Food Security and the UK:

An Evidence and Analysis Paper

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Food Chain Analysis Group

Defra

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EXECUTIVE SUMMARY

Introduction (section 1)

E.1 In the overall context of a shift to a more open, and less subsidy-dependent, trading environment, the issue of the nation's food security policy is often raised.

E.2 The **Strategy for Sustainable Farming and Food (SFFS)** does not define a particular structure of farming that the Government wants to promote. Its emphasis has been on a competitive and environmentally sensitive farming sector that is responsive to the market; in which profitability matters more than production; sustainability more than size; efficiency more than self-sufficiency. Besides its strategic priorities on sustainable farming and food, a significant part of Defra's work is concerned with preparedness for emergencies and contingencies, including those impacting food supplies.

E.3 In recent years, food security has become increasingly discussed as a matter of concern in some developed countries, including in the UK. Two main triggers appear to be at work:

- In the UK, the **self-sufficiency ratio** of domestic production to consumption has been in noticeable decline over the last decade. The 'decoupling' reforms of the CAP, together with the prospect of trade liberalisation in agricultural products, are expected to reduce domestic agricultural production in the UK and Europe.

- In the context of climate change, international energy concerns, geopolitical tensions and international terrorism, a growing sense of the potential for **disruption** to domestic food supplies in an uncertain world.

E.4 Within the UK, other factors have emerged, which, coinciding with the falling self-sufficiency ratio, have contributed to a sense of growing unease: the power of globally-sourcing supermarkets; a sharp decline in farm incomes; public health concerns with food safety; growing awareness of environmental issues; the potential for short-term interruptions to fuel supply, and longer-term concerns over energy security and climate change.

What is "food security"? (section 2)

E.5 Discussions around food security can be confusing because food security for a developed economy like the UK is multi-faceted and complex in which different aspects are interlinked. Various definitions of national food security exist (see Annex B). The common themes are: availability of food; access of consumers to affordable, nutritional and safe food; resilience of the food system to significant disruptions, and public confidence in that system. The language of "security" may also be a barrier to a clear understanding of the issues.

The long-term perspective (section 3)

E.6 Since the industrial revolution, food imports have been a crucial element of Britain's food supply. Food imports were severely disrupted during the two world wars of the twentieth century; maintaining food supply then involved securing the flow

of imports, as well as boosting home production and other food chain interventions. The post-war drive for greater self-sufficiency across Europe was a response to wartime and post-war shortages. The problems of the 1970s reinforced self-sufficiency thinking across Europe, and the incentives provided by the CAP boosted the UK's self-sufficiency ratio. Since the 1980s the return of globalisation and other economic trends have weakened self-sufficiency arguments, especially at national level, while the self-sufficiency ratio has also declined. Current levels of UK self-sufficiency are in fact pretty normal by historical standards.

Food security and the role of markets (section 4)

E.7 This section considers what economic theory can tell us about the role of markets in food security and to what extent governments ought to intervene. Food security is essentially about identifying, assessing and managing risks associated with food supply. A completely risk-free supply chain is an unrealistic objective. Eliminating the last vestiges of risk would involve costs that consumers and taxpayers would find excessive.

E.8 Many risks associated with food supply are likely to be adequately dealt with by markets. Food security might be further enhanced by removing any disproportionate barriers that prevent markets supplying the resources and infrastructure to make food supply robust, particularly in the event of severe disruptions. Systemic risks to food supply may not, however, be adequately managed by markets, either for domestic or overseas produce; these need to be correctly identified and appropriately targeted.

The global picture (section 5)

E.9 Poverty and subsistence agriculture are root causes of national food insecurity. National food security is vastly more pressing for developing countries than for the rich countries of western Europe. As a rich country, open to trade, the UK is well placed to access sufficient foodstuffs through a well-functioning world market.

E.10 International trade enhances global food security by maximising productive potential. As world trade in foodstuffs has expanded, world food supplies have consistently outgrown world population. Undernourishment continues to prevail in certain areas owing to a complex of regional socio-economic and political factors, typically involving a combination of poverty, conflict and temporary or chronic lack of self-sufficiency.

E.11 In the context of climatic, economic and demographic change, however, global self-sufficiency should not be taken for granted. Climate change particularly is likely to bring new challenges for the food security, not of rich countries like the UK, but of less developed, tropical, regions. The work of the FAO and research organisations continues to be important in this regard, as well as the ongoing challenge of climate change mitigation.

Self-sufficiency and food security (section 6)

E.12 This section examines the various arguments and assumptions around self-sufficiency, as well as trends in trade and the self-sufficiency ratio, and assesses what, if anything, they mean for food security. National self-sufficiency figures based

on market shares provide a very broad indicator of UK agriculture's ability to meet consumer demands, but fail to reflect many dimensions of "food security":

- Consumer demands for increased variety and more exotic foods tend to reduce UK market share without compromising our ability to meet our nutritional needs.

- The self-sufficiency ratio calculates market values rather than calorie requirements. Over-eating, waste of food and the ability to switch to more calorie-efficient foodstuffs suggest that the UK may be more self-sufficient than is evident from market shares.

- Food security involves diversifying supply options. The UK is able to source efficiently foods from a wide variety of stable countries, especially from other EU countries.

- Domestic agriculture itself depends upon a variety of imported inputs such as fertiliser, fuel and machinery. Circumstances in which food imports were cut off would also be likely to hamper domestic production potential.

- Importantly, self-sufficiency fails to insulate a country against disruptions to its domestic supply chain and retail distribution. Domestic farm crises, such as a harvest failure or animal disease, or natural disasters within our borders, will mean that imports become critical to maintaining a stable food supply.

E.13 It is difficult to envisage a scenario in which domestic agriculture does not play a substantial role. Were food self-sufficiency, in nutritional terms, ever to fall radically, the risks associated with significant 'dependence' on imports could need greater assessment and managing (there are parallels with future projections of gas imports). It would not be a question of including fixed minimum targets for UK self-sufficiency, but asking questions such as: What risks are not being factored in by commercial operatiors? How reliable are our main suppliers? How secure are our ports and shipping routes? How robust is the self-sufficiency of the wider EU?

The domestic supply chain (section 7)

E.14 A narrow focus on agricultural self-sufficiency ignores the relevance of the whole food chain, and how the food chain itself might enhance or weaken food security. Using the standard food security definition, it is clear that the modern retailer-driven food supply chain has generally provided consumers with sustained "physical and economic access to sufficient, safe and nutritious food". Modern supply chains have vulnerabilities, but are not necessarily more risky than alternative, or historic, supply chain systems. There may, however, be a degree of trade-off between resilience and efficiency in the issue of redundant physical capacity.

E.15 Resilience itself is increasingly a commercial issue. Many of the risks involved are in firms' interests to guard against since this directly affects their business or reputation. Business continuity planning has grown in recent years, but there is potential for further improvement. Contingency planning by Government, and the need to work closely with the food industry, remains important to overcome any infrastructure, information and co-ordination failures.

Threats and disruptions: recent experience and potential scenarios (section 8)

E.16 This section reviews recent crises affecting food supply and considers various future threats. The unpredictable nature, however, of potentially major risks to food supply suggest that maintaining food security involves a variety of approaches and cannot be reduced to a choice between domestic and imported production. Equally, the "precautionary principle" appears to be too simplistic a tool for addressing the multi-faceted challenge of food security.

E.17 The ability of competitive markets, domestically and internationally, to adapt to shocks should not be understated. In fact the UK food chain has been remarkably resilient in recovering from a range of crises in recent decades. *Flexibility* – in domestic agriculture, international markets, and the domestic food industry - will always be crucial in building resilience to and dealing with short and long term threats. Judicious intervention can facilitate the resolution of crises, but intervention can also create perverse outcomes.

Food security and related issues (section 9)

E.18 Food security is often linked with a wider range of sustainability issues, such as environmental protection, local food, health and nutrition, and so on. This section considers the extent to which these wider issues have any bearing upon food security. It concludes that links between food security and other food sustainability objectives are weak and should be addressed separately.

E.19 Food security concerns share common elements with energy security, but the differences are greater. Food security itself depends upon national and international energy security. In an energy and oil dependent economy, threats to domestic energy security, in particular fuel supplies, are likely to have adverse impacts on domestic food security, both through supply disruptions, and for lower income groups, through reduced affordability for nutritious food. This makes energy security the prior short and long-term concern. Differences apart, there are themes common to both food security and energy security: the diversity and reliability of supplies and supply routes; the role of market incentives in facilitating supply and managing risks; and the importance of international market liberalisation and integration.

Conclusions (section 10)

E.20 The key conclusions of the paper have been highlighted in the individual chapter summaries above. These conclusions suggest that a discourse centred on 'UK self-sufficiency' is fundamentally misplaced and unbalanced. The real issues extend beyond the UK, beyond agriculture, beyond food. Hence food security cannot be the object of a single policy, but needs to be underpinned by a range of cross-cutting policies. These would include:

- promoting and, where appropriate, developing business and contingency planning, together with relevant industry players; improving co-ordination and information flows across industry; contingency governance arrangements; and early warnings preparedness for private sector;

- strengthening energy security;

- promotion of food security in developing countries through development and entitlements; and boosting efforts to tackle climate change which can have disproportionate effects on the food security of vulnerable countries;

- strengthening the multilateral trading system, Single European Market and international relations generally;

- identifying and strengthening resilience and capacity of strategic infrastructure e.g. ports;

- tackling domestic poverty issues – also a question of localised access to healthy food, which could have implications for competition and local planning policies;

- developing and enforcing food safety regulations;

- promoting a flexible, skilled and market-oriented agriculture, across the EU and domestically, able to flex production in extreme circumstances;

- promotion of global food security through appropriate international R&D.

E.21 Much of this is already happening, but it also cuts across policy boundaries and different levels of government and governance. The relevant weight accorded to individual policies may vary over time as new threats, trends and geopolitical circumstances emerge, as shown in our historical survey. Hence it is worth reassessing the dimensions of food security from time to time.

E.22 The conscious or unconscious identification of food security with self-sufficiency has often obscured the real issues. The self-sufficiency ratio is better construed as a broad indicator of UK agriculture's ability to meet consumer demands at home and abroad - its competitiveness.

E.23 Notwithstanding these conclusions, areas in which further investigation could be informative are:

- the potential impacts of climate change on global food potential;

- the environmental effects of trends in global food production and distribution;

- the resilience of domestic and international trading infrastructure;

- popular perceptions of risk and security with respect to food.

E.24 The paper concludes by outlining possible indicators of food security that might better reflect its several facets.

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1. INTRODUCTION AND BACKGROUND

Purpose of this paper

1.1 In the overall context of a shift to a more open, and less subsidy-dependent, trading environment, the issue of the nation's food security policy is often raised. This discussion paper, which was heralded in the Government's 'Forward Look' of July 2006[1], takes a wide-ranging and critical view of the arguments and evidence in relation to food security issues, offers some conclusions, and identifies outstanding evidence and research gaps. It is not necessarily a statement of Government policy.

The policy context

1.2 The **Strategy for Sustainable Farming and Food (SFFS)** is the Government's policy framework on farming issues. A comprehensive and long term blueprint for the future development of the industry, it identifies how Government will work with the food chain to secure a sustainable future for the English farming and food industries, as viable industries contributing to a better environment, an attractive countryside, and healthy and prosperous communities. Related to this, in December 2005 HM Treasury and Defra published a clear and challenging vision for the Common Agricultural Policy, taking a long-term perspective through to 2020. In July 2006, Defra published a **Forward Look**, which builds on the SFFS and offers a fresh focus on the business and environmental challenges facing the farming and food industry.

1.3 The SFFS does not define a particular structure of farming that the Government wants to promote. Its emphasis is on a competitive and environmentally sensitive farming sector that is responsive to the market; in which profitability matters more than production; sustainability more than size; efficiency more than self-sufficiency.

1.4 Besides its strategic priorities on sustainable farming and food, a significant part of Defra's work is concerned with preparedness for emergencies and contingencies. These include emergencies that directly or indirectly affect domestic food supply.

Why the growing interest in food security?

1.5 The sustenance of its people is a basic objective of any nation, particularly in less developed countries. History shows how food shortages have stoked civic unrest, and how the ability to source and distribute adequate food has been critical in times of major war. Yet food security is increasingly discussed as a matter of concern in some developed countries, including in the UK. The question is asked: are we taking our food security for granted? Two main triggers appear to be at work:

[1] Defra, *Sustainable Farming and Food Strategy: Forward Look* (July 2006), para 2.22.

- In the UK, the so-called **self-sufficiency ratio** of domestic production to consumption, has been in noticeable decline in the last decade or so. The 'decoupling' reforms of the CAP, and prospective trade liberalisation, are expected to reduce domestic agricultural production in the UK and Europe.

- In the context of climate change, international energy concerns, geopolitical tensions and international terrorism, a growing sense of the potential for **disruption** to domestic food supplies in an uncertain world.

1.6 Within the UK, other factors have emerged, which have contributed to a sense of growing unease: the power of globally-sourcing supermarkets; a sharp decline in farm incomes; public health concerns with food safety; the potential for short-term interruptions to fuel supply, and longer-term concerns over energy security and climate change.

1.7 No food supply system can ever be totally secure. Rather, food security is about managing **risk**. Identifying, assessing, managing and mitigating risk has in recent years become a much more conscious exercise in the public and private sectors. Consideration of risk in relation to a matter as strategic as food supply is therefore perhaps unsurprising.

1.8 Risk and uncertainty are facts of life, but there is a growing view that the world is becoming increasingly unstable and uncertain, whether in terms of terrorist activity, oil shortages, commodity price shocks, climate change and international and regional conflicts. Home production is then seen as a vital means of insuring against these potentially disastrous threats.

1.9 The concept of "**sustainable development**", with its stress on irreversibility, resilience and the precautionary principle, may itself have lent weight to arguments in favour of self-sufficiency and against import "dependence"; and to presumptions that domestic ("local") food production is more environmentally sustainable than that which is imported. Within this thinking, domestic production is considered a 'safe' choice, and sustainable - fresh, healthy, non-exploiting - in all respects.

Scope of this paper

1.10 Food security can be a slippery concept, and direct analysis is not always tractable. Therefore the paper addresses food security from different angles, bringing together theory, evidence and experience, in order to identify some common themes and arrive at some preliminary conclusions. To keep the discussion focussed and tractable, this papers addresses a number of key questions which are implicit in the wider discourse around food security:

- *What is meant by "food security"?*

- *Is self-sufficiency a good indicator of UK food security?*

- *Does reliance on trade and modern supply chains undermine food security?*

- *What should Government be doing to strengthen food security?*

2. WHAT IS FOOD SECURITY?

2.1 According to the Food and Agriculture Organization of the United Nations (FAO), food security exists

> *when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.* [2]

2.2 It is a broad definition. More specifically, we can consider different levels of security.

- ***Individual*** or ***household food security*** relates to income, access to resources, and affordability of food. It is largely a question of purchasing power, but can also suggest localised issues such as 'food deserts'.[3]

- ***Regional food security*** could also be relevant. For instance, the recent London Food Strategy includes food security as one of its five key policy themes.[4] Small islands are particularly dependent upon mainland travel links.

- ***National food security*** relates to the ability of a country to consume sufficient foodstuffs, even in the face of severe disruptions to the supply chain. It can also be relevant at trading-bloc level, like the EU.

- ***Global food security*** is concerned with the ability of the world's agricultural producers to meet global demand, and the efficiency and effectiveness of trading and distribution systems.

2.3 The main focus of this paper is national food security, but reference is made to other levels, particularly the global.

Key themes

2.4 Discussions around food security can be confusing because, in addition to these different levels, for a developed economy like the UK, national food security is multi-faceted and complex in which different aspects are interlinked. Various definitions of national food security exist (see Annex B). The common themes are:

- **Availability** – The most obvious facet is the volume of food, and its reliability. This brings in questions about *provenance*, and *diversity* of supplies.

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[2] FAO (1996). *Rome Declaration on World Food Security and World Food Summit Plan of Action*. World Food Summit 13-17 November 1996, Rome.

[3] "Food deserts" refers to geographical areas where access to grocery retail outlets and healthy food is relatively limited, particularly for those on low incomes or without cars. See Competition Commission, *Supermarkets: a report on the supply of groceries from multiple stores in the United Kingdom* (2000), vol. II, p. 312.

[4] London Development Agency, *Healthy and Sustainable Food for London: the Mayor's Food Strategy* (May 2006). See pp. 20, 149.

- **Access** – Availability focuses upon supply, and access stresses demand. It "includes the ability to afford food and a well-functioning transportation and food distribution system".[5]

- **Affordability** – Can low-income individuals afford decent food, and to what extent does 'food poverty', like 'fuel poverty' exist? In otherwise rich countries, such as the US, *household* food insecurity is the key focus, being driven by household demographics, local economic and social conditions, housing costs, and poverty support programmes (such as federal food stamps)[6]

- **Nutrition and quality** – The composition, as well as the overall volume, of food available and consumed is critical. This will have close links with affordability.

- **Safety** – As in other areas of concern, security and safety go together. Recent history shows that many crises relate to food safety issues. In rich countries, people are more likely to die of food poisoning than of starvation.

- **Resilience** – Even if a food system normally performs well under the previous four headings, can it adequately handle risk and withstand significant disruptions and major incidents?

- **Confidence** – In a developed economy like the UK, consumers and the media have high expectations of the food system and 'food scares' make headlines. According to one definition

> *a country and people are food secure when their food system operates efficiently in such a way as to remove the fear that there will not be enough to eat.* [7]

2.5 This emphasis on expectation, fear and perception renders objective measurements of food security, like crime, rather problematic.

The importance of language

2.6 Language is powerful. Notions of "security" are particularly charged in an era of terrorist attacks. In this context, the term "food security" carries connotations which go beyond the possibility of disruptions, and itself induces fears which may have little rational foundation. For developing countries, such as in sub-Saharan Africa, the language of "food security" signifies matters of life and death, and has been at the heart of the FAO's mandate. More recent use of the same language within a rich country like the UK insinuates an equivalence with the developing world. The reality, as subsequent chapters will show, is very different.

2.7 Moreover, phrases like "a country's ability to feed it's people" are loaded in favour of a *supply-side*, somewhat *military*, perspective, which implicitly equates food

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[5] OECD, *Multifunctionality: towards an analytical framework* (2001), p. 47.

[6] For instance, see L. Bernell et al, 'Restricted opportunities, personal choices, ineffective policies: what explains food insecurity in Oregon?', *Journal of Agricultural and Resource Economics* 31 (2006), pp. 193-211.

[7] S. Maxwell, *National Food Security Planning: First Thoughts from Sudan* (1988), workshop paper, Institute of Development Studies, University of Sussex.

security with national self-sufficiency and a production-led supply chain. Such language wrongly implies that consumers and those who source commercially on their behalf - the major retailers - are passive recipients of some centralised agency or agricultural community, as if they had no purchasing power, no choice, no influence over suppliers, nor incentives to adapt to changing circumstances.

2.8 The language of "security" also allows easy but unproven parallels to be drawn with security concerns in other areas, such as on transport networks, water security and energy security. However, close analysis is required in order to identify common features and avoid misleading analogies. This is made clear in the case of energy security (see Box 9-1).[8]

[8] Analysis of "water security" warrants a separate study, but the importance of specialised infrastructure, the volatility of demand suggests that water has more in common with energy security than food security (see Box 9-1). The non-tradeability of water is obviously a major difference.

3. THE LONG-TERM PERSPECTIVE

Key points

- *Since the industrial revolution, food imports have always been a crucial element of Britain's food supply. Britain has long been a strong trading nation.*
- *Food imports became severely disrupted during the two world wars; maintaining food security involved a range of interventions, including maximising imports, as well as boosting home production.*
- *The post-war drive for greater self-sufficiency across Europe was a response to shortages. The problems of the 1970s and the incentives provided by the CAP reinforced self-sufficiency thinking, but the return of globalisation and other economic trends have weakened the self-sufficiency model, especially at national level.*

3.1 Because food security is such a basic aim in all times and places, a historical perspective can furnish several lessons for current debates. This section is not an exhaustive history of British agricultural policy. Rather it charts the changing economic and political context within which Britain's understanding and experience of food security has developed to the present day. Recent crises affecting the food chain are considered in section 8.

Industrialisation and the end of self-sufficiency

3.2 Starvation was rare in pre-industrial England. Historians speak of 'crises of subsistence' rather than starvation, notable years being 1586-7, 1596-7 and 1623-4. When harvests were tight, villagers and townspeople would expect local authorities actively to distribute available supplies fairly. But shortages only led to increased deaths when these were combined with administrative failure or disease outbreaks, rather than famine per se. When the paternalistic system broke down in the eighteenth century, rising grain and bread prices could spark food protests and riots.[9]

3.3 After 1750, Britain experienced rapid population growth and urbanisation. Wheat prices began to creep up. Bad domestic harvests, particularly during and after the 1795-1815 wars, brought dearth and distress, threatened social stability and highlighted the need for imports.[10] Yet the early nineteenth century **Corn Laws**, like the modern CAP, severely restricted imports and inflated prices (Box 3-1).

[9] P. Laslett, *The world we have lost – further explored* (1983) pp. 128-52; E. Evans, *The forging of the modern state, 1783-1870* (1996), p. 154.

[10] J. C. Drummond and A. Wilbraham, *The Englishman's food: five centuries of English diet* (1957), pp. 279-83.

Box 3-1 The Corn Laws

Import and export of grain had been regulated since the seventeenth century, but the new Corn Laws of 1815 sought to safeguard prosperity of farmers and landlords and encourage food production in the aftermath of war. It was assumed that grain imports were largely not needed to supplement home supply.[11] But as industrialisation gathered pace, government quickly came to recognise that Britain could not feed itself and that the safest means of guaranteeing food supply was by encouraging a steady trade flow from European surplus-producing countries. Because of the burden they put on the lower classes, on commerce and industry, and the social unrest that high prices brought, the Corn Laws were widely slated as endangering, rather than engendering, stability and security. [12]

This conviction – combined with the unfolding potato crisis in Ireland - underpinned their eventual abolition in 1846 by Prime Minister Robert Peel. Peel realised that protection was neither a necessary nor efficient means of feeding a growing population, and that Britain's comparative advantage subsisted in industry rather than agriculture. Indeed, during the nineteenth century, British exports of manufactured goods were exchanged largely for foodstuffs and raw materials, from regions such as the US, Baltic and south Russia.[13]

3.4 Except in years of poor harvest, Britain was, until the 1830s, largely self-sufficient in 'temperate' foodstuffs such as grain, meat and dairy produce, and potatoes became an important domestic crop for the labouring poor. Only around 10-15% of food and drink imports were of the indigenous kind. By the 1850s, this share had risen to 43%. Expanding imports of sugar, tea, wine, coffee and cocoa – accompanied by an expansion of port infrastructure – ensured that Britain's overall self-sufficiency ratio remained relatively low. By 1870, 40% of domestic demand was being supplied by imports.[14]

3.5 Tragically, in one part of the (then) United Kingdom food did run out. In the **Irish potato famine** of 1845-9, perhaps a million souls died. The basic problem was over-reliance on a single crop, the potato - itself a result of subsistence small-hold farming - and potato blight hit remote, unindustrialised, poor areas worst. Securing access to cheap cereal imports was one element of a policy response, but progress was slow because corn law repeal was not immediate and transport infrastructure was poor. Poor relief was generally inadequate. The emerging crisis, together with poor harvests in England provided additional grounds for Peel to abolish the Corn Laws. The Highlands of Scotland, also dependent upon potatoes, suffered malnutrition at about the same time, though relief efforts were more effective.[15]

3.6 Food imports surged after 1870 as the US prairies opened up and ocean carriage costs plummeted. Tropical fruit and vegetables could now be imported at affordable prices.[16] Import competition forced domestic agriculture to restructure and focus upon meeting growing urban demand for meat, dairy and garden produce in the large towns. Britain's industrialisation brought suffering and unrest as well as growing prosperity, but the Victorian experience suggests that trade made a

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[11] R. Davis, *The Industrial Revolution and British overseas tra*de (Leicester, 1979), pp. 42-3.

[12] On the Corn Laws, see M. Daunton, *Progress and poverty: an economic and social history of Britain, 1700-1850* (1995), pp. 545-51, and Evans, *Forging of the modern state,* pp. 278-84.

[13] B.R. Mitchell, *British Historical Statistics* (1988), pp. 456-7; Davis, *Industrial revolution*, pp. 36-8.

[14] Davis, *Industrial Revolution*, p. 37; Evans, *Forging of the modern state,* p. 144.

[15] See R. Foster, *Modern Ireland, 1600-1972* (1988), pp. 318-44; Drummond and Wilbraham, *The Englishman's food*, p. 283.

[16] P. Davies & D. Hope-Mason D, *From orchard to market: an account of the development of the fruit and vegetable trade in the UK* (2005), pp. 31-3.

significant contribution to a more secure, nutritious and affordable food supply. Even when free trade policy was challenged by the "tariff reform" campaign of 1902-10, the arguments rested on fiscal, industrial and imperial objectives, rather than food security per se.

The wartime experience

3.7 The identification of domestic self-sufficiency with food security is rooted in Britain's experience of wartime disruption. Shipping, labour and resource shortages during **World War One** (1914-18) strained Britain's food supply and highlighted the role of nutritional science. The government established a Food Production Department to encourage farmers to maximise output from their resources. In practice this meant shifting production from livestock towards wheat and potatoes in order to maximise calories per acre. This expansion and substitution of production reduced the demand for imports, but home production still supplied less than half of the national diet. Imports remained essential. Policy therefore focused upon cutting the amount of shipping required by concentrating on highly nutritious products, and sourcing these from locations which minimised transportation.[17]

3.8 Despite these initiatives, shortages had emerged by the end of 1917, and a number of products (including sugar, meat, butter and jam) were rationed, though increased consumption of bread and potatoes maintained the sustenance of the nation. After the war, many believed the agricultural sector should be recognised for its vital role in feeding the nation, and the 1920 Agricultural Act introduced a series of guaranteed prices to continue stimulating domestic production. However, the high cost of supporting British agriculture during a period of fiscal retrenchment, together with a desire to return to the free-trade environment from which the country was seen to gain so much, led to the abolition of much of this protective legislation, resulting in increased food imports. Consequently, self-sufficiency remained at pre-War levels throughout the 'twenties and 'thirties.[18]

3.9 In **World War Two** (1939-45), Britain's food imports - particularly from Europe and the Empire - were seriously impeded by German u-boats, overseas enemy occupation and the Pacific War.[19] By 1943, food and feed imports were only half their 1930s' level. Yet adaptation was impressive. The 1941 Lend-Lease Act in the USA brought additional supplies to the UK, particularly protein-based foods. Shipping space and capacity were used more efficiently and animal feedstuffs gave way to human food. As some import sources dried up, others (e. g. Canada, US and West Africa), expanded. In 1944, imports still supplied the major share of consumption of wheat / flour (56%), fats (98%) and sugar (73%). The drive to boost domestic food production was targeted on certain commodities in order to complement import supplies and maximise production of wheat, potatoes, liquid milk and vegetables.

3.10 Feeding the nation during the War was not simply a question of 'digging for victory'. Consumption and waste had to be reined back and nutritional campaigns were critical. Rationing and price controls sought to guarantee that a limited food

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[17] Davies & Hope-Mason, *From orchard to market,* pp. 70-72; Drummond & Wilbraham, *The Englishman's food*, pp. 431-42.

[18] Davies & Hope-Mason, *From orchard to market,* pp. 69, 92-93; H. Marks & D. Britton, *A Hundred Years of British Food and Farming* (1989) p. 5.

