Liberating farming from the CAP

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Summary

By 2020 the EU is planning to increase expenditure on the Common Agricultural Policy (CAP) by some €8billion a year at a time of catastrophically bad public finances.

Despite the concern about pressure on food prices, reform of the CAP will not increase efficiency or lower prices to the consumer.

The sweeping rejection of the benefits of new technologies and the proposals for more government control of food markets by many NGOs and lobby groups would exacerbate current problems.

The geographical and economic realities are such that yields per hectare will have to increase substantially over the next 40 years.

The CAP – especially after recent reforms – leads to farm yields well below the level of maximum efficiency. This lack of efficiency has several dimensions: land is not used for the most efficient crops; yields per hectare are well below the maximum attainable levels; and incentives to adopt – or research – new technologies that will increase productivity have been blunted.

Research shows that farm subsidies do not necessarily help bio-diversity and that their abolition would lead to a less than corresponding fall in farm incomes. To a large extent, subsidies become capitalised in land values, thus increasing costs to farmers. Between 1992 and 2009 – the period since the introduction of direct payments under the CAP – the value of agricultural land and buildings in the UK rose 400 per cent compared with 38 per cent general inflation. This suggests that one of the effects of removing direct payments would be a decline in land prices, rents and associated production costs.

The abolition of subsidies in New Zealand demonstrates how government subsidies damage productivity and their removal leads to increased productivity.

The EU has articulated an ambitious strategy for Europe that sees biotechnology as key in fighting hunger and malnutrition and feeding an increasing human population on the currently cultivated land area with reduced environmental impact. Yet, the EU has positioned itself at the extreme restrictive end of the regulatory continuum concerning GM products thereby effectively constraining research and reducing take-up – the EU is therefore holding back potentially far reaching changes in farm productivity growth and competitiveness.

In addition to deregulating agricultural technology, the EU should also phase out direct payments to farmers amounting to €40bn per year. This would dramatically reduce government expenditure as well as leading to a more efficient farming sector, higher productivity and lower food prices.

The current review of the CAP represents the best opportunity for a complete change in agricultural policy that meets the challenge of rising global demand for food, but the reform must be radical.

Introduction

On 12th October the European Commission published its 'plan' to reform the Common Agricultural policy (CAP) post 2013[1]. The word 'reform' is, however, misleading. It would be more correct to say that the proposals are largely concerned with changes to the conditions attached to the receipt of direct farm payments. Despite the desire by heavily indebted member states to reduce public expenditure the annual cost of the CAP is set to rise from its current €55billion to €63billion by 2020. It is a feature of CAP reforms – of which there have been several since 1992 – that the principle of using public funds to subsidise farm incomes is never questioned. Since the first major reform in 1992 the Commission has increasingly justified farm subsidies as necessary for the sustainable management of natural resources and the preservation of the countryside and biodiversity. Despite this, attempts to cap payments for larger-scale farms – and therefore large areas of farm land – reveal a social objective: the protection of the incomes of small-scale farms.

Despite the Commission's growing interference in the way farm businesses use their land, the response of environmental groups has not been supportive. Typical is the WWF which claimed that the proposals would merely support '… intensive agricultural practices that mainly benefit only large farms and which will damage the environment'[2]. I will show below that this criticism of the CAP is ill-founded. But, of greater concern, is the sweeping rejection of the many benefits of a modern, technology-based agriculture and the unquestioning acceptance of official planning and control at the farm level. Typical of this was an Oxfam report published earlier this year which called for a focus on the productive potential of smallholder agriculture on the basis that '…modern agro-industrial farming is running faster and faster just to stand still'[3]. It is however, industrial-scale farming that is more suited to adopting the scientific advances that are the basis of efficient, productive and sustainable farming.

This paper argues that, not only is there an urgent need for science and technology – within the EU and more generally – to provide the knowledge that will enable farming to substantially and sustainably increase its productivity, but also that the CAP, through its interference with market forces, actually constrains the ability of EU farming to increase its productivity and competitiveness.

The paper is divided into three sections. The first explains why the CAP is failing: indeed, it is incapable of delivering the modern, highly productive farming industry that is now needed. The second explains the challenges that agriculture must surmount if it is to provide food at affordable prices. The third explains how EU agricultural policy is inappropriate to the demands now being made on the industry and suggests how it should change.

1 Legal Proposals for the CAP after 2013, Briefing Papers, (2011), *European Commission*, 12th October, http://ec.europa.eu/agriculture/cap-post-2013/legal-proposals/index_en.htm

2 Environment Threatened by CAP Proposal, Press Release, (2011), *WWF*, Brussels, 12th October, http://www.wwf.org.uk/what_we_do/press_centre/?uNewsID=5337

3 Small Farmers Big Change: scaling up impact in smallholder agriculture, Wilson, D, *et al,* (2011), *Oxfam- Practical Action*, London

Agricultural policy eras

One way to approach the challenges now facing EU agricultural producers – indeed, global producers – is to place EU agriculture in context by briefly looking back over the post-war period. The 60 years after 1945 can be divided into two distinct eras: the first lasting into the 1980s; and the second lasting until 2005. Following the shortages of food during the war, the thirty years after its end saw the expansion of interventionist agricultural policies across the developed world, all of which included, as a key objective, higher volumes of production. In the embryonic European Community the policy was based on 'price support', secured by tariff barriers and intervention buying which the UK adopted – abandoning its 'deficiency payments', subsidies – when it joined the Community in 1973. Article 39 of the 1957 Treaty of Rome defined five objectives for the Common Agricultural Policy (CAP) the first of which was '…to increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, in particular labour.' A second objective was '…to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture'[4].

