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**AGRICULTURE AND STRUCTURAL CHANGE: LESSONS FROM THE UK
EXPERIENCE IN AN INTERNATIONAL CONTEXT**

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I. INTRODUCTION

This chapter examines the role of the agricultural sector in economic growth in the light of its declining share of overall economic activity. Lessons are drawn from the experience of the United Kingdom compared with other developed economies, focusing in particular on the contrasts with the United States and Germany. The share of agriculture in economic activity was bound to decline, given the relatively low income elasticity of demand for food. Although protectionist policies were used to slow down the shift of resources out of agriculture in Germany and in other European countries, these policies had some serious consequences for overall productivity performance.

The chapter is organised as follows. The next section sets out the productivity performance of Britain compared with the United States and Germany on a sectoral basis, highlighting the contribution of agriculture, but also showing how it fits together with industry and services. The analysis is conducted in terms of total factor productivity (TFP) as well as labour productivity levels. Section III then considers the role of structural change, showing how important the shift of resources out of agriculture was for American and German overtaking of Britain in overall labour productivity. Although conventional shift-share analysis suggests a relatively small contribution of structural change to overall productivity growth, this is shown to rest on inappropriate assumptions. Section IV then considers the role of protection in slowing down the shift of resources out of agriculture. Attention is drawn to the adverse consequences of such protective policies, highlighting Olson's (1963) conclusion that although protection preserved a large agricultural sector in Germany, it did not provide food security during two world wars. Section V then applies the lessons from the experience of Britain, the United States and Germany to the wider European economy. There is a very close relationship within Europe between the share of the labour

force in agriculture and the level of per capita GDP, which holds across both space and time. Section VI concludes.

II. UK PRODUCTIVITY PERFORMANCE IN AN INTERNATIONAL CONTEXT

Table 1 presents sectoral estimates of comparative labour productivity levels for the US/UK and Germany/UK cases over the period 1870-1990, derived from Broadberry (1997b; 1997c; 1998). The United States and Germany were Britain's main trading rivals during most of this period. The concept of labour productivity used here is output per person engaged. For the whole economy, labour productivity in the United States was about 90 per cent of the British level in 1870, and the United States overtook Britain as the aggregate labour productivity leader during the 1890s and continued to forge ahead to the 1950s. Since then, there has been a slow process of British catching-up, but by 1990 there was still a substantial aggregate Anglo-American labour productivity gap of more than 30 per cent. Turning to the Germany/UK comparison, for the whole economy, German labour productivity in 1871 was about 60 per cent of the British level, and had still reached only about 75 per cent of the British level by World War I. After a setback across the war, Germany again reached about 75 per cent of the British level by the mid-1930s, rising to about 80 per cent by the late 1930s. After another setback across World War II, Germany continued to catch-up, overtook Britain only during the mid-1960s and by 1990 had a labour productivity advantage of about 25 per cent.

The sectoral patterns of comparative productivity performance are quite varied. Here the nine-sector analysis provided in Broadberry (1998) has been simplified onto a three-sector basis, distinguishing between agriculture, industry and services, as in Broadberry and Ghosal (2002) and Broadberry (2006). Industry includes mineral extraction, manufacturing,

construction and the utilities, while services includes transport and communications, distribution, finance, professional and personal services and government. Both Germany and the United States caught-up with and overtook Britain in terms of aggregate labour productivity largely by shifting resources out of agriculture and improving their comparative productivity performance in services rather than by improving their comparative productivity performance in industry (Broadberry, 1998).

