soil, water quality and biodiversity should be reduced.

It should be noted that the MSO point is not static. It is a function, ultimately, of physical, not financial, factors. The availability of grass on a farm changes from year to year and the true physical MSO therefore will change accordingly. It would be expected that the MSO would move to a greater volume (to the right) over time as the fertility of the land recovers (free-issue grass increases) and the land has the capacity to carry more stock. It is also important to be clear that the MSO calculations that come out of the study are designed to provide a direction towards which farms can move over time, the scale of the task involved and the likely economic benefits. The acid test for reaching the MSO point is that at that point no

corrective variable costs are incurred. The aim of the MSO calculation is to allow farmers to identify where they are situated on the graph (Figure 5) and to then move the MSO as far to the right as possible by implementing a grazing management regime that takes the most advantage of the naturally available grass. It should be noted, however, that in some situations it may be desirable for environmental reasons to have stocking rates at a level that is higher (or indeed lower) than the economic optimum (MSO level) in order to achieve a specific environmental outcome. In the situation where different stocking rates were desirable, the higher costs required to achieve those higher stocking levels or the loss of income from having lower stocking rates would have to be paid for in return for providing the associated public goods. However, while determining the MSO level and reducing output to this level will improve profitability, this is not the end of the story. Even at the MSO level of output, many of the farm businesses whose accounts were examined were making a loss before agricultural support. This means that, for upland farms to make a profit without agricultural support or with environment payments only, other solutions are also required, such as increasing the price received per unit of output and/or reducing fixed costs.

4.2.2 Investigating fixed costs

In the Nethergill analysis the fixed costs have been taken as those declared without removing lifestyle related or unnecessary costs.

In many of the case studies, fixed costs were very high in comparison to the value of sales and therefore place a considerable burden on farm operations. It was apparent that, while some of the fixed costs were essential or mandatory²⁹, others were more about lifestyle choices (e.g. when tractors much larger than the real requirement are acquired, or machinery is purchased for tasks which result in very low levels of utilisation). A common issue found was that many of the assets were not working as efficiently for the business as they could do, the result of being caught by what might be called an 'inflationary assets trap'. For example, it is common practice for farm accountants to advise that tax liabilities can be reduced by purchasing new capital assets (such as machinery). On upland farms (and probably many others) this machinery is used infrequently and is left unused for most of the farming year. This leads to additional costs in machinery repairs and maintenance, which in turn reduces profitability even further. In many cases, farmers say that they use their direct payments pot of money for making these purchases, which raises additional questions about good value for public money.

4.2.3 Results from the case studies

Analysis using the Nethergill approach was carried out in seven case studies in England, Scotland, Wales and Northern Ireland. Some of these case studies involve aggregated accounts from more than one farm business. In total the accounts of 29 farm businesses were examined across the seven case studies. In addition to the seven case studies, an analysis of the Farm Business Survey (FBS) data for 2016/17 for 17 SDA grazing farms in Yorkshire, Lancashire and Cheshire was carried out.

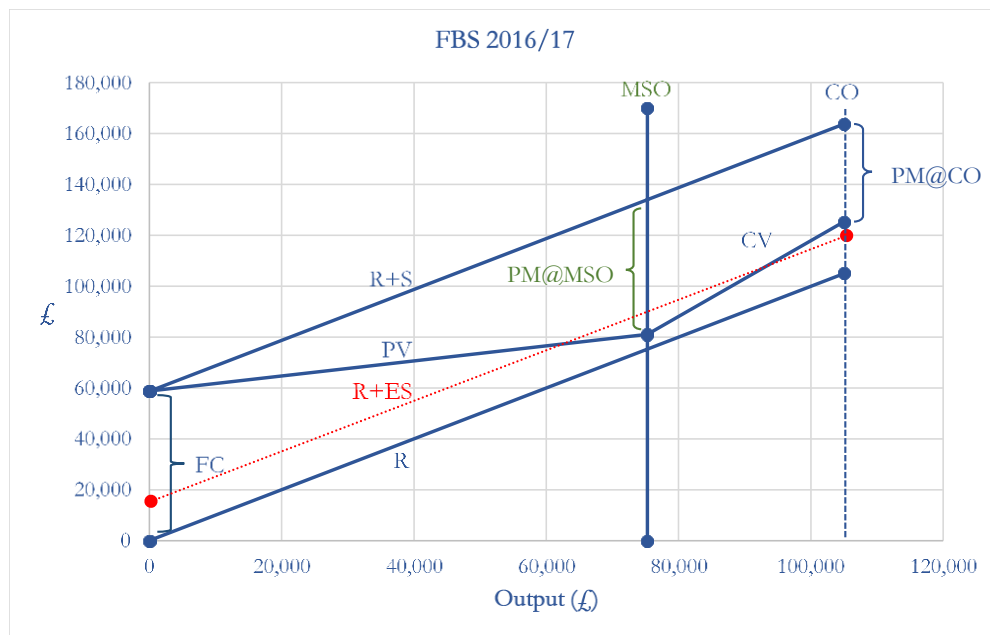
Turning first to the analysis of the FBS data (see Figure 6), here the average figures show that without any public support (direct payments and environmental payments), on average the farms were making a loss of -£20,362/year (on an average revenue of £105,044). With support, the farm business income turned

²⁹ Essential costs would be those costs required to carry out activities that are critical to having a credible business operation and are set at a level consistent with being the least cost possible. Mandatory costs are costs such as those incurred through carrying out obligations in the rental agreement or in cross compliance, such as to maintain walls or other aspects of the property.

positive, on average £38,376/year. The level of maximum economically sustainable output (MSO) was calculated to be an average of £75,270. The calculations indicate that if farms operated at this level of output:

- Without any financial support, they would reduce their losses to -£5,807.
- With only current levels of environmental support (i.e. no direct payments), which average £18,686/farm, the farm business income would be £12,869.
- With all current support (direct payments and environmental payments), farm business income would rise to £52,931/year.

Figure 6: MSO Calculation for 17 FBS SDA grazing farms in Yorkshire, Lancashire and Cheshire



Turning to the seven case studies (details of which can be found in Annex 2), the analysis has led to results that all tend to follow a common pattern, whether the farm is managed by individuals or environmental organisations, whether in a protected landscape or not. As with the analysis of the Farm Business Survey data, farm business income was examined at both current output levels and with output levels reduced to the MSO level under three scenarios:

- 1) all current support included;
- 2) only environmental support; and
- 3) no financial support.

The findings, showing in which case studies farm business incomes are positive or negative at existing levels of output and at MSO (reduced output), and with and without financial support, are shown in Table 3.

Table 3: Results of reducing output on profitability for the seven case study farms

Type of support included in calculation	Level of output	Case studies operating with a positive farm business income	Case studies operating with a negative farm business income
All current support included	Current output	4	3
	MSO	6	1
Only environmental support ¹	Current output	1	5
	MSO	2	4
No support	Current output	0	7
	MSO	1	6

¹NB: it was not possible to verify the allocation of environmental support to case study D. In addition, environmental payments for case study B are an underestimate meaning it is not possible to calculate whether the farm would be in profit or loss with only environmental support (see note to table 4 below).

This shows that moving to MSO, i.e. a situation where stock are grazed only on the naturally available grass (but with no other actions taken to increase price or reduce fixed costs) improves the farm business income (either making it move into the black or reducing losses) on all the farms examined. However, with no support payments, only one of the case studies moves into a profitable situation. If environmental payments are included (at current levels), farm business income becomes positive for two case studies (see also Table 4). Therefore, to move the case study farms to a profitable situation without direct payments would require some combination of price increases, reductions in fixed costs and environmental payments.