The era of price and incomes support

Over the first era, ending in the 1980s, agricultural production across Western Europe expanded rapidly. By the 1970s phrases such as 'grain and butter mountains' – colloquial expressions for structural surpluses – had become common. It is part of the mythology, nurtured by European farmers' unions, that the rapid expansion of agriculture was due to both the breadth and level of farm support under the CAP[5]. The reality, however, is somewhat different. While direct support to farmers in the 1945–1980s era might appear consistent with induced innovation[6] empirical work has found little evidence that the CAP has been useful in this regard[7]. Indeed, many studies have found that farm subsidies have a negative impact on technical efficiency and productivity[8]. At best, price support was only one element of a more broadly based suite of policies designed by successive governments to boost output via technological progress. The very rapid growth of productivity during the 1960s was not confined to developed nations. Developing countries also benefited. In both cases the growth of productivity owed much to the application of scientific and technological advances financed by private companies, universities, governments and philanthropists – no better illustrated than the Rockefeller Foundation's success in developing dwarf Mexican wheat that heralded the so-called Green Revolution in the 1960s. To take a few examples, in Europe, between 1960 and the early 1980s, wheat yields more than doubled, the litres of milk produced by the average dairy cow trebled and feed conversion rates for pigs and poultry rose fourfold. Put simply twenty-five years after the signing of the Treaty of Rome, the European Community had achieved its objective of feeding itself from its own resources thanks to a broad range of innovations involving seeds, chemicals, irrigation, mechanical power and a distinct trend towards large-scale production at the farm level.

The CAP may have played an ancillary role in the productivity revolution that characterised European agriculture during this period, but, once supplies of basic agricultural commodities started to outstrip demand, the policy became an obstacle to bringing markets back into balance. At its heart the CAP contained a fundamental weakness: namely, the interpretation that politicians and farmers' leaders placed on the objective of ensuring a fair standard of living for the agricultural community. In well behaved markets, as supply exceeds demand, prices weaken serving to bring the market into balance. But this mechanism was overridden by the CAP where support prices were set annually by politicians who were subject to the powerful lobbying of farmers' unions. The flawed logic was that maintaining or indeed increasing prices would protect farm incomes. In fact increases in CAP support prices tend to be capitalised into land values rather than securing farm incomes over the longer term[9]. Indeed, despite annual increases in the cost of the CAP the whole of the period was characterised by a steady but slow decline in the numbers of farmers and farm workers.

By the early 1980s agricultural policy was entering its second post-war era. It was becoming very apparent that the cost of the CAP was out of control and threatening to absorb the Community's total budget in its attempts to maintain levels of support in the face of growing surpluses. Moreover, the policy of subsidising exports of high priced surplus production

4 The Making of the CAP: Towards a historical analysis of the EU's first major policy, Ludlow, N, P (2005), *Contemporary European History*, 14(3):341-71

5 The Future of the CAP after 2013, COPA and COGECA, (2010), PR(10)3360 Brussels

6 Agricultural Development: An International Perspective. Hayami, Y and Ruttan, V (1985), Hopkins University Press.

7 Do subsidies drive productivity? A cross-country analysis of Nordic dairy farms, McCloud, N. and Kumbhakar, S, (2009) in T. B. Fomby and R. C. Hill (eds), *Bayesian Econometrics (Advances in Econometrics, Volume 23)*. Emerald Group Publishing Limited, pp. 245-274.

8 Patterns in Technical Efficiency and Technical Change at the Farm-level in England and Wales, 1982-2002, Hadley, D, (2006). *Journal of Agricultural Economics* 57(1): 81-100.

9 The So-called Non Economic Objectives of Agricultural Policy, Winters, A, (1988), *OECD Working Papers*, No52, April

was manifestly trade distorting and a growing source of tensions with global trading partners. The result was a series of reforms starting with the introduction of milk quotas and other production control policies in the 1980s and then, in 1992, the abandonment of full-blown price support with the so-called McSharry reform. This reform made area-based, direct income compensatory payments – effectively a deficiency payments system – the basis of support under the CAP. The McSharry reform[10] represented the start of a process of radical change in policy involving the decoupling of farm incomes from production. In so doing it shifted the burden of support from consumers to taxpayers. The reform was designed not only to meet the demands of farmers for income protection and member states for limits on the cost of agricultural support but also to achieve agreement within trade negotiations in the Uruguay GATT Round.

New environmental objectives

The 1992 reform did not change the Treaty of Rome's objectives but, significantly, it included, for the first time, measures designed to meet environmental objectives[11]. Member states were required to implement an 'agri-environmental' programme, though in practice the schemes were *ad hoc* varying greatly between member states and only attracting some four per cent of the CAP budget (a situation considered highly unsatisfactory by leading environmentalists[12]). The rather piece-meal approach to the environment embodied in the McSharry Reform adds weight to the belief that the objective was primarily to support farm incomes but that a reason other than this had to be advanced to justify the direct payments to farmers. That said, a tilt towards an environmental dimension for the CAP was inevitable. Professor John Marsh, a seasoned observer of the CAP observed in the 1980s that '…the astute politician is growingly aware of the need to listen as well to other voices in the formulation of agricultural policy. The more visible the cost of farm support becomes, the more influential those other voices are likely to prove'[13].