[19] All information taken from Ministry of Food, *How Britain was fed during the War* (1946)

supply was fairly allocated, and stockholding providing back-up in the face of wartime disruptions. Garden allotments were acquired and promoted as a means of increasing vegetable consumption. In fact, nutrition improved during the war, as adequate diets became more affordable and science improved.[20] But the reduction in imports brought a duller diet centring on bulk vegetables, cereals, potatoes and powdered egg.

3.11 Securing wartime food supplies also involved rationalising and concentrating scarce resources throughout the food chain (in fuel, manpower, factory space, transport, packaging). The machinery of food control was complex and far-reaching. As well as intervening in agriculture, the Ministry of Food regulated wholesaling, manufacture and distribution to different degrees, often with the private sector acting as Government agents. Raw materials such as milk were regulated for priority uses (e.g liquid milk). Government controlled imports and ports through buying agencies; in fact, imports were easier to control than dispersed home agricultural production. Air raids would also threaten to cripple internal distribution networks. Ensuring nutritionally adequate industrial catering and school meals was equally critical.

3.12 It is very difficult to envisage a recurrence of such extreme circumstances, but we can draw a number of general lessons from the wartime experience:

- In extreme circumstances, food security involves maximising supplies from all sources, including domestic and international sources, and maintaining effective distribution systems;

- It involves identifying and meeting nutritional needs most efficiently from scarce resources, at home and abroad. Influencing consumption through rationing and advice becomes as important as influencing the level and composition of production;

- 'Feeding the nation' is a whole food chain issue, in peace or war. Processing, distribution and consumption are as important as primary production.

Post-war agricultural support in the UK

3.13 Europe's food supply in 1945 was in a parlous state. War-induced dislocations in international trading relationships and shipping shortages precluded the resumption of food imports at pre-war levels. Famine in countries like India forced the diversion of available food supplies to those areas.[21] The sudden termination of American lend-lease aid in August 1945 sparked a dollar shortage in Britain, and hampered the acquisition of high priced foodstuffs in the world markets. Rationing was extended to new products.

3.14 "There was an urgent need to produce more food at home. To do this the co-operation of farmers was essential … To restore confidence the government of the day needed to provide incentives for farmers and credible assurance that these

[20] Drummond and Wilbraham, *The Englishman's food*, pp. 448-55.

[21] The worst case of malnutrition occurred in the Netherlands in 1944-5, when a harsh winter combined with wartime dislocation and conflict to disable production, distribution and trade. Relief came with liberation in May 1945, Z. Stein et al, *Famine and Human Development: The Dutch Hunger Winter of 1944-1945* (1975).

would survive the end of scarcity."[22] In response, the landmark **Agriculture Act of 1947** aimed at:

> *promoting and maintaining…a stable and efficient agricultural industry capable of producing such part of the nation's food and other agricultural produce as in the national interest it is desirable to produce in the United Kingdom.* [23]

No production or income targets were laid down, but the Act established a system of guaranteed prices for the main products, through a system of deficiency payments which avoided inflating consumer prices and allowed imports from Commonwealth suppliers to continue (See Box 3-2).[24] Elsewhere in Europe, similar protection was offered to domestic farmers.

Box 3-2 Agricultural support in the UK after 1947

Guaranteed prices were the main means of expanding agricultural production and investment, virtually regardless of commodity, or the costs and efficiency of expansion. An official target to increase net output of UK agriculture by 50% over pre-war levels (equivalent to an increase of 20% from 1947) was met by 1952, albeit unevenly across sectors (output of potatoes, milk and pigmeat exceeded their targets, whereas beef, mutton, wheat, oats and sugar beet did not).

Regulations aimed at good farming practice, protection for tenant farmers, encouragement of county council smallholdings to foster enterprise, and the establishment of county agricultural committees to promote agricultural development. A free **National Agricultural Advisory Service** encouraged agricultural improvement and more productive and modern farming methods. **Production grants** and **input subsidies** were later introduced to encourage the adoption of more efficient methods of production.

After 1951 the addition to guaranteed prices was generally less than the increase in average costs, so farm incomes could continue to rise only through greater efficiency. Nevertheless, the strategy of higher guaranteed prices led to significant increases in the cost of agricultural support. As world prices began to fall, the Exchequer costs of supporting guaranteed prices increased, and led eventually to reform of the support system in the early 1960s and a move towards import controls.

3.15 The new regime was a success. It helped bring ratoning to an end, and by the 1970s, agricultural output had trebled, although overall productivity only grew by around 1% per annum[25]. Despite rising Exchequer costs from the deficiency payments system, and the need for reform in the 1960s, it could be argued that policies intended to overcome wartime shortages and post-war austerity had been transformed into a peacetime programme; "the spirit of the 1947 Agriculture Act underpinned farming and food policy up to Britain's entry into the EC." [26]

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[22] J. Marsh, 'The changing relationship between the state and the farmer' in *Agriculture in the UK – its role and challenge,* prepared for the Foresight Food Chain and Crops for Industry Panel (Sept 2001).

[23] Section I of the 1947 Agricultural Act, quoted in J. K. Bowers, 'British Agricultural Policy Since the Second World War', *Agricultural History Review* 33 (1985), pp. 66-77.

[24] Until 1953, when guaranteed prices were brought in, the Ministry of Food simply bought produce at the farm gate at fixed prices, before disposing of their purchases to the wholesale and retail trade.

[25] K. Ingersent. & A. Rayner, *Agricultural Policy in Western Europe and the United States* (1999), p. 140.

[26] Martin, J. (2000) *The Development of Modern Agriculture*. Macmillan, UK. p. 72.

The Common Agricultural Policy

3.16 Like UK policy, the EC **Common Agricultural Policy** (CAP) was forged in the furnace of war and Cold War. According to the European Commission, it has its roots

> *in 1950s western Europe, whose societies had been damaged by years of war, and where agriculture had been crippled and food supplies could not be guaranteed. The early CAP reflected the need to maintain and increase food production … Agriculture sat high on the agenda of European policymakers, especially at the time when the Treaty of Rome was being negotiated. The memory of post-war food shortages was still vivid and thus agriculture constituted a key element from the outset of the European Community*.[27]

3.17 The objectives of the Common Agricultural Policy (CAP) were set out in the 1957 Treaty of Rome (Article 39). These included "certainty of supplies" that would "reach consumers at reasonable prices". National self-sufficiency was not itself endorsed; rather the implication was that security of supplies would be achieved through specialisation and trade within the Community – hence the construction of a 'common' policy, rather than separate national ones.

3.18 The Treaty's signatories were France, Germany, Italy, the Netherlands, Belgium and Luxembourg, to all of whom "the need for a common agricultural policy was paramount". Farming was an important part of their economies, with around 20% of the total working population of the Community dependent on agriculture for its livelihood. Other perceived problems were the prevalence of small farms and low-income farmers, as well as "technological backwardness". [28]

3.19 Britain's situation was quite different. As a large net food importer, the higher cost of food imports and budgetary contributions to the EC would mean the UK 'losing out' from membership of the CAP. However, due to the manner in which its support mechanisms were constructed, the CAP soon led to large food surpluses, ("grain mountains" and "wine lakes"). Furthermore, UK production expanded rapidly in the early 1970s in an attempt to mitigate the losses associated with membership of the CAP, a trend which is reflected by an increasing UK self-sufficiency ratio over the period. The British government stated in 1970 that "expansion is needed not only to save imports now but if we join the European Economic Community, to reduce the bill which would have to be paid through adoption of the CAP." It has been argued that the history of the CAP, at least since 1980, has been a series of attempts to correct the mistakes of expansion. [29]

Europe and the return of globalisation

3.20 Global economic, financial and geopolitical troubles during the 1970s reinforced the self-sufficiency mentality, as professed in the Government's 1975 White Paper, *Food from our own resources.*

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[27] European Commission website, *Agriculture: Introduction* http://europa.eu/scadplus/leg/en/lvb/l04000.htm; *The Common Agricultural Policy – a policy evolving with the times*, http://ec.europa.eu/agriculture/publi/capleaflet/cap_en.htm

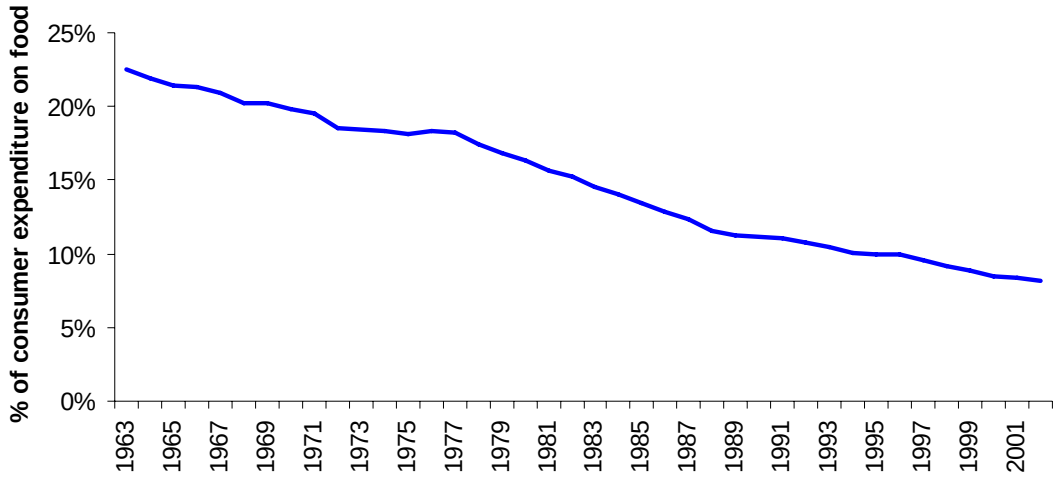
[28] J. Martin, *The Development of Modern Agriculture* (2000), p. 134; Ingersent & Rayner, *Agricultural Policy,* p. 151

[29] C. Ritson & D. Harvey (eds), *The Common Agricultural Policy and the World Economy* (1991), pp. 51, 73; J. Ockenden & M. Franklin, *European Agriculture – Making the CAP Fit*. (1995), p. 5.

3.21 The troubled history of the CAP since then, and the resurgence of market liberalism, is well-known. A number of broad socio-economic developments in the last few decades have altered our understanding of food security (of developed countries) and the role of markets:

- the downfall of Communist central planning and the demonstration of its economic failure. The famines of Stalinist Russia and post-War China (the "Great Leap Forward") were failures of government, not the market;
- rapid post-war economic growth in Europe and in emerging economies;
- rapid growth in trade, and the strengthening of the multilateral trading system through the GATT and the creation of the World Trade Organisation;
- increased European integration and the peace and stability associated with it;
- rapid agricultural growth across the globe (see section 5.12);
- with rising incomes, falling shares of consumer expenditure on food (Figure 3-1). Partly as a result, the share of agriculture in GDP has declined;
- the shift from supply-driven, to demand-led, supply chains (section 7.1 ff.)
- the advent of floating currencies and deregulation of financial markets;
- growing awareness that the CAP drive for self-sufficiency was hurting the food security of other developing countries.

Figure 3-1 Declining share of food in UK consumer expenditure 1963-2002



Source: ONS

3.22 We return to some of these factors in the discussion on the validity of self-sufficiency as a strategic indicator of food security (section 6). Recent decades have also seen a number of international crises with implications for food supply in Britain, and these are considered in section 8.

Conclusion: Reflections from history

3.23 Since the period known as the Industrial Revolution (1750-1850), Britain has never been self-sufficient in food. This reflects an ongoing shift of comparative advantage (from agriculture to industry, and now to services) and, with rising incomes, growing consumer demand for imports.

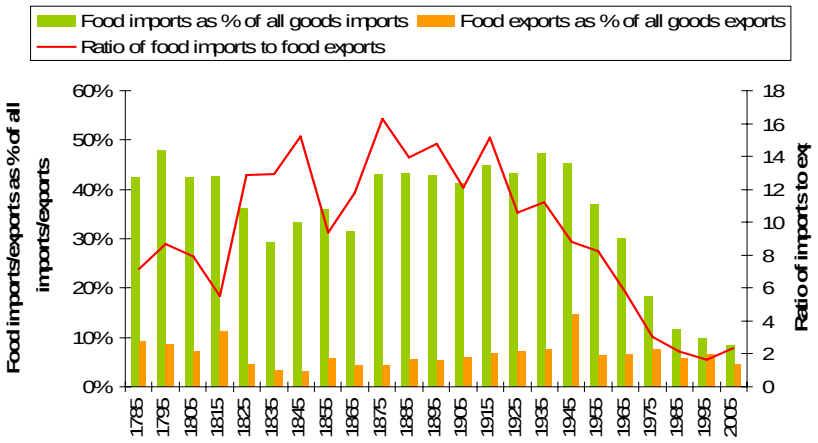
3.24 Britain has long been a trading nation: with Europe, with the Commonwealth, with the Americas and now more widely. Cities such as London, Bristol, Glasgow and Liverpool have flourished on the back of mercantile trade, as have many other cities Europe- and world-wide. The globalisation of recent decades in some ways represents a return to the late nineteenth century, and this is broadly reflected in Britain's historic self-sufficiency figures (Table 3-1).[30] Historical statistics also show the dominance of food imports in Britain's trade, together with their relative decline in the second half of the twentieth century (Figure 3-2). These historical facts should guard against exaggerated interpretations of the current levels of, or trends in, the food trade 'gap'.

Table 3-1 Indicative British self-sufficiency ratios over different periods[31]

pre – 1750	around 100% (in temperate produce)
1750 – 1830s	around 90-100% except for poor harvests
1870s	around 60%
1914	around 40%
1930s	30 - 40%
1950s	40 - 50%
1980s	60 – 70%
2000s	60%

For all food unless stated. Sources - see footnote

Figure 3-2 Food and drink's share in total British trade, 1785-2005



Based on Mitchell, British Historical Statistics *(1988)*

[30] Analysis of recent trends in the self-sufficiency ratio is provided in section 6.

[31] Figures derived from B.R. Mitchell, *British Historical Statistics* (1988); Davis, *Industrial revolution*; Evans, *Forging of the modern state*, p. 144; *How Britain was fed during the War* (1946); Defra statistics.

3.25 Historically, food crises have occurred, not simply because domestic production fails, but when financial resources are lacking, trade is blocked, distribution channels are inefficient or crippled and governance is poor. In the extreme circumstances of World War Two, action was required on all these fronts to prevent disruptions turning to crisis. Similarly, in his studies of Asian famines – like the notorious Bengal famine of 1943, when 3 million people perished - Nobel prize economist Amartya Sen has identified inadequate purchasing power, lack of democracy and poor distribution systems as more critical than inadequate domestic production.[32]

3.26 Despite these general lessons for food security from history, it remains true that changes and trends in international circumstances, in addition to the dynamics of agriculture and the domestic economy, suggest that the respective contributions of trade, domestic production and other elements to Britain's food supply will vary over time. Hence it is worth re-assessing the various dimensions of food security from time to time.

[32] A. Sen, *Poverty and Famines: An Essay on Entitlement and Deprivation* (1981).

4. FOOD SECURITY AND THE ROLE OF MARKETS

Key points

- *Maximising food security may not be optimal if the benefits are outweighed by the costs.*
- *Many risks associated with food supply are likely to be adequately dealt with by well-functioning markets.*
- *Systemic risks to food supply may not be adequately managed by markets; these need to be correctly identified and appropriately targeted.*
- *As well as market failures, other barriers may exist that prevent markets supplying the resources and infrastructure to make food supply robust.*

4.1 Having considered Britain's food security in its historical context, we now explore what economic theory can tell us about the role of markets in food security and to what extent governments ought to intervene. As before, the focus is the UK, and whilst the discussion is broadly applicable to other developed democratic countries with functioning market economies, it may be less so for developing countries.

The costs and benefits of food security

4.2 Food security does not and should not mean that food supply should be completely insulated from every risk, or that every risk must be minimized. Benefits of reduced risk (reduced costs to industry, reduced consumer anxiety, reduced risk of civil disturbance and malnutrition due to food shortages, etc) need to be weighed against costs.[33] The costs of enhancing security is easier to estimate than the benefits, because the latter depend upon both probabilities and uncertainties, as well as attitudes to risk, which will vary across the population and time.[34] Nevertheless, the costs of increasing security can also be hidden, and therefore susceptible to understatement.

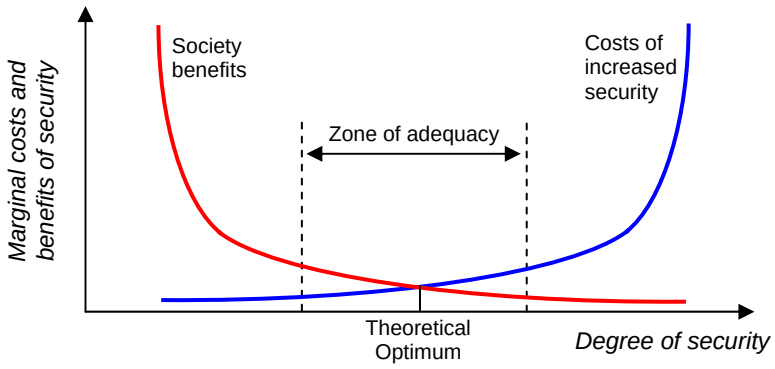
4.3 This suggests that investment in order to enhance security and reduce risks should tend to avoid extremes. Where security levels are low, demand for more security is likely to be relatively high and the associated costs of raising security are likely to be low, since simple measures could be identified and introduced to address some of the bigger risks. However, as security improves, the remaining risks are those which are difficult or expensive to deal with, or cause inefficiencies elsewhere. Eliminating the last vestiges of risk would involve costs that consumers and taxpayers would find excessive. In theory, food security is optimal when the cost of

[33] For instance, countries with regular heavy snowfall, such as Canada, find it worthwhile to invest in expensive snow-clearing equipment; countries where heavy snowfall is exceptional, such as England, typically do not. Similarly it may be efficient to *tolerate* certain infrequent disruptions in a food supply system, rather than making heavy investments to avoid them.

[34] For instance, people may place a higher value on reducing risk in the wake of a terrorist attack, partly reflecting expectations of more attacks, and partly reflecting a higher aversion to exposure to risk.

increasing food security is equal to the benefit that such an increase would bring (Figure 4-1). But given the uncertainties on costs and benefits, it makes more sense to conceptualise a 'zone of adequacy' around the theoretical optimum in which marginal costs and benefits are not far apart.[35]

Figure 4-1 Comparing marginal costs and benefits of food security



Source: Adapted from NERA

4.4 The key question then, becomes 'is there any reason why a level of food security close to the theoretical optimum would not be achieved through the natural workings of the market?'

Is food security a public good?

4.5 The market could fail in providing adequate food security if there are significant "externalities" or "public good"[36] characteristics associated with it. This issue is often couched in terms of the link between levels of domestic production and food security. Food security has been claimed to be a positive agricultural production externality, which implies that left to the market, domestic production would be "too small".[37] As we shall see later, this argument makes the strong assumption that domestic sources of supply are lower risk than imported sources. That is essentially an empirical question and depends also upon how much people value food security.

[35] NERA, *Security in Gas and Electricity Markets* (2002), p. 12.

[36] A public good is a commodity, service or institution which provides net benefits to communities as a whole but is unlikely to be fully provided by the market because non-payers cannot be excluded from consuming, and consumption by one person does not deprive consumption by others. "Positive externalities" are similar: a good has positive externalities when the social benefits of production or consumption exceed the private commercial benefits, leading to under-provision by the market.

[37] The notion that agricultural production provides benefits other than the food itself is known more formally as the '**multifunctionality'** of agriculture. As well as food security, these benefits include rural amenities, viable rural communities and the environment, D. Vanzetti & E. Wynen, 'The "Multifunctionality" of Agriculture and its Implications for Policy' in Ingco & Nash (eds.), *Agriculture and the WTO*; OECD, *Multifunctionality* (2001), p. 74.

OECD reckons that demand for perceived food security in association with domestic production declines rapidly to zero as domestic production potential increases.[38]

4.6 If food security were a public good, it raises the issue about people's willingness to pay for it. But, as the OECD points out, it is extremely difficult to assess people's demand for food security credibly.[39] Food itself does not have public good characteristics and people do not buy and sell food security *per se*. Some people may express their preferences for domestic production by buying locally or domestically produced food, but this too assumes that domestic is more secure and also that people have correct information regarding the nature of risk.[40]

4.7 Food security should not be confused with national security, which is a pure public good. Rather, food security could be classified as an open-access resource with non-excludability and congestion in consumption.[41] A well-functioning food chain and retailing system – as is the case in the UK - would appear to meet this definition.

4.8 If food security itself is not a public good, food supply certainly depends upon other quasi public goods, open access resources and 'natural monopolies' such as the transport and utilities networks (eg energy and utility infrastructure, motorways, ports), including shipping and air routes. Resilience of food supply will be strongly linked with the resilience of this basic infrastructure. Because of the potential market failures involved, many of these are in various degrees provided, regulated, influenced or supervised by governments, domestically and internationally.

Are externalities present?

4.9 Individual companies seek to insulate or insure themselves against the risk of disruption, and they do so if the expected benefits to themselves outweigh the costs they bear. But they may not take into account any benefits to the rest of the food chain of the security measures they adopt. This would result in less investment in security measures than would be valued by the overall food chain. For example, the Foot and Mouth Disease crisis in 2001 highlighted the external costs to rural tourism of a crisis in the agricultural sector.

4.10 A number of factors, however, suggest that these externalities should not be overstated. Some of the spill-over benefits between different stages of the food chain may be factored into market values (e.g. traceability elements). Increasing concentration at and between stages of the food chain mean that more of the spill-over benefits become 'internalised' to the firm's decision-making. Generally, supply chains are becoming more integrated and collaboration is increasingly necessary for efficiency and commercial success. Large retailers, for instance, have a strong interest in the continuity of supplies while assurance schemes also forge strong links along chains.

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[38] OECD, *Multifunctionality* (2001), p. 74; OECD, *Multifunctionality: the policy implications* (2003), pp. 96, 98.

[39] OECD, *Multifunctionality: the policy implications* (2003), p. 98.

[40] This paper does not examine popular concerns and perceptions in relation to risk and food security. But it can be observed that in general consumers through their shopping patterns express confidence in the food chain, although occasional outbreaks of panic buying (for instance, in relation to petrol shortages) suggest that this may be superficial.

[41] OECD, *Multifunctionality* (2001), p. 83.

4.11 Externalities, like public goods, are certainly present in other aspects of food supply. Although there are external benefits associated with consumption of nutritious food, there are also external costs of over-eating or unhealthy diets, such as the health costs of treating obesity-related conditions. Indeed, these are already the subject of particular policy initiatives.

Imperfect information?

4.12 Market players might also make inefficient decisions on risk management if information is imperfect. Markets may struggle to deal with low-probability / high-impact events, with individuals either acting as if the hazard doesn't exist, or as if the risk is significantly greater than it really is.[42] The former is akin to an attitude of 'it won't happen to me', whilst the latter is often fuelled by media exposure. In the absence of, or sometimes despite, evidence to the contrary, firms can act on their perception of risk rather than the risk itself.

4.13 Individual firms are also unlikely to have the information necessary to assess the probability of disruptions occurring when the source of the disruption is outside their immediate sphere of influence. For example, it is unreasonable to expect a small baker to know how likely it is that yeast supplies will be disrupted due to a power shortage. In ignorance of these probabilities, assessments of potential impacts become flawed and potentially misleading.

Distributional issues

4.14 Markets may be generally efficient in responding to consumer demand, but they respond to effective purchasing power rather than physical need. Food security problems often arise where groups with lower purchasing power do not obtain sufficient food, even though in aggregate, there is enough to supply everyone's basic requirements. Perversely, food supplies could well be diverted away from a starving region to more lucrative export markets where purchasing power is greater, a factor which exacerbated the Irish famine of the 1840s. This is not itself an argument against the efficacy of markets and trade, but it suggests that the challenge is to ensure vulnerable groups have sufficient purchasing power or entitlements to food (e.g. food stamps in the US).

Some conclusions

4.15 Theory does not offer clear-cut conclusions regarding food security and market failure, which is why much of this paper focuses upon a range of evidence. In part this reflects the multi-faceted nature of "food security" and the need to make assumptions about how food security is actually achieved. But a number of observations are relevant:

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[42] O. Ozdemir & J.B. Kruse, *Relationship between Risk Perception and Willingness-to-Pay for Low Probability, High Consequence Risk: A Survey Method*. Available online at http://www3.tltc.ttu.edu/ecowp/working paper/survey paper.pdf

- Conceptually, food security is about identifying, assessing and managing risks associated with food supply. A completely risk-free supply chain is neither realistic nor cost-effective.

- Food security is the outcome of a complex system involving myriad transactions and mechanisms: as a bi-product of food production, through trade and via the strategies and actions of firms and individuals along the food chain. Whilst market mechanisms co-ordinate the decisions of various players, it is unclear whether there would be sufficient co-ordination of information and incentives to head off or tackle systemic threats to the food chain, in particular threats to national security and strategic infrastructure.

- Different aspects of food security should be assessed and addressed separately. For instance, market failure is more likely to characterise the food safety and nutritional aspects of food security, than it does the food quality aspects. Distribution may be a particular problem, where poverty exists.

- Food security might be enhanced, not by correcting alleged market failures, but by removing any disproportionate barriers that prevent markets supplying the resources and infrastructure to make food supply robust, particularly in the event of severe disruptions.

- Even where market failure may exist, could Government enhance food security efficiently without imposing larger costs elsewhere? For instance, as has been noted in the case of energy markets, the prospect of Government intervention may undermine existing commercial incentives to manage these risks.[43]

4.16 Evidence relating to some of these risks and issues is considered further in the remainder of the paper.

[43] *The Economist*, 24 June 2006.

5. THE GLOBAL PICTURE

Key points

- *Poverty and subsistence agriculture are root causes of national food insecurity. National food security is hugely more relevant for developing countries than the rich countries of western Europe.*
- *As a rich country, open to trade, the UK is well placed to access sufficient foodstuffs through the world market.*
- *International trade enhances global food security.*
- *In the context of climatic, economic and demographic change, global self-sufficiency should not be taken for granted. The work of the FAO continues to be important in this regard.*

5.1 Concerns for domestic food security are sometimes linked to the global situation, and concerns over climate change and falling stocks. If world food supplies are to become ever tighter, should not countries maximise food production in order to minimise threats to global food security? This section addresses these concerns by putting the UK food security into the context of global food security.

Putting the UK in global context

5.2 In a global economy, food security is fundamentally an international and global issue. Global food security is concerned with ensuring that "the aggregate supply of food produced in the world is adequate to provide sufficient calories to feed the world population at levels consistent with their demands."[44] For many low income countries characterised by subsistence agriculture, food security is an ongoing challenge. Most of the food security literature focuses on them and they are the central concern of the UN's Food and Agricultural Organization (FAO).[45] This global and comparative context brings a sensible perspective to discussions of the UK's "food security". A few key facts are worth bearing in mind:

- The UK is amongst the richest countries in the world. In 2005, it was sixth in the world – second in the EU – in terms of GDP at Purchasing Power Parity, with **GDP per capita** of $30,470, putting it in the top 10% of the IMF's 180 members. [46]

- The UK population represents around 13% of the EU population and less than 1% of global population. Its combination of purchasing power and low share of international population make Britain well-placed to source from international markets.

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[44] M. Ingco, D. Mitchell & J. Nash, 'Food Security and Agricultural Trade Policy Reform' in Ingco & Nash (eds.), *Agriculture and the WTO*, p. 184.