Broadberry (1993; 1997a) established that comparative labour productivity in manufacturing has remained stationary in both the US/UK and the Germany/UK cases since the late nineteenth century, and Table 1 shows that this result generalises to industry as a whole. By contrast, in both cases the aggregate labour productivity ratio moves broadly in line with the labour productivity ratio for services. Although both Germany and the United States have improved their labour productivity performance relative to Britain in agriculture, there has also been a dramatic decline in the importance of agriculture, which can be seen in Table 2. Whereas in 1870 agriculture accounted for about half of all employment in Germany and the United States, by 1990 this had fallen to under three-and-a-half per cent. The shift out of agriculture has nevertheless had an important impact on comparative productivity performance at the aggregate level. This is because in the late nineteenth century Britain already had a much smaller share of the labour force in agriculture, which has had a substantially lower value added per employee than in industry or services. Hence the large share of resources tied up in agriculture in the United States exercised a significant negative influence on the aggregate US productivity performance relative to Britain in the late nineteenth and early twentieth centuries, and as the importance of agriculture declined this negative influence was removed. Similarly, the relatively large share of resources in German agriculture had a negative effect on Germany's aggregate productivity performance relative

to Britain until after World War II. Note that Germany in 1950 had a bigger share of the labour force in agriculture than Britain in 1871.

The labour productivity differences in Table 1 may be explained in part by differences in capital intensity. So it will be useful to provide estimates of comparative levels of total factor productivity (TFP), where TFP measures the productivity of labour and physical capital, weighted by their respective shares in income. The share of capital declines from 0.4 before World War I to 0.25 after World War II. These shares are derived from Matthews et al. (1982), Kendrick (1961) and Hoffmann (1965). Comparing Table 3 with Table 1, we see that although capital explains a part of the labour productivity differences between the three countries, it is not sufficient to eliminate differences in TFP.

For the US/UK case, trends in comparative TFP and labour productivity at the aggregate level are similar, but with TFP differences generally smaller than labour productivity differences. One point worth noting here is that whereas the United States overtook Britain before World War I in terms of labour productivity, it was only between the wars that the United States gained a TFP advantage. This would be consistent with the emphasis of Abramovitz and David (1973; 1996) on the importance of capital rather than TFP in American economic growth during the nineteenth century. It is also consistent with McCloskey's (1970) claim that Victorian Britain did not fail, in the sense that the United States was still catching-up in terms of aggregate TFP levels. In services, too, note that US overtaking of Britain also occurred later in terms of TFP than in terms of labour productivity. For the Germany/UK case, again comparing Tables 1 and 3 we see that trends are very similar for comparative TFP and labour productivity at the aggregate level, with differences in TFP generally smaller than differences in labour productivity. Note that in industry,

Germany had caught up with Britain in terms of TFP as well as labour productivity before World War I.

III. THE IMPORTANCE OF STRUCTURAL CHANGE

It is possible to quantify the relative importance of structural change and internal labour productivity growth to the American and German overtaking of Britain, using shift-share analysis.¹ The basic approach is set out by Nordhaus (1972). The level of aggregate labour productivity (A_0) is given by aggregate output (Q_0) divided by aggregate employment (L_0), and can also be written as the sum of share-weighted labour productivities by sector:

$$A_0 = Q_0 / L_0 = \sum A_i S_i \quad (1)$$

where A_i is labour productivity in sector i and S_i is the share of employment in sector i .

Taking time derivatives, denoted by hats above variables, we have:

$$\hat{A}_0 = \sum \hat{A}_i S_i + \sum A_i \hat{S}_i \quad (2)$$

Dividing through by A_0 and multiplying and dividing the first term by A_i , we have:

$$\hat{A}_0 / A_0 = \sum (\hat{A}_i / A_i)(A_i / A_0) S_i + \sum (A_i / A_0) \hat{S}_i \quad (3)$$

Letting lower case letters denote logarithms this can be written as:

$$\hat{a}_0 = \sum \hat{a}_i (A_i / A_0) S_i + \sum (A_i / A_0) \hat{S}_i \quad (4)$$

The standard shift-share approach is to evaluate the effects of structural change by setting the second term on the right-hand side of equation (4) to zero. A counterfactual productivity growth rate is then obtained as:

$$\sum \hat{a}_i (A_i / A_0) S_i \quad (5)$$

¹ The following analysis was initially reported in Broadberry (1998), but the number of typographical errors makes it difficult to follow there.

The productivity growth rate in each sector is thus weighted by two terms to take account of both the difference in productivity levels between that sector and the aggregate economy (A_i/A_0) and the employment share of that sector (S_i).