The 1992 reform had pushed open the door for the environmental lobby and they seized the opportunity. Their influence on agricultural policymakers increased steadily during the 1990s. The effect was that the Treaty of Rome's emphasis on increasing agricultural productivity by promoting technical progress and rational development was sidelined. In 1997, the European Commission set-up an expert group to consider the future for the CAP. The report spelt out the strategy subsequently followed, at least in part, for the development of the CAP which involved three major strands: market stabilisation; environmental and cultural landscape payments; and rural development incentives[14]. This approach was embraced by the new UK government who in listing its '…key principles for sustainable farming and food now and in the future' identified eight objectives, not one of which referred to productivity, technical advance, competitiveness or indeed the affordability of food[15]. This reworking of the CAP into a social and environmental farm income support policy rather than a production-orientated policy was consolidated in the 2003 reform. Under the reform, the main condition for receipt of an area payment was that the farm complied with a series of environmental, food safety and animal welfare standards and that it maintained the land in good environmental and agricultural condition. The reform was indifferent to the role of markets in dictating the use of productive land and encouraging farmers to strive to be more efficient and competitive. Bizarrely, it was no longer necessary to grow anything in order to receive area payments[16].

Despite the distinct shift in EU agricultural policy away from its original objective of increasing agricultural productivity by means of technical progress and rational development, consumers across the EU enjoyed an era when food prices rose at a slower rate than prices generally. In part this was due to the large-scale removal of price supports and thereby greater influence of global markets on prices. Figure 1 shows, for the UK, the relationship between the growth of the retail prices index (excluding mortgage payments) and retail food prices. The diagram is split showing how over the period 1990 to 2004 the rate of increase in food prices was significantly lower than prices generally. However, the relative growth of these two price series has reversed since 2005 and this marks the start of what I refer to as the third, agricultural post war era.

10 Council Regulation (EEC) No.1765/92
11 Council Regulation (EEC) No.2078/92
12 If the CAP doesn't fit – reform it, Pretty, J (1998), Pesticides News No.39, March p 6-7
13 Alternative policies for agriculture in Europe, Marsh, J, (1987), *European Review of Agricultural Economics*, Vol. 14(1), pp11-21.
14 Towards a Common Agricultural and Rural Policy for Europe, (1997), *European Commission DG VI/A1*, Report of an Expert Group, April.
15 The Strategy for Sustainable Farming and Food: Facing the Future, (2002), Defra, London p12
16 Council Regulation (EC) No.1782/03

Figure 1: General and Food Retail Prices

Future challenges

The change in the relative rate of growth of food prices after 2005 was not confined to the UK: indeed experts and the media referred to the change as a global food crisis[17]. Spikes in agricultural commodity prices are a periodic event but the rapid rise that commenced in 2007 was not a one off spike. The latest OECD-FAO 'Agricultural Outlook' points out that

> '…. A period of high volatility in agricultural commodity markets has entered its fifth successive year. High and volatile commodity prices and their implications for food insecurity are clearly among the important issues facing governments today...This Outlook maintains its view in recent editions that agricultural commodity prices in real terms are likely to remain on a high plateau during the next decade compared to the previous decade'[18].

A 2009 report by the authoritative Chatham House opened with the words '...what we had thought of as abundant food supply is anything but. Western societies in particular, have tended to take their food supply for granted. The global system as currently operated will reach breaking point unless action is taken'[19].

Chatham House is one of many organisations researching the global food system who have identified a number of challenges agricultural producers must overcome in the coming decades. There is general agreement that the combination of a rising world population and continued per capita income growth in developing countries will greatly increase global demand for food. Most experts put the increase at or near a doubling of demand by 2050[20,21]. The UN expects the world's population to rise by 2 billion to 9.2 billion by 2050, an increase of about one-third, and all of this population growth will take place in the word's developing and underdeveloped countries[22] where agricultural industries lag behind the more advanced farms typical of North America and Western Europe.

While population growth is an important influence, the growth of demand for food will owe more to development and its associated per capita income growth than population growth. Rapid development – China is the best example – drives what the Chatham House authors describe as 'nutrition transition'. This is a feature of rising affluence in developing countries which involves populations shifting away from traditional staples such as roots and tubers towards more meat and dairy products, as well as more refined and processed foods. In developing countries in the twenty years prior to the global downturn in 2008, demand for meat more than doubled while demand for dairy products almost doubled[23]. More to the point, the Food and Agriculture Organization (FAO) expects that demand for meat and livestock products in developing countries will more than double again between now and 2050[24]. This will require associated increases in the production of grain for animal feeds and animal populations.

The main purpose of the Chatham House report was to draw attention to the difficulties farmers face in supplying this rising demand. The report's executive summary warned that '...if action is not taken, there is a real potential for demand growth to outstrip increases in global food production.' And, most significantly, it went on to state '…the UK can no longer afford to take its food supply for granted'[25]. The report identified five major challenges facing global agricultural producers in the coming years and these are summarised in Figure 2.