[45] FAO, *The state of food and agriculture: can trade work for the poor?* (2005), pp. 80-97.

[46] International Monetary Fund, *World Economic Outlook Database*, accessed April 2006. http://imf.org/external/pubs/ft/weo/2006/01/data/dbginim.cfm

- Rich countries like the UK tend to be afflicted by excessive, rather than deficient, food consumption. Around 23% of adults in the UK are obese, compared to around 6% worldwide.[47]

- With 246 people per km^2, the UK is the fourth most densely populated country in Europe[48], and is denser than populous countries like China and Pakistan and far denser than the global average of 48 peope per km^2. [49] Basic trade theory teaches that in densely populated countries like the UK where land is relatively scarce compared to its other resources, agriculture is unlikely to be a major source of international competitive advantage (see below). Rather it makes economic sense for the UK source part of its raw food requirements from countries with more appropriate resource endowments. This has been the case for two hundred years.

Global food security and the case for trade

5.3 International trade is founded on the principle that open markets allow countries to specialise in producing the goods or services in which they have a 'comparative advantage'. This theory (outlined by David Ricardo two centuries ago) demonstrates that a country will be better off if, rather than producing everything it consumes, it specializes in producing goods and services in which it is particularly productive. This advantage might occur because of climate, natural resources, plentiful land or labour, specialist knowledge or so on. It can then trade its surplus of these goods with other countries to obtain other goods it wishes to consume. With specialisation and trade, the country is able to consume more than it would have done if it had consumed only what it produced (i.e. 100% self sufficient).

5.4 Historically, trade has often been instrumental in generating wealth for cities, regions and nations. Moreover, comparative advantage, rather than 'self-sufficiency', is manifest at regional level. The food "self-sufficiency" of London, for instance, must be very small indeed. Similarly, individuals seek food security, not by growing their own food, but by using their skills to earn income and then "trade" this for food and other goods and services. This potentially applies also to developing countries:

> *At the national level, the evolving food security debate during the 1970s and 1980s made clear what is obvious at the individual level: national food security does not require individual countries to achieve food production self-sufficiency. Depending on a country's factor endowments, a more lucrative and perhaps even safer option might be to produce and export high-value crops or manufactured goods, and to purchase some proportion of national staple food requirements on world markets"*[50]

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[47] A figure which has increased from around 15.5% in 1994, Department of Health, *Health Survey for England 2004* (2005). http://www.ic.nhs.uk/pubs/hlthsvyeng2004upd; World Health Organisation, *Obesity and Overweight* (2003), http://www.who.int/hpr/NPH/docs/gs_obesity.pdf

[48] Excluding "micro states" such as the Vatican City, Monaco and San Marino.

[49] United Nations *World Populations Prospects Database* (2004 revision database). The densest European countries are Belgium and the Netherlands.

http://www.un.org/esa/population/publications/WPP2004/WPP2004_Volume3.htm

[50] C. Stevens et al, *The WTO Agreement on Agriculture and Food Security* (for DfID, 2002), pp. 2-3. http://www.dfid.gov.uk/pubs/files/agriculture-food-security.pdf

5.5 This view is echoed by the OECD which, whilst recognising the potential for trade disruptions, affirms:

> *Agricultural trade enhances national and global food security by increasing the sources of food supply and lowering prices in importing countries, stimulating food production in countries that have a natural or structural advantage in agriculture, and increasing overall economic growth rates through a more efficient allocation of resources*.[51]

5.6 An open trading system enhances global agricultural potential in various ways, through:

- increasing production in more productive countries;
- allowing production to respond more readily to international price signals;
- widening competition which encourages greater productivity and uptake of innovation;
- facilitating the spread of new technologies that are embedded in agricultural inputs.

5.7 More broadly, growth in overall trade has accompanied global economic growth. The Commission for Africa, which describes trade as "a key driver of growth over the last 50 years", notes that rapid post-war expansion of trade amongst developed countries "contributed to the strongest period of growth in their history", and that "in the last 20 years, China and now India have seen rapid trade expansion contribute to their growth acceleration". It also warns that "Africa will not … set itself on a sustainable path to growth and poverty reduction without increased trade".[52]

5.8 Trade has clear potential to reduce poverty, but the specific links between trade liberalization and the food security of undernourished countries are complex and variable. The FAO affirms that "multilateral trade liberalization offers opportunities for the poor and food-insecure by acting as a catalyst for change and by promoting conditions in which the food-insecure are able to raise their incomes and live longer, healthier and more productive lives". But it also recognizes that "trade liberalization can have adverse effects, especially in the short run, as productive sectors and labour markets adjust", especially if appropriate infrastructure and institutions are not in place. Domestic policies become very important in minimizing any harm and maximising the opportunities that trade brings.[53]

5.9 Another important, if overlooked, argument for multilateral trade concerns its ability to bring nations closer together, by fostering mutual dependence, awareness and ultimately, peace. Excessive reliance upon a single, unreliable supplier may be imprudent, but it is also the case that by increasing mutual bonds, trade makes conflict more costly and less likely. In Europe, for instance, the original "common market", the CAP itself and the "Single market" have become the basis for closer cultural and political integration over the years. That trade flourishes in a secure and

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[51] OECD, *Multifunctionality* (2001), p. 47.

[52] Commission for Africa, *Our Common Interest,* Section 8 (2005), Available online at http://www.commissionforafrica.org/english/report/thereport/english/11-03-05_cr_section_8.pdf

[53] FAO, *State of food and agriculture*, p. 7.

peaceful environment is well recognised: that trade helps to enhance peace and security is less so.

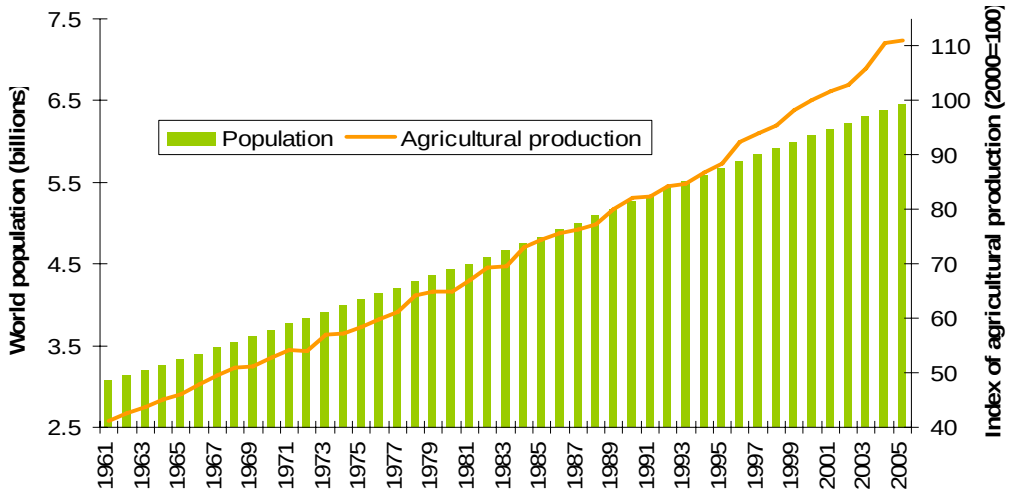
5.10 Unfortunately, some of these benefits of trade - such as higher global incomes, overseas development, better international relations and global security – are spillover benefits ("positive externalities" - see 4.9 ff) and are therefore likely to be 'underprovided'. For instance, it suggests that individual countries, whilst recognizing these broader benefits, may be concerned more with the immediate costs of more liberal trade, particularly to domestic sectors which are likely to lose out to overseas competition. This is very apparent in world trade negotiations.

Global supply and demand

5.11 World population is rapidly increasing whilst the factors of agricultural production (particularly land and water) are limited. International food security relies on the ability of the world's producers to continue to increase the efficiency with which these resources are used. We have seen how trade is critical for this.[54]

5.12 Despite a doubling of global population in the last 40 years, agricultural production has expanded faster still (Figure 5-1), suggesting that global food security has increased.[55] This rapid expansion has been driven by greater use of irrigation, fertilisers, pesticides and machinery, as well as by new areas of cultivation (e.g. South America).

Figure 5-1 World population and agricultural production 1961-2005



Source: FAO

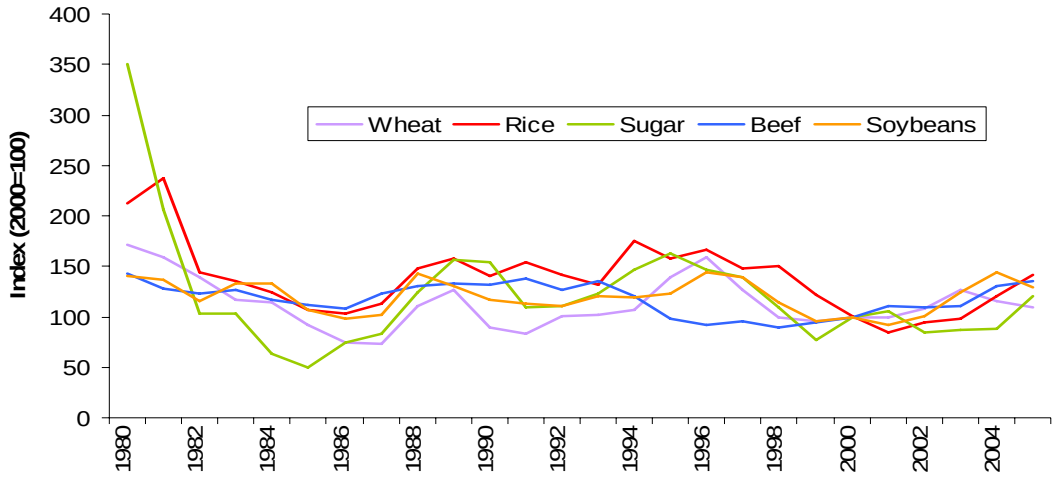
5.13 This outstripping of supply over demand is broadly reflected in relatively flat nominal commodity prices since the early 1980s (Figure 5-2), implying that real prices have fallen. Notably, this favourable trend has coincided with substantial and

[54] Ingco et al, 'Food Security', p. 184.

[55] See http://www.fao.org/waicent/faostat/agricult/indices-e.htm for further details.

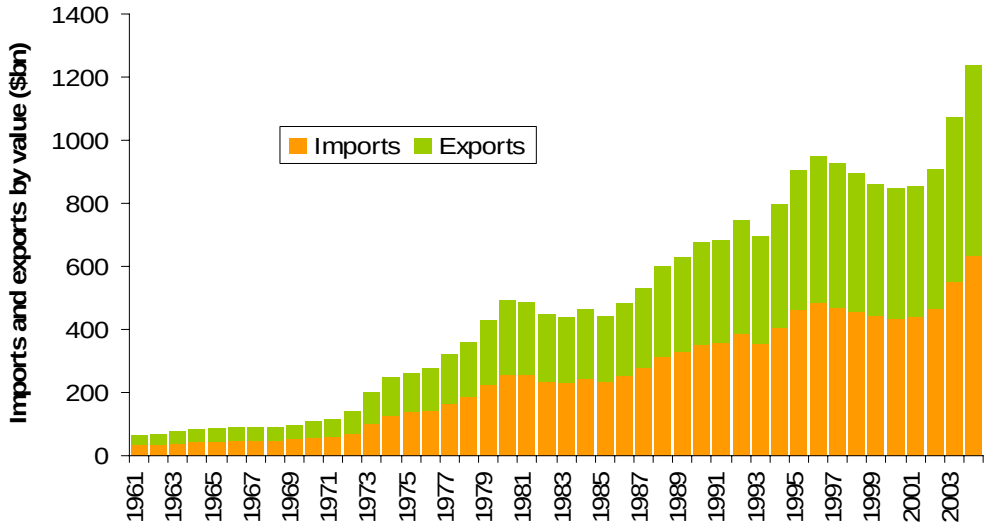
sustained growth in international trade of food products over the last thirty years (Figure 5-3), despite widespread agricultural protection.

Figure 5-2 Indexed commodity prices 1980-2005



Source: UNCTAD

Figure 5-3 World imports and exports of food and agricultural products 1961-2002



Source: FAO

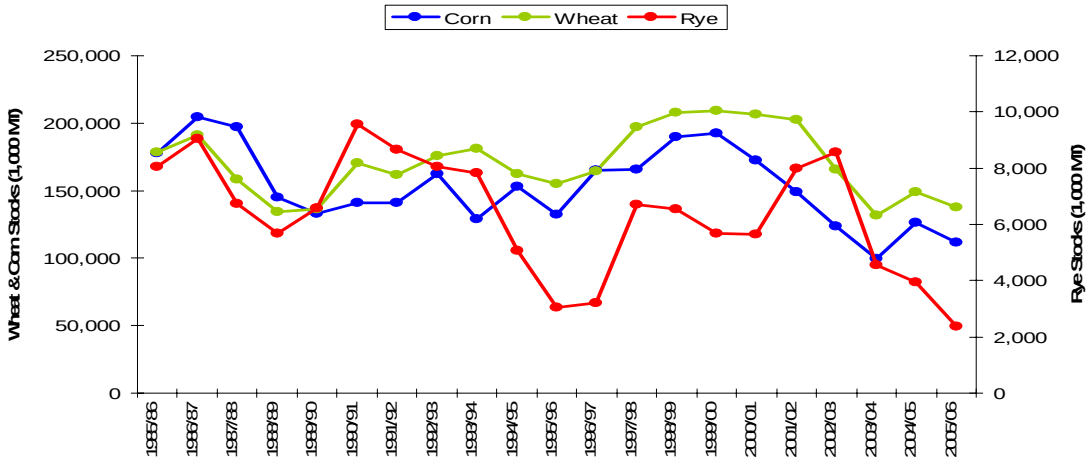
5.14 Looking ahead, the FAO stated in a 2000 report that, even with 8 billion people by 2030, "more people [will have] an adequate access to food than in earlier times…Growth in agriculture will continue to outstrip world population growth of 1.2% up to 2015 and 0.8% in the period to 2030." It expects that "population growth will continue to slow down and food consumption levels will be higher in an increasing number of countries. This causes world agriculture to grow at a slower pace, from an annual 2.1% over the last two decades to 1.6 in the period to 2015 and to 1.3% up to 2030". It also states that "cereals will remain the principal source of food supplies,

accounting for about half of daily calorie intakes", whilst growth in world meat demand is expected to ease. [56]

5.15 Of course, having enough food in aggregate does not guarantee that all peoples obtain sufficient food or nutritional intake – what the FAO calls "world food security". It estimates that 852 million people worldwide were undernourished in 2000-02.[57] This is the result of social, economic and political factors affecting the distribution and local provision, rather than the overall supply, of food. Examples include poverty, war and civil conflict, corruption, environmental degradation, barriers to trade, ill-defined property rights, insufficient agricultural development, rapid population growth, poor health and education, social and gender inequality, cultural insensitivity and natural disasters.[58] That is why "food security" is such a pressing and complex issue for these countries and for development institutions.

5.16 Longer term, the prospect of climate change creates new concerns (see below). Nearer term, poor harvests and falling stocks (Figure 5-4) have increased anxieties in developed countries that a continuation of such trends will reduce physical food security and create instability in world markets.

Figure 5-4 Global commodity stocks 1985-2006



Source: HGCA/USDA

Market instability is common in commodity and financial markets, and it can have adverse effects on various groups, particularly vulnerable countries. But market mechanisms are also very efficient in bringing supply and demand into line. Where global demand outstrips supply for a time, causing reductions in stock levels and increases in imports, theory and experience show that market prices get pressured upwards, which in turn encourages producers to plant and invest more, and users to ration consumption and switch to alternatives. Over the medium term, the latest international projections - which incorporate demographic trends - do not expect world commodity prices to rise substantially, and some are projected to remain flat or

[56] FAO, *Agriculture: Towards 2015/2030*, technical interim report (2000); FAO, 'Food supplies set to grow faster than population, but undernourishment will remain widespread'. FAO Press Release, 24th July 2000, http://www.fao.org/waicent/ois/press_ne/PRESSENG/2000/pren0043

[57] FAO (2004) *The State of Food Insecurity in the World 2004*, Rome.

[58] Lori Keeling Buhi, *Food Insecurity*. http://www.faqs.org/nutrition/Erg-Foo/Food-Insecurity.html

fall.[59] This suggests that the outlook for world food supplies is in fact relatively stable and that supply is keeping up with demand.

5.17 Reductions in stock-to-use ratios for many commodities in recent years partly reflect policy changes, such as market reforms of the CAP and China's increased integration into the world market. Moreover, other trends have greatly lessened the significance of this secular decline in stocks, including:

- reduced supply volatility (through, for example, crop improvements and technology) which have reduced the need for stockholding;
- lower tariff barriers, allowing trade to expand and markets to function more efficiently with less need of stocks;
- a better functioning market, with information on availability and demand more accurate and easier and faster to obtain, which reduces price variability and therefore the demand for stocks.

Climate change and food security

5.18 Broadly caused by the release of greenhouse gases into the atmosphere, global warming could have potentially serious implications for agriculture across the globe. Among the associated physical impacts are biodiversity loss, sea level rise, increased drought, spread of disease, weather pattern shifts, increased flooding, changes in freshwater supply, and an increase in extreme weather events.[60]

5.19 The *Stern Review on the Economics of Climate Change* states that "on current trends, average global temperatures could rise by 2-3% within the next fifty years". This could particularly harm agricultural yields in Africa.[61] Reduced water availability could also threaten productive capacity in some regions. On the other hand agricultural productivity in other areas could benefit from increased levels of carbon dioxide in the atmosphere ('carbon fertilisation') and modest increases in temperature (1°). On balance, higher temperatures could reduce global cereal production by perhaps 5%, with a production shift from developing to developed countries. Higher prices are likely to boost supply, but they also affect the purchasing power, and hence nutritional intake, of people in poorer countries.[62]

5.20 Increased reliance on home production makes little sense if the UK itself is materially affected by climate change. According to Defra, by the 2080s "average annual temperatures across the UK may rise by between 2° and 3.5°C" and in the South East "summer precipitation may decline by up to 50%".[63] Such changes could

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[59] *OECD-FAO Agricultural Outlook 2006-2015* available online at: http://www.fao.org/es/esc/common/ecg/109555_en_AgOutlook2006.pdf

FAPRI Agricultural Outlook 2006 and can be found at: http://www.fapri.org/outlook2006/

[60] Defra (2006) *Climate Change: What is Climate Change?* accessed online at http://defraweb/environment/climatechange/about/index.htm; WWF (2005) *Climate Change: Basic Information*. accessed online at http://www.worldwildlife.org/climate/basic.cfm

[61] Stern Review on the Economics of Climate Change (October 2006), pp. 56-7, 67-8, 71.

[62] *Stern Review*, p. 71; L. Sacks & C. Rosenzweig, *Climate Change and Food Security* available online at http://www.climate.org/topics/agricul/index.shtml#warming

[63] Defra, *About Climate Change: UK*, http://defraweb/environment/climatechange/about/ukeffect.htm

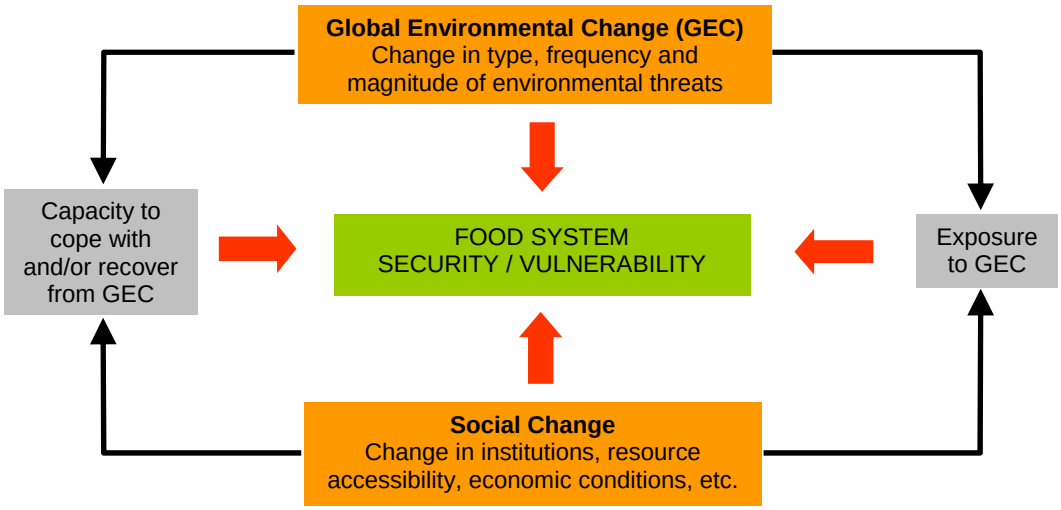
materially affect the volume, composition and stability of domestic agricultural production.

5.21 On the other hand, to the extent that climate change reverses long run declines in real global commodity prices (e.g. for wheat), market returns to UK farmers and incentives to maintain or expand production would increase. It has also been pointed out that, in the short to medium term, "policies designed to slow down climate change will have an impact rather than climate change itself". These include increased costs of international transport (leading to a degree of protection for UK agriculture), and removal of land from food production into bio-fuel crops and carbon-fixing forests, again with a favourable impact on prices for producers (see below).[64]

5.22 In any event, trade represents an important element of climate change adaptation. Already, global markets continually incorporate potential and actual impacts of supply disruptions and extreme weather events (e.g El Nino; hurricanes). Greater supply volatility will increase, not reduce, the need for well-functioning and widely traded international markets to smooth out short term surpluses and shortages. The incentives for stockholding would increase too. In addition to handling short-term volatility, international market systems are equally well placed to adapt to gradual changes in the pattern of supply and demand over time, whether caused by climate change or other significant demographic and economic developments.

5.23 Nevertheless, developing countries are likely to suffer most from climate change, particularly when combined with socio-economic changes.[65] Not only are developing countries likely to be worse hit in terms of reduced food production capacity, but they also have fewer resources to absorb shocks and deal with disruptions. Figure 5-5 shows that "the vulnerability of food systems is not

Figure 5-5 Determining the vulnerability of food systems to climate change



Source: Gregory et al (2005)

[64] Marsh, *Agriculture in the UK*, p. 45.

[65] P. J. Gregory et al, *Climate Change and Food Security*. Philosophical Transactions of the Royal Society (2005) B, 360, p. 2143. http://www.gecafs.org/Publications/Gregory%20et%20al%20GECAFS%20CC%20and%20FS%202005%20paper.pdf

determined by the nature and magnitude of environmental stress *per se*, but by the combination of the societal capacity to cope with, and/or recover from environmental change, coupled with the degree of exposure to stress." Compared to countries like Britain food systems in less developed countries are less developed and a larger proportion of their resources "are spent either purchasing or producing food, thereby reducing their capacity to cope with perturbations."[66]

5.24 Climate change then raises equity issues rather than overall issues of global food supply. This provides further support for the worldwide programme of climate change research and mitigation to ensure that the gap between developed and developing countries - in terms of income, vulnerability, and so on - does not widen. In the context of climate change, the FAO sees its role as twofold: firstly, "promoting policies and practices in member countries in support of emission reductions and carbon sequestration"; and secondly, "assist[ing] Members, in particular developing countries, which are vulnerable to climate change, to enhance their capacities to confront the negative impacts of climate variability and change on agriculture".[67] The research work of GECAFS[68] on understanding the links between global environmental change and the food security of vulnerable regions is particularly pertinent.

5.25 These adverse distributional impacts reinforce the imperative for developed countries to mitigate global warming. They also raise the question whether in the event of a global crisis the UK or EU would be willing to help developing countries by reducing their own consumption in order to allow food to be distributed more widely elsewhere. The role of food aid is likely to remain important to cope with crises of supply among some of the weaker developing economies, although historically food aid has been more forthcoming during times of world surplus.[69] One potential solution is the use of strategic stockpiling in developing countries, although this is not always easily achieved. Safeguarding crop diversity through international seed vaults also becomes increasingly important.[70]

Implications of increased energy crop demand

5.26 Attempts to mitigate climate change could have more impact on food supplies than climate change itself. Thus increased demand for biofuels for could have a significant impact on crop patterns. Comparative advantage becomes relevant here. For instance, a recent OECD study suggests that, for the EU15, with current technologies, over 70% of its land currently cultivated for cereals, oilseeds and sugar crop would be needed to produce biofuels equivalent to 10% of its transport fuel consumption. By contrast, for Brazil (where biofuels already account for over a fifth of transport fuel), the equivalent area requirement for a 10% share is only 3%. For the world as a whole, 9% of cereals, oilseeds and sugar land would be required in order

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[66] Gregory et al, p. 2142.

[67] FAO, *Climate Change – Role of FAO* (2004), http://www.fao.org/clim/role.htm

[68] GECAFS stands for *Global Environmental Change and Food Systems*. It is an international, interdisciplinary research programme, which aims to "determine strategies to cope with the impacts of global environmental change on food systems and to assess the environmental and socio-economic consequences of adaptive responses aimed at improving food security". For more information, see http://www.gecafs.org/index.html

[69] Marsh, *Agriculture in the UK,* p. 43; FAO, *Food aid in the context of the WTO negotiations on agriculture* (2001), http://www.fao.org/docrep/005/Y3733E/y3733e06.htm

[70] See, for example, *Financial Times*, 19 June 2006.

for a 10% biofuels share of transport fuel. Currently, just over 1% of transport fuel is renewable. Whilst such figures are necessarily indicative rather than definitive, they reinforce the message that international trade, rather than national self-sufficiency, is the key to achieving renewable energy obligations whilst minimizing impacts on global food supply.[71]

5.27 The OECD study demonstrates that the commodity price impacts of higher oil prices and increased demand for biofuels (relative to constant biofuel production) are likely to be more significant for vegetable oil (20%) and sugar (60%) than for cereals (4%). Whilst significant for those markets, the implications for food security should not be exaggerated. The impact of short-term harvest shortages are likely to have more impact on wheat prices, for instance. Price-induced reductions in sugar consumption, particularly in emerging economies, will have health benefits. Improved biofuel technologies will also serve to reduce knock-on impacts on food markets.

Conclusions

5.28 We can draw a number of conclusions from this general assessment of global food security, and the position of the UK within it:

- The definitional gulf between "food security" applied to rich countries like the UK and poverty-stricken developing countries (e.g. in Africa) should always be kept in mind. Poverty and subsistence agriculture, not trade, are the root causes of national food insecurity.

- UK food security should not be assessed in isolation, but is actually underpinned by global output – in other words there is 'enough food to go round'. As a rich country, integrated into a well-functioning trading system, the UK is well placed to access sufficient foodstuffs through the world market.

- International specialisation and trade enhances global food security, including in the context of climate change. International trade in both agricultural and biofuel should help to minimize any adverse impacts of increased biofuel cropping on global food supplies.

- Recent trends in food stocks do not represent growing threats to global food security, but short term world food shortages can have grave impacts on vulnerable countries.

- Climate change poses new challenges for global food production, and particular threats to the food security of poorer, tropical regions (e.g. Africa). The work of the FAO and GECAFS and the support of participating countries continues to be important in this regard, and redoubles the imperative for developed countries to mitigate climate change.