A major problem with the basic shift-share approach is that it assumes that productivity growth rates in each sector would be unaffected by the absence of structural change. Thus, for example, during the period 1950-90, agriculture experienced extremely rapid labour productivity growth in most western countries, including the three countries considered here. But it is simply not credible that labour productivity in German agriculture would have grown at 5.99% per annum if agriculture had continued to employ 24.3% of the labour force, as it did in 1950. The modified shift-share approach proposed here proceeds on the basis that counterfactual productivity growth rates would inevitably be affected by the absence of structural change. For the purposes of the calculations below, a standard Leontief production function is assumed:

$$Q = \min(uL, vK) \quad (6)$$

where K is capital and u and v are fixed coefficients. If Kindleberger's (1967) assumption that surplus labour was being reallocated from agriculture to other sectors is accepted, then restoring labour to the agricultural sector would not have raised output, but merely lowered the productivity growth rate of agriculture. On the other hand, taking labour away from the expanding industrial and service sectors would have reduced output as well as employment, thus leaving productivity growth unchanged. If Kaldor (1966) was correct and there were increasing returns to the expanding activities, counterfactual productivity growth should also be reduced in those sectors, and the modified measure proposed here would continue to understate the contribution of structural change. The modified counterfactual productivity growth rate can be written as:

$$\sum \hat{\alpha}_i (A_i / A_0) S_i \quad (7)$$

where the counterfactual productivity growth rate in each sector is given by:

$$\begin{aligned} \hat{\alpha}_i &= \hat{a}_i - (\hat{L}_0 - \hat{L}_i) && \text{if } \hat{S}_i < 0 \\ \hat{\alpha}_i &= \hat{a}_i && \text{if } \hat{S}_i \geq 0 \end{aligned} \quad (8)$$

In a declining sector, the actual productivity growth rate is reduced by the difference between the growth rate of the aggregate labour force and the growth rate of the labour force in the particular sector, while in expanding sectors, the actual productivity growth rate is used.

The modified shift-share calculation can be seen as a generalization of the method used by Denison (1968) to assess the impact of the reduction of employment in agriculture in nine western countries during the period 1950-62. Denison (1968: 254) assumed first, that the percentage increase in total non-farm input and hence in total non-farm output that resulted from the shift out of agriculture was four-fifths as large as the percentage increase in non-farm employment resulting from the shift out of agriculture, except in the United States and Italy, where it was three-fourths as large (the modified shift-share approach assumes a one-to-one relationship in all countries). Second, he assumed that the percentage reduction in total farm output resulting from the shift out of agriculture was one-third as large as the percentage reduction in farm employment in the United States, the United Kingdom and Denmark, and one-fourth as large in the other countries except Italy, and zero in Italy (the modified shift-share approach assumes zero in all countries).

The results of the shift-share calculations over the period as a whole are given in Table 4, using base year-weights. Using the basic shift-share method, internal productivity growth accounts for the bulk of aggregate labour productivity growth in the British and

German cases, and more than the aggregate in the US case, leaving little role for structural change to account for differential aggregate labour productivity growth. Using the modified shift-share method, however, we see that structural change accounts for a significant portion of aggregate labour productivity growth in each of the three economies. The effect of structural change is sufficient to account for the bulk of the Germany-UK aggregate labour productivity growth differential, and to more than account for the US-UK differential, since the decline of agriculture was much more pronounced in the US and German cases. These calculations should be regarded as upper bound estimates of the effect of structural change, but they are nevertheless useful in putting some flesh on Kaldor's (1966) argument that slow growth in Britain reflected "premature maturity".