17 Responding to the Global Food Crisis: Three perspectives, von Braun, J, *et al*, (2008), *International Food Policy Research Institute*, http//dx.doi.org/10.2499/0896299201AR0708E

18 Agricultural Outlook 2011-2020, (2011), *OECD-FAO* (2011), p14, Paris, ISBN 978 92 64 10676-5

19 Food Futures: Rethinking UK Strategy, Ambler, S. *et al*, (2009), *Chatham House (Royal Institution of International Affairs)*, p8, London, ISBN 978 1 86203 211 8

20 Food Security, Farming and Climate Change until 2050: Scenarios, Results and Policy Options, Nelson, C, *et al*, (2010), *International Food Policy Research Institute*, http//dx.doi.org/10.2499/9780896291867

21 Global Summary for decision makers, International Assessment of Agricultural Knowledge, Science and Technology for Development, Beintema, N, *et al* (2008), (IAASTD), http://www.agassessment.org

22 World Population to Exceed 9 Billion by 2050, (2009), *United Nations Population Division/DESA*, Press Release, March, New York

23 The State of Food and Agriculture, (2009), *FAO Rome*, ISSN 0081-4539

24 Long-Term Scenarios of Livestock-Crop-Land Use Interactions in Developing Countries, Bouwman, J, (2003), *FAO Land and Water Bulletin 6*, Rome, 1997, M-08, ISBN 92-5-103985-2

25 Food Futures: Rethinking UK Strategy, Ambler, S. *et al*, (2009),*Op cit.*

Figure 2: Challenges in supplying the global demand for food

Issue	Concerns	Challenge
1. Severe limits on the growth of agricultural land	The per capita area of cultivated agricultural land has declined	Future production increases will need to come from higher output per hectare of land.
2. The dependency of food production on energy	Energy prices have risen and are expected to rise further	Rising production costs plus increasing diversion of arable land from food to bio-fuels
3. Global supply of water failing to match demand	Agriculture production is heavily dependent on fresh water	Increased agricultural trade to compensate with the water embedded in food products
4. Stress of climate change on agricultural production	Identified as a cause of crop losses in recent years	Will contribute to the more rapid spread of crop and animal disease
5. Rural populations are declining as a proportion of total population	Global harvests already dependent on migrant labour	Rising urban populations will become reliant on a reduced rural population for their food

Source: Chatham House[26]

The first supply side challenge, relates to the constraints preventing a significant increase in the world's agricultural land area. Cultivated land per capita has declined worldwide, a process that is exacerbated by the spread of urbanisation in both developed and developing countries. Estimates vary but it seems that the available area of productive arable land – ignoring the scope that would be provided by deforestation – could increase by some nine per cent by 2050[27]. Put another way today there is approximately 0.22 hectares of farmland per person but by 2050 this will have fallen to 0.17 per person. The logic is inescapable, the bulk of the future increase in production will have to come from greater output per hectare of land i.e. higher yields. Yields per hectare are positively related not only to natural resources such as good quality soil and adequate amounts of water, but also to the use of energy, fertilisers and crop protection products. The price of fertilisers is closely related to the price of energy and, given that reputable forecasters expect energy prices to rise over the foreseeable future, farmers will be under pressure to ensure they maximise their efficient use of fertilisers and fuel. To complicate matters the global stresses on available fresh water are increasing. According to the Chatham House Report, overall usage currently stands at 54 per cent of the world's freshwater supply but it goes on to point out that '...if per capita consumption rises across the globe at the rate seen within developed countries this could increase to 90 per cent by 2025'[28].

In addition to the foregoing, yields are dependent upon favourable climate conditions. Climate change therefore poses an additional threat. Rising temperatures and changes in rainfall patterns have direct effects on crop yields, as well as indirect effects through changes in water availability. Higher temperatures reduce crop yields while encouraging weed and pest proliferation[29]. The challenge will be to achieve the required increase in food production in parallel with a reduction in greenhouse gas emissions. Agriculture is a major contributor to climate change, responsible for around ten to 12 per cent of emissions, though the UK's Chief Scientific Adviser is of the opinion that a significant reduction in UK agriculture's current emissions could be achieved through a combination of changing farming practices and new technologies and that the global abatement potential is of the order of 60 per cent[30].

The challenges identified in Figure 2 show a food system under growing pressure and this implies higher food prices. One of the major challenges facing the world – arguably the most fundamental of challenges – is to be able to meet its growing demand for food at affordable prices. In developed countries such as EU members, higher food prices reduce living standards. In under-developed countries, higher food prices threaten the pace of development and, in the world's poorest countries, they will lead to hunger and malnutrition.

26 Food Futures: Rethinking UK Strategy, Ambler, S. *et al*, (2009), *Op cit.*

27 The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050? Bruinsma, J, (2009), *Expert Meeting on How to Feed the World in 2050*, FAO, Rome, ftp://ftp.fao.org/docrep/fao/012/ak971e/ak971e00.pdf

28 Food Futures: Rethinking UK Strategy, Ambler, S. *et al*, (2009), *Op cit.*

29 Climate Change: Impact on Agriculture and the costs of Adaption, Nelson, G, *et al* (2009),International Food Policy Research Institute, Washington, ISBN 10-digit: 0-89629-535-4

30 Food security: contributions from science to a new and greener revolution, Beddington, J, (2010), Philosophical Transactions of the Royal Society B, 365, p61-71

The policy response

Farming industries across the world will need to adapt to these challenges and, as a major agricultural producer, the EU will need to respond in policy terms. In essence, the challenge is to greatly increase the productivity of agriculture but in a manner that is sustainable. That is, not only will farmers have to increase the output they get from each hectare of land but also they will have to achieve this by using less water and energy per unit of output. This is the case regardless of one's views on issues such as climate change. It is highly likely that energy and water will become more expensive and thus the amount used per unit of farm output will fall.