[71] OECD, *Agricultural market impacts of future growth in the production of biofuels* (2006) http://www.oecd.org/dataoecd/58/62/36074135.pdf

6. SELF-SUFFICIENCY AND FOOD SECURITY

Key points

- *Trends in the self-sufficiency ratio are a misleading indicator of underlying food security for the UK.*
- *There are sound economic reasons why the UK produces less food than it consumes.*
- *Diversity enhances security. The UK sources foods from diverse stable countries – mainly European - and imports can make up for domestic supply shortages.*
- *Self-sufficiency fails to insulate a country against many possible disruptions to its supply chain.*
- *Production potential is more relevant at EU level, but further trade liberalisation is unlikely to materially affect food security within the EU*

6.1 Previous sections have suggested that the identification of national food security with a certain level of domestic food production is a tenuous one for developed countries. Yet the prospect of agricultural policy and trade reform continues to raise concerns about food security, which is claimed as one of the 'multifunctional' benefits of domestic agriculture (see para 4.5). A net food importer in particular 'may see only limited scope for addressing sources of food security problems that lie outside its borders, and … might attempt to increase domestic production … to reassure its consumers.'[72] In this context, 'self-sufficiency' becomes interchangeable with (domestic) 'food security', and is its prime indicator.

6.2 But how closely linked is self-sufficiency with food security? At the household level, self-sufficiency is irrelevant. Indeed, historically, it is subsistence households who have been most vulnerable to shortages. At regional or city level, self-sufficiency also makes little sense. This section examines the UK self-sufficiency statistics and the various arguments that link it with national food security. European self-sufficiency is also considered.

Interpreting the self-sufficiency statistics

6.3 Put simply, the self-sufficiency ratio measures the value of home food production (including exports) as a share of total domestic food consumption. (Annex C has more details). The historical dynamic of comparative advantage has led the UK to specialise and export, first manufactured goods and more recently services (such as finance and tourism), whilst agriculture's share of the economy has continued its decline.[73] This has led to a self-sufficiency ratio significantly and consistently less than 100% over the last 50 years (Figure 6-1).

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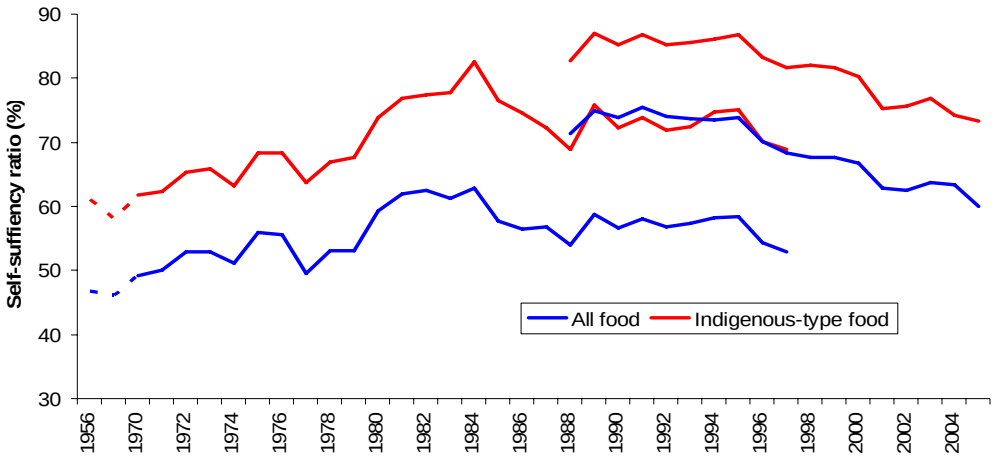
[72] OECD, *Multifunctionality* (2001), pp. 47, 74. Japan's 'Basic Plan for Food, Agriculture and Rural Areas' has explicit targets for food self-sufficiency, although these have not been met.

[73] It is evident as well that the UK has very low self-sufficiency in sectors such as electrical goods, toys and clothing.

Figure 6-1 The UK Self-Sufficiency Ratio 1956-2005

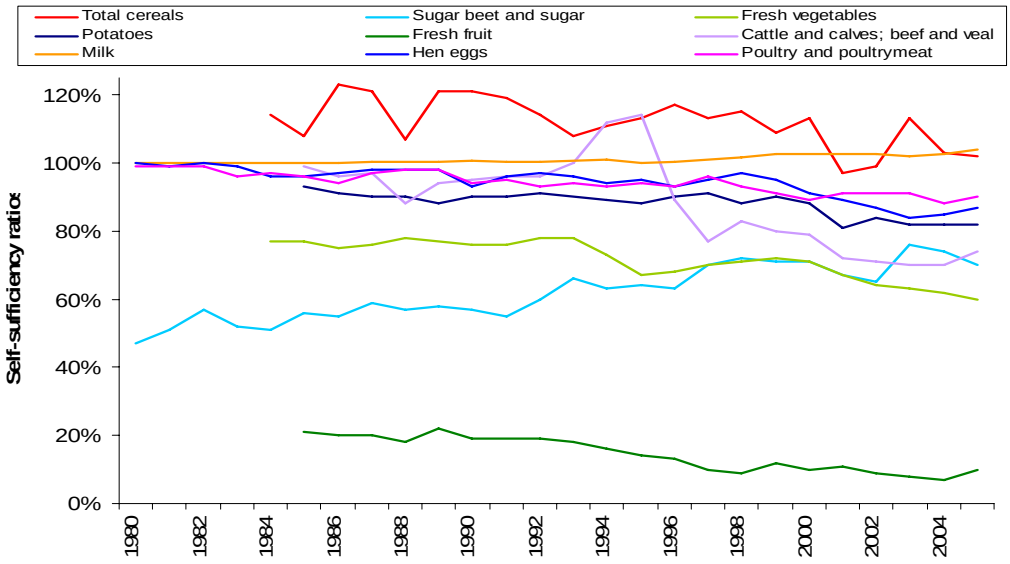


Source: Defra, Agriculture in the United Kingdom, 2005

6.4 Growth in the ratio towards a peak in the 1980s reflects the influence of the CAP on UK agriculture (see para 3.19).[74] It should be noted that these figures are based upon market values rather than production volumes or calorific requirements. Falling unit prices, for instance of grain and milk, imply that *values* are affected more than *volumes*. Physical production of staple commodities have not been in secular decline. Moreover, calorie excess, waste of food and the ability to switch to more calorie-efficient foodstuffs suggest that the UK may have greater *potential* or *underlying* calorific self-sufficiency than the figures suggest. It seems clear that some key nutrients are provided through the import of fruit and vegetables.

(i) Self-sufficiency ratios by commodity sector

Figure 6-2 Self-sufficiency ratios for a sample of commodities 1980-2005



Source: Defra, Agriculture in the United Kingdom, 2005

[74] The discontinuous trends shown in Figure 6-1 reflect a change in methodology in 1998 to incorporate the additional processing found in imports (Figure 6-7**).** **Annex C** has more details.

6.5 Trends in the aggregate self-sufficiency ratio mask variations across commodities (Figure 6-2). For instance, 90% of the fresh fruit we consume is imported, but we typically have an exportable surplus of cereals. Increasing imports of vegetables and poultry meat have been notable. Such variations reflect differences in CAP support, consumer tastes and degrees of indigeneity and comparative advantage across sectors (Box 6-1) That the aggregate ratios have declined is undisputed, but it is necessary to understand the factors that drive the differences in the ratios to see if there is any bearing on food security as such.

Box 6-1 Why do we produce less than we consume?

The basic, though not whole, answer to this question is "comparative advantage" (see 5.3). Relating this to food, there are several aspects:

- Agricultural land in the UK is relatively scarce compared to our population density and to land in other countries (see para 5.2).
- By nature of our climate, some food simply cannot be meaningfully produced e.g. bananas, tea, coffee, cocoa etc.
- By the seasonal nature of our climate, some food which is grown here cannot be supplied all year round (e.g. most fruit). Supermarkets, large-scale caterers and consumers want consistent supply, and imported produce can often provide or enhance this.
- Comparative advantage is obscured by CAP subsidies and tariff protection – for instance there would be much less sugar beet grown in the UK and the EU in the absence of support, and far greater imports of lower cost cane sugar.
- Even within indigenous commodities, some types that are demanded cannot be commercially grown e.g. hard North American wheat remains critical for bread making.
- Some products we produce, but less efficiently than other European countries, particularly those where they have a market surplus e.g. Danish bacon. Imports tend then to have a large market share. This lack of competitiveness may be less about comparative advantage than other competitive barriers e.g. a lack of scale or innovation or collaboration among domestic producers.
- Diversity of consumer taste means that overseas varieties are in demand e.g. French apples; Italian ham and pasta; Irish cheddar; Indian rice. Diverse consumer taste is also the basis for many UK food and drink *exports*, as well as the growing interest in regional foods *within* the UK.

These factors vary across commodities, hence different 'self-sufficiency' ratios.

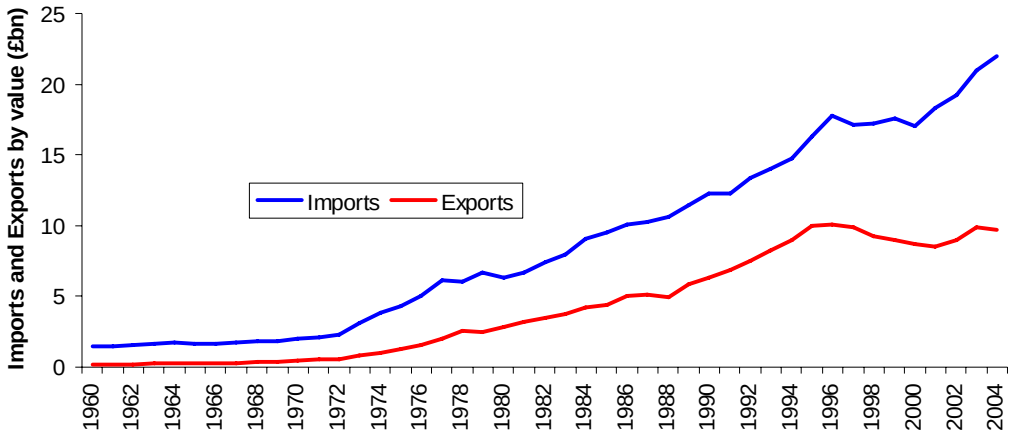
(ii) Why has the self-sufficiency ratio fallen?

6.6 The decline in the ratio reflects a lack of export growth after 1994 (Figure 6-3) and a tailing off and reduction in agricultural output (Figure 6-4). The widening trade gap needs to be seen in the long-term context in which the value of food and drink imports have traditionally been a large multiple of food exports (Figure 3-2).

6.7 Significant **long-term factors** driving these trends include:

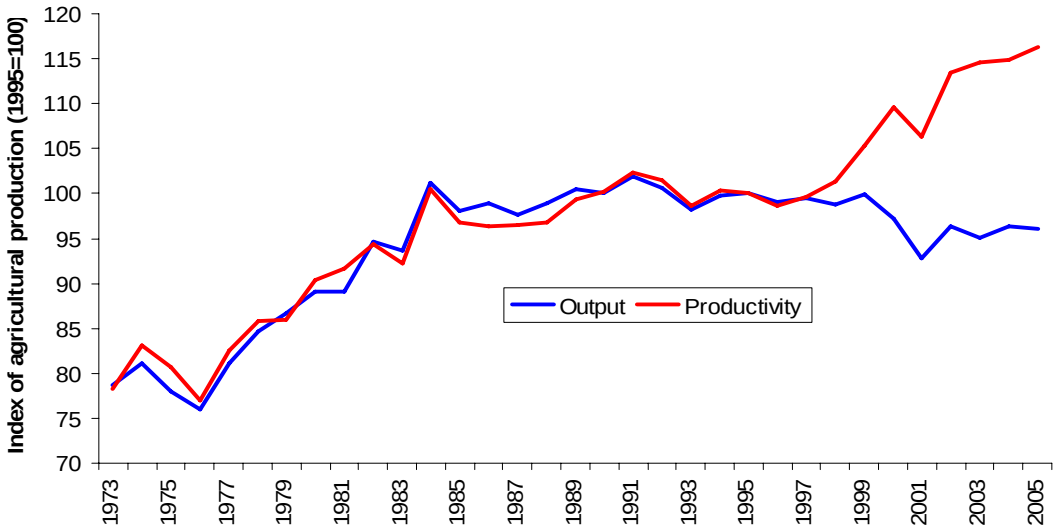
- changing tastes, in both retail and foodservice, towards more exotic and varied produce;
- fewer trade restrictions, through the WTO and the Single European market;
- cheaper transport and communications (making distant sourcing more viable);
- wider sourcing by supermarkets (which in turn is a response to a number of these other factors).

Figure 6-3 The widening UK food trade deficit 1960-2004



Source: Defra, Agriculture in the United Kingdom 2005

Figure 6-4 Indices of Agricultural Output and Total Factor Productivity 1973-2005



Source: Defra, Agriculture in the United Kingdom, 2005

6.8 Significant **short-term factors** include:

- BSE-inflicted ban on UK beef exports and the Over Thirty Month Scheme which diverted home production away from consumption;

- Foot and Mouth Disease in 2001, which reduced pigmeat exports;
- The appreciating £ between 1995 and 2000 made imports cheaper and exports more expensive, worsening competitiveness;
- CAP reforms of 1993 and 1999 have ended the expansionist trend of the 1970s and 1980s.
- Sluggish growth in Europe may have affected UK food export opportunities;
- Increasing organic share in UK production has probably reduced the physical volume of UK farm output, and possibly also the value.

6.9 Taken together, these factors do not suggest that underlying food security has materially worsened. They relate more to UK agriculture's ability to meet consumer demands, i.e. it's "market share", both at home and abroad. The next section examines whether there are more fundamental food security arguments for greater home production.

Assessing the arguments for self-sufficiency

6.10 In the post-1945 period, food security came to be identified with increased domestic production. This section analyses various arguments which have been put forward in support of this hypothesis.

(i) The Balance of Payments

6.11 In the dollar-starved post-War period, Britain was heavily reliant on capital inflows to offset a negative trade balance. Food was a large share of trade, and reducing food imports was considered easier than increasing other exports. In his famous white paper on employment, William Beveridge argued that "the necessity of paying by current exports for a large proportion of Britain's imports, will make it desirable to diminish the dependence of Britain on food from overseas". In the following decades, empirical estimates were made of how marginal adjustments in domestic agricultural production positively affected the British balance of payments. [75]

6.12 In the fixed exchange rate era, when a reasonable trade balance was a necessary objective of policy, the argument had some relevance. It is clearly less valid in the 21st century: food now forms only a small proportion of the UK's trade in goods and services (Figure 6-5) and international market liberalisation allows current account deficits to be readily financed by short or long-term capital flows, or reduced through a depreciation in the exchange rate.[76] Thus the Balance of Payments is now a broad indicator of the macroeconomic situation, rather than a target. Of course, financing trade deficits is still an issue for many developing countries which experience economic or financial problems.

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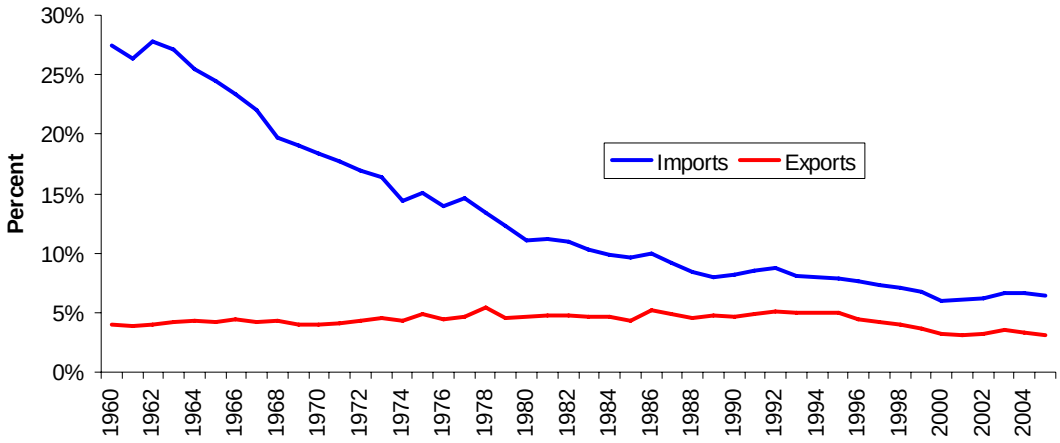
[75] Beveridge, W. *Full Employment in a Free Society* (1944), p. 164. Ingersent & Rayner, *Agricultural Policy*, p. 133.

[76] A weaker currency makes imports more expensive at home and exports cheaper abroad, so that current account deficits can, if necessary, become self-limiting.

Figure 6-5 UK Trade in Food, Feed and Drink as a Proportion of Total Trade in Goods and Services (1960 – 2005)



Source: Defra / HMRC, ONS (2006)

6.13 Table 6-1 summarises the contribution of food to the UK Balance of Payments in 2004. The food deficit accounts for only 1% of total credits.

Table 6-1 UK Balance of Payments (2004)

	Credits (£m)	Debits (£m)	Gap (£m)	'Food' Credits as a % of	'Food' Debits as a % of
Food, feed & drink	9,701	21,941	-12,240	-	-
Goods	190,859	249,473	-58,614	5%	9%
Goods and services	289,959	328,384	-38,425	3%	7%
Current account	442,434	465,409	-22,975	2%	5%
Financial and capital accounts	529,355	515,337	14,018	2%	4%
Total current, capital and financial accounts	971,789	980,746	theoretically zero	1%	2%

Sources: ONS (2005) The Pink Book, Defra (2005) Agriculture in the United Kingdom.

(ii) Industrialisation in other countries

6.14 Beveridge also considered that "the gradual development of manufacturing in other countries" made import substitution necessary, the implication being that global food supplies would become ever scarcer. We have already noted that global supplies have become greater, not scarcer. Indeed, the industrialisation argument ignores the dynamic of comparative advantage, which suggests that, however much countries may industrialise, some, by virtue of their resource endowments, will be better placed to specialise in agricultural produce. Whilst patterns of comparative advantage and agricultural efficiency may have been unclear in 1945, it is not so in the early 21st century. For instance, the world's most economically advanced country, the USA, is one of the world's leading exporters of hard wheat, maize and soybeans. Australia, New Zealand and Canada, also rich countries, enjoy comparative

advantage in certain agricultural enterprises, as have various European countries – despite the distortions wrought by the CAP.

(iii) Volatility of global markets

6.15 Encouragement of domestic production has often been viewed as a way of insulating the nation from the uncertainties of the global market. This view was set out in the 1975 British White Paper, *Food from our own resources:*

> *Greater home production … would give the country an insurance against periods of shortage and higher [world] prices … There are greater risks than in the past of wide fluctuations in price and of world shortages. These risks threaten both our balance of payments and the cost of food to the consumer. Agricultural expansion represents a partial insurance against them.* [77]

6.16 The 1970s was indeed a volatile decade for markets, yet the CAP had already raised prices well in excess of normal world levels, and greater UK production would also reduce its CAP bill (see 3.19). Nowadays, certainly, the UK is well-placed to secure international supplies in times of shortage. Consumer costs arguments are also weak: even a doubling of world wheat prices would be unlikely to increase retail bread prices by more than 10%, once processing is factored in. Volatility is more an issue for poorer countries than rich countries like the UK.

6.17 Protection against volatility can become a vicious circle. It reduces trade and makes world markets more volatile. Multilateral trade liberalisation reverses this process. A defensive, nationalist, protectionist view of food security may also have diverted attention from the question of how the trading system could be used to prevent short-term concerns of disruption.[78]

(iv) Dependence on foreign suppliers

6.18 Dependence upon 'unreliable' suppliers has been a central concern for energy security, especially crude oil, but it is weak in the case of food (see Box 9-1. Trade of any sort involves risks, but these must be kept in perspective:

- Most trade is conducted through private enterprise, rather than government orders. Food (like energy) is imported by private operators who need to manage the risks of unreliability or reputational damage, and seek to diversify risks where necessary:

  > *Imports by definition increase diversity of supplies, which enhances security, and they normally reduce costs … There is no obvious reason why markets will not factor in their own estimate of the risk of unreliability, and act to diversify such risks where necessary.*[79]

- "Dependence" can be a loaded term. Exporters such as Australia, Argentina, Brazil as well as developing African countries are themselves highly

[77] *Food from our own resources*, Cmnd. 6020 (April 1975)

[78] Ingco et al, 'Food security', p. 183.

[79] NERA, Energy Regulation Brief: *Security of Energy Supply* (2003). The quote is about energy imports.

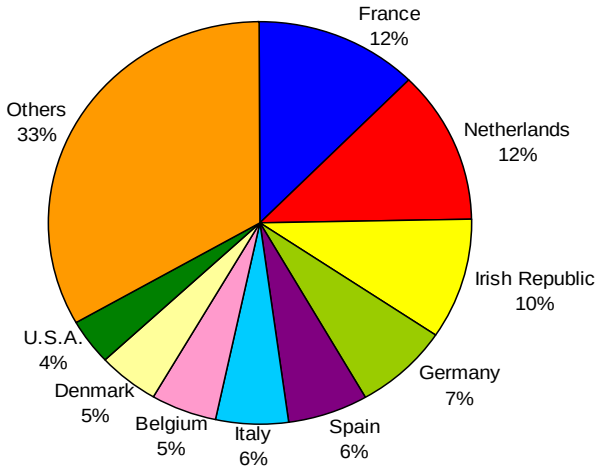
"dependent" upon their export earnings, and themselves export in order to reduce "dependence" on their home market. Domestic consumers can also become "dependent" upon domestic supplies. By increasing *interdependence*, trade paradoxically reduces the dependence of exporters on isolated markets and importers on isolated suppliers. Such interdependence is a fact of social and economic life and is a key element in the rationale for the European Union and the Single European Market.

- Serious trade disruption in food would require concerted action by a large number of competitive exporters which is highly improbable.[80]

- The World Trade Organization provides an institutional, if imperfect, framework for regularising trading relations. For instance, large food producers such as Brazil and China are now part of the WTO.

6.19 The UK's membership of the EU itself suggests that if domestic sourcing is assumed to be "reliable", so should European sourcing. Most UK food imports are indeed sourced from Europe (Figure 6-6). Individual non-EU countries have import shares of less than 4%, giving a very low 'concentration ratio' and we have already seen that the risks associated with such sources should not be overstated. The UK's import base is highly diverse, as befits an open economy.

Figure 6-6 UK imports of food, feed and drink by source country



Source: Defra, Agriculture in the United Kingdom 2005. 'Others' all have shares below 4%.

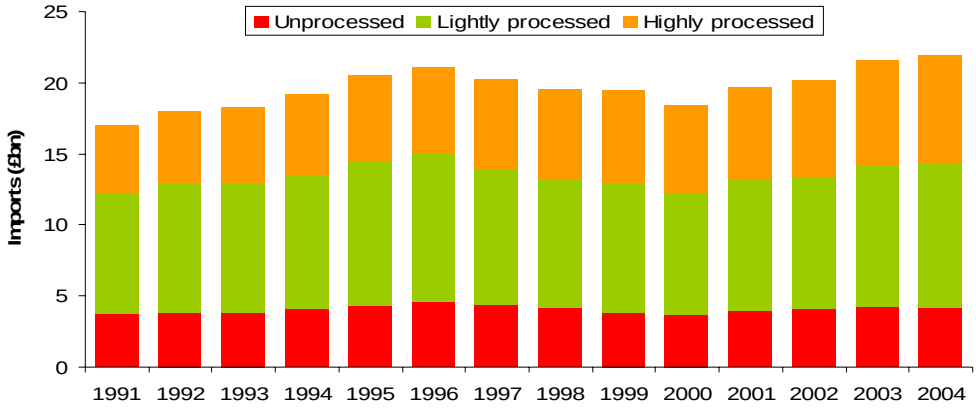
6.20 Figure 6-7 shows that the majority of the UK's trade in food, feed and drink involves processed goods, with unprocessed products representing less than 20% of imports.[81] Highly processed foods have exhibited the largest growth in imports, up 34% by value in real terms between 1994 and 2004. This is not itself a cause for concern. The substitutability of foodstuffs and the high 'self-sufficiency' of the EU in most products (Annex D) reduces both the likelihood and impact of a disruption

[80] Ingco et al, 'Food security', p. 183.

[81] Unprocessed goods include fresh fruit and vegetables, honey, eggs, milk, cream and unmilled cereals. Lightly processed goods are those which retain their raw recognisable form, such as meat, cheese & butter, powdered milk, flour and sugar. Highly processed foods include confectionery, canned meats, jams, alcoholic drinks and ice cream, *Agriculture in the UK 2005*, p. 37.

resulting from a problem with supplies from any one country. Moreover, there are 34 countries across the globe that each supply the UK with at least 0.5% of its food imports. The role of the major retailers in achieving that diversity is examined in section 7.

Figure 6-7 UK imports of food, feed and drink by degree of processing (2004 prices)



Source: Defra, Agriculture in the United Kingdom 2005

(v) Dependence on shipping and ports

6.21 Imported produce is reliant on shipping, air freight and ports. It is very difficult to envisage in the current geopolitical climate any future conflicts or events which would recreate the spatial circumstances of WW2, and if so, what the contingencies might be, although there are some lessons from history (see 3.12). Since most UK imports come from mainland Europe (and Ireland) within the framework of the European Union and its Single Market, the probability of EU shipping routes being severely disrupted appears extremely remote.[82]

6.22 More relevant for the UK today is the concern that the majority of imported food is channelled through relatively few container ports (Box 6-2) – in mainland Europe this is probably less of an issue. This is partly a question of port capacity and resilience, and the ability of other channels to accommodate displaced goods. The vast majority of food imports arriving on British shores comes by sea, and more recently the Channel Tunnel, with less than 1% attributable to air freight.[83] Excluding air freight, methods used for the importing of food can be divided into three main types: **bulk** (non-unitised) shipping, **container-based** (unitised) shipping and "**roll-on/roll-off**" (RORO) traffic which is carried by lorries on ferries or through the Channel Tunnel.

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[82] It's also worth pointing out that, historically, being an island has enhanced as much as threatened our security, by making direct invasion difficult. Also, during the Second World War, the supply of imported food through a limited number of sea ports and via buying agencies was more amenable to Government control than was dispersed home agricultural production, *How Britain was fed in war time*, pp. 25-6.

[83] AEA Technology, *The Validity of Food Miles as an Indicator of Sustainable Development* (for Defra, 2005), pp. 30-2. Air is generally "reserved for highly perishable goods (e.g. seafood), high value goods (e.g. alcohol) or for exports from countries where the road/sea route is less convenient (e.g. exotic fruit from sub-Saharan Africa)."

Box 6-2 UK shipping ports

The UK ports industry is the largest in Europe, handling around 570 mt of tonnage each year. There are about 120 commercial ports in the UK. These include major all-purpose ports such as Liverpool and Tilbury, ferry ports such as Dover, specialised container ports such Felixstowe, Immingham and Southampton, and ports catering for specialised bulk traffic such as coal, grain, oil or timber such as Ipswich, Thamesport (Isle of Grain), Hull and Silloth. Others cater for local traffic, or specialise in particular sectors such as fruit or vegetables or fishing. The top sixteen ports account for 80% of total tonnage. There are 3 main types of ports (by ownership) in the UK:

- **PLCs Ports** include most of the largest ports such as Liverpool, Felixstowe, Tees & Hartlepool and the Forth Ports. This group also includes the 21 ports owned by the Associated British Ports (ABP) such as Southampton, Hull, Immingham, Kings Lynn, Ipswich, Grimsby, Garston, Barrow and Lowestoft. This sector accounts for 64% of the total tonnage handled in the UK.

- **Trust Ports** consist of many of the smaller ports plus 1 or 2 of the larger ones such as the Port of London Authority. The trust ports sector accounts for about 24% of total tonnage.