It should be noted that profit here is meant in the way as would be calculated by a tax accountant – i.e. does not include drawings, tax or contributions to capital expenditure or the opportunity costs of using own land, labour, management and capital.

Table 4: Comparison of the contribution of environmental payments to farm business income in six of the seven case studies

Case Study**	A	B	C	E	F	G
Profit/Loss (without any support) at current output levels (£)	-190,466	-86,588	-24,211	-17,293	-129,149	-27,739
Profit/Loss (without any support) at MSO (£)	-171,978	-64,533	-13,006	-13,553	-78,324	7,046
Environmental payments (£)	199,682	638*	9,732	2,500	42,500	5,910
Profit / Loss at MSO plus existing environmental payments (£)	27,704	-63,895	-3,274	-11,053	-35,824	12,956

* To note that this figure excludes substantial environmental payments, the figures for which were not available. Therefore the real figure of profit/loss at MSO including these payments would be less of a loss or perhaps even a profit.

**NB: it was not possible to verify the allocation of environmental support to case study D and therefore the results for this case study are not included here.

Source: Case study results

These findings are also corroborated by research from the Pasture Fed Livestock Association (PFLA)³⁰ which has shown that pasture-based farms can achieve similar or better profit margins compared with producers using bought in feed. As found through the Nethergill Associates' research, the report shows that while relying on forage alone can mean reducing livestock numbers and total output, cutting inputs such as concentrated feeds can bring costs down dramatically, thereby improving profit margins. These margins can be increased through attracting a premium price, for example via PFLA certification (see Chapter 5). The PFLA has also shown that animals grazing on herb-rich grassland also have a more diverse diet which can give better natural protection from disease and pests and therefore cuts the need for pesticides, antibiotics and veterinary care, with research showing that the meat has benefits for human health³¹.

5. Implications for farm businesses and the environment

The findings of the farm accounts analysis carried out on the 29 upland farms highlighted above (and the 17 FBS SDA grazing farms) indicate that to improve profitability, upland farms will have to think differently about the way their businesses are run in the future and to consider what changes would be required to ensure their longer-term viability. This will have knock on implications for the environment, farming and wider rural community more generally. Some of the considerations are set out below, first looking at the importance of business planning and then outlining some of the options for farmers to improve the performance of their businesses, drawing on examples from the case studies.

5.1 Greater focus on business planning to improve farm business performance

If the profitability issues facing upland farms are to be resolved, these case study examples show the benefits to farmers of exploring proactively the various options open to them to improve the viability and profitability of their businesses. This will require a greater focus on the detail of their farm accounts than is often the case currently and means keeping detailed digital records so that business decisions can be made objectively and on the basis of data.

In deciding how to improve the performance of the agricultural parts of the farm business, one of the first decisions to be made is what the Return on Total Assets (ROTA) is that the business aspires to (and can realistically achieve). This helps subsequently to determine what changes are required within the farm business to achieve this goal (see below and Annex 3 for more details). ROTA is a composite measure that combines the influence of balance sheet related issues and profit and loss account related issues on overall performance. Mathematically,

$$ROTA (\%) = \text{asset turn} \times \text{profit margin} (\%)$$

Asset turn is a balance sheet related item and measures how hard the assets are working in the business. Profit margin (%) is a profit and loss account related item that measures profitability. The target for ROTA should be:

the cost of money (say building society interest rates)

³⁰ Pasture for Life (2016) *It can be done – The farm business case for feeding ruminants just on pasture*.

³¹ The research shows that grass-fed meat tends to be lower in total fat content, but with higher levels of fats such as omega 3, as well as containing higher levels of vitamin A and E. See <https://www.pastureforlife.org/media/2016/07/the-human-health-benefits.pdf>

+ a premium for the risks taken by the business (%)

In farming, because of land values (to owners directly, or tenants through their rents), the asset turn challenges will be greater. With typically low asset turns in farming the ROTA objective puts more pressure on margins to compensate and this, too, is not an easy proposition.

Once the goal has been set, decisions can then be made about how to achieve this. The consideration might include, for example:

- The potential to remove surplus assets and make assets work more efficiently, such as to:
 - reduce the cost of fixed assets (e.g. machinery, equipment, land, buildings, stock);
 - increase intangible asset turn or reduce intangible asset liabilities - assets that have value but do not show up on the balance sheet and may require additional revenues to service them (e.g. reputation, product recognition, relationships with neighbours, suppliers etc, high quality environment and landscape);
 - increase accounts receivable (i.e. the amount of money received for goods and services provided) and reduce debtor days;
 - decrease accounts payable (i.e. the amount owed to others for goods and services received).
- The potential to improve profit margins, for example through:
 - increasing the price received for goods;
 - reducing variable costs (materials, labour, etc);
 - changing the volume of production.

Once decisions have been made about what changes to make to the business these can be turned into Key Performance Indicators (KPIs) to set out clearly the result required (e.g. size of the reduction in fixed costs or price increase to attain). This then allows progress against these targets to be assessed objectively over time.

5.2 Options for improving profitability

Controlling costs: As shown above, **reducing stocking densities and associated output to remove 'corrective' variable costs** leads to improvements in profitability/reductions in losses. In many upland situations reducing stocking levels to the carrying capacity of the land would also reduce environmental pressures and lead to environmental improvements, particularly in areas where high stocking densities currently (and historically) are leading to overgrazing, reducing the biodiversity value of upland habitats, poaching leading to soil erosion and fertiliser use which is causing pollution of water courses. Research has shown that feeding animals on pasture rather than cereals brings other environmental benefits and that the meat has health benefits too (see above). Conventional beef production uses around 1.25m tonnes per year of grain – or 10% of UK production from 150,000ha of land, with grain fed to sheep requiring another 16,000ha. Replacing cereals with pasture also would avoid some of the negative environmental effects associated with cereal production, such as the effects on water, soils, wildlife and the greenhouse gas emissions of ploughing, fertiliser and pesticide use³².

³² Evidence from the PFLA as quoted in CPRE (2018) Back to the land: rethinking our approach to soil, Food & Farming Foresight – Paper 3

Through the approach taken it is possible to demonstrate that by damaging the environment, farmers are decapitalising the value of their land if the profit stream is examined over the lifetime of that asset (i.e. the land/farm) – for example through reducing the natural ability of the land to produce grass through overgrazing or by creating situations where upland grass or dwarf shrub is replaced by bracken. Although this does not currently show in the balance sheet, if the net present value of the environmental assets of the farm were to appear on the balance sheet then it would be much clearer that the focus of the business model should shift towards recapitalising the farm through looking after the environment. However, given that operating at the MSO alone does not always enable upland farms to make a profit without direct payments, other options to improve business performance must be considered. Some of these are set out in more detail below.

Increasing price: Initiatives that add value can help increase the price received for meat from the uplands. Quality is the key to success with added value options, with the price premium as the prize. Pasture animals deliver a high-quality product, especially when traditional breeds are used that have the right genetics for grazing successfully in upland situations. Delivering on quality can be done in many ways, but fundamental to all is moving towards sustainable farming practices that can show a demonstrable positive impact on the environment, landscapes and minimising their greenhouse gas emissions. With consumers becoming more interested in where their food comes from and more discerning about what they eat, there may be a considerable increase in the potential to market meat based on its provenance, including its environmental and health credentials. Although currently many upland farmers produce store animals rather than finishing them on the farm, this is starting to change, with farmers keeping their animals for longer (over two years) to achieve the desired finished weight and market the meat on that basis. Although there is an additional charge to slaughter animals over thirty months (OTM), there are also reduced costs and risks to the business as breeding stock can be reduced and the risks with birthing are reduced as well as the improved price received for the meat.