Building on the Chief Scientific Adviser's opinion, this suggests a two pronged approach to policy. At the farm level the policy response should create the incentive and ability for innovative and entrepreneurial farmers to invest in more productive and efficient production systems. The second prong would operate to encourage private and public research institutions to focus on delivering a new *green revolution* involving higher yielding plant and animal varieties based on new technologies and management systems capable of increasing agricultural productivity. As noted above, key to the success of the first *green revolution* was improved crop management systems based on high-yielding crops whose potential was delivered with the aid of chemical advances and technological advances in plant and machinery. These systems became known as intensive or industrial farming and in the view of the Royal Society what is now needed is *sustainable intensification*[31].

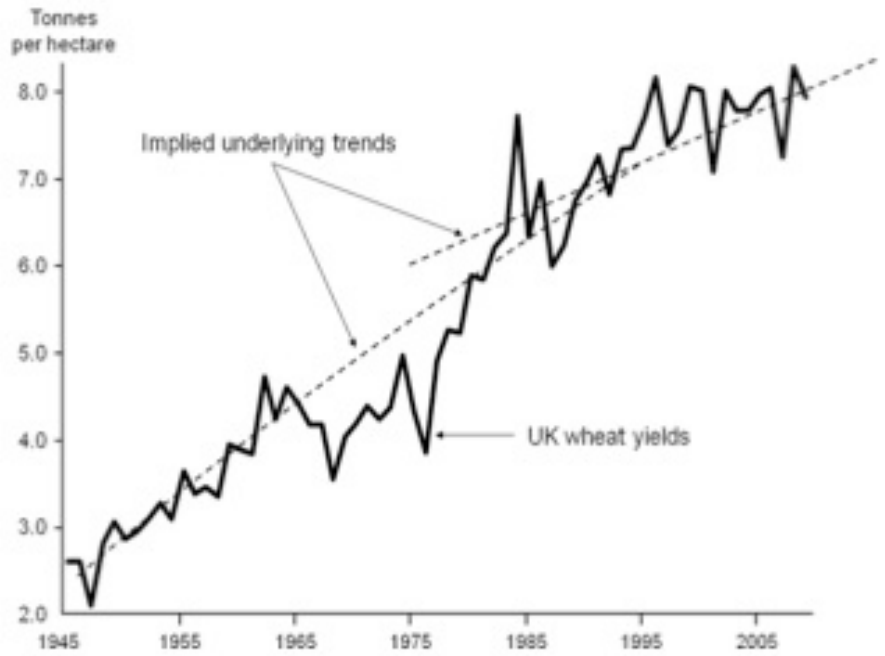
Increasing farm productivity

We can demonstrate what is required, using cereals as an example. Cereals – or more correctly grains – lie at the heart of agricultural production. In addition to providing the raw materials for bakery goods and alcohol they also provide the bulk of feeds necessary for the production of meat and livestock products. In common with other EU agricultural industries the UK has greatly increased its production of cereals over the past 65 years from a cereals area that has been declining since the 1980s. This has been made possible by the growth of yields. As can be seen from Figure 3, the typical UK wheat farm now produces three times more per hectare than was the case in 1945. However, inspection of Figure 3 indicates a slowing in the rate of growth since the early 1990s. This pattern has been widely observed across the EU and there is some evidence that average crop yields in major cereal-producing countries have plateaued[32].

31 Reaping the benefits: science and the sustainable intensification of global agriculture, (2009), Royal Society, London, October, ISBN: 978-0-85403-784-1

32 Crop Yield Gaps: Their Importance, Magnitudes and Causes, Lobell, D, *et al*, (2009), 34, p1-26

Figure 3: The Growth of Yields



Source: Defra

Different explanations have been offered for this slowing rate of growth. One explanation could be that yields are approaching their potential using existing technology. Others have raised concerns over declining soil fertility and poor agronomy. An alternative explanation is based on misdirected policy, in particular the greater emphasis on agri-environmental schemes since the 1990s and increasing publically funded incentives for farmers to adopt extensive crop farming practices[33,34]. According to this research, the switch in CAP policies towards 'environmentally friendly' production systems during the second era is a contributor to the slowdown shown in Figure 3.

At the farm level the first priority of policy, given the background outlined above, must be to allow farmers to achieve the maximum feasible efficiency. Efficiency, defined here as the minimum cost for producing a given yield, can be separated into technical and allocative efficiency. In principle technical inefficiency refers to a yield that is below the level that could reasonably be obtained using the same level and mix of inputs and allocative inefficiency refers to a failure to meet the conditions for profit maximisation. These two concepts in relation to CAP policy are summarised schematically in Figure 4. The curve labelled 'average farm yield' is shown consistently below 'attainable yield' which reflects factors such as geographical constraints e.g., below optimum rainfall, but also a lack of knowledge and skills on the part of farmers as well as satisficing behaviour enabled by farm support programmes. The UK has one of the highest national wheat yields – just over eight tonnes per hectare – yet there exists a significant gap between average farm level yields and attainable yields[35]. The attainable yield is the yield that could be attained under efficient market conditions. The attainable yield curve is not static but shifts upwards over time reflecting the dynamic influence of new knowledge, in particular, new technologies, genetic advances and improved management systems.