- **Local Authority Ports** consist of a few ports, notably Portsmouth and the oil terminals in Orkney and Shetland. This sector accounts for 12% of total tonnage but this figure is inflated by the large tonnage handled by the Scottish oil terminals.

6.23 Bulk transportation accounts for around 8.5m tonnes, equivalent to around 25% by tonnage, of imports of agricultural products.[84] Products carried in this form are generally unprocessed commodities such as cereals, fruit, animal feeds, sugars, oils and nuts. Bulk food imports are concentrated at a number of locations, namely Liverpool and London in England, and Belfast in Northern Ireland (Table 6-2).[85]

6.24 The remaining 75% or so of food imports are transported in 'unitised' form (i.e. in separate units rather than in bulk). These units range from simple metal containers to complex multi-partitioned temperature-controlled trailers. The larger (and rising) proportion of unitised traffic compared to bulk reflects the growing trend in processed imports. Food-specific statistics for container and RORO traffic are limited, since data on the contents of containers and trailers are not collected (but see Box 8-2). Aggregate data (i.e. non-food and food) shows that container imports are concentrated at a relatively small number of locations, with three ports in the South-East of England accounting for 63% of total container volumes in 2004 (Table 6-2). RORO imports are less concentrated, although Dover and the Channel Tunnel (again in the South East) are considerably more significant than other ports.

6.25 The private sector operates fifteen of the twenty largest ports and handles around two-thirds of the UK's port traffic.[86] Ports thus compete with each other for business, and firms in the food supply chain make decisions about which ports to use on the basis of factors such as efficiency, proximity, service and reliability:

[84] DfT, *Maritime Statistics 2005*.

[85] DfT, *Focus on Ports* (2006). Information on all the UK ports can be found in here: http://www.dft.gov.uk/stellent/groups/dft_transstats/documents/downloadable/dft_transstats_611028.pdf

[86] DfT, *Focus on Ports*.

"customers want speedy access to ports, to deliver goods just in time."[87] Good inland transport links and proximity to major conurbations and distribution centres are one reason why ports in the South East have flourished in recent years.

Table 6-2 Proportion of total traffic arriving at major UK ports, by traffic type, 2004

Ports	Bulk (25% of total agricultural products)	Container[a] (approx 30% of total agricultural products[b])	RORO[a] (approx 45% of total agricultural products[b])
Dover	-	-	25%
Liverpool	27%	8%	6%
Felixstowe	-	34%	3%
London	20%	12%	4%
Belfast	17%	3%	4%
Southampton	3%	18%	-
Grimsby & Immingham	5%	2%	5%
Hull	2%	4%	2%
Medway	-	8%	-
Harwich	-	-	5%
Larne	-	-	5%
Portsmouth	-	-	4%
Bristol	7%	-	-
Other sea ports	*19%*	*12%*	*21%*
Channel Tunnel			16%
Total	100%	100%	100%

Notes: [a]The percentages for containers and roro are for total traffic, as food-specific data is not available

[b] The proportions for container (30%) and RORO (45%) traffic are crudely assumed to be the same for agricultural as for all products.

Source: DfT, Maritime Statistics 2005 and Focus on Ports (2006)

6.26 The extent to which any concentration of food imports through specific ports should be cause for concern depends upon both the likelihood and potential impact of severe disruption to such ports. Further consideration of these is given later. For now we can say that it is a question of risk management rather than self-sufficiency: it is more efficient to manage risks directly rather than through the indirect means of a drive for self-sufficiency. In any case, if imports were impeded for some reason, it would be by no means just food that was affected – agricultural inputs could also be affected, which makes self-sufficiency itself a problematic aim (see 6.34 ff).

(vi) Erosion of the productive base

6.27 Domestic agricultural production has been considered critical for maintaining skills, resources and a base for boosting output quickly in the case of crisis. It is argued that if production falls below a certain '**critical mass'**, related industry infrastructure disappears, and productive capacity quickly become unviable.

6.28 There is currently little hard evidence in this area to test these assertions. However, a number of observations are relevant:

[87] DETR, *Modern Ports: A UK Policy* (2000), p. 21.

- Productivity growth, combined with a lack of output growth (see Figure 6-4), has underpinned the on-going shedding of labour in the agricultural sector. Labour input has almost halved in the thirty years after 1973.[88] Productivity growth and technological change remains an important element in the economic sustainability of farm businesses.

- As average farm sizes increase, skill requirements per labour unit tend to increase and become more specialised, in areas such as business management, crop husbandry, animal husbandry, machinery maintenance and land management. Many farms are also increasingly reliant on importing certain skills, via the use of contractors. Such developments accord with wider economy trends away from low-skilled employment.

- Skill requirements tend to be greater in livestock rather than arable sectors. This reflects the variety of skills required for successful animal husbandry, including nutrition, fertility/reproduction and animal health management.

- Agriculture education establishments are themselves adjusting to the restructuring of agriculture by diversifying into broader areas such as countryside management, rural leisure and food marketing.[89]

6.29 The concept of "critical mass" comes from physics[90] and has links with clustering and location theory.[91] It has some relevance in the livestock sector, in which there are many business inter-linkages and a recognisable and specialised domestic infrastructure (e.g. abattoirs, auction marts, veterinary services, shearers, and so on). Just as these ancillary industries grew up with and in turn facilitated further expansion of the livestock sector, so the reverse might happen.

6.30 Whether there is some 'point of no return' is questionable. At a localised economy level, critical mass has some relevance.[92] At aggregate levels, in relation to a large and diverse agricultural industry, the concept seems less intuitive. For instance, the fruit and vegetable sector is much smaller than the livestock sector, and has a very low 'self-sufficiency' ratio, but it has been relatively unsubsidised and is increasingly market-oriented. Critical mass notions also seem less relevant for arable farming – a key sector for calorific food security. Arable has less specialised infrastructure than livestock and is in any case more integrated into international markets for its inputs and outputs.

6.31 For food security, *capability* is more important than current production. As the OECD points out in its work on multifunctionality, a low-input extensive agriculture maintains productive capability without necessarily requiring artificially high levels of

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[88] *Defra Reference Database*. Labour input fell from 567,400 annual work units in 1973 to 312,600 AWUs in 2002, a reduction of 45%. *Agriculture in the UK 2005*, table 3.6.

[89] Recent growth in demand for traditional land management skills (such as dry stone walling) has been driven by growth in stewardship payments and private residential investment in the farmland aesthetic. However these skills have little direct connection to intensive modern systems of food production.

[90] Defined in the *Oxford English Dictionary* as the "minimum amount of fissile material needed to maintain a nuclear chain reaction".

[91] If enough businesses in the same sector group together, they can benefit from economies of clustering (e.g. network benefits, dedicated infrastructure, skilled labour force).

[92] For instance, farmers on the Isles of Scilly are currently concerned that the departure of their last resident vet could hasten withdrawal from livestock production on the islands. In other remote areas clusters of milk producers, who are dependent on a single buyer of their milk, are vulnerable: if a buyer stops collecting milk from any particular farm, and overall milk production falls, it becomes less economic for the milk buyer to continue buying from the cluster, and a spiral of decline can ensue.

current production.[93] This consideration may also lie behind set-aside land and CAP cross-compliance conditions to maintain land in 'good agricultural and environmental condition', even if it is not actively farmed. The ability to switch production from livestock to cereals and farm more intensively (at least in lowland areas) also means that physical output can be boosted if required. And an efficient but extensive agricultural industry not dependent on high levels of inputs could be better placed to adapt in a crisis when inputs themselves may be limited.

6.32 Ultimately, arguments about capability assume that in a crisis imports could not be sourced over a sustained period, and that home production is the only significant means of supply. Even in the Second World War, as we have seen, this scenario did not fully pertain. And, as we discuss below, domestic production is itself by no means immune from crisis.

Problems and risks associated with self-sufficiency

6.33 We have seen that the food-security arguments for UK self-sufficiency in the modern world are weak. Moreover, a drive for self-sufficiency will bring its own problems, some of which are the converse of the rationale for trade:

- Resource inefficiencies as manifested by the CAP e.g. artificial output prices encourage inefficiency and benefit landowners; resources are diverted from more productive economic uses; food producers focus on volume rather than what consumers demand, and inputs can be used excessively, often with environmental costs.[94]

- The push for self-sufficiency at EU level has arguably hampered efficient developing country exporters, who themselves face real challenges of food security. For poorer countries, domestic production capacity is important, but subsistence agriculture can be very vulnerable to crop failures (e.g. Ireland in the nineteenth century; Africa in the twentieth). Such countries need to be integrated into the world trading system to improve their resilience.

- Self-sufficiency risks fosters reciprocal protection, isolationism and nationalism.

6.34 A more fundamental objection, however, is that a drive for self-sufficiency cannot insulate an economy against all, or even, many risks:

- Domestic farm crises, such as a harvest failure or animal disease, will mean that imports become critical to maintaining a stable food supply. This is not to suggest that imports are intrinsically more or less safe than domestic produce: merely that reliance on one source of supply – in this case domestic – poses avoidable risks, and that trade increases resilience.
- Self-sufficiency fails to insulate a country against disruptions to its domestic supply chain, which might occur as a result of natural disasters (e.g. extreme

[93] OECD, *Multifunctionality* (2001), p. 48.

[94] Self-sufficiency policies in Japan, Korea, Norway and Switzerland necessarily tend to concentrate on supporting single commodities – such as rice, potatoes or milk. They create very high consumer costs and provide little incentive for quality and – like Ireland in the nineteenth century - are vulnerable to factors such as domestic disease.

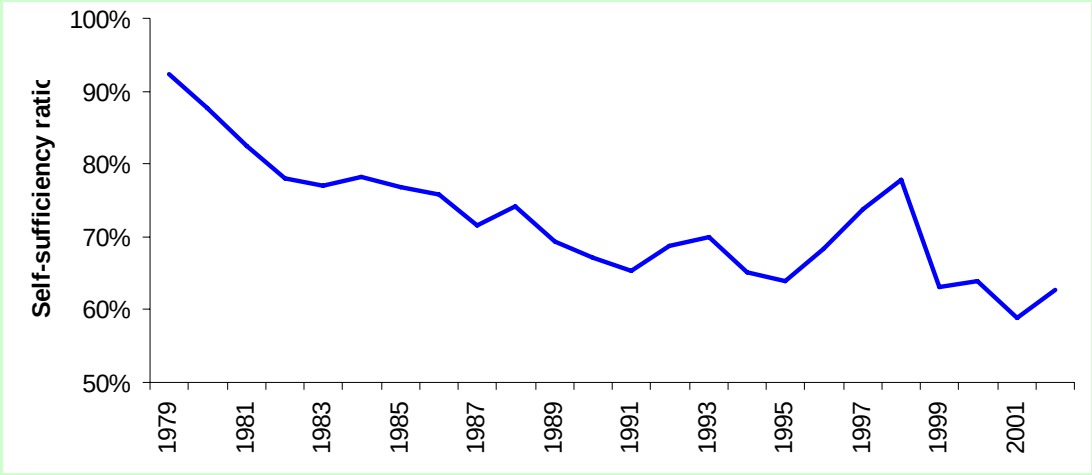
weather events), food health scares at the processing stage, fuel disruptions, industrial action or another source. Even overseas calamities, like the Chernobyl fallout of 1986 (see 8.6), can indirectly affect UK agriculture.

- Self-sufficiency makes little sense in today's world of inter-related international markets. As the OECD surmises, "it is likely that events that would prevent access to food imports would also have repercussions on access to imported inputs necessary for domestic production". Modern agriculture involves a wide range of inputs, many of which are internationally sourced - especially oil, fertilisers, feed and machinery.[95] Box 6-3 suggests that it is unrealistic to suppose that domestic agriculture can be completely insulated from the external environment. Without energy security, the UK is unlikely to enjoy food security, whatever its level of food self-sufficiency.

Box 6-3 Imported energy and the UK agri-food sector

The UK's fertiliser self-sufficiency ratio is around 63%, down from 90% in the 1970s (Figure 6-8).[96] Fuel is imported both directly and indirectly (for example to produce the energy required to manufacture fertilizer) and the total agri-food sector accounts for around 8.5% of total UK energy consumption (excluding fuel used by consumers). The UK is less reliant on imported energy than other EU countries, but fuels still account for 78% of all traffic through UK ports.[97] The UK is expected to remain broadly self-sufficient in oil until around 2009/10, but even now trade is necessary.[98] In 2004, the UK imported around 55m tonnes of crude oil and Natural Gas Liquids, plus a further 20m tonnes of petroleum products.[99]

Figure 6-8 UK fertiliser self-sufficiency 1979-2002



Source: FAO

[95] OECD, *Multifunctionality* (2001), p. 47; Speech by S. Panitchpakdi, *Why Trade Matters for Improving Food Security: High-Level Round Table on Agricultural Trade Reform and Food Security*, 13 April 2005. Available online at http://www.wto.org/english/news_e/spsp_e/spsp37_e.htm

[96] Whilst the UK is a relatively large producer of potash fertiliser (and a net exporter), demand for the more commonly used nitrogenous fertilisers exceeds domestic production of them.

[97] See *Agriculture in the UK 2005*, table 14.5 (2006); DfT, *Maritime Statistics 2004*

[98] UKOOA (2005) *Press Release: Maximising the Recovery of UK Oil and Gas is a Vital National Goal*

[99] DTI Energy Statistics (2005) http://www.dti.gov.uk/energy/inform/energy_stats/oil/3_10.xls. Most UK production takes place at off-shore locations, which carry their own risks.

Implications of very low levels of self-sufficiency

6.35 If self-sufficiency is not itself an object, would it matter if the self-sufficiency ratio, now at 60%, fell to much lower levels? This question can be addressed by recalling or developing some of the themes which have emerged so far in this paper.

6.36 Food security relates fundamentally to affordability, robust access to, and confidence in, food supplies (para 2.4). Low self-sufficiency only affects this insofar as the actual risks of import disruption – relative to home production - become excessive. Such risks became significant during the Second World War (when British self-sufficiency was 30-40%), but such a wartime scenario appears extremely improbable (para 6.21), and we have also noted the risks associated with domestic supplies. There may be a perception that we have more control over the risks involved in domestic production, and self-suffiicency policies may offer psychological reassurance. But this ignores the realities of an interdependent world, and a sophisticated market-, not Government-, driven food chain in the UK and Europe, whether domestic or overseas production is sourced.

6.37 Is a return to very low self-sufficiency levels likely? We have seen that current levels are high by historical standards. On the other hand, the recent decline in the ratio is largely driven by monetary factors and the fortunes of individual sectors and has little bearing upon underlying food security. The future outlook for the UK's self-sufficiency ratio will in turn be shaped by:

- the production and trade impacts of CAP and trade reform;
- the effect on exports of the lifting of the beef export ban;
- how far energy crops displace home food production;
- the outlook for fuel and transport costs (which will affect trade);
- consumer preferences and UK agriculture's ability to meet these, both at home and in export markets (e.g. for premium produce).

This last point is central to the Government's *Forward Look*, and suggests that the self-sufficiency ratio is better construed as a market share indicator for UK agriculture. For instance, it is difficult to demonstrate that the UK's current low "self-sufficiency" of fruit (5-10%) is a cause for concern on security grounds. Construed as competitiveness, it raises the different question whether UK producers could not market their produce more effectively to UK consumers.

6.38 If food self-sufficiency, in nutritional terms, were ever to fall radically, the risks associated with significant 'dependence' on imports could need greater managing. This is partly a circular argument, because any additional risks associated with overseas sourcing would be factored in to the choices of commercial operators within the food chain (para 7.18). There is a parallel with energy supplies, in which Government recognises the need to manage the increased dependence upon oil and gas imports. Energy imports are more problematic than food imports, because there is less choice over sourcing, and investment and infrastructure are more specific and critical (see Box 9.10 for more discussion of the differences between energy and food

security).[100] Analysing these supply risks would be the logical approach, and it would involve addressing questions such as:

- What risks are not being factored in by commercial operators?
- Who are our main suppliers, and how reliable are they?
- In which sectors is self-sufficiency lowest?
- How secure are our ports and shipping routes?
- How robust is the self-sufficiency of the wider EU?

6.39 Notwithstanding the risks facing domestic agriculture, home production certainly contributes to the 'supply mix', and it is difficult to envisage a scenario in which domestic agriculture, together with European agriculture, does not play a substantial role. But the analysis in this paper suggests that there is little logic in having fixed minimum targets for self-sufficiency. That is not to say, of course, that a reduced domestic agricultural base would not have other adverse social, environmental and economic effects.

Self-sufficiency and Food Security in the EU

6.40 Self-sufficiency becomes a better indicator of food security the larger the region in question. This is clear at the global level (see para 5.11 ff). The Single European Market and the institutional security of the European Union certainly make a major contribution to the food security of its members. It provides diversity and flexibility, the advantages of specialisation and trade, stable relations and physical proximity. Excessive and isolated focus upon UK food security appears misplaced.

6.41 In its early years, the CAP was instrumental in boosting EU agricultural production. That does not mean that **radical CAP and tariff reform** (as outlined in the HMT-Defra Vision paper) would materially undermine either EU self-sufficiency in particular or food security in general. Reform would not mean simply removing artificial production incentives, but also production controls, such as milk quotas and set-aside. The experience of reform both to date and more radically in other countries suggests that productivity gains and restructuring follow from reform so as to minimize overall reductions in competitiveness and output.[101] Moreover, ongoing productivity improvements in the new accession countries could also strengthen Europe's overall production potential. And to the extent that agricultural productivity growth outstrips population, self-sufficiency should increase.

6.42 The logic of trade liberalisation is that more efficient producers will expand their international market shares and more trade occurs. For specific commodities, in which the EU is not well suited (e.g. sugar), liberalisation would be expected to result in substantial increases in net imports. Individual member states are likely to be affected more than the EU as a whole, which implies greater intra-EU trade. Third country imports to the EU would increase but are no more likely to materially affect Europe's food security than Britain's demand for imports currently affects its own

[100] DTI, *The Energy Challenge* (2006), pp. 78-82

[101] See HM Treasury and Defra, *A vision for the Common Agricultural Policy* (2005), pp. 35-43.

food security. Even now, Europe is a significant importer of important foodstuffs such as bananas and rice as well as tropical staples such as tea, coffee and cocoa. Lower EU protection should also have favourable impacts on the food security of developing country exporters as well as on the stability and security of world markets.

6.43 Many of the other arguments already made or refuted in this section and the last in relation to Britain apply in whole or part to the EU. In general, the food security challenges facing the EU as a whole are not fundamentally different to those facing the UK.

Conclusions

6.44 National self-sufficiency figures based on market shares provide a very broad indicator of UK agriculture's ability to meet consumer demands, but fail to reflect many dimensions of "food security", in several ways:

- There are sound economic reasons why we import a share of our food consumption, a share which varies between sectors and reflects changing consumer preferences over time;

- The declining self-sufficiency ratio reflects factors which have little bearing on underlying food security. Consumer demands for increased variety and more exotic foods tend to reduce UK market share without compromising our ability to meet our nutritional needs.

- The self-sufficiency ratio calculates market values rather than calorie requirements. Over-eating, waste of food and the ability to switch to more calorie-efficient foodstuffs suggest that the UK may be more self-sufficient than is evident from market shares.

- Arguments used after the war in favour of high levels of self-sufficiency are no longer relevant.

- Food security involves diversifying supply options. The UK is able to source efficiently foods from a wide variety of stable countries, especially from other EU countries.

- Domestic agriculture itself depends upon a variety of imported inputs such as fertiliser, fuel and machinery. Circumstances in which food imports were cut off would also be likely to hamper domestic production potential.

- Importantly, self-sufficiency fails to insulate a country against disruptions to its domestic supply chain and retail distribution. Domestic farm crises, such as a harvest failure or animal disease, or natural disasters within our borders, will mean that imports become critical to maintaining a stable food supply.

6.45 Ultimately, security involves spreading risks, and this is what trade, supplementing domestic production, does. Trade is a major element of, and not a barrier to, domestic food security. As an EFRA committee report of 2002 concluded,

> *The continuing development of free trade offers the best approach to maintaining a secure food supply. If relationships are developed across the globe on the basis of interdependence and trust, operating within the World Trade Organisation, the likelihood of access to the foods we need being*

> *restricted is very remote. Protecting trade on the grounds of ensuring self-sufficiency in food production is an outmoded concept in a globalised world.*[102]

6.46 Trade, however, is not sufficient for food security. Security of food supply requires a resilient food industry and security of energy and fuel supplies, issues which are covered in the following sections.

[102] House of Commons Environment, Food and Rural Affairs Committee, *The future of UK agriculture in a changing world* (October 2002), para. 93.

7. THE DOMESTIC SUPPLY CHAIN

Key points

- *Modern supply chains have vulnerabilities, but are not necessarily more risky than alternative systems.*
- *Many of the risks involved are in firms' interests to guard against since this directly affects their business or reputation. Business continuity planning has grown in recent years, but there is potential for improvement in this area.*
- *Contingency planning by Government, and the need to work closely with the food industry, remains important to overcome any infrastructure, information and co-ordination failures.*

7.1 A narrow focus on agricultural self-sufficiency ignores the relevance of the whole food chain, and how the food chain itself might enhance or weaken food security. After all, food security is about citizens enjoying "physical and economic access to sufficient, safe and nutritious food".[103]

> *When food was scarce and production encouraged by support, the farmer saw it as his job to produce and the responsibility of others to find a profitable outlet for what left his farm. The system was essentially supply driven. Attention focused on how to improve productivity on farm rather than how to meet the requirements of a diverse and exacting market … This is no longer the case. As farmers make investments for future production, the prime consideration has to be where there is a market that will offer sufficient return to justify the risks to be undertaken.*[104]

7.2 This shift from a 'supply-driven' to 'market-led' food chain shifts the focus of food security away from farmers and agricultural self-sufficiency towards retailers and the whole food chain (Figure 7-1). Like agriculture, the post-farmgate industries rely heavily on energy, water, infrastructure and climate in processing and distributing food to consumers. In 2005 the food industry beyond the farm gate accounted for almost 200,000 enterprises and over 3 million employees (excluding third party logistics providers).[105] We need to ask what implications a modern 'market driven' food chain has for domestic food security. Does it operate in a way which increases the risk of disruptions occurring, and the impact of disruptions when they do occur? The first step is to look at some of the recent developments in the UK food industry.

Developments in the food chain

7.3 Recent decades have seen substantial developments in the way that food is processed, stored, distributed and sold across the UK. The rise of the multiple food retailers (Figure 7-2), has in turn stimulated technical advances and significant shifts in approach by firms throughout the supply 'chain'.

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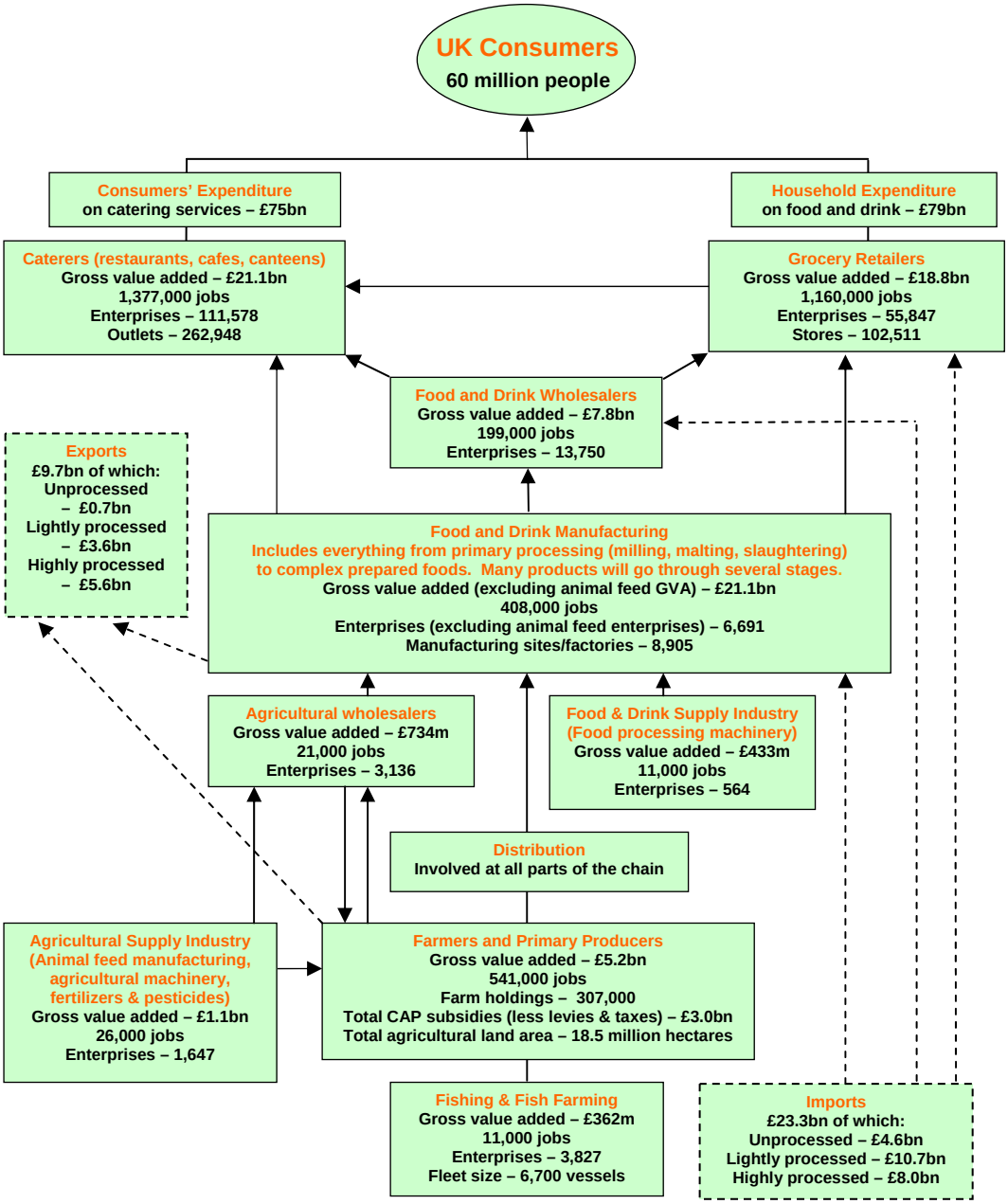
[103] FAO. *Rome Declaration on World Food Security*.

[104] Marsh, *Agriculture in the UK*, p. 36.

[105] Defra, *Agriculture in the United Kingdom 2005* pp. 54-5.

Figure 7-1 Economic summary of the UK Food Chain



Source: Defra, ONS.