National Parks and other bodies should be the catalysts for creating new umbrella brands to market this kind of upland meat, its provenance and its environmental credentials. Some work carried out for the Yorkshire Wildlife Trust by Nethergill Associates looked at the pros and cons of different ways of branding meat from the livestock grazing on their reserves, including the price premia that might be achieved. The study looked at strengths and weaknesses of selling the meat via local butchers, via setting up a local meat box scheme, developing ready meals from the meat and selling meat online. Of these options, developing and selling ready meals was shown to be the most profitable, with selling the meat via a local butcher coming a close second. The difference, however, is the investment (both in time and equipment) required for selling ready meals, even though this was more than made back in the profitability of the enterprise. While selling via a local butcher was also shown to be profitable, for this option to work successfully required good branding and ensuring traceability of the meat. This provides some useful indications of options that could be considered by other farmers operating in an upland environment.

In the Welsh case study example (Case Study F), opportunities existed to raise prices by adding value to their meat. This would be possible through, for example, reviving the currently redundant cutting room activity, possibly supported by online artisan meat sales to high net-worth individuals in the region and to the captive caravan, glamping and camping tourists. In the Scottish croft example (Case Study E), there were opportunities to focus attention on the continued development of the successful farm shop business, and to continue to sell the meat through the farm shop focussing on the environmental sustainability of the lower stocking rates (once reduced to MSO level), traceability and the integrity of the food chain. Making the changes necessary can start small and build over time.

Reducing fixed costs and making assets work more efficiently: The level of fixed costs as a proportion of output on the upland farms examined ranged from 56% to 290% of revenue. A focus on reducing fixed costs is therefore essential in all cases as this could improve profitability significantly. It should be noted that there is inevitably a minimum level of fixed costs required for the efficient operation of the farm business (essential and mandatory fixed costs), but these should be minimised insofar as is possible. If revenues fall below the level of fixed costs in a situation where agricultural support payments disappear, then farming ceases to be a realistic possibility.

One of the main opportunities for reducing fixed costs is carrying out a review of the equipment and machinery on the farm and assessing whether or not savings could be made. It may be that smaller or less advanced models would be just as effective or hiring equipment when it is required would be more efficient. There may also be opportunities for the business to share machinery wherever feasible to make sure that repair and maintenance costs are spread. In an upland situation machinery would need to be shared between farms at different altitudes - not necessarily all that far apart - so the machinery is not required at the same time in the season.

Options for collaboration and cooperation go beyond sharing machinery and were once prevalent in the uplands, where farmers shared labour across their farms to carry out tasks such as shepherding, livestock gathering, shearing etc. Thinking about what sorts of cooperation might work in today's situations (e.g. sharing of human and physical resources, including the way land is used) would be useful as a means of making assets work more efficiently across a larger area of land. One example of collaboration that currently works in the Yorkshire Dales is shown in Box 2.

Box 2: Example of collaboration to make the most of the assets between two farms

Farm A: Shortage of in-bye land and stocking rates below MSO

Farm B: Plenty of in-bye, as located at a lower elevation, with stocking rates above MSO, but under-utilised farm machinery

The issue facing Farm A:

- Farm A has a yield of hay that is not enough to satisfy the number of winter-housed stock that could be grazed year-round, even at MSO
- To avoid Corrective Variable Costs (CVC), stocking rates are based on the amount of winter forage available and so are below MSO
- Buying in winter forage to increase stocking numbers creates a CVC and therefore reduces margin

The solution:

- Use Farm B's stock in summer to raise stocking to MSO level for Farm A
- This reduces the summer stocking rate on Farm B, which takes it closer to the MSO level and also reduces the CVCs for fertilisers and purchased feed
- The summer grazing on Farm A by Farm B is 'paid' for by hay/silage from Farm B and by Farm B undertaking the haymaking on Farm A
- This additional winter forage allows more stock to be housed during the winter on Farm A
- Farm B's machinery is being utilised over more acres, stock and bales.

Turning back to fixed costs alone, if the farm business is viable and there are opportunities for diversification to create a portfolio of revenue streams, then this provides an opportunity to allocate certain fixed costs (e.g. personal and living costs) between the diversified activities. This can have a significant impact on the accounts of the farming activities.

Environmental payments: Payments for environmental public goods and ecosystem services are set to become an increasingly important focus of public funding for farming in many parts of the UK in the future, and indeed the primary focus in England and Wales. It is also increasingly something that private companies are investing in, for example water companies paying farmers for carrying out land management practices that reduce pollution of water courses and therefore reduce the costs of cleaning the water to be fit for public consumption.

All farmers and other land managers that contribute to delivering environmental outcomes should be eligible to receive these sorts of payments, which can become a valuable income stream in their own right, providing a secure source of income over a period of time. As shown in the case study examples above, without direct payments, having environmental payments as part of the revenue stream can make the difference between a farm being profitable and making a loss. In the hills, a shift in mindset is required about the purpose of upland farming from producing food (as a commodity) to producing environmental public goods / sustainable management of natural assets (e.g. habitats and species). In turn the environment can be used as a marketing offer to add value to the meat which has been produced for the purpose of grazing land to produce environmental benefits. The more farms that enter into environmental agreements in the future to produce environmental and climate goods and services in return for income, the more this could become a more mainstream income stream for upland farms. This would, of course, require Governments to make sure that sufficient budget was available for such schemes in the future. Recent work has estimated that £2.9 billion annually would be required to meet the identified environmental land management priorities in the UK, based on current payment rates for land management schemes as well as historic estimates of the costs of habitat creation and restoration, adjusted for changes in cost drivers³³. England accounts for 60% of the overall cost estimate, followed by Scotland (25%), Wales (9%) and Northern Ireland (7%).

Question the ongoing viability of farming: If none of the options highlighted above provide opportunities for the farm to become profitable, then questions would have to be asked about whether or not it is possible to sustain a farm business in those circumstances. In these situations, other options would have to be considered about what to do with the land, which might include renting it or selling it to neighbouring farmers and potentially using the buildings for other purposes or considering changing the land use – for example through afforestation or rewilding. However, any changes would have to be carefully considered in terms of their location and species used, would be subject to the relevant planning regulations and environmental impact assessment rules, be environmentally beneficial and in keeping with the character of the landscape.

³³ Rayment M (2019) Paying for public goods from land management: How much will it cost and how might we pay? Final Report, A report for the RSPB, the National Trust and The Wildlife Trusts

6. Conclusions

The results of applying the Nethergill approach to the farm accounts of 46 farms in upland and marginal areas have shown that expanding flock and herd sizes in the uplands to overcome disadvantages of latitude, elevation and precipitation is economically damaging as well as damaging for the environment. The nature of non-linear variable costs implies that future success will not come from chasing volume growth alone. In fact, once the locally available grass (essentially at free-issue cost) has run out the farming activity becomes less profitable with expansion. Therefore, pursuing a business model that is solely production based – assuming increased profitability will ensue from increased volume of output – is not economically sustainable.

The findings from this analysis challenge the received wisdom that greater profitability can be achieved from increasing production as a result of economies of scale. Instead, the results should help farmers focus on adjusting their management towards activities that would achieve greatest profit margin. If this is done, the analysis shows that this would lead many upland farmers to adjust their stocking levels downwards. In turn, where over-grazing is an issue, this in turn will have knock on environmental benefits by reducing some of the environmental pressure on the land.