One way of understanding the existence of surplus labour in declining sectors is to think in terms of the role of demand constraints in structural transformation. Following Chenery et al. (1986), we can split the demand for the gross output of sector i (X_i) into the following components:

$$X_i = D_i + W_i + E_i - M_i \quad (9)$$

where D_i is domestic final demand for the output of sector i , W_i is domestic intermediate demand for the output of sector i , E_i is export demand for the output of sector i and M_i is total imports of products classified in sector i . Slow growth of domestic demand may act as a constraint on the expansion of sector i . If sector i produces output that is geared largely to the satisfaction of final demand, then a low income elasticity of demand may act as a constraint on the growth of that sector. On the other hand, if sector i produces output that is used largely as intermediate inputs, then growth of sector i may be held back by slow growth in the sectors that use the output of sector i as inputs. In tradable sectors, foreign demand (E_i) and foreign penetration of the domestic market (M_i) also need to be taken into account. If there is

technical progress in sector i but demand is constrained in that sector, then this creates the conditions for surplus labour.

The structural transformation between 1870 and 1990 involved a reduction in the importance of agriculture in all three countries. Domestic demand can be seen as playing a role here, with the low income elasticity of demand for food acting as a constraint on further expansion of agriculture, as in Crafts' (1985: 116-122) analysis of the conditions for the release of labour from agriculture during British industrialisation. The low income elasticity of demand for food is a robust finding of the many budget studies conducted for Britain, the United States, Germany and other countries, confirming Engel's law, which states that the proportion of income spent on food declines as income rises (Houthakker, 1957; Deaton and Muellbauer, 1980). Gallman (1960) appeals to Engel's Law to explain the shift out of agriculture in the United States.

However, as noted above, the shift out of agriculture occurred rather later in the United States and Germany than in Britain. To understand the differences between Britain and the United States, we also need to consider the international sphere, with the United States a major net exporter of agricultural produce and Britain a major net importer. At first sight, this might appear to run counter to the comparative labour productivity evidence. However, the US comparative advantage in agriculture during the nineteenth century reflected the abundance of land in the New World compared with the Old World. In addition, David (1996) notes that although output per person was comparatively low in US agriculture in the nineteenth century, hours per person were very low, so that output per hour was correspondingly much higher. This raises another apparent puzzle; if the United States had a comparative advantage in agriculture, why didn't the share of agricultural employment rise?

In fact, the existence of an export market was not sufficient to offset the effects of domestic demand constraints in the US case. As Lewis (1979: 696) notes, “even though 23 percent of agricultural output was exported in 1899, growth in farm productivity lowered the proportion of workers in agriculture because in the absence of such growth the number of workers producing farm output for the domestic market would have increased by more than the total number of farm workers engaged in export production.”

To understand the much later shift out of agriculture in Germany, we also need to consider the international sphere. In contrast to the United States, where agriculture was an exportable, in Germany agriculture was an importable sector, but was prevented from shrinking too rapidly by a policy of protection (Webb, 1982). Hence the release of labour from agriculture was retarded in Germany by policies to switch demand away from imports towards domestically supplied produce.

Although the decline in agricultural employment still played an important role in the structural transformation of Germany after World War II, in Britain and the United States the emphasis has shifted towards de-industrialisation. Here, again, the income elasticity of demand may be expected to play a role, with demand patterns shifting in favour of services as incomes continued to rise. In a budget study for Britain in 1974 using four categories of expenditure, Deaton and Muellbauer (1980) find the highest income elasticity of demand for services, while Houthakker and Taylor (1970) also find income elasticities of demand greater than unity in many service sector categories for the United States since World War II. But to understand the differences between the countries, again we need to consider the international sphere, since industrial goods are tradable. While the United States has maintained manufacturing and non-manufacturing trade balances that were both small relative to GDP, at

least compared to other OECD countries, Germany has maintained a persistent substantial surplus in manufactures throughout the postwar period, and Britain has moved from a position of surplus in manufactures to a position of deficit. However, Rowthorn and Wells (1987: 63-65) also argue that the primary reason for Britain's change from a net exporter to a net importer of manufactures was an exogenous improvement in the non-manufacturing balance of trade. This is an example of the "Dutch disease", with an improvement in the balance of trade leading to an exchange rate appreciation and adversely affecting the competitiveness of the manufacturing sector. In addition to the obvious effects of the rise of North Sea oil production from 1973, Rowthorn and Wells (1987: 155-160) also point to growing self-sufficiency in food (as a result of protection coupled with very rapid productivity growth), substitution of domestically produced synthetic materials for imported natural materials and growing non-government service sector net exports.