(i) Retailer-driven supply chains

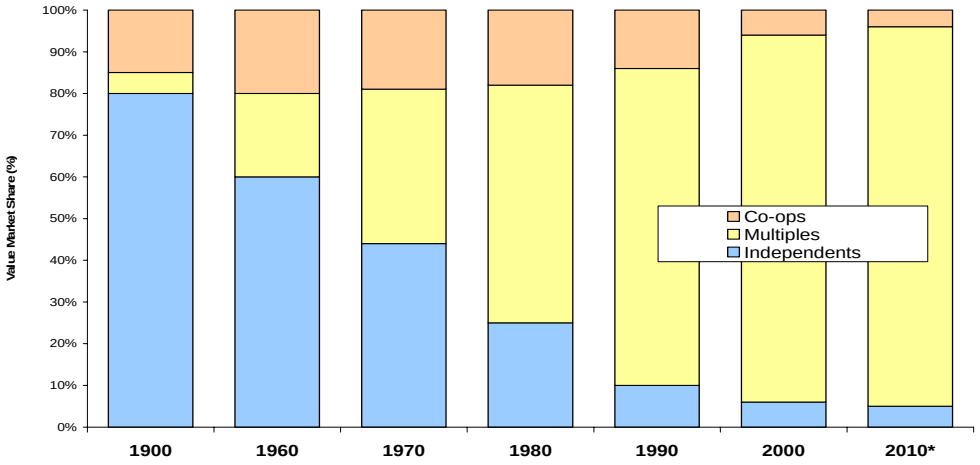
7.4 As the supermarkets have grown, they have increasingly sought to gain control over their supply chains in the pursuit of both high quality and low prices for their products to satisfy the demands of UK consumers in a number of ways:

- Two-thirds of manufacturers now supply retailers on the basis of Factory **Gate Prices** (FGP) in an attempt to improve vehicle utilisation and reduce distribution costs.[106] This means that the retailer manages transportation of

[106] *Supply IT*, Editorial supplement to *The Grocer*, 13th May 2006. p. 17.

goods from the supplier's premises right through to retail outlets. Although the retailer may have 'control' over the shipment, this may be through a contract with a third party logistics provider. For example, in 2005 Sainsbury's outsourced 49% of its transport, Waitrose 52% and Somerfield 100%.[107]

Figure 7-2 Consolidation over time in the UK grocery market, 1900-2010



Source: IGD, Grocery Retailng (2005)

- Current systems of **electronic labelling** allow the major supermarkets to trace products back to their processor or even farm of origin, as well as providing information on dates and batch numbers. Developments in the pipeline include the introduction of Radio Frequency Identification (RFID) technology, which allows goods to be tracked throughout the supply chain much more easily than with barcodes.[108]

- **Rationalisation** - supermarkets have tended to reduce the number of suppliers they deal with in order to achieve economies of scale and build closer relationships. This has also enabled them to monitor products more closely and work with suppliers to improve reliability and quality.[109]

(ii) Changes in stockholding and distribution

7.5 As distribution systems and their associated technologies have become more sophisticated, firms throughout the supply chain have increasingly adopted **Just-In-Time** (JIT) principles of operation. Retailers wish to minimise stock levels in order to cut storage and inventory costs. Firms operating on a JIT basis minimise inventory by sourcing supplies in small quantities at frequent intervals (Figure 7-3).[110] JIT has enabled manufacturers and retailers to reduce the amount of stock being held in the

[107] IGD, *Retail Logistics 2006* (2005)

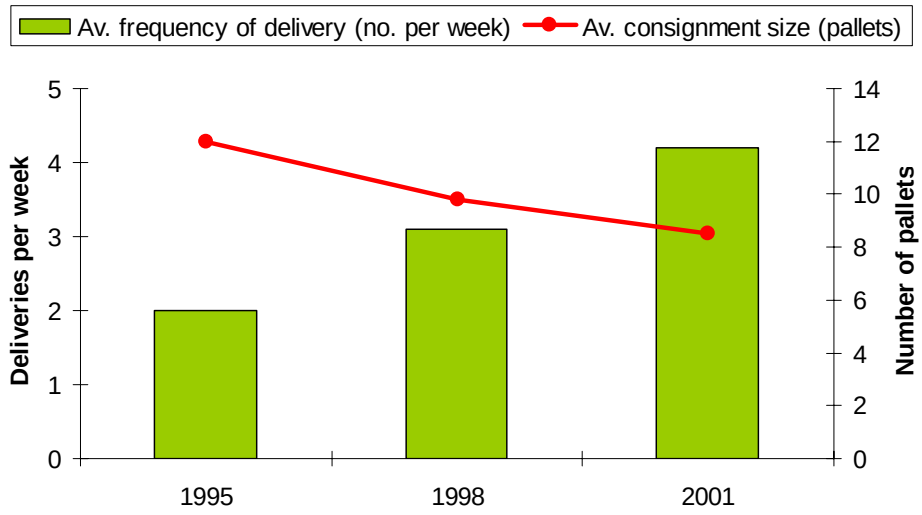
[108] See GS1 UK, http://www.gs1uk.org/supplychain-1.asp?fid=275

[109] AEA Technology, *Food Miles,* Annex 2, p. 11.

[110] A. McKinnon & J. Campbell, *Quick response in the frozen food supply chain: the manufacturers' perspective* (1998), Logistics Research Paper no. 2, Herriot Watt University.

system and improve quality management (Figure 7-4). JIT is more marked in frozen and fast-moving categories, where replenishment or shelf costs are important.

Figure 7-3 Adoption of JIT in the frozen food sector



Source: McKinnon and Campbell (1998)

7.6 In addition, there is some evidence to suggest that firms have also reduced the number of locations in which they store their ingredients and products, offsetting slightly higher delivery costs with greatly reduced storage and inventory costs. This in turn reduces overall stock levels, since having fewer stockholding points in a production and distribution system reduces the amount of 'safety stock' required to maintain a given level of customer service.[111]

Figure 7-4 Average retailer stock levels across different food categories

Source: IGD

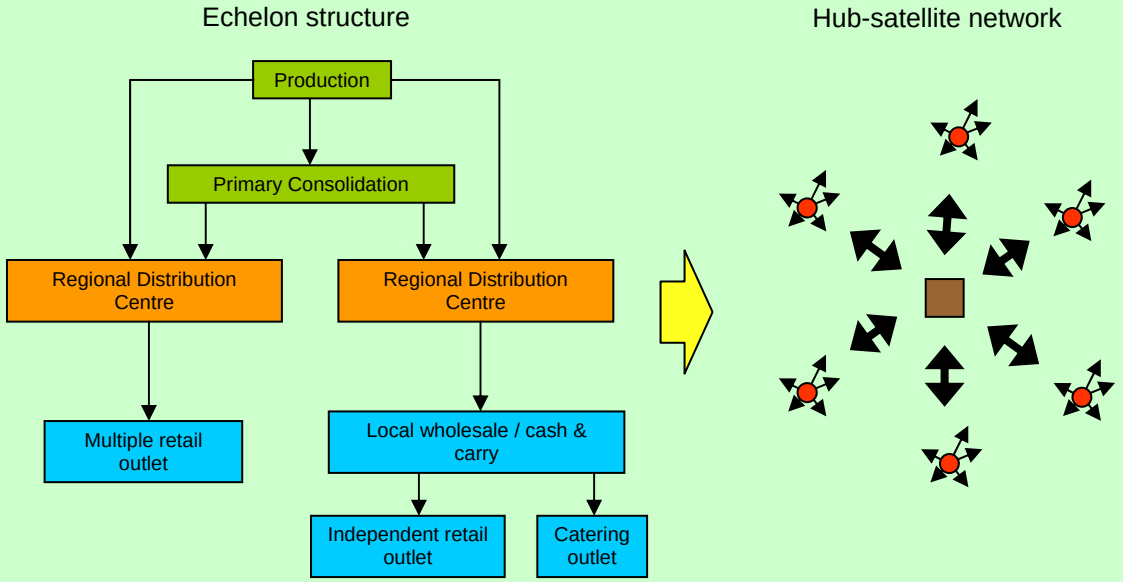
[111] AEA Technology, *Food miles,* Annex 2, pp. 7-8.

(iii) Restructuring of logistical systems

7.7 As a result of increasing supermarket control of the supply chain, and to enable JIT to operate effectively, the structure of the chain itself has altered significantly in recent decades.

- Logistics have been restructured away from multi-tiered distribution structures towards **hub-satellite networks** (Box 7-1). Almost all of the major multiples' grocery sales are now channelled through their Regional Distribution Centres (RDCs), compared to between 20% [ASDA] and 80% [Sainsbury's] 15 years ago.[112] Only a few morning goods (bread, milk, eggs, etc.) now go directly to stores. This facilitates high lorry loading rates - a lorry bringing a consignment from a supplier can deliver goods to stores on its return journey - and effective management of the supply chain.

Box 7-1 Development of hub-satellite networks



Source: AEA Technology

In the hub-satellite network, pallets of food products (in 'less than truck loads') are collected from several suppliers and aggregated at local 'satellite' depots. They are then transported in large lorries to a central hub. For fresh products, this may be a regional Distribution Centre (DC) relatively close by, but for long-lasting goods each retailer may have a single large DC located in the Midlands. At the hub, products are sorted for onward transportation (again in large lorries) direct to stores, or to the local satellite depot closest to their destination.

- Similarly, food processors are concentrated in fewer locations to reap **scale economies**, improve productivity and service the RDCs efficiently. In many sectors of the food industry, factory numbers have been declining while average output has been rising.[113] Outsourcing has become common for

[112] IGD, *Retail Logistics 2003: Benchmarking Supply Chains*. The large supermarket and wholesale chains operate around 70 RDCs, AEA Technology, *Food Miles*, Annex 2, p. 10.

[113] AEA Technology, *Food Miles,* Annex 2, pp. 7-11.

back-office functions, although evidence of production 'off-shoring' remains limited.[114]

- As processed foods have increased their share of diets, and fresh produce undergoes more preparation prior to sale (washing, grading, freezing, packaging, etc.), additional links have been added to the supply chain.[115]

(iv) Wider sourcing of supplies

7.8 Although supermarkets have reduced the number of suppliers they contract with, they (together with manufacturers and wholesalers) have also been willing to travel further afield to find the right products at the right prices. Benefits of imported supplies can include greater competition, lower prices, higher quality, more diverse ranges and better availability. This trend has been assisted by falling relative costs of long-distance transport, liberalisation of international trade and advances in IT which make long supply chains easier to manage.

7.9 Counter to this trend is the growing demand for "locally" sourced foods (see also 9.4). The large retailers have sought to capitalise on this trend – for example Sainsbury's claims to source from the UK wherever possible, ASDA has a dedicated local sourcing team, while Tesco stocks over 7000 "local" products.[116] If such demand continues to grow, we may yet see another shift in logistics in order for suppliers and retailers to distribute these products in the most efficient way. Certainly it should not be assumed that modern supply chains are simply "global". Apart from fruit, at least half of food retailed will be domestically (if not strictly "locally") sourced.

Modern supply chains and the implications for food security

7.10 Recognising that there is no such thing as a "risk-free" food chain, are these developments positive or negative for the overall security of the food chain?

(i) Increased retailer control

7.11 Retailers' ability to track products throughout the system has positive effects on security. It allows retailers to head off potential disruptions and to react more rapidly than if tracing were not possible. This is particularly pertinent in the case of food safety scares, but also relevant in providing swift, co-ordinated responses to other problems (e.g. severe winter weather).

7.12 Concentration can be good too: larger firms are generally more geared up and resourced for robust **business continuity management** (BCM) and have the resources to put in place the appropriate infrastructure and procedures to create

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[114] Defra, *UK Food and Drink Manufacturing: an economic analysis* (May 2006), available online at http://statistics.defra.gov.uk/esg/reports/FDM%20paper%2019%20May%202006.pdf p. 37.

[115] AEA Technology, *Food Miles*, Annex 2, p. 10.

[116] Information taken from the companies' CSR reports.

transparent and traceable supply chains.[117] More can certainly be done in this area, but BCM has expanded rapidly across the food industry in recent years, in response to a number of drivers[118] including:

- experience of terrorist attacks, fuel protests, Millennium Bug, etc;
- recognition of the risks associated with JIT and lean distribution systems;
- spread of the corporate responsibility agenda and pressure from customers;
- regulatory compliance and insurance requirements.

7.13 On the other hand, retail concentration at urban or regional level can make areas of supply more vulnerable to company-specific supply shortages (e.g. arising from industrial action), which could be exacerbated by panic buying. This could have a disproportionate impact on less mobile and more isolated shoppers, and this could have implications for the application of competition policy.

(ii) Just-In-Time and supply chain management

7.14 JIT and the drive for efficiency have reduced the role of stocks and 'contingent capacity', and so risks have shifted towards transport-related disruptions. Even a short delay in supplies can have an impact – the high throughput of products in a supermarket means a delivery that is just two hours late can lead to temporarily empty shelves for particular product lines. Even so, adoption of JIT has widened at the same time as congestion on Britain's roads has increased, which suggests that congestion related delays are not a fundamental problem. Disruptions to individual deliveries do not pose fundamental threats, owing to the potential for consumer switching. But where many or all deliveries are blocked for some reason, shelves are likely to go empty, and this can be exacerbated by panic buying.

7.15 The commercial importance of **flexible supply chain management** makes supermarkets anything but passive recipients of risk. The logic of JIT both forces and facilitiates retailers to be pro-active in monitoring supplies and managing risks: better information flows along supply chains reduce the need for contingency stockholding, increasing efficiency and reducing risks. Empty shelves are certainly not in retailers' commercial interests. In times of disruption they would generally use their understanding of the supply chain to ensure adequate deliveries take place.[119]

(iii) Concentration of production and distribution

7.16 Concentration of production and distribution, like JIT, places greater reliance on transport, and again poses a trade-off of risks: a simpler, focused supply chain facilitates traceability and network planning for disruptions, but individual sites

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[117] T. Garnett, *Wise Moves: Exploring the relationship between food, transport and CO_2* (for Transport 2000, 2003), p. 50.

[118] The development of business continuity planning is discussed H. Peck, *Resilience in the Food Chain: A Study of Business Continuity Management in the Food and Drink Industry* (for Defra, forthcoming).

[119] On flexible supply chain management and its relevance for supermarkets, see *The Economist,* Survey of Logistics, 17 June 2006, pp. 6, 8.

become more strategic to the whole chain (eg. a problem at a single Regional DC could adversely impact the supply of around 100 retail outlets). Again, though, retailers will face strong incentives to manage these risks and maintain site security. They may be more vulnerable to infrastructure disruptions (e.g. motorway closures) but, short of whole networks closing down, supplies to consumers are unlikely to be fundamentally threatened. Moreover, this risk of disruption is not necessarily greater than more localised logistics, as consolidation may actually reduce overall vehicle mileage.[120] Also, the use of a network rather than the more rigid echelon structure allows retailers to be more flexible in the event of a disruption: satellite depots can be bypassed if necessary, with deliveries going straight to stores, or to a different depot.

(iv) Changes in the supplier base

7.17 **Single sourcing** allows retailers to monitor products more closely and build strong relationships with suppliers so that they can work together to anticipate and resolve disruptions. Relying on fewer suppliers inevitably means that any disruption that does occur could have more impact, but better relationships help to build flexibility in to the system. Experience also shows that supermarkets can rapidly switch sources of supply and so absorb shocks. Out-sourced logistics and deliveries may introduce other vulnerabilities (witness the problems in 2005 of British Airways in-flight catering), although – as a form of trade – it can also spread risk and increase flexibility, including in emergencies.[121]

7.18 The benefits and risks of **wider sourcing** (imports) were largely dealt with in section 6. Wider sourcing reduces the impact of more localised disruptions, but also creates new risks (e.g. port disruptions; importation of food-borne pathogens). Again many of these should be factored in to the commercial calculus or are covered by food safety legislation. For instance, where a buyer or supplier perceives additional risk from overseas sourcing, risks can be managed by dual sourcing (maybe from the same country) and increased commercial stockholding or domestic sourcing.[122] Reliability and continuity of supply are crucial for supermarkets' competitiveness. Indeed, one reason for their success has been their ability to provide consistent product availability to consumers. Nor should it be assumed that smaller scale retail is necessarily more local: most small businesses - such as small grocery stores and newsagents - source widely and globally via their wholesalers.[123]

7.19 A more **complex production process** is ultimately a reflection of consumer demand for more processed and convenient products, so it is difficult to identify alternative systems, at least for the mass market. In this context, disruptions are most likely to reduce consumer choice rather than compromise food security in any fundamental sense.

Conclusions

7.20 We can draw a number of conclusions from this section:

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[120] AEA Technology, *Food Miles*, p. 11.

[121] See *The Economist,* Survey of Logistics, pp. 4-7.

[122] Personal communication, foodservice supplier.

[123] Garnett, *Wise Moves*, p. 50.

- Modern supply chains are not obviously more vulnerable than alternative or historical models. Not only is a risk-free supply chain neither achievable nor efficient, different systems are vulnerable to different disruptions e.g. centralised vs. decentralised systems; out-sourced vs in-house production. A complete fuel or power shortage, for instance would cripple all systems. The Transport 2000 report, *Wise Moves*, acknowledged that

  > *all supply chains are exposed to risk of one kind or another, and although a shorter supply chain will not be vulnerable to some of the risks threatening a global one, the reverse is also true. The risks may be different but not necessarily of less magnitude.*[124]

- Lean supply chains create risks, but the flexibility that increasingly characterises modern supply chains – including food - is crucial to their resilience.[125]

- Many risks are in firms' - particularly large firms' – interests to guard against. Shortages threaten not only short-term turnover and profitability, they can also undermine longer term competitiveness through the effect on a firm's reputation. Food scares, for instance, have long been a major commercial threat to industry; hence it is generally well prepared for such events. Recognition of the risks associated with long and lean supply chains grows with experience. Risk management in general and business continuity planning in particular are thus rising in profile across industry, particularly among larger firms.[126] This suggests that a highly decentralised supply chain populated by small firms would give rise to greater market failures and need for government intervention in respect of food security (cf. para 4.10). In any case more can be done to raise awareness of business continuity, spreading best practice and embedding it as a culture.[127]

- In assessing implications for risk and security, other factors such as cost, speed and efficiency should not be ignored (see 4.2 above). New research for Defra suggests a degree of trade-off between ultra-efficiency and vulnerability, in the sense that the introduction of redundant capacity by firms in the short term would enhance resilience but undermine competitiveness.[128]

- Contingency planning by Government, and the need to work closely with the food industry, remains important to overcome any infrastructure, information and co-ordination failures (see 4.13). This should be distinguished from the commercial risks facing individual firms.

7.21 Using the standard food security definition, it is clear that the modern retailer-driven food supply chain has generally provided consumers with sustained "physical and economic access to sufficient, safe and nutritious food". The achievement of private corporate enterprise, operating within a regulatory and cultural framework, in managing risks and continually delivering food to consumers, should not be forgotten.

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[124] Garnett, *Wise Moves*, pp. 49-50.

[125] *The Economist*, Survey of Logistics, pp. 18-20.

[126] Peck, *Resilience in the food chain*.

[127] Various material exists for firms developing BCM e.g. British Standards BCM code of practice, http://www.bsi-global.com/Risk/BusinessContinuity/bs25999.xalter; Business Continuity Institute, http://www.thebci.org/trainingcourses.htm; UK Resilience http://www.ukresilience.info/index.shtm

[128] Peck, *Resilience in the Food Chain*.

8. THREATS AND DISRUPTIONS: RECENT EXPERIENCE AND POTENTIAL SCENARIOS

Key points

- *The random and varied nature of potential threats to food supply suggest that maintaining food security involves a variety of approaches and cannot be reduced to a simple question of domestic vs. imported production.*
- *The ability of competitive markets to adapt to shocks should not be understated.*

8.1 A number of the themes emerging from previous sections are given expression when we review recent crises affecting Britain's food supply (the first part of this section) and consider various future threats (the second part).[129]

Crises affecting the food chain

8.2 The first **oil crisis in 1973** exposed the dependence of the food manufacturing sector – and the rest of the economy – on oil, particularly when the UK was a net oil-importing country. Food production accounts for a significant proportion of energy use, with large quantities of oil, natural gas and fossil fuels used. After 1973, energy security became a new priority, with increased exploration of North Sea reserves and new efforts to substitute away from oil.

8.3 At this time, global agricultural production was also afflicted by bad weather leading to **poor harvests**. According to the FAO, "in 1972 world agricultural production had fallen slightly for the first time since the Second World War". The USSR, which was one of the worst-affected areas, bought huge quantities of grain on the world markets, which reduced world grain stocks to their lowest level for two decades. This, together with general inflation, currency changes and higher transport costs caused prices to rise rapidly: wheat prices trebled between mid-1972 and mid-1973. Various national policies to encourage production coupled with improved weather the following year prevented prices from escalating further. FAO also recommended that financial assistance be increased to support developing countries in their efforts to meet the long-term demands of expanding populations. [130]

8.4 Similarly, the **sugar shortage of 1974** followed a severe global shortfall and world prices spiked. The impact in the UK was exacerbated by the system of regulated prices and quotas which led to the diversion of import supplies to the world market. By mid-1974, it was apparent that the UK "would be short of more than 20% of its annual sugar requirement for that year", a situation aggravated by a series of poor domestic crops. Imports recovered only when prices were increased, and this affected retail prices. EC production was boosted by higher quotas and support prices. One consequence of this was to encourage investment in alternative natural

[129] The discussion only considers recent crises in terms of their relevance for food security, rather than their wider (often more important) economic, social, environmental and political impacts.

[130] FAO, *Report of the Conference of FAO: Seventeenth Session, Rome* (1973), Section III-A.

sweeteners (such as isoglucose), a development perversely restricted by the EC in order to protect its sugar beet sector.[131]

8.5 The 1970s was also a decade scarred by industrial disputes, culminating in the "**winter of discontent"** in 1978/9.[132] Widespread strikes had the potential to cripple food supplies, since they affected the provision of many essential services, including lorry drivers carrying food. The Government intervened effectively to ensure that there were few serious shortages of food and tellingly, "the strike produced more warnings of shortages and more signs of damage than actual disruption".[133] The crisis was managed by the Regional Emergency Committees, reporting to the Civil Contingencies Unit in the Cabinet Office. Clearly the potential of trades unions to cause such serious disruption has substantially reduced since that time.

8.6 On 26 April 1986, an accident at the **Chernobyl nuclear power complex** in the Ukraine led to an explosion that released a plume of radioactive smoke into the atmosphere. Subsequent heavy rain released high concentrations of Caesium-137 from this cloud, dropping radioactive fallout over many European countries, including parts of the UK. Instead of being 'locked' in soil, it was taken up by grass and plants in certain upland areas. Once sheep grazing on this land ate these plants, they became radioactive too. As a consequence, the government introduced tight restrictions on the sale and slaughter of affected sheep. These restrictions were expected to last for only a few months, but in 2004 they remained on 14 farms totalling 16,300 hectares in Scotland, 359 farms totalling 53,000 hectares in Wales, and 9 farms totalling 12,000 hectares in England They are still required to "to ensure that no significant amounts of caesium-137 from Chernobyl enter the food chain". In 2000, it was estimated that they may be needed for "another 10 to 15 years" illustrating the length of time environmental damage can persist. Whilst the restrictions have helped maintain public confidence in the affected meats, it had cost UK taxpayers around £13m in compensation payments by 2003.[134]

8.7 The **global cereals shortage of 1995**, caused by a sharp reduction in production and spike in demand, put immense pressure on global cereal prices, which rose by some 50%. UK production actually increased, allowing net exports to rise. Developing countries became vulnerable as prices rose and food aid fell. Global stocks fell by around 15%, and substitution away from cereals increased. In 1996, global production and stocks recovered as more cereals were planted and yields

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[131] Monopolies and Mergers Commission (MMC), *Tate & Lyle PLC and British Sugar plc: A report on the proposed merger* (1991), Appendix 4.1: The European Community Sugar Regime. http://www.competition-commission.org.uk/rep_pub/reports/1991/fulltext/297a4.1.pdf; MMC, *S & W Berisford Ltd and British Sugar Corporation Ltd: a report on the proposed merger* (1981), Section 2: The UK sugar market. http://www.competition-commission.org.uk/rep_pub/reports/1981/fulltext/134c02.pdf

[132] Strikes had previously brought national crisis. In 1966, Britain's **merchant seamen** also went on strike (over working hours), causing the government to declare a state of emergency after just one week. Prime Minister Harold Wilson claimed they were "endangering the security of industry and the economic welfare of the nation". Shortly after these comments the strike was called off. In 1970, a nationwide **dockers' strike** triggered another state of emergency, as imports and exports were held up, and the Government put 36,000 Army troops on standby to handle cargo. A similar strike occurred in 1972,http://news.bbc.co.uk/onthisday/hi/dates/stories/may/23/newsid_2504000/2504227.stm; http://news.bbc.co.uk/onthisday/hi/dates/stories/july/16/newsid_2504000/2504223.stm

[133] W. Rodgers, 'Government under stress: Britain's Winter of Discontent 1979' , *The Political Quarterly*, Vol. 55, Issue 2 (1984), pp. 171, 177.

[134] Sunday Herald, *Sheep still contaminated by Chernobyl* (2004); Health Protection Agency, *Chernobyl closure* (2000) http://www.phls.co.uk/radiation/publications/bulletin/bulletin_223/rpb223-1.htm BBC (2000). *Chernobyl's effects linger on*. http://news.bbc.co.uk/1/hi/sci/tech/743879.stm; BBC (2003). *UK farms still radioactive*. http://news.bbc.co.uk/1/hi/uk/2813685.stm

rose in response to the higher prices. Within two years, global prices had returned to pre-1995 levels although food security issues in some developing countries remained.[135]

8.8 During the **BSE crisis of 1996** – sparked by the Government's confirmation of a probable link between infected meat and vCJD - beef consumption fell by 20%, exports were banned, and home-fed production fell about 29% year-on-year in 1996.[136] Low quality products, such as mince meat and burgers, experienced the greatest decline as consumers shifted away from beef to lamb, pork and poultry. The crisis brought significant restructuring to the livestock sector and a growing demand for traceability and assurance.

8.9 The outbreak of **Foot and Mouth Disease in February 2001,** though not a public health issue, also resulted in export bans and mass culling. In 2001, home-fed production of mutton and lamb fell by 30% year-on-year. Beef and veal production fell by 8% and pork, 16%. Only lamb supply was seriously affected as imports did not respond to the decline in domestic production, resulting in a 14% decline year-on-year in 2001.[137]

8.10 The **Fuel Protests of September 2000,** led by a group of farmers and hauliers, caused severe disruption to the supply of fuel in the UK, affecting both public and private sectors of the economy, including the food chain.[138] Supermarkets were left exposed when deliveries failed, although it is doubtful that a more inventory-based supply system would have been any less affected. And not all retailers experienced problems. Sainsbury said that "food deliveries … continued as normal"[139]. The consumer response to the perceived threat of food shortages did not help matters, with evidence of 'panic buying' draining shelves of goods like bread and milk. Limited rationing was introduced at some stores. Food manufacturers were less affected by the fuel crisis, with the Food and Drink Federation reporting that many firms had "contingency supplies of raw materials and fuel" [140], allowing them to continue operations unimpeded. Again, the role of imports became critical:

> *Recent agricultural and global crises have in fact impressed upon retailers the need to widen the food network; during the 2001 fuel protest, businesses were actually more able to source goods from the Continent than from within the UK, because the fuel was easily available across the Channel. Those with the most local supply and distribution bases were worst affected.*[141]

8.11 The impact on food supply of the **Buncefield fuel depot explosion** in 2005 was largely localised e.g. Marks & Spencer was forced to close one of its food

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[135] FAO (Various). *Food Outlook: Cereals – Supply/Demand Roundup*. October 1995, January/February 1996, November 1996.

[136] For more on the impact of the crisis, see DTZ Pieda Consulting (1998). *Economic Impact of BSE on the UK Economy* and BSE Inquiry (2000), http://www.bseinquiry.gov.uk/pdf/volume10/Section3.pdf

[137] Defra and DCMS, *Economic Cost of Foot and Mouth Disease in the UK* (2002).