The analysis has also shown that, when public support payments are taken out of the revenue line, for some farms reducing stocking levels to the MSO reduces financial losses, but it does not take them into profit. The current system of support has hidden the true financial situation of the agricultural activities taking place on upland farms and has provided a safety net that has meant that insufficient attention has often been paid to the underlying profitability of their operations. This highlights the importance for farmers to review their farm accounts in detail and proactively engage in business planning to find ways to improve their long-term viability. This is especially important now in order to prepare for the introduction of new systems of public support to agriculture in the UK, particularly the planned removal of direct payments in England and Wales.

By looking in detail at the accounts of the agricultural part of the business for this selection of upland farms, it has also become clear that the level of fixed costs is unsustainable, particularly looking ahead to a situation without direct payments. Not all fixed costs identified were essential to the farm operation or being used as efficiently as they could be, and this suggests that urgent attention is required to reduce these as far as possible as another means of boosting profit margins (or reducing losses). There are a number of options to address this. Where the agricultural enterprise is or becomes one of a portfolio of businesses on the farm, fixed costs can be spread between the businesses, however in other cases, a more collaborative and cooperative approach to managing multiple farms' resources may provide a solution. Focussing on these types of solutions may help maintain many of the small to medium sized family farms that are under pressure financially and yet form an important element of local communities.

Given the reduced pressure on the environment that would be brought about by reducing stocking levels to the MSO, this also provides farmers with opportunities to benefit from increased income associated with the delivery of environmental outcomes. This could be through changing their focus and purpose towards producing meat as a means of delivering environmental outcomes, resulting in a focus on producing high quality meat products, using their environmental credentials to achieve a price premium. In addition, there will be opportunities to take greater advantage of public payments for delivering environmental and climate benefits that are valued by society.

However, it should also be recognised that in some upland situations, under-grazing is increasingly becoming an issue from an environmental perspective, particularly on areas of land that are more difficult to access and manage. In these cases, for environmental purposes an increase in stocking levels would be required, to bring levels up to the MSO level. In other situations, there may be a need to maintain stocking output levels above the MSO level to manage a particular habitat to achieve an identified environmental outcome (e.g. increase populations of breeding waders). In these cases, payments to farmers to deliver these outcomes will also be required, either to increase stocking levels to the MSO level or maintain them above.

It may be that, as agricultural support systems change in coming years, if reducing fixed costs and increasing income cannot deliver the necessary profit margins, that some restructuring may take place, with larger farm units, managed by fewer farmers, a trend which has been taking place for many years already. However, improved business planning and taking advantage of the options above should help avoid this wherever possible. Key will be to find a way that this can happen without damaging the environment or losing the character of the countryside or local communities that are an important part of our natural and cultural heritage.

This transition to a new business model for upland farming will not take place overnight nor without additional support for farmers and crofters such as through enhanced advice, training and knowledge transfer initiatives. It is also clear that there will remain situations where the economics of running an upland farm cannot be made to work. In these cases, decisions will have to be made about what course of action to take. For smaller enterprises, developing a portfolio of revenue streams is likely to be the future, whereas larger farms may be able to justify focussing on farming alone. It would be interesting to apply this approach to other farming systems in the UK, such as lowland grazing and arable systems, as initial analysis suggests that similar results may be found.

Some of the key messages that flow from this analysis are as follows:

- Hill farms and those in other marginal areas face economic challenges but they could improve their own business performance without recourse to financial support by reducing stocking levels. This requires the farm business model to shift from a focus on production to a focus on profit margins.
- Moving stocking levels to MSO levels, i.e. those that can be achieved on the naturally available grass, without requiring additional inputs, is also generally beneficial for the environment. By improving the condition of a farm's natural assets this in turn should improve the flow of ecosystem services, such as clean water or reduced flood risk.
- Alongside reducing stocking levels, reducing fixed costs and increasing income from farming activities are important components of improving profit margin. Making farm assets work harder, for example through greater collaboration and cooperation between farmers, as well as adding value to meat products and marketing on the basis of its environmental credentials, are examples of opportunities to which farms operating in upland and marginal areas could give greater consideration.
- To inform such decisions, business planning is critical. This allows the underlying profitability of the farming part of the business to be understood before income from financial support and other sources is taken into account, which in turn can inform decisions to be made about the

course of action to take to assure the long-term viability of the business. Farming activities can be one of a portfolio of businesses operating on or from the farm, but it is important that the economic viability of each of these is understood.

- Reversing the environmental declines in upland and marginal farming areas requires more than simply adjusting stocking levels. In some cases, under-grazing is the issue and stocking levels require increasing and in others stocking levels above the MSO may be required to achieve specific outcomes. The approach therefore has relevance to public policy in demonstrating that in some cases, payments may be required to cover these additional costs for the delivery of public goods.
- Finally, these findings suggest that in these upland and marginal situations, a shift in mindset away from the production of meat as a commodity towards grazing livestock to produce environmental benefits can actually improve the economic resilience of the business and help assure the long-term economic viability of these farming systems.

Annex 1 – The Nethergill Approach - methods

The steps taken to analyse the accounts and identify the maximum level of farm output that is economically sustainable under the Nethergill approach are set out below. These are:

- A. Analysis of the accounts
- B. Calculation of the Maximum Sustainable Output
- C. Examination of fixed costs

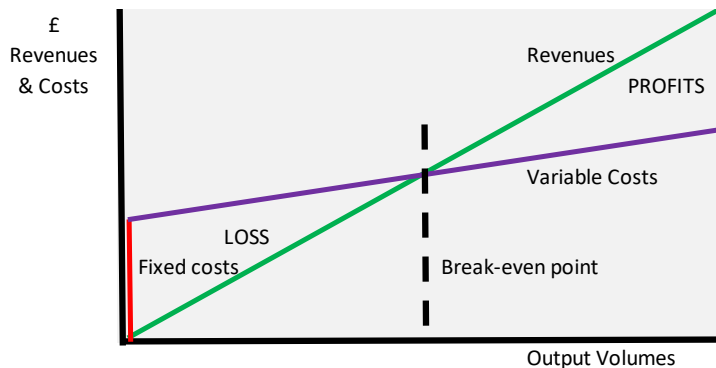
A. Analysis of the accounts

The accounts are re-ordered from standard accounting format and the following steps are carried out:

1. The value of sales from farming-only activities is established first and taken to be the primary measure of revenues.
2. The variable costs associated with farming-only activities are then established. These are broken down into productive variable costs and corrective variable costs (see below for an explanation as to what these are and why this was done).
3. A first level contribution is calculated which comprise the cash flows resulting when total variable costs are deducted from revenues (gross margin). What remains will have to cover the remaining fixed costs, drawings, capital expenditure and tax liabilities left in the business. If this contribution is negative the business is losing cash and, by default, will be decapitalising. Businesses that fail to produce a positive first level contribution are intrinsically non-viable.
4. Fixed costs are established. These will fall into five categories:
 - Essential and unavoidable costs. Without these items no business will be possible. Sometimes these costs, when being projected, are referred to as zero-based budgeting costs.
 - Mandatory costs. In farming cross compliance and some leases will contain covenants, for example regarding dry-stone walls, which may involve significant maintenance or repair obligations. These, too, are unavoidable.
 - Intangible costs. Balance sheets are balanced to account first for liabilities not assets. Invariably there will be an apparent shortfall of true assets to match liabilities. The balancing item becomes the intangible assets of the business and these are deemed to value such things as good will and reputation. Intangible assets represent the premium paid for the quality aspects of a business.
 - Lifestyle costs. These cover a spectrum of types and many, for historical reasons, can incur extremely high maintenance and running costs (e.g. farmhouses).
 - Unnecessary costs. Whenever farms take on assets that are over-specified for the job or are not strictly needed on profitability to service these costs.
5. A second level contribution is then calculated. This is the amount left to cover drawings, capital expenditure and tax liabilities. This measure is essentially the profit or loss associated with farming-only activities.
6. Support payments are then identified.
7. Support payments are added to the second level contribution to provide the actual profits on the farming business as reported in its Profit & Loss accounts.