Point A reflects the first post war era where farmers supported by high product prices purchased high levels of inputs – input intensification – but on average failed to achieve attainable yield levels. In the second era, the incentivising of more extensive farming practices is captured by point B where farmers continued to operate below the attainable efficiency yield. Now in the third era the emphasis needs to switch towards not only improving technical and allocative efficiency – represented by the movement towards point C – but also the fruits of scientific research must be directed to raising productivity to higher levels and in a sustainable manner. As noted above, there is significant potential in developed countries such as the UK, let alone the developing countries, to deliver significantly higher levels of agricultural

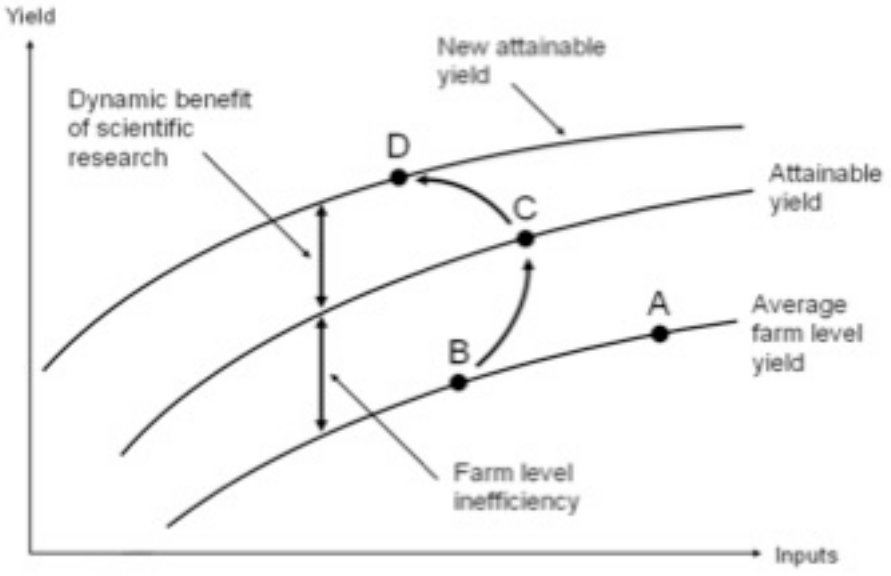
33 Evidence of slowing yield growth – The example of Swiss cereal yields, Finger, R, (2010), Food Policy, 35, p175–182

34 On the Choice of Farm Management Practices after the Reform of the Common Agricultural Policy in 2003, Schmid, E, and Sinabell, F, (2007), *Journal of Environmental Management*, 82 (3), p332–340

35 Can Technology Deliver on the Yield Challenge to 2050, Fischer, R, *et al*, (2009), *FAO Expert Meeting on How to Feed the World in 2050*, 24-26 June

productivity[36]. But there will be a need to go further and history demonstrates that science and technology are proven means of delivering substantial increases in productivity.

Figure 4: Degrees of Efficiency



The effect of science and technology on productivity over the longer term is represented by the movement towards point D. Yet, according to the government's Chief Scientist, spending by the public sector in developed countries on agricultural R&D has seen an extended period of stagnation and, while private sector research has grown, its commercial orientation has placed emphasis on cost reduction rather than yield increases[37]. But point D cannot be achieved by the fruits of scientific knowledge alone, to be of value the research must be embodied in production systems by farm businesses that have the skills, access to capital and the incentive to invest in the new varieties and technologies generated by scientific advances. Second era CAP policies not only discouraged public and private research into highly productive farm systems but also direct farm payments where designed to maintain farm numbers, regardless of average levels of efficiency. They are also not conducive to bringing forth the levels of investment and entrepreneurial flair needed to convert science-based advances into commercial opportunities.

Releasing market forces

The issue is therefore what type of CAP is most likely to achieve farm businesses that will have the drive and incentive to persistently seek not only higher levels of productivity and efficiency but also be capable of generating the funds necessary to invest in the development of their businesses. In essence what is needed is a CAP that will allow market forces much greater influence over the behaviour and rewards for farm businesses. This means the removal of direct payments as an automatic right based solely on precedent rather than any objective assessment of needs, albeit subject to providing minimum maintenance of the land. Perennial income support not only affords farmers the scope to be less responsive to market price signals but it also constrains the longer term operation of market forces to restructure the size and number of farm businesses while reducing the incentive to seek farming systems and supply chain relationships that are new and innovative. The farm lobby remains largely silent on these consequences of subsidies and focuses instead on the claim that income support for farming benefits the environment and the rural economy. However, such claims are not supported by research. A major study found limited overlap between income payments and biodiversity rich farmland[38] and the OECD argues that farm support makes it more difficult for rural regions to adapt and diversify[39].

In 2011 the Community expects the CAP to cost around €55bn of which about €40bn is accounted for by direct pay-

36 Future Wheat Yields: evidence, theory and conjecture, Sylvester-Bradley, R, et al, (2006) in *Yields of Farm Species Constraints and Opportunities in the 21st Century*, (eds, R. Sylvester-Bradley & J. Wiseman), p233-260, Nottingham University Press.