[138] For an outsider's account of the crisis, see Public Safety and Emergency Preparedness Canada (PSEPC), *Impact of September 2000 Fuel Price Protests on UK Critical Infrastructure* (2005)

http://www.ocipep.gc.ca/opsprods/other/IA05-001_e.asp

[139] Guardian Unlimited. (2000). *Rationing keeps NHS afloat.*

http://www.guardian.co.uk/petrol/story/0,7369,368702,00.html

[140] Guardian Unlimited. (2000), *Post, banks, food supply now at risk.*

http://www.guardian.co.uk/petrol/story/0,7369,368262,00.html

[141] Garnett, *Wise Moves*, p. 49.

depots, resulting in "dozens" of stores in North London and the South East facing a shortage of sandwiches in the immediate aftermath of the explosion.[142]

Lessons from these disruptions

8.12 From a food security perspective, some general themes emerge from these events:

- The impact of any disruption is, broadly speaking, determined by three key characteristics of the scenario in question:[143]

  Scale – a disruption would be expected to have greater impact the larger the scale of the incident;

  Pervasiveness – the more widely an incident permeates through the economy the greater the likely impact. For food, this relates to the breadth of products affected;

  Duration – the longer a scenario endures, the greater the impact.

- Calamities like Buncefield hit headlines, but firms in the food chain face everyday disruptions such as factory fires, industrial action, safety alerts and demonstrations. These risks are typically factored in to commercial decision-making through insurance, contingency planning, product recalls and so on.

- The UK food chain has been remarkably resilient in recovering from a range of crises. Judicious intervention can facilitate the resolution of crises, but intervention can also create perverse outcomes.

- Some of these crises emerged over time; others appeared quickly and unexpectedly.

- The importance of *substitution*, *adaptation* and *innovation*, both on the supply and demand sides.

- Disruptions often affect individual commodities or product groups, facilitating substitution. Temporary supply shortages are evident in many sectors: disruptions are not the same as crises, and food security is not fundamentally threatened in these instances.

- The importance of energy security, in production and distribution, for the smooth functioning of the food chain. Threats to food supply are often a second-order effect. Hence the need to promote (cost-effectively) security, resilience and diversity in other areas of the economy's critical infrastructure.

- UK agriculture itself can be a source of risk, and is not insulated from external crises.

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[142] Waverley TSB (2005). *News & Events.* http://www.waverley-group.co.uk/site/default.asp?CATID=130 Financial Times. (2005). *Oil depot fire takes its toll on local businesses*. http://news.ft.com/cms/s/d224c00a-6b4c-11da-8aee-0000779e2340.html

[143] Cabinet Office, *NRA Economic Impact Assessment Method* (2005).

- Whether or not domestic agriculture remains robust, food security depends upon the whole food chain.

- Global commodity markets have strong tendencies to correct themselves. Thus shortages push up prices, which in turn creates powerful incentives to ration demand, stimulate supply and build stocks.

Thinking about future risk and uncertainty

8.13 By definition the future is uncertain, but potential threats to food security should be kept in perspective. Recent decades have been far from immune from crises as we have seen: there have been economic crises, geopolitical crises, financial crises, wars and terrorist acts and campaigns, extreme weather events and natural disasters in different parts of the globe. These events have impacted on different regions in different ways, and typically it is poorer countries who are less resilient to shocks of various kinds. The food security of OECD countries has hardly been threatened.

8.14 There are broadly two ways of thinking about future scenarios: "*threat-based*" scenarios and "*effects-based*" (what-if?) scenarios. *Threat-based scenarios* focus upon a potential primary agent of disruption, such as 'climate change' or 'terrorist activities'. The latter particularly dominated the thinking of the US authorities after the 9/11 attacks.[144] Table 8-1 outlines a typology of threats to food security, adapted from the OECD. Threats might spring from various sources, globally as well as nationally, and many apply more to developing than developed economies. The problem with this approach is that it can ignore other events or factors which could ultimately have

Table 8-1 Typology of potential threats to food security

	Political	Technical	Demographic & economic	Natural
Food Supply reductions	Wars	Radioactive fallouts		Floods, droughts Plants / animal disease
Decline in productive capacity		Decline in non-renewable energy		Water scarcities Desertification, Soil erosion Climate change
Global Demand			World population growth Incomes growth	
Crises of affordability			Poverty, Currency devaluations Economic crises	
Disruption to trade and distribution	Strikes, Wars, Trade embargoes, export restrictions,	IT corruption	Absenteeism due to pandemic flu	Earthquakes

Based on OECD, *Multifunctionality*, p. 47.

[144] Peck, *Resilience in the food chain*

greater impact (for instance, Hurricane Katrina in America, which was obviously not terrorist-based). An *effects-based approach* considers more proximate causes of disruption without reference to the primary cause: for instance, "what would be the impact if no lorries operated on Britain's roads for a week?"[145] Whilst this approach focuses upon impacts and resilience, it ignores probabilities and potentially exaggerates actual or relative risks. This is a more general problem in speculating about future scenarios – risks without reference to probabilities can become exaggerated, and comparisons of different risks obscured. But they do remind us to focus on minimizing risks – such as world war and power shortages – which would have the greatest impacts.

8.15 The 'precautionary principle' approach to risk and uncertainty combines both threat-based and effects-based thinking. However, it does not appear to be an adequate tool for addressing the multi-faceted challenge of food security (Box 8-1).

Box 8-1 The Precautionary Principle

The "Precautionary Principle" is generally applied to issues concerning human health or the environment. It embodies the idea that "where there are threats of serious and irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation".[146] Preventative action should not be deferred just because full information about the likelihood and exact causes of a serious problem is not available. Economists have also shown that where irreversibilities are present, risk-neutral societies should favour taking conservative decisions now to 'keep their options open' in the future. [147]

Take the threat of climate change. The Precautionary Principle suggests that we are justified in trying to mitigate climate change by curtailing GHG emissions, even though we lack certainty about its precise nature, because the potential result of inaction might ultimately be catastrophic.

Can the principle be applied to security (rather than safety) of food supplies? Food insecurity is clearly a grave matter, and we do not possess perfect information about future threats to our food supply. The difficulty is what action to take. In the presence of uncertainty and potential future threats to food security, there is no logical policy imperative equivalent to, say, banning consumption of a product (because of a health scare) or reducing carbon emission (because of climate change). We have already shown that a drive for self-sufficiency does not meet the criteria, because it is so poorly aligned to food security. Rather upholding food security in the presence of uncertainty involves maintaining options, supply diversity and resilience of trade and physical infrastructure. Arguments for self-sufficiency predicated on the precautionary principle are therefore somewhat circular (cf para 6.27).

Potential threats and scenarios

8.16 In 2005, the Research Priorities Group for Defra brainstormed, though did not analyse, a number of possible 'acute and longer term threats' to food supply.[148] An exhaustive appraisal of each is not possible in this paper, and more detailed research

[145] A. McKinnon, *Life without lorries* (2004)

[146] Article 15 of the Rio Declaration on Environment and Development, *cited in* C. Gollier et al. (2000) 'Scientific progress and irreversibility: an economic interpretation of the Precautionary Principle', *Journal of Public Economics* 75 (2000), pp. 229-253.

[147] C. Henry, *Investment Decisions Under Uncertainty: the "Irreversibility Effect",* American Economic Review 64 (1974), No. 6, pp. 1006-12.

[148] http://www.defra.gov.uk/science/documents/RPG/Papers/FinalRPGreport.pdf

may be beneficial in specific areas, though by definition such research will have very limited empirical basis). On the basis of the evidence and argument in this paper, however, we can offer preliminary assessments of some of these, as well as other relevant scenarios. Climate change is dealt with at greater length.

(i) Worldwide non-renewable energy shortage

8.17 This "what if" scenario assumes that the price mechanism – which continually factors in risks of shortage and the outlook for reserves - cannot encourage new extraction, supply or alternative energy, especially over time. Short term oil crises creating price spikes could bring stagflation to the UK economy, increasing the cost of food somewhat and impoverishing certain groups, but again would not trouble the fundamental food security of rich economies like the UK and the EU. Unanticipated and artificially induced physical shortages are likely to be more serious, such as a crisis in the Middle East (as in 1973). This too would depend upon scale and duration, and the ability of other oil producers to supply the shortfalls. Interestingly, the recent high oil prices have had far less impact in the UK than the hikes of 1973-4. Energy security remains a key government priority and is discussed in para 9.10 ff.

8.18 A high and rising price of oil could affect patterns and terms of trade, depending upon the energy and transport intensity of different locations of production. Higher freight costs will make imports less competitive, allowing more domestic produce to remain competitive, despite input prices increasing also.

(ii) Commodity shortages

8.19 Global commodity shortages do not pose a significant threat to UK food seucrity. We have seen that poor countries are more vulnerable than rich countries like the UK, that commodity markets tend to correct themselves in time, and subsitution on the demand and supply sides is likely to mitigate adverse impacts.

(iii) Corruption of food chain IT

8.20 The dependence of food supply upon IT is another area of concern, as evidenced by the (unfounded) anxieties over the 'Millenium Bug'. Generally, it seems that private firms are very conscious of such risks: according to latest Defra research, back-up systems are typically a high priority in business continuity planning amongst larger firms in the food industry.[149]

(iv) Loss of major trading partners; collapse of the WTO

8.21 Another question-begging scenario. Most of our major food trading partners are EU member states. Only a major crisis or conflict within Europe would fundamentally threaten trade. Maintaining good relations with such countries is clearly important for food security. And trade is itself an important means of embedding good relations exemplified by the Single European Market. The major retailers are increasingly able to source from a diversity of international suppliers,

[149] Peck, *Resilience in the food chain*.

within commercial and regulatory constraints. A certification scheme run by the British Retail Consortium for suppliers to UK retailers includes suppliers from sixty nine different countries, a remarkable testament to supply diversity.[150]

8.22 Ensuring that international trade operates within a robust legal framework is an important element of international food security. UK food security is not conditional upon further trade liberalisation (i.e. in the context of the Doha Round), but the benefits of multilateral trade suggest that a reversion to increased protectionism or bilateral trade would be inimical to long-term global food security, as it would reduce supply diversity.

(v) Nuclear fallouts

8.23 The Chernobyl explosion gave birth to new fears of peacetime nuclear fallouts. Certainly a drive for self-sufficiency is no insulation against these risks, which need to be managed directly in the context of energy policy.

(vi) Acts of food terrorism

8.24 This is largely a safety rather than supply issue, and could be associated with either domestic or imported food. We have already noted that private firms have most to lose, in the short and long term, from food scares. For Government the key is ensuring current regulations and their enforcement are adequate. If contamination– malicious or accidental - does occur, certain product ranges would be affected and consumer choice reduced, particularly for the more processed foods which appear to be more vulnerable to contamination. Short-run substitution on the demand and supply sides would ensure that food consumption remained robust.

(vii) Pandemic Flu

8.25 Just as manpower shortages during two world wars put strains on food supply, so growing awareness of the potential for a flu pandemic has exposed potential vulnerabilities in modern food supply chains.[151] Businesses have been advised to plan for a cumulative total of 25% of workers taking some time off – possibly up to eight working days – over a period of three to four months. Absenteeism would be likely to peak at around 5-7% at any one time (the higher number including people who take time off to care for those who are ill), with reasonable worst case scenarios suggesting 10-15%.

8.26 The food industry has been viewed by some as being particularly vulnerable. A report by the House of Lords Science and Technology Committee highlighted the

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[150] Peck, *Resilience in the food chain*.

[151] According to the Department of Health, "Experts are concerned that the H5N1 avian flu virus … may emerge to form a pandemic…A flu pandemic occurs when a new influenza virus emerges for which people have little or no immunity, and for which there is no vaccine. The disease spreads easily from person to person, causes serious illness and can sweep across the country and around the world in a very short time", *What is Pandemic Flu?* (2006).

http://www.dh.gov.uk/PandemicFlu/PandemicFluArticle/fs/en?CONTENT_ID=4135538&chk=Sr2G85

need for resilience of food distribution networks in relation to a potential pandemic flu outbreak.[152] It drew attention to a number of potential weak points within the industry:

- an apparent shortage of qualified HGV drivers on whom food distribution networks depend – it was suggested that replacing drivers who fell ill at short notice would be difficult;
- the large numbers of staff required to keep shelves stocked in supermarkets, who again might be difficult to replace in a flu pandemic;
- the potential for panic buying to make any shortages worse.

8.27 In new research for Defra on business continuity planning, all companies consulted "were conscious that a pandemic could mean labour shortages and high levels of absenteeism," leading to store closures and higher levels of home delivery (though there could be reallocation of staff to checkouts). Preparations for dealing with it were "well underway in the biggest supermarket chains and to a lesser extent in the wholesale and smaller supermarket chains".[153]

8.28 In the event of a serious pandemic, the need to ensure workers are retained in essential sectors, such as the food industry, will be key. Government's role would appear to be ensuring industry is clearly informed of the potential for disruption, so it can adapt in the most effective manner. It has been suggested by the industry that in the event of a such an emergency, the waiving of various labour, product and even competition regulations may be necessary to minimize disruption.[154]

(viii) Disruption to ports and shipping

8.29 Serious disruption of UK ports might also impact on food supply. A number of factors must be taken into account. Which commodities would be affected, and how important is the disrupted port in terms of their overall consumption? In aggregate, imports represent less than half of total UK consumption. So, if a port managing 15% of all food imports were to be disrupted, less than 7.5% of total consumption would potentially be affected. However, it might be that one port accounts for 75% of all banana imports to – and therefore consumption in - the UK. As before, the impact on any set of commodities will be reduced by the potential for demand-side substitution. A shortage of bananas, for instance, might mean consumers increase purchases of other available fruits. Much would also depend upon how well anticipated closures were, seasonality effects, and, critically, how long disruption lasted. Box 8-2 details the food importing role of the main UK ports. Fruit imports are prominent in many ports, and there is a significant degree of diversity.

8.30 Impacts of individual port disruptions would also be mitigated to the extent that shipments could be diverted to other ports with spare capacity in order to enter the UK supply chain. Currently, ports are run on a competitive basis and incentives to invest in significant spare capacity have been limited, partly also because of planning obstacles. Whilst the Government has given consent to a number of port developments since 2004 future port capacity will need to expand to accommodate rising demand.[155] Other adjustments are possible to maximise capacity – for

[152] House of Lords Science and Technology Committee, *Pandemic Influenza* (December 2005).

[153] Peck, *Resilience in the food chain*.

[154] Peck, *Resilience in the food chain.*

[155] MDS Transmodal, *UK port demand forecasts to 2030* (for DfT, May 2006). Expansion programmes at Felixstowe and Harwich are now underway and Liverpool is considering the possibility of building a river terminal on the Mersey capable of accommodating "post-Panamax" size container ships. Port

instance, using smaller ships to gain entry into smaller ports. In its consultation on the future of ports, the Government considers whether additional capacity might in any case enhance resilience in the face of disruptions as well as strengthening competition:

> *The importance of ports to national trade and the economy implies that there is a national interest in ensuring the collective robustness and resilience of ports to large-scale disruption (whether natural or by human intervention), perhaps going beyond what the market will ordinarily provide ... Avoiding the risks of under-provision … [might] provide an element of redundancy and greater responsiveness in the event of a disruption.* [156]

Box 8-2 Selected UK ports and their role in food imports and distribution

- **Grimsby** together with its sister port of Immingham is the UK's largest port complex and handles 10% of the UK's entire seaborne trade. Grimsby has become well known as the UK's premier centre for the frozen food industry and plays a pivotal role in the UK fishing industry.
- **Immingham** is the largest dry bulk-handling port in the country as well as being the UK's second busiest ro-ro port. It is handling ever increasing volumes of fresh fruit and vegetables with current imports mainly from the Mediterranean, with potatoes and citrus fruits from Israel. Large volumes of fish are also handled.
- **Hull** is a leading cocoa import centre, providing dedicated storage facilities for major producers such as Rowntree, Nestle and Cadbury's. It is also a major contributor to the UK fishing and fish-processing industries.
- **Southampton** is home to the second largest container operation in the UK and is the sole UK port for all Canary Islands fresh produce such as tomatoes, peppers, cucumbers and advocados. It is also a growing force in the import of dry bulk cargoes sector.
- **Liverpool** is the UK's leading import port for grain and animal feed whilst cocoa is also imported from West Africa.
- **Sheerness** claims to be the leading port when it comes to handling fresh produce including apples, pears, grapes, citrus fruit, bananas, melons, mangoes, avocados and potatoes. Nearly 900,000 tonnes of fresh produce were imported in 2003.
- **Ipswich Port** handles over 1 million tonnes of agribulk cargoes every year including cereals, animal feed and pulses.
- **Portsmouth** handled almost 700,000 tonnes of fruit on 305 ships during 2005. All of Morroco's 45,000 citrus fruits, and 70% of the UK's consumption of bananas along with other exotic fruits from South and Central America, the Caribbean, Jamaica and the Windward Islands.
- **Tilbury** specialises in refrigerated cargoes such as Australian & New Zealand meat. The terminal also handles frozen and chilled goods, butter, cheese, fruit, edible oils including sunflower, rapeseed, palm, coconut and olive oils and further upriver raw sugar is imported from African, Pacific and Caribbean countries at Silvertown. Tilbury grain Terminal is one of the largest grain facilities in the UK handling imports of wheat, maize and soya beans.

capacity is also highlighted in Rod Eddington's *Transport Study* (December 2006), see para 1.38 of the main summary.

[156] DfT, *Ports Policy – your views invited: DfT's discussion document for the Ports Policy Review* (May 2006) http://www.dft.gov.uk/stellent/groups/dft_shipping/documents/page/dft_shipping_611693.pdf, p. 50.

8.31 In the event of serious disruption at a UK container port, it is likely that shipments would be redirected to one of the major EU container ports – such as Rotterdam, Hamburg or Antwerp – before being transferred to lorries and entering the UK as RORO traffic. This could, however, cause logistical problems due to limited compatibility between ports.

8.32 Clearly, the economic role of ports, and the related resilience issues, extends well beyond food. Recognising the critical role that ports play, the Government states

> *We have been working with the industry to ensure that each main port has a contingency plan that provides for a range of scenarios and that allows it to continue to operate a service in the event of disruption arising wherever possible. Such scenarios include the loss of primary power, loss of personnel, and total closure of their facilities – perhaps through blockage of the harbour approach … Some major ports now have a statutory role in contingency planning for major incidents.*[157]

Conclusions

8.33 Whilst it is relatively easy to identify potential threats, without reference to probabilities it is difficult to say how seriously they should be treated. As the OECD notes in its work on multifunctionality, "some of the threats to food security are associated with temporary events, others with long-term developments. Many of them are unpredictable".[158] The random and varied nature of such threats suggests that maintaining food security involves a variety of approaches and certainly cannot be reduced to a simple question of agricultural self-sufficiency or 'lean supply chains'.

8.34 In this vein the OECD suggests that problems of food security should be directly addressed by directly tackling their causes e.g poverty, inadequate information, currency instability, energy insecurity, weaknesses in physical and trading infrastructure. Similarly, proportional contingency and disaster planning, by the private and public sectors remains important. Ensuring industry is fully informed of possible radical disruptions (e.g. pandemic flu), also provides a specific role for Government.

8.35 Because the future is uncertain, there are no single or simple answers. Yet as historical crises have highlighted the importance of substitution, adaptation and innovation, on both the supply and demand sides, so *flexibility* will always be crucial in building resilience to and dealing with short and long term threats: the flexibility of retailers and processors in sourcing widely, switching suppliers and altering logistics; of farmers in responding to large swings in world market conditions; of governments in relaxing regulations that might impede necessary adaptation; and of the trading system in reflecting shifts in comparative advantage.

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[157] DfT, *Ports Policy*, p. 76.

[158] OECD, *Multifunctionality* (2001), p. 47.

9. FOOD SECURITY AND RELATED ISSUES

Key points

- *Links between food security and other food sustainability objectives are weak.*
- *Food security concerns share common elements with energy security, but the differences are greater. Food security itself depends upon national and international energy security.*

9.1 The evidence in this paper suggests that it is misleading to identify Britain's food security with the economic health of its agricultural sector. As the SFFS Forward Look shows, the vision is for an efficient and profitable British agriculture that can make a positive contribution to social and environmental sustainability. Food security is often linked with this wider range of sustainability issues: environmental protection at home and abroad, food transport, local food, health and nutrition, the power of retailers and so on. This section considers the extent to which these wider issues – some of which have been touched upon – have any bearing upon food security.

9.2 For instance, by linking concerns over growing "**food miles**" and "food security" it is possible to suggest that transporting food from "far" countries is both environmentally damaging and risky, such that some form of protection is justified. In fact, all the evidence suggests that the links between food transport and environmental damage are weak, complex and differentiated. Most damage is inflicted internally by road traffic. Air freighting, although the most polluting mode of travel, represents only 1% of all food imports. Furthermore, transport is only part of a broader product lifecycle in which varied and complex **environmental impacts** are generated throughout.[159] And as we have seen, assertions about imports being distant and unreliable have no basis in fact, while self-sufficiency is a rather misleading indicator of food security. Therefore neither food transport nor food security form a logical basis for the restriction of international trade.

9.3 This is why the concept of the "**multifunctionality**" of domestic agriculture or local food can be problematic, particularly when used loosely. By dwelling on the general range of benefits associated with domestic or local or organic production, it can avoid testing the assumptions underlying the separate claims of each, and the implicitly assumed risks and costs associated with imports.[160]

9.4 This is not to say that "**food localism**" is without value. "Local" is not the same as "British", but the renewed interest in provenance, trust, assurance, heritage, authenticity, regionality, farmed landscape and food education – virtual forms of "countryside access" to a "cultural landscape" - clearly have merit. Some of these

[159] A new study for Defra on lifecycle impacts of food concludes that "evidence for a lower environmental impact of local preference in food supply and consumption overall is weak; the evidence for the environmental impact of bulk haulage is not decisive. Since there is a wide *variation* in the agricultural impacts of food grown in different parts of the world (eg in the amounts of water consumed), global sourcing *could* be a better environmental option for particular foods.", University of Manchester (forthcoming)

[160] For a thorough examination of the concept, see OECD, *Multifunctionality* (2001)

aspects demonstrate (local) public good features, although such values are increasingly expressed in market demands for **organic** and **regionally distinctive** produce as well as in increased interest in recreational kitchen gardening and cooking. Ironically it in part reflects a reaction to the negative experiences of FMD, BSE, salmonella and other food safety scares, some of which emanated internally.

9.5 Still, these are weak grounds to link food localism with food security. In the extreme, food localism implies subsistence production, which history shows can be very insecure. Equally, organic production may bring environmental benefits, but its additional land requirements raise questions about the implications for global food supplies – and hence global food security - if organic production were to spread worldwide. Certainly, local sourcing can add to the diversity of overall food supply, but then so does sourcing from different international suppliers. And the weight of evidence in section 7 suggests that decentralised supply chains are no more resilient to disruptions than modern centralised ones.

9.6 The assurance benefits associated with local and organic provide a link with **food safety**, but it is also true that the growing demand for assurance and traceability extends to imported and conventional produce, at least where supermarket sourcing is concerned (see 7.18). Underpinning good food safety practice globally is the Codex Alimentarius, which is a collection of international food standards that cover all the main processed, semi-processed and raw foods, as well as separate EU legislation which applies throughout the chain.[161] A related issue is food *quality*: supporters of local and organic produce have argued, for instance, that modern retailers are more interested in the appearance, rather than taste, of fresh fruit. The quality of supermarket food may be a matter of opinion, but it is not a matter of security: the consistency of generally affordable food supplies provided by supermarkets is not in doubt. Linked to food safety are issues around animal health and welfare. Again these issues are ones either of food safety, or equitable trade (to the extent that welfare requirements differ across borders), rather than food security as such.

9.7 **Nutrition and health** are major food issues, that are at the heart of food security concerns of developed countries. For developed countries such as modern Britain, more illness and death are caused by excessive, rather than deficient food consumption. Whilst domestic agriculture and the food industry has a role to play in promoting good nutrition, many of the key components of decent nutritional health – particularly fruit and vegetables – are imported. The nutritional importance of imports was quickly recognised during the Second World War (para 3.9), and they remain crucial today. Moreover, demand for fruit and vegetables provides crucial export opportunities for economies with far lower incomes than the UK – particularly in Latin America and central and southern Africa. Substitution, for instance, of imported fruit by domestic meat might improve UK self-sufficiency but would not really affect food security, other than in the negative sense of adverse impacts on health.

9.8 Cutting across many of these themes is the predominance and practices of Britain's **major grocery retailers**.[162] Section 7 has examined the implications of modern food chains for food security and highlighted retailers' role in enhancing supply diversity and traceability. Whilst the effect of retail structures on the fortunes of UK agriculture itself remains debatable, the competitiveness and profitability of

[161] See also the discussion on food safety in HMT and Defra, *A Vision for the CAP*, 3.38-3.40.

[162] For an overview of the UK grocery sector by Defra economists, see http://statistics.defra.gov.uk/esg/reports/Groceries%20paper%20May%202006.pdf

domestic production - which is broadly reflected by the self-sufficiency ratio – has little bearing on food security.

9.9 Other trade-offs are apparent. An undue focus on *domestic* food security can obscure the *international and global* dimensions of food security. We have already argued that trade promotes food security by stimulating growth, spreading risks, making better use of limited global resources, and facilitating closer international relations. The global issues of poverty and climate change suggest that the focus of food security must be increasingly on the developing world.

Food Security and Energy Security

9.10 Finally, concerns for food security are increasingly associated with debates over energy security. The latter reflects a number of developments:

- declining North Sea oil and gas production, and the prospect of heavy dependence upon imported gas;
- continental market problems and Russian's supply dispute with the Ukraine;
- increased geopolitical concerns and perceptions of unreliable exporters;
- domestic gas storage problems;
- high and rising cost of crude oil.

9.11 In an energy and oil dependent economy, threats to domestic energy security are likely to have adverse impacts on domestic food security, both through disruptions to food production and distribution, and for lower income groups, through reduced affordability for nutritious food. This makes energy security the prior concern. Indeed, the contrasts between the nature of energy and food supply strongly suggest that the two forms of security should be treated quite differently (Box 9-1).

9.12 Differences apart, there are themes common to both food security and energy security:

- the diversity and reliability of supplies and supply routes;
- the role of market incentives in facilitating supply and managing risks;
- the importance of international market liberalisation and integration.

The DTI's recent paper, *The Energy Challenge* stresses these themes.[163] It recognises that increasing dependence upon oil and gas imports – gas self-sufficiency could fall to as low as 10% by 2020 – will bring new risks. Limiting demand for gas imports will be one aspect of managing risks, but the basic challenges are to promote:

- a strong inernational agenda of more open and competitive markets. This involves building stronger political relationships, supporting energy market liberalisation in the EU and promoting multilateral dialogue on the benefits of investment and trade.

[163] DTI, *The Energy Challenge* (2006), executive summary.

- a market framework in the UK that encourages investment and diversity of supplies, including domestic sources. This includes facilitating appropriate investment in infrastructure and storage of gas.