Under the traditional theory of the firm (see Diagram 1) as output is sold, so revenues increase (green line). Costs are a composite of fixed costs (red line) at zero output and variable costs (purple line) which increase with output. Where the green line crosses the purple line is the break-even point. Beyond the break-even point all costs are recovered and profits are made. Such firms expand outputs to grow profits.

Diagram 1: The traditional theory of the firm



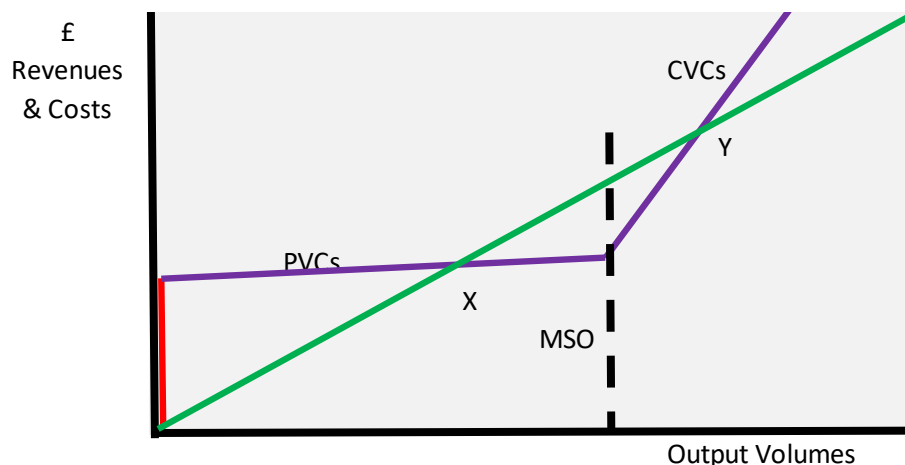
Under an upland farm model (see diagram 2), variable costs are divided into productive and corrective components - the inflexion point in the variable cost line is the onset of corrective costs.

Productive variable costs (PVCs) are those associated with exploiting the natural resources of the farm (typically the grass in upland farming) to the maximum extent. *Corrective variable costs (CVCs)* are the additional costs to cover the additional cost of purchased feeds and fertilisers inputs required to produce at the current level of output after the naturally available grass has been exhausted.

Where the variable costs undergo inflexion is the point of maximum economically sustainable output (MSO) beyond which profitability is eroded and may eventually reverse (as it does at Y, the break-back point). The new break-even point moves down to X.

The issue faced is how to calculate where the point of Maximum economically sustainable output (MSO) lies for an individual farm business.

Diagram 2: the upland farm model, showing the inflexion point between PVCs and CVCs



B. Calculating the MSO

As the physical aspects of farming have not been analysed or modelled under the Nethergill approach, the estimate of when *Productive Variable Costs* are affected by the onset of *Corrective Variable Costs* is based on an empirical interpretation of the Accounts. Under the Nethergill approach, a geometric method has been applied to identify the MSO point. The process followed for doing this is set out below .

A visual representation of the geometric method used in the study is provided as an aid to general understanding. A proprietary algebraic solution was developed specifically for the study work.

It should be noted that:

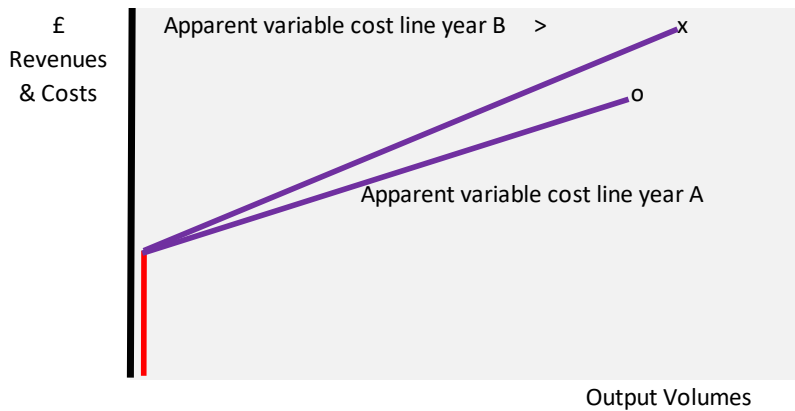
- The MSO for a farm is not a single number that prevails for all time. It is a function, ultimately, of physical, not financial, factors. The availability of grass on a farm changes from year to year and the true physical MSO will change accordingly. The weather and previous grazing intensities make this the case.
- The MSOs that come out of the study are designed to provide a direction for farms to move towards, the scale of the task involved and the likely economic benefits. The acid test for reaching the MSO point is that at that point no corrective variable costs are incurred. This is obvious and measurable.

Step 1:

- a) Let o be the total cost in year A
- b) Let x be the total cost in year B (where year B = year A+1 and adjusted for changes in monetary values)



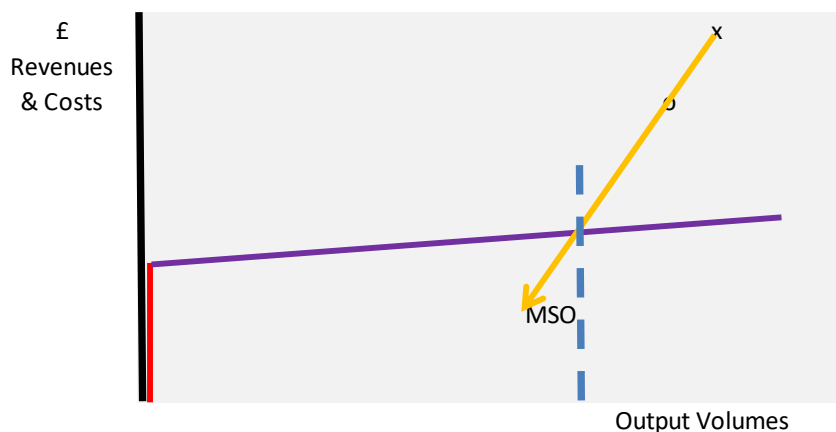
Step 2: If points o and x are connected to the fixed cost line, the two purple lines represent the apparent total cost lines for years A and B as outputs increase. This is the pattern observed in the Traditional Model of the Firm.



Step 3: The fixed costs line and the PVCs line are taken from Diagram 2 (the upland model) and the PVC line is projected forward as if it were continuously variable. Then a line is projected from x through o (which represents total variable costs in Years A and B) downwards (orange line) until it crosses the PVC line. The point of intersection is when the CVCs start and is therefore the MSO. The MSO is intended as an indication of where the point of maximum economically sustainable output lies and this will vary over time.

NB: This method uses only 2 years' data for total variable costs. Whilst, in general, line fitting (by regression analysis) improves with more data points, two points are preferred for identifying the point of MSO. This is due to the fact that:

- Data from different years are complicated by issues relating to the value of money (inflation, purchasing power, etc); and
- As the data points increase (relating to more years) the problems of correcting for monetary values outweigh the benefits (theoretically) of more data



NB: Because the formulae are empirical, based on a set of Accounts and not the physical situation on the ground, the new level of activity cannot be guaranteed to be the best possible, only likely to be better than before.