37 Food security: contributions from science to a new and greener revolution, Beddington, J, (2010), *Op cit.*

38 Funding for Farmland Biodiversity in the EU: Gaining Evidence for the EU Budget Review, Farmer, M, *et al*, (2008), *Institute for European Environmental Policy*, London. http://www.birdlife.org/eu/pdfs/ieepreport.pdf

39 The New Rural Paradigm: Policies and Governance, OECD, (2006), ISBN 92-64-02390-9

ments, commonly referred to as Pillar I payments[40]. In the UK, official figures for 2010 show that total support to agriculture amounted to £3.6bn of which £3bn was in the form of direct income payments[41]. In principle the removal of all direct income payments would be accompanied by a similar fall in the industry's revenue, however, it would not be correct to translate this loss of revenue directly to a loss of income from farming. Echoing the point already made, the OECD is firmly of the view that a very significant proportion of farm support payments are capitalised into land values – and also input prices – with the effect that they drive up land prices and, hence, raise the industry's production and entry costs[42]. Between 1992 and 2009 – the period since the introduction of direct payments under the CAP – the value of agricultural land and buildings in the UK rose 400 per cent compared with 38 per cent general inflation. This suggests that one of the effects of removing direct payments would be a decline in land prices, rents and associated production costs.

That said, there can be no doubt that a significant proportion of smaller-scale farms employing at least one person full-time would be vulnerable to the removal of direct income payments if they lack other sources of income and many would cease production. The effect would be a 'hollowing out' of the industry's structure. Many of the very smallest part-time farms – which by definition earn an income from non-farming activities – are likely to survive and there are a large number of such farms in the EU. For example, in the UK around 70 per cent of farm holdings are part-time i.e., too small to employ one person full time,[43] but such farms account for a very small proportion of the agricultural area and production. At the other extreme larger-scale farmers would benefit from lower land prices and reduced rents as well as an exodus of many smaller-scale full-time farms from the market. Such farms would find it easier to expand their scale of production and this process would be augmented by the reduction in barriers for new entrants – a prime source of innovative ideas. Farm level research shows that increasing scale is associated with greater efficiency; for example, a recent study by Defra concluded that: "…large farms tend to be inherently more efficient than smaller ones"[44]. This research is reinforced by the empirical fact that, despite income support, the average size of farm has for more than 60 years been slowly but steadily increasing across the EU.

The example of New Zealand

The removal of agricultural subsidies in New Zealand in the early 1980s provides a pertinent case study. Driven largely by a deteriorating macro-economic performance and an increasing budget deficit, practically all forms of assistance to New Zealand's farmers were withdrawn over a period of five years. As expected the removal of subsidies were followed by structural change. The national sheep flock was reduced by almost a half and the number of beef and sheep farms fell by about one third. However, these changes were accompanied by productivity gains involving a 25 per cent increase in lambing rates and a similar percentage rise in carcass weights. In the dairy sector, there was a decline of 17 per cent in the number of herds but this was more than offset by an increase in the average herd size from 150 to 270 cows and by higher yields. Horticulture and viticulture were perhaps the primary beneficiaries of the removal of subsidies. Production of apples, kiwi-fruit and wine all rose sharply in the succeeding years.

Not only did the removal of subsidies encourage larger-scale farms and higher levels of productivity, it also encouraged supply chain efficiencies and innovation. Following the decline in sheep numbers, processing plants modernised and focused on adding value and branding. In 1982, carcasses accounted for 82 per cent of New Zealand's global lamb exports whereas today 90 per cent of sheep meat exports are cut and pre-packed before being exported. In 1984, New Zealand did not have a deer industry and there were no venison exports: today the national deer herd is around two million generating significant export earnings. These examples have been drawn from a report prepared by the New Zealand Ministry of Foreign Affairs and Trade which went on to point out that "…the removal of subsidies helped increase the [farming] sector's incentives to respond more effectively and efficiently to price signals by switching to new or different types of production...risks have been diversified – and responsibility for commercial viability squarely accepted by farmers themselves." The report concluded "...overall the economic performance of farming improved"[45].

The behavioural and structural changes that followed the removal of farm subsidies in New Zealand are not only in accord with the predictions of economic theory but also they provide support for the view that very similar changes would

40 Draft General Budget of the European Union for the Financial Year 2012, Volume 3, (2011), European Commission, III/219, http://eur-lex.europa.eu/budget/data/DB2012/EN/SEC03.pdf

41 Agriculture in the United Kingdom, Defra *et al*, (2011), p99, http://www.defra.gov.uk/statistics/files/defra-stats-foodfarm-crosscutting-auk-auk2010-110525.pdf

42 Agricultural Support, Farm Land Values and Sectoral Adjustment: The Implications for Policy Reform, Huang, H, (2008), OECD, Paris.

43 Agriculture in the United Kingdom, Defra *et al*, (2011), p99

44 Cereal Farms: Economic Performance and Links with Environmental Performance, Langton, S, (2011), Defra, *Agricultural Change and Environment Observatory Research Report No. 25.*

45 Subsidy Reform in the New Zealand Agricultural Sector, Vangelis, V, (2006) in *Subsidy Reform and Sustainable Development: Economic, Environmental and Social Aspects*, OECD, p57- 76, ISBN 92-64-02564-2

follow the removal of all farm support under the CAP. The creation of more larger-scale farms would impart an immediate efficiency gain but there is also a longer term benefit. We noted above the challenges facing the world's food production and an investigation by the Royal Society concluded "… addressing [these challenges] requires action on many fronts …. there is a need to build resilient global agricultural systems …[and these] need to be underpinned by science and technology"[46]. The Royal Society's report examined the potential of biological science-based technologies in general, including genetic modification, to improve food crop production in a sustainable way. New technologies, such as GM to enhance traits such as drought, heat and pest tolerance would seem to offer great potential in meeting the challenges outlined above. Moreover, genetic engineering offers both the prospect of increased productivity while reducing the impact of farming on the environment[47].