Box 9-1 How food security differs from energy security

The issues of energy security and food security appear similar, but various factors suggest they are quite different animals:[164]

- Global oil production for export is concentrated far more than food production for export. Oil producing countries have the ability to operate in collusion (OPEC), and several are considered to have unstable or unfriendly governments. The case of food is very different, and to some extent the reverse, as many oil and gas exporting countries are also food importers (e.g. in the Middle East).
- There is more scope for substitution on the demand and supply sides between different foodstuffs than between sources of energy, especially in the short term. Supply of energy involves single large physical networks (e.g. gas and electricity), and there are little alternative means of sourcing energy if these networks are interrupted.
- Unlike food, many sources of energy can be stored for long periods (though electricity storage is limited). Potential volatility of demand, for instance during very cold winters, means that storage is commercially desirable as well. Food demand can surge during periods of 'panic buying' but these tend to be short-lived, and overall food consumption levels generally remain predictable.[165]
- Energy provision is far more capital intensive than food provision. It requires expensive and long-term investment decisions that become 'sunk costs' (eg on extraction, power generation and storage), and in which delay can make supply vulnerable to shortages. The potential for national and local government interference in this sector can also adversely affect incentives to make these investments.[166]
- Cold winters, strong demand and rising energy costs raises the social and political issue of 'fuel poverty' among certain groups of elderly people, who may struggle to keep warm and risk serious illness by keeping heating down in order to save on bills.[167] Food consumption, in contrast to domestic heating needs, typically falls with age.[168]

9.13 For gas, as with food, the way to security is through making markets and trade work more, not less, efficiently. There is no risk-free scenario – it is question of managing risks, in particular facilitating and encouraging the private sector to manage those risks effectively. Yet government's role is likely to be significantly greater in energy than food, simply because the market frameworks involved are more legislative in nature and specialised infrastructure is fundamental to that market.

[164] See also NERA, *Security in gas and electricity markets*, for reasons why energy security is deemed particularly important, and upon which this box draws.

[165] Seasonal demand surges for food and drink (eg at Christmas) are predictable and therefore anticipated by retailers and suppliers.

[166] NERA, *Security of Energy Supply*

[167] According to the DTI, a household is said to be in fuel poverty if it needs to spend more than 10 per cent of its income on fuel to maintain a satisfactory heating regime.

[168] *Family Food in 2004-5* (2006), Table 8.6, though note the cautions on interpreting the figures.

Conclusion

9.14 Just as food security should not be confused with self-sufficiency, nor should it be conflated with wider sustainability concerns and aspirations. *If* food security and sustainability were simply a matter of self-sufficiency, policy would need to be directed towards maximising the production of domestic agriculture, and minimizing dependence upon imports. This might bring in old-style market intervention, price and procurement guarantees, tariffs on imported 'food miles'; tight restrictions on supermarket behaviour, less environmental regulation, and so on. Whether such measures are feasible or not, they would be misaligned with the actual evidence relating to food security and sustainability issues, they would risk causing serious harm to competition, consumers, overall welfare at home and overseas, without necessarily improving either food security or genuine environmental and health concerns. Rather the philosophy of the SFFS and the FISS is to address individual issues directly and to work through, not against market mechanisms and actors, in order to achieve sustainability objectives.

10. CONCLUSIONS

10.1 A number of preliminary conclusions emerge from the range of evidence and analysis in this paper:

- Considered globally, **the UK is, and has long been, 'food secure'.** By contrast, for many developing countries, food security is a major ongoing concern. Food security for them requires, in the short term adequate access and entitlements, and in the long term sustained economic development. These are clearly issues for overseas development policy. Mitigating climate change is becoming increasingly urgent in their regard.

- For richer countries, **threats to food security are less about malnutrition and starvation than food safety and consumer choice**. Higher consumer *expectations* of the food industry suggest that the political risks of food crises could outweigh the human and economic risks.

- **International trade has long been a central feature of UK food supply**, and has remained critical even during times of emergency. There is no reason to suggest this will be less in future. At the very least, UK food security is tied up with the EU single market and, ultimately, the efficiency of the world trading system.

- **Food security goes beyond agriculture**. It involves promoting resilience in the food chain, the security of industrial and trading infrastructure, and, fundamentally, the security of energy supplies.

- **The self-sufficiency ratio is a poor, even misleading, indicator of food security**. It better reflects the overall competitiveness of UK agriculture in meeting domestic and overseas demands.

- **Adaptation through market mechanisms**, and learning-from-experience provides a dynamic and critical element to food chain resilience.

- **Modern risks to food supplies are heterogeneous and uncertain**, suggesting that food security is multi-faceted. And there is growing awareness that threats to security, whether in relation to food, energy or more generally, can arise from within as well as from without.

Policy implications

10.2 These conclusions suggest that a discourse centred on 'UK food security' or 'UK self-sufficiency' is fundamentally misplaced and unbalanced. The real issues extend beyond the UK, beyond agriculture, beyond food. Hence what is called food security cannot be the object of a single policy, but needs to be underpinned by a range of cross-cutting policies. As a multi-faceted, often second-order issue, the efficient policy framework for food security should seek to tackle any related problems directly. Such policies would include:

- contingency planning for severe disruptions;

- promoting and, where appropriate, developing better business and contingency planning, together with relevant industry players; improving co-ordination and information flows across industry; and contingency governance arrangements; early warnings preparedness for private sector.

- strengthening energy security;

- promoting developing countries' food security through development and entitlements, as well as climate change mitigation to head off greater vulnerability;

- strengthening the multilateral trading system, single European market and international relations generally;

- identifying and strengthening resilience of critical infrastructure e.g. ports and utilities;

- tackling domestic poverty issues – also a question of localised access to healthy food, which could have implications for competition and local planning policies;

- promoting a flexible, skilled and market-oriented agriculture, across the EU and domestically, able to flex production in extreme circumstances;

- developing and enforcing food safety regulations;

- promotion of global food security through appropriate international R&D.

10.3 Much of this is already happening, but it also cuts across policy boundaries and different levels of government and governance. The relevant weight accorded to individual policies may vary over time as new threats, trends and circumstances emerge, as we have seen in our broad historical survey (section 3). It is reasonable therefore, to monitor over time what "food security" means for us, and how it can best be promoted. In doing so, clarity of definition (section 2) and understanding of market failure (section 4) and historical change (section 3) are vital in identifying what are the precise challenges and potential solutions (section 9).

10.4 Self-sufficiency is better construed as a broad indicator of UK agriculture's ability to meet consumer demands at home and abroad - its competitiveness. It also suggests that "food security" is not simply or solely an objective of domestic agricultural policy. Recalling the key food security themes outlined in section 2.4, Table 10-1 summarises the main issues as they relate to the current and prospective situation of the UK. It is not exhaustive but highlights the range of considerations.

Further areas of investigation

10.5 Although the broad conclusion is that the current policy framework is appropriate, the multi-faceted nature of food security suggests there remain areas in which further investigation could be informative:

- The potential impacts of climate change on global food potential, and the prospects for global food supply generally, remain important. The work of the FAO and GECAFS continues to be important in this regard.

Table 10-1 Summarising UK food security

	Situation	Issues	Scope for Government involvement
Availability	Wide range of products Wide diversity of supply sources, including overseas; UK has about 60% market share	Dependence on fuel and energy Global food security Food security of developing countries European productive potential	Promoting energy security Focus on global availability / research Strengthening trading system Mitigating climate change
Access	Competitive retail structure Sophisticated distribution system 80-90% of food consumption through retail sector; remainder through food services sector	Dependence on lorry and car transport for distribution and purchasing Excessive retailer concentration at local / regional level	Promoting energy security Ensuring key sectors are supplied in crisis Competition policy Contingency planning for severe disruptions
Affordability	UK has very high per capita incomes; Real price of food has declined over time; Food a declining share of household budgets	Low income groups; Possible “food deserts”	Tackling poverty directly Inclusive and integrated transport Reducing import tariffs (through WTO) Competition policy
Nutrition & quality	UK suffers from calorie excess, not deficient nutrition; Widespread assurance schemes	Related to affordability – poor nutrition linked with low income Excess calorie intake; obesity	Promoting healthy diets
Safety	Food Standards Agency EU and international laws and codes Occasional food scares Private assurance and traceability	Cross-border contamination Food terrorism	Food Standards Agency EU safety laws
Resilience	Scope for demand and supply-side substitution in response to particular shortages Retailers pro-actively managing supply chains	Business continuity planning could be improved Preparedness of industry for crises	Promoting business continuity planning Contingency planning involving industry
Confidence	Consumers have confidence in retailers but have high expectations of food supply Occasional panic-buying of essentials	Confidence issues linked to provenance and assurance rather than actual quantity of food	Importance of communication with industry particularly when crises arise

- The environmental implications (negative and positive) of the evolution of global food production and distribution.

- Popular perceptions of risk and security with respect to food.

- The resilience of domestic and international trading infrastructure.

10.6 Finally, in the light of the analysis in this paper, it is reasonable to ask whether meaningful **indicators of food security** could be developed. The many-sided nature of food security suggests caution in attempts at its measurement.

10.7 For poverty stricken countries, some basic indicators will be more meaningful: for instance, the proportion of incomes spent on food; degrees of subsistence farming; trends in real commodity prices; and so on. For countries such as the UK, attempts to identify indicators must similarly be related to the key issues and cover a number of aspects. These might include:

- indicators of energy security;

- numbers of people who spend a high share of income on food;

- extent of genuine contingency planning across the food industry;

- indicators of multilateral trade in foodstuffs;

- levels of European self-sufficiency and trade (see 6.40);

- nutritional indicators;

- total number of supplying countries (and indicator of diversity);

- productive capacity of UK agricultural land;

- spatial indicators of ‘food deserts’;

As with all indicators, they would need carefully specifying and intelligent interpretation, and to be supplemented by qualitative analysis.

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Annex B Selected definitions of food security

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

> FAO (1996) *Rome Declaration on World Food Security and World Food Summit Plan of Action*. World Food Summit 13-17 November 1996, Rome.

"A country and people are food secure when their food system operates efficiently in such a way as to remove the fear that there will not be enough to eat."

> S. Maxwell (1988) *National Food Security Planning: First Thoughts from Sudan*, Paper presented to a workshop on Food Security in Sudan. Institute of Development Studies at the University of Sussex.

Oxfam defines food security as: "*when everyone has at all times access to and control over sufficient quantities of good quality food for an active healthy life*."

> Humanitarian Practice Network (2001) *Food-security assessments in emergencies: a livelihoods approach.* Overseas Development Institute, London.

"[Food security means] sustained access at all times, in socially acceptable ways, to food adequate in quantity and quality to maintain a healthy life."

> Life Sciences Research Organization (1991) cited in Galal, O. (2002) *Scoping Workshop on Future Activities of ICSU on Food Security*, Paris. Available at http://www.iuns.org/features/sciences_for_food_security.htm

"A basket of food, nutritionally adequate, culturally acceptable, procured with human dignity and enduring over time."

> E. Oshaug (1985) *The composite concept of food security* in 'Introducing nutritional considerations into rural development programmes with focus on agriculture: a theoretical contribution' (ed. W. B. Eide *et al.*). Institute of Nutrition Research, University of Oslo.

"A quantity of nutriments that meets fundamental nutritional requirements and is provided to a person, group or community on a continuing basis."

> European Environment Information and Observation Network (EIONET) Concept definition. http://www.eionet.eu.int/gemet/concept?cp=2760

Annex C Calculation of self sufficiency in food

The self-sufficiency ratio is expressed as the value of domestic production of food as a share of national consumption of food in a given year. This is greater than the same as the import share of consumption because it takes account of exports too. The self-sufficiency ratio can be expressed with respect to all food or to those foods which are considered "indigenous". The following table presents the components of the calculation.

Home production of food for human consumption	**(1)**
Exports of livestock, feed for livestock and crop seeds [i.e. inputs]	(2)
Imports of livestock, feed for livestock and crop seeds [i.e. inputs]	(3)
Net imports of inputs (3-2)	**(4)**
Adjusted home production of food (1-4)	**(5)**
Exports of indigenous type food	(6)
Exports of non-indigenous type food	(7)
Total food exports (6+7)	**(8)**
Imports of indigenous type food	(9)
Imports of non-indigenous type food	(10)
Total food imports (9+10)	**(11)**
Total consumption of food = (1)+(11)-(8)	**(12)**
Total consumption of indigenous type food = (1) + (9) – (6)	**(13)**

➔ **Self-sufficiency ratios for:**

all food = (5) ÷ (12) x 100

indigenous type food = (5) ÷ (13) x 100

Sources of data for calculation are:

- **Production of food for human consumption (1)** – *Defra, Agriculture in the United Kingdom* (sales + change in stocks + fish landed + fish farmed)
- **Imports and exports of agricultural inputs (2 & 3)** - *HM Customs and Excise*
- **Food imports and exports (6, 7, 9 & 10)** - *HM Customs & Excise* (adjusted afterwards for duties, levies and export refunds. Beverages are excluded.)

Imports and exports are **revalued** (see below) to raw food content prices and exclude duties, levies and export refunds. The definition is therefore:

$$\frac{\text{Agricultural output to human consumption + Exports of agricultural inputs - Imports of agricultural inputs}}{\text{Agricultural output to human consumption + Revalued imports - Revalued exports}}$$

A better measure of self-sufficiency might use volume measures or even nutritional values, but adjusted prices are a close enough proxy if the adjustment factors are appropriate. Agricultural inputs are included in the numerator to ensure that the values assigned to food consumption (the denominator) better reflect the UK's ability to produce these goods. So, as the UK is a net importer of inputs, agricultural

production is effectively worth less in the calculation, and the self-sufficiency ratio is lower than it would be if the UK was self-sufficient in its agricultural inputs. However, only livestock, feed and seeds are considered inputs: fertiliser, pesticides, machinery and oil are ignored.

Revaluing imports and exports

Imports and exports of processed food need to be revalued so that they represent their constituent ingredients. This is done by multiplying the value of imports and exports by a revaluation factor. This is determined by the degree, or average 'value added' of processing. These revaluation factors are shown below:

Product type	Revaluation factor
Unprocessed commodities	1.00
Lightly processed foods	0.27
Highly processed foods	0.10

Source: Defra calculations

Unprocessed commodities include those in the raw state (eg fresh or chilled) and those which have been frozen or dried for the convenience of transportation. Foods which have undergone a simple treatment, e.g. gutting of fish, are included in the unprocessed category. Such processing does not add anything to the value of the treated food compared with the unprocessed food.

Lightly processed foods have undergone simple processing which does not add much to the value. They include foods such as joints of meat, cereal flours, pickled vegetables and cheese.

Highly processed foods include those which have a low raw food equivalent content and whose value is greatly increased as a result of processing. Examples are chocolate biscuits, cooked stuffed pasta and chutneys. Whether a food is highly or lightly processed depends upon the increase in value, not the complexity of the nature of the processing.

Changes to the methodology

Some improvements in the self-sufficiency calculation were made in 1998: resulted in

- **Export refunds** – removed from the calculation.
- **Import levies and duties** – removed from the calculation.
- **Agricultural and Fish Production** – fish production now includes farmed fish as well as catches of seafish. Some minor products (e.g. rye, other livestock products) removed.
- **Revaluation of imports and exports** – Imports are now revalued as well as exports.

These changes significantly reduced the estimated value of raw food consumption, and hence a rise (of about 16-17 percentage points) in the self-sufficiency ratio.

The following example shows how the self-sufficiency figure is calculated using data from 2004:

2004 Figures, £m

Home production of food for human consumption	**(1)**	**10,683**
Exports of livestock, feed for livestock and crop seeds [i.e. inputs]	(2)	590
Imports of livestock, feed for livestock and crop seeds [i.e. inputs]	(3)	1,155
Net imports of inputs (3-2)	**(4)**	**565**
Adjusted home production of food (1-4)	**(5)**	**10,118**
Exports of indigenous type food*	(6)	1,424
Exports of non-indigenous type food*	(7)	492
Total food exports (5+6)	**(8)**	**1,916**
Imports of indigenous type food*	(9)	4,373
Imports of non-indigenous type food*	(10)	2,818
Total food imports (8+9)	**(11)**	**7,191**
Total consumption of food (1+11-8)	**(12)**	**15,958**
Total consumption of indigenous type food (1+9-6)	**(13)**	**13,632**
➔ Self-sufficiency ratios for: all food	**= (5 ÷ 12) x 100**	**63.4%**
indigenous type food	**= (5 ÷ 13) x 100**	**74.2%**

** revalued according to their degree of processing.*

The following table shows revaluation of imports and exports, using the 2004 figures:

Item	Original value (£m)	Revaluation factor	New value (£m)
Exports Ind HP	1,309	0.10	125
Exports Ind LP	1,913	0.27	524
Exports Ind U	776	1.00	776
Exports NI HP	423	0.10	40
Exports NI LP	710	0.27	195
Exports NI U	257	1.00	257
Total Exports Ind	**3,998**	**-**	**1,424**
Total Exports NI	**1,390**	**-**	**492**
Imports Ind HP	2,051	0.10	195
Imports Ind LP	6,045	0.27	1,656
Imports Ind U	2,522	1.00	2,522
Imports NI HP	1,387	0.10	132
Imports NI LP	2,196	0.27	602
Imports NI U	2,084	1.00	2,084
Total Imports Ind	**10,618**	**-**	**4,373**
Total Imports NI	**5,667**	**-**	**2,818**

Ind = Indigenous type food NI = Non-indigenous type food

HP = Highly processed LP = Lightly processed U = Unprocessed

Source: Defra calculations

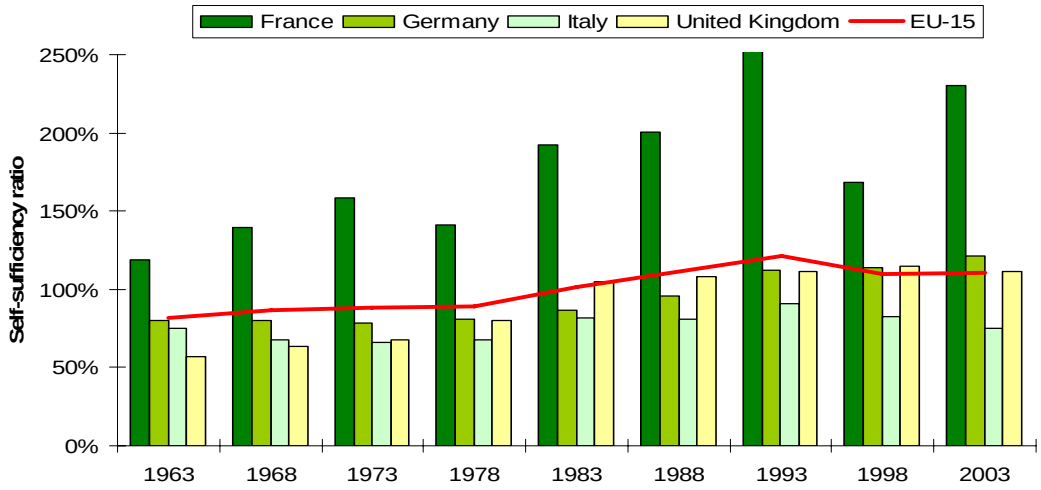
Annex D EU self-sufficiency ratios[169]

Source: FAO statistics. These ratios have been calculated on the basis of:

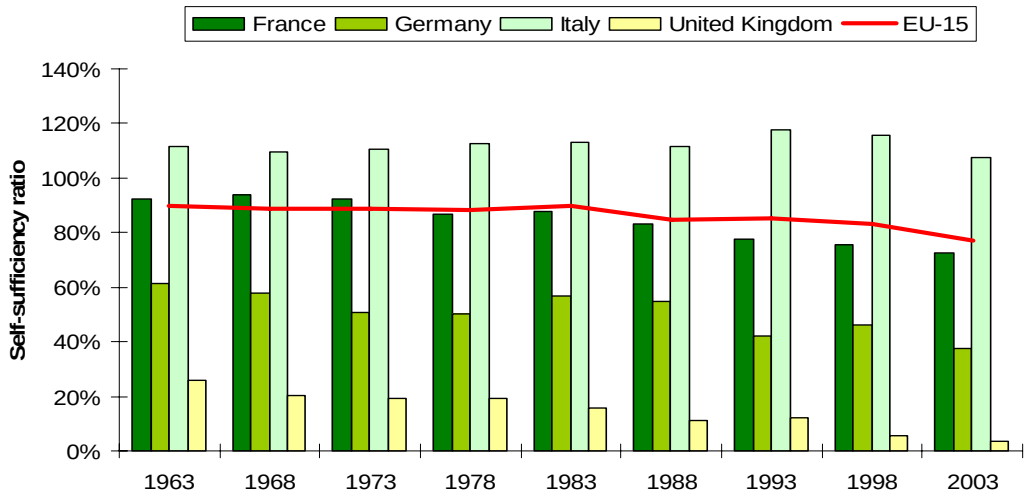
production / (production + imports – exports).[170]

These data are in tonnes, rather than in revalued monetary terms.

EU self-sufficiency ratios for cereals (1963-2003)



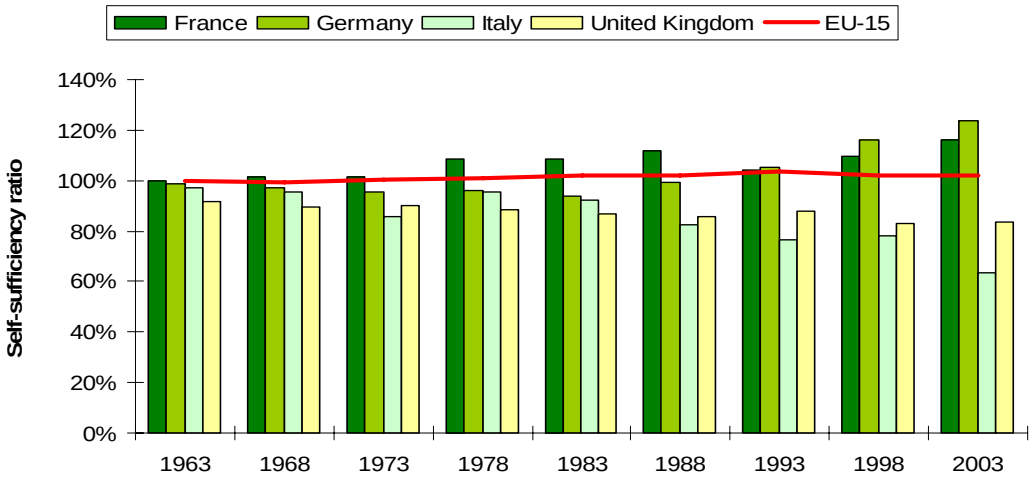
EU self-sufficiency ratios for fruit (1963-2003)



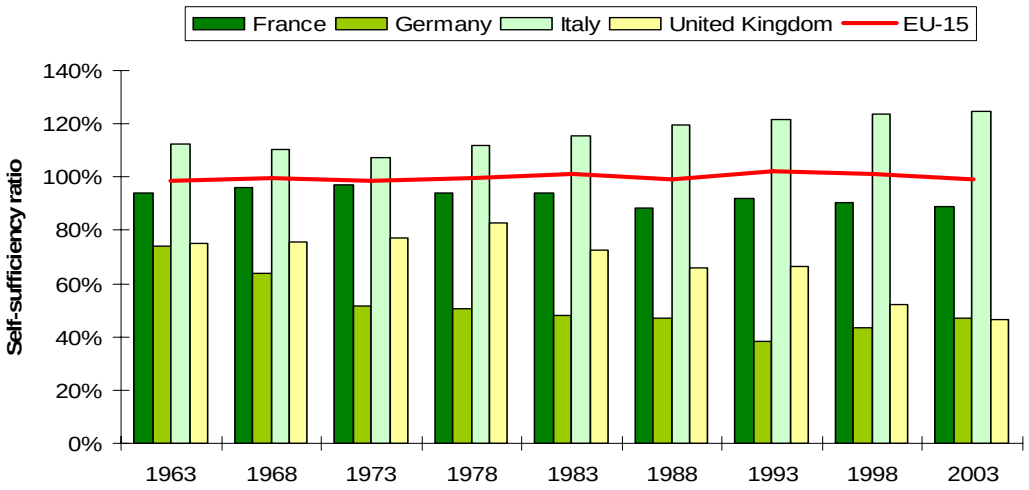
[169] The figure for the EU-15 actually refers to the combined self-sufficiency of the countries which made up the EU prior to the latest accession round, regardless of whether they were actually part of the EC in the years stated.

[170] The underlying EU-15 import and export data are the sums of imports and exports from member states which will be mainly trade between them. Therefore the EU-15 figures are not imports and exports into and out of the EU. However as intra-EU imports and exports should balance out (assuming there are no inconsistencies in data between MS) the self sufficiency ratio should be broadly accurate.

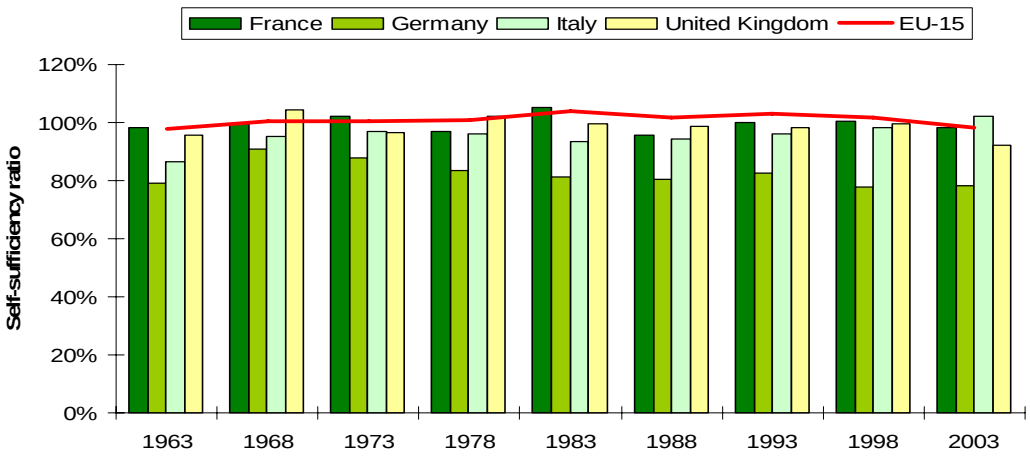
EU self-sufficiency ratios for potatoes (1963-2003)



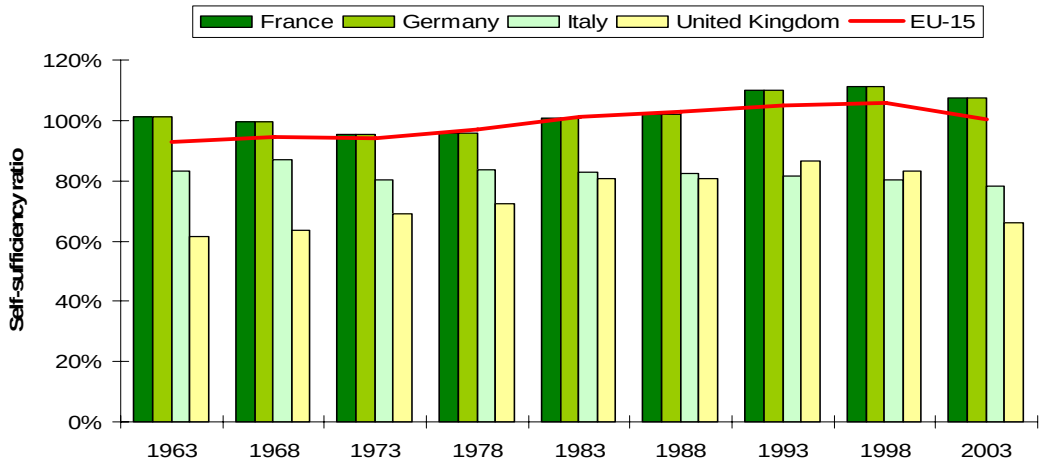
EU self-sufficiency ratios for vegetables (1963-2003)



EU self-sufficiency ratios for eggs (1963-2003)



EU self-sufficiency ratios for meat (1963-2003)



EU self-sufficiency ratios for milk (1963-2003)