C. Examining fixed costs.

Given that, in many of the cases examined, the farm businesses are making a loss before (and sometimes also after) CAP support payments, a further set of calculations are made to provide an indication of the magnitude of the increase in price or reduction in fixed costs that would be required to break-even (before drawings, capital expenditure etc) both at current levels of output and at MSO level.

Annex 2 – Results of the accounts analysis on case study farms

The results of the analysis of the farm accounts on the case study farms are set out below, using the Nethergill approach (as set out in Annex 1).

Box 3: Results of the accounts analysis on case study farms - examples of improved profitability/ reduction of losses by reducing output to MSO levels

Legend for graphs:			
FC	Fixed Costs	CO	Current Output
R	Revenue without Support	PM	Profit Margin (Positive)
R+S	Revenue with Support (BPS + environmental payments)	L	Loss
R+ES	Revenue with Environmental Support	PM@CO	Profit Margin @ Current Output with support
PV	Productive Variable Costs	L@CO	Loss @ Current Output
CV	Corrective Variable Costs	PM@MSO	Profit Margin @ Maximum Sustainable Output with support
MSO	Maximum Sustainable Output	L@MSO	Loss @ Maximum Sustainable Output with support

Case Study A: Upland sheep farm and associated common land: heavily stocked, although stock numbers have come down in recent years. The land is owned by United Utilities and is part of a larger RSPB reserve.

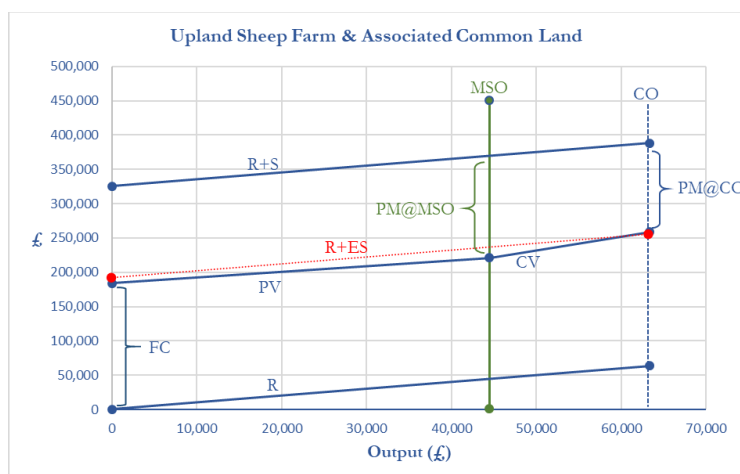
Analysis of the 2016 accounts showed that the farms' incomes are not above zero without public support. Looking only at the value of sales, on a current output level equivalent to £63,321, once variable and fixed costs were taken into account, the business made a loss of £190,446.

Fixed costs are extremely high, amounting to 2.9 times the value of sales. After support of £325,183 (~£125,000 direct payments and ~£200,000 environmental payments), the business incomes were £134,717. At this level of output and without any support payments, to achieve a break-even position would require: a price-rise of 401% (based on price alone); a reduction of fixed costs by 104% (based on fixed costs alone); a combination of the two.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £44,479.

This reduces the farming business losses by £18,488 to leave it with an improved income of £153,205 (assuming the continuation of existing levels of support) or £27,704 with only the environmental payments. Without any support the farm would still be running a loss of -£171,978/annum.

Therefore, to operate the farm at MSO, to reach a break-even position without any public support would require a price rise of a factor of 4.87 (based on price alone) or a reduction of fixed costs by 94% (based on fixed costs alone), or a combination of the two.



Case Study B: Two large high nature value upland farms in the North Pennines.

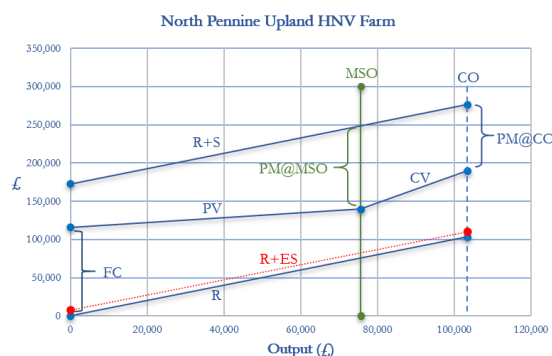
Analysis of the 2017 accounts showed that the farms' incomes are not above zero without public support. Looking only at the value of sales, on a current output level equivalent to £103,599, once variable and fixed costs were taken into account, the business made a loss of £86,588.

Fixed costs are very high, amounting to 1.12 times the value of sales. After support of £172,594 (almost all direct payments, with only about £600 environmental payments¹), the farm business incomes were £86,006. At this level of output and without any support payments, to achieve a break-even position would require: a significant price-rise of 84% (based on price alone); a reduction of fixed costs by 75% (based on fixed costs alone); a combination of the two.

¹ To note that this figure excludes substantial environmental payments on one of the farms, the figures for which were not available. Therefore the real figures of profit/loss including these payments would need to be recalculated to take these into account.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £75,664.

This reduces the farming business losses significantly - by £22,055 to leave it with an improved income of £108,061 (assuming the continuation of existing levels of support). However, without support the farm would still run at a loss of -£64,533/annum. Therefore, even running the farm at MSO, to reach a break-even position without any public support would still require prices to rise by a factor of 1.85 (based on price alone) or a reduction of fixed costs by 56% (based on fixed costs alone), or a combination of the two.



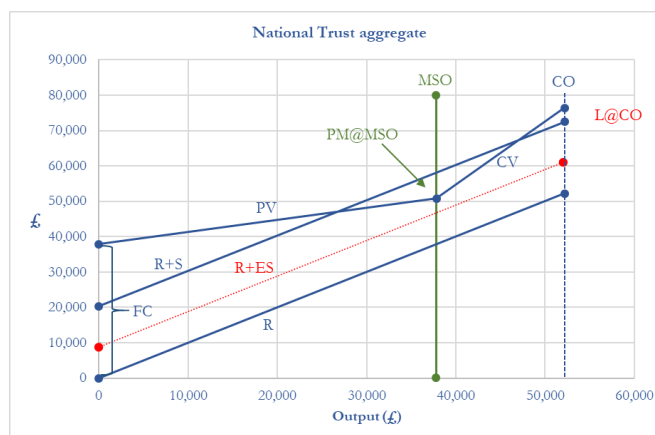
Case Study C: Three small North Yorkshire upland farms, cumulatively under 250 ha, with a mix of sheep and beef cattle, with moorland and grazing rights. Intensively stocked with history of farms in the area reliant on off farm income; limited opportunities for diversification.

Analysis of the 2016/17 accounts showed that the income of the farm(s) was below zero both with and without public support. Looking only at the value of sales, at existing output level equivalent to £52,178, once variable and fixed costs were taken into account, the business made a loss of -£24,211. Fixed costs amounted to 73% of the value of sales. After support of £20,310 (52% direct payments and 48% environmental payments), the businesses made a small loss of -£3,901. On this level of output and without any support payments, to achieve a break-even position would require: a significant price-rise of 46% (based on price alone); a reduction of fixed costs by 64% (based on fixed costs alone); a combination of the two.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £37,814.

Reducing farming activity to this level would reduce the losses from the three farming businesses by £11,205 to bring a small level of income of £7,304 (assuming the continuation of existing levels of support) – an increase of 87%. However, with only the environmental payments, the farms would have made a loss of -£3,274 and without any support the farms would run at a loss of -£13,006/annum.