Liberating technology

Biotechnology, of which GM is a part, is a technology that is at a similar stage of development as Information and Communications Technology at the start of the 1980s. Few, if any, at that time saw the many benefits of ICT, nor how it would transform the way businesses and society interact. Similar, it is not possible to articulate all the benefits that will be delivered by biotechnology but it is safe to conclude they will go far beyond higher levels of productivity. Currently GM crops mostly embed agronomic traits such as herbicide and insect resistance. Prospective applications include the tackling of more complex agronomic traits, such as drought resistance. Second-generation GM crops are likely to be engineered to possess desirable quality attributes such as improved nutritional profiles and third generation GM crops are expected to embrace novel uses, such as plant-based industrial products. Animal applications are also being pursued and include the development of transgenic livestock and fish with various purposes, such as improved production traits, the building of genetic disease models, and the production of biomedically useful products in the animals' blood or milk[48]. The EU has articulated an ambitious strategy for Europe that sees biotechnology as key in fighting hunger and malnutrition and feeding an increasing human population on the currently cultivated land area with reduced environmental impact. Yet, the EU has positioned itself at the extreme restrictive end of the regulatory continuum concerning GM products thereby effectively constraining research, take-up and the medium-term potential of biotechnology in Europe[49].

There is strong evidence that larger-scale farms are much better positioned than their smaller counterparts to invest in new technologies generated by scientific advances[50]. One of the major benefits of an unsubsidised farming industry would, *ceteris paribus*, be the more rapid take-up of new technologies and production systems to meet the challenges now faced by the industry. Scale and access to capital appear critical to the adoption of new technologies, the more so if new technologies are inter-related. For example, two new technologies, genetically modified crops and precision agriculture, appear to have greater potential if farmers invest in them jointly. Monsanto is close to field-testing a drought-tolerant variety of corn and the company has indicated that, rather than offsetting the need for precision agriculture, their new seed technologies complement it[51]. As precision agriculture technologies improve the efficiency of mechanised inputs they are likely to be adopted first by farms that are already highly mechanised and, as these technologies are costly, the farm must have access to the funds and the scale to spread the costs. Other factors influencing the adoption new technologies relate to the farmer's level of education, technical sophistication and management acumen – all of which also appear positively correlated with farm size.

46 Reaping the benefits: science and the sustainable intensification of global agriculture, (2009), Op cit.

47 Biotechnology in Forestry and Agriculture: Economic Perspectives, Cornelis van Kooten, G, (2011), *REPA Working Paper*, No 5, University of Victoria

48 Agricultural Applications for Transgenic Livestock, Wheeler, M, (2007), *Trends in Biotechnology*, No.25, p204-210.

49 Biotechnology and Development of Food Markets: Retrospect and Prospects, Moschini, G, (2008), *Working Paper 08-WP 477*, Centre for Agricultural and Rural Development, Iowa State University, Iowa.

50 Decomposing The Size Effect On the Adoption of Innovations: Agrobiotechnology and Precision Agriculture, Fernandez-Cornejo, J *et al*, (2001), *Economic Research Service*, USDA, http://www.agbioforum.org.

51 Industry Leaders Collaborate on Precision Agriculture, (2011), Monsanto, http://monsanto.mediaroom.com/ industry-leaders-collaborate-on-precision-agriculture

Conclusion

The European Commission frequently claims that the switch from price support to direct income payments has made EU agriculture more market orientated[52]. This is not the case. Of course, fluctuations in market prices will be followed by changes in cropping patterns and livestock numbers but the longer term benefits of restructuring and the adoption of new technologies are frustrated by the operation of the CAP and in particular direct income payments. The evidence is now overwhelming: global food producers face severe challenges in feeding the world's population at affordable prices and it is incumbent, indeed morally imperative, that EU agricultural policy now focuses on maximising the Community's food production. This is only likely to be achieved – and using methods that are efficient and cost minimising – if direct income payments are rapidly phased out allowing the industry to restructure which will involve the concentration of production on larger-scale farms.

The main argument advanced by the authorities for the continuation of income subsidies is that they are necessary to protect biodiversity and the rural economy. Yet, the evidence that an industry composed largely of small-scale, subsidised farms delivers greater biodiversity and better supports the rural economy than the more concentrated structure that would result if subsidies were ended is lacking. Moreover, larger-scale farms are more likely than their smaller counterparts to invest in and efficiently manage the sustainable intensification that will deliver the optimum balance between environmental protection and affordable food while taxpayers would also benefit from the removal of the financial burden of direct income payments. Over the next twelve months EU agricultural ministers are expected to reach an agreement on the next stage of CAP reform. It is to be hoped that the arguments advanced here are examined and widely debated before ministers come to a final decision.

52 The CAP in Perspective: from market intervention to policy innovation, European Commission, Agriculture and Rural Development, (2011), *Agricultural Policy Perspective Briefs*, No. 1, http://ec.europa.eu/agriculture/publi/app-briefs/01_en.pdf

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