Therefore, even running the farm at MSO, to reach a break-even position without any public support would require a rise in price by a factor of 1.34 (based on price alone) or a reduction of fixed costs by 34% (based on fixed costs alone), or a combination of the two.



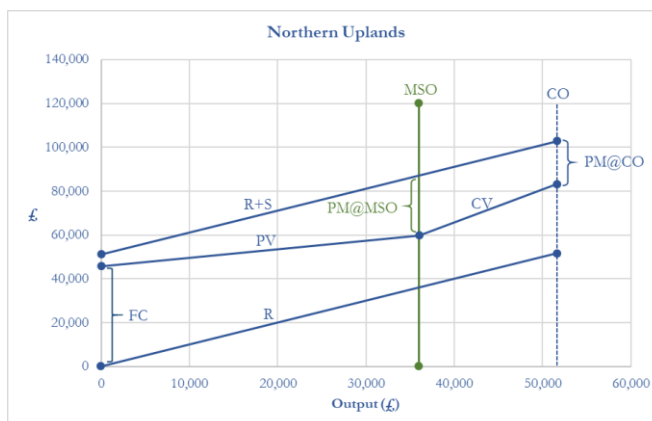
Case Study D: 15 LFA livestock grazing farms in protected areas in Northern England, both SDA and DA (mix of sheep and cattle). The results are an average of the situation on the 15 farms.

Analysis of the 2017 accounts showed that overall the farm(s) were not profitable without public support. On the basis of the value of sales (averaged at £51,648), once variable and fixed costs had been taken into account, the businesses made an average loss of -£31,605. Fixed costs were very high, amounting to 89% of the value of sales. Average support per farm was £51,171 (the break down between direct payments and environmental payments is not known), and after taking this into account, the business incomes were £19,566 on average each.

On this level of output and without any support payments, to achieve a break-even position would require: a significant price-rise of 61% (based on price alone); a reduction of fixed costs by 69% (based on fixed costs alone); a combination of the two.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £36,022.

This reduces the farming business losses significantly - by an average of £7,878 to leave them with an average improved income of £27,444 (assuming the continuation of existing levels of support). However, without support the farms would still be experiencing an average loss of -£23,727/annum. Therefore, even running the farm at MSO, to reach a break-even position without any public support would require a price rise by a factor of 1.66 (based on price alone) or a reduction of fixed costs by 52% (based on fixed costs alone), or a combination of the two.



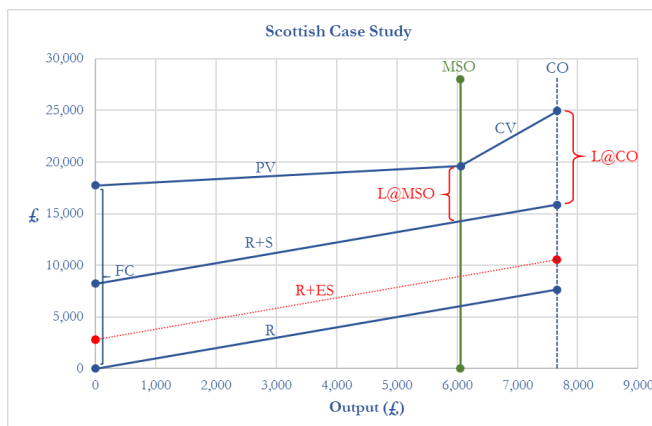
Case Study E: Traditional croft, Scotland: a 100-acre (40 hectare) coastal croft, fragmented into a number of separate plots of varying quality. The croft has been in the family for a number of centuries and is managed in the Scottish tradition. The croft grazes sheep and the farming activity is constrained by a very short (May to September) growing season. The landscape is exposed to high salt-laden winds and local practice reflects a tendency to overgraze all pastures and allotments. The business has put great effort into diversification - a successful and profitable farm shop has been developed, connected to the farming business.

The farming business has never had an income above zero even with public support (direct payments). The farming turnover was £7,661, but even after £5,716 from direct payments and LFA payments and environmental payments of £2,500 the business made a loss of -£9,077, as a result of very high fixed costs (almost £18,000 – a factor of 2.32 times turnover) in combination with variable costs in the region of £7,000). On this level of output and without any support payments, to achieve a break-even position would require: a price-rise of 3.26 times based on price alone; a reduction of fixed costs of 97% based on fixed costs alone; a combination of the two.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £6,060.

However, this only reduces the farming business losses by £3,740 to -£5,337 (assuming the continuation of existing levels of support). If only environmental payments remained, the loss would be -£11,053 and without any support the business would run at a loss of -£13,553.

Therefore, even running the farm at MSO, to reach a break-even position would require a price rise of 3.24 the revised output (based on price alone) or a reduction of fixed costs by 76% (based on fixed costs alone), or a combination of the two.



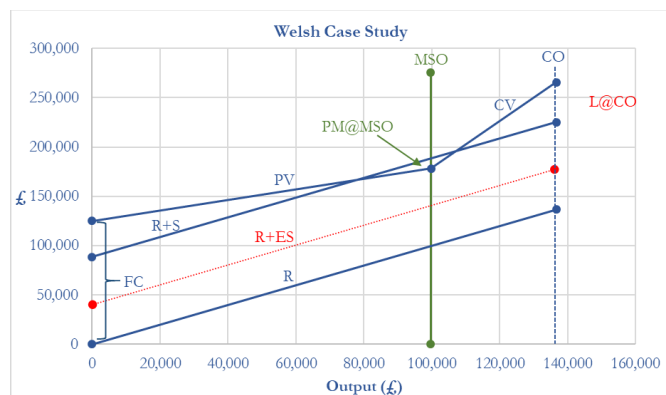
Case Study F: Welsh marginal grazing livestock family farm (sheep and cattle) - 161 hectares, split into two holdings. Although the grass grows all year round on well-drained soil, the two properties have varying soil types/underlying geology and one is significantly more exposed to the weather. The sheep are a Welsh breed with some crosses, and the cattle are a non-native breed which are quicker to mature but at some extra cost and attention. The farm is run by two generations of the family.

The farm makes a loss even with public support. Looking only at the value of livestock sales, on a current output level equivalent to £136,648, once variable and fixed costs were taken into account, the business makes a loss of -£129,149. Fixed costs amounted to 92% of the value of sales. After support of £88,607 (~£46,000 direct payments and £42,500 environmental payments), the business reduced its loss to -£40,542. On this level of output and without any support payments, to achieve a break-even position would require: a significant price-rise of 95% (based on price alone); a reduction of fixed costs by 103% (based on fixed costs alone); a combination of the two. It should be noted that one of the farms only received environmental payments and no direct payments – as both farms are one business, this masks the issues faced by the other farm.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £99,755.

This reduces the farming business losses significantly - by £50,825 to leave it with an income of £10,283 (assuming the continuation of existing levels of support). If environmental payments only remained, the farm would make a loss of -£35,824, and without any support, it would run at a loss of -£78,324/annum.

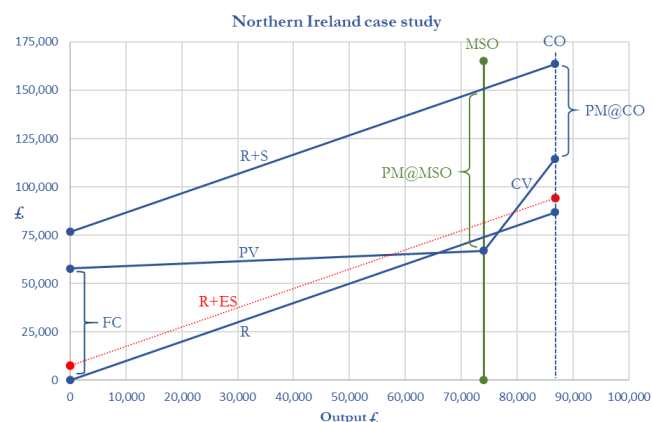
Therefore, even running the farm at MSO, to reach a break-even position would require prices to rise by a factor of 1.79 (based on price alone) or a reduction of fixed costs by 63% (based on fixed costs alone), or a combination of the two.



Case study G: upland grassland farm (sheep and cattle) in Northern Ireland, comprising 161 ha and run by the third generation to farm the land. Much of the land is marginal and the farm has to cope with the disadvantages of elevation, precipitation and some rush dominated and boggy areas, but benefits from the mild climate and the relatively short winter.

The farm's income was only above zero if public support was taken into account. Taking public support out of the revenue line and looking only at the value of livestock sales, on a current output level equivalent to £186,817, once variable and fixed costs were taken into account, the business made a loss of £27,739. Fixed costs amounted to 67% of the value of sales/turnover. After support of £76,758 (~£71,000 direct payments and ~£6,000 environmental payments), the income of the business was 49,019. On this level of output and without any support payments, to achieve a break-even position would require: a price-rise of 32% (based on price alone); a reduction of fixed costs by 48% (based on fixed costs alone); a combination of the two.

The Maximum Sustainable Output (MSO), i.e. point of maximum profitability was calculated to be £74,048. By lowering the level of farming activity to this level increases the income from the farming business by £34,785 to leave it with £7,046 even without any public support. If existing environmental payments were retained, this rises to £12,956. If all existing levels of support were continued, income would rise to £83,804 – an improvement of 71%.



Annex 3 - Return on Total Assets (ROTA): An explanation

As highlighted in the report, ROTA is a measure of how hard a business's assets (e.g. machinery, buildings, land, natural capital etc) are working to generate sales over time. The harder a business can make its assets work, the greater its profitability.

Setting a target ROTA for the business must take into account both a profit margin that is sufficient to support the living expenses of the family farm and the asset turn³⁴ possible, based on the nature of the assets the business has (both tangible and intangible) and the volume of sales that can be generated.

A ROTA for a farm business will generally be much lower than one for industry due to the fact that a farm's assets work far less efficiently.

A proper financial return for any enterprise can be calculated by:

- $x\%$ (return on total assets) = bank rate% + premium for risk %
- for example: 15% ROTA = 5% (bank rate%) + 10% (risk premium)

The ROTA objective can be met by any combination of:

- Asset Turn ($Y = \text{sales} / \text{total assets}$) x Margin ($X = \text{profit as \% sales}$)
 - To secure a 15% ROTA with a 5% margin will require an asset turn of 3, i.e. sales would have to be 3x the value of the assets
 - For example, a 400-acre owner/occupied hill farm worth £1,500 per acre including a farmhouse (approximately £200,000) would have a total asset value of £800,000, and therefore would have a minimum sales challenge of £2.4 million
- A 400-acre hill farm would do well to achieve £50,000 in sales before support
- Even without the inclusion of the land value, a 400-acre tenanted farm with assets of only £80,000 would require a minimum sales challenge £240,000.

Therefore to survive, without aggregations into larger units (which would reduce levels of employment in farming) other forms of off-farm income need to be won.

The percentage ROTA can be plotted on a graph and can be used to show what combination of profit margin and asset turn are required or should be aimed for to achieve the goal set. Figure 7 below shows a theoretical example of plotting ROTAs at 10%, 15% and 20%. Any of the points along each of the curves would achieve the ROTA identified, they simply represent different combinations of profit margin and asset turn required to achieve this.

In general, landowners tend to be situated in the 'service provider' segment, whereas farmers sit in the commodity trader segment. This is because landowners have significantly more assets in the form of land, with low asset turn, whereas tenant farmers have more variable costs in the form of rent etc which eat into the profit margin.

³⁴ Asset turn = sales / assets. If these are £100K of assets and £200K of sales, then the asset turn is 2.

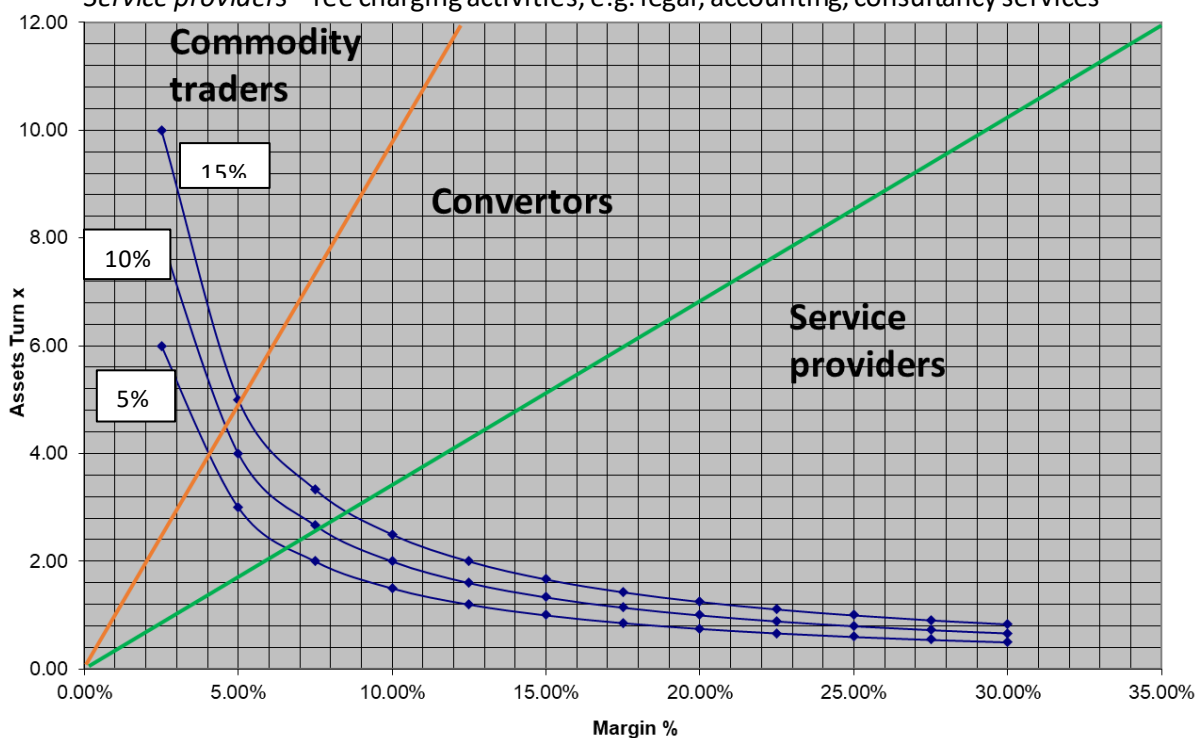
In a farming situation, the ROTA curve can then be used to determine which elements of the farm business can be varied along each of the axes to achieve the desired ROTA.

Figure 7: Theoretical depiction of a ROTA curve (Return on Total Assets)

Notes: *Commodity traders* –for example traders in precious metals

Convertors –organisations with the primary purpose of adding value per person employed, e.g. car producers, supermarkets etc.

Service providers – fee charging activities, e.g. legal, accounting, consultancy services



Source: created by Chris Clark and Brian Scanlon

We welcome feedback and comments about the content and presentation of this report. Please contact Pat Thompson at patrick.thompson@rspb.org.uk for more details

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