The structural transformation, then, can be understood basically in terms of Engel curves, with all three economies moving from agriculture to industry to services as income continued to grow and demand shifted to sectors with high income elasticities of demand. However, patterns of comparative advantage have also played a role in explaining differences in the precise patterns of structural transformation in the three economies.

IV. FREE TRADE, PROTECTION AND THE SHIFT OUT OF AGRICULTURE

1. Before World War I

Before 1914, Britain's continued commitment to openness despite growing restrictions abroad had beneficial effects on aggregate productivity performance through the shift of resources out of low value added agriculture and high productivity in Britain's cosmopolitan commercial and financial service sectors. These factors are rarely given sufficient weight in

the literature on British growth, which focuses on the difficulties faced by British industry as a result of tariffs faced in foreign markets and dumping by foreign producers in the British market.

Free traders in nineteenth century Britain pointed to the benefit to consumers of cheap grain prices arising from free trade in corn (Imlah, 1958: 145-146). However, the implications of this for productivity in domestic agriculture have not received the attention that they deserve in the economic history literature. In Britain, the main impact of the grain invasion from the New World was a shift of the product mix away from grain towards higher value-added pastoral products, coupled with higher capital intensity in what remained of the British arable farming sector (Ó Gráda, 1994: 149-156; Brown, 1987: 25-26, 33). As a result, the high levels of labour productivity that already characterised British agriculture during the Industrial Revolution were raised still further, and the relatively small British agricultural sector continued to achieve output per worker levels on a par with the United States before World War I. The highest levels of labour productivity were recorded in the parts of the New World concentrating on pastoral products, especially Australia, New Zealand and Argentina (Rostas, 1948: 80; Broadberry and Irwin, 2006). In much of continental Europe, however, the response to the grain invasion from the New World was an intensification of agricultural protection from the 1870s to World War I (Bairoch, 1989: 51-69). With grain prices maintained artificially high by tariff barriers, low productivity continental farmers were able to remain in business. Given the weight of agriculture in overall economic activity at the time, this had important consequences for aggregate productivity performance which lasted well into the post-World War II period.

As noted in Broadberry (1997c), Germany had caught up with Britain in all industrial sectors before World War I, but German aggregate labour productivity nevertheless remained at about three-quarters of the British level. This can be explained in part by low productivity in German services, but agriculture played a more important part since: (1) the productivity gap was larger in agriculture than in services; (2) agriculture accounted for a larger share of employment than services; (3) value added per employee was lower in agriculture than in services. Although the United States also had a large share of the labour force in agriculture this was because of favourable land endowments that enabled farmers to produce at high levels of labour productivity, even without much capital.

2. The two world wars

It is worth noting that the strategic justification for protecting agriculture in peacetime so as to secure food supplies during war did not prove to be of much value during the twentieth century. As Olson (1963: 138-140) notes, it was Germany rather than Britain that succumbed to blockade during World War I. Olson (1963: 138-139) points to the ability of the British agricultural sector to expand output on the stored-up fertility of grasslands brought back into arable use compared with the inability of German agriculture to maintain output at full stretch in the face of wartime disruption. However, Olson (1963: 146) also stresses the flexibility of the British service sector through administration as well as distribution as the decisive factor.

One factor behind the increase of arable output in Britain during World War I was a system of guaranteed minimum prices set under the Corn Production Act of 1917. If market prices fell below the minimum for the following six years, farmers were to receive deficiency payments equal to the difference between the market and minimum prices on the volume of output that they produced (Whetham, 1978: 94-95). The system was extended for an

indefinite term in the Agriculture Act of 1920, but when agricultural prices suddenly collapsed the legislation was hastily repealed in 1921 in what became known in farming circles as the “Great Betrayal” (Whetham, 1978: 139-141). Apart from a system of beet sugar subsidies introduced in 1924, there were few measures to protect agriculture during the 1920s, which continued to be a difficult time for British farmers, particularly arable producers. During the 1930s, however, a wider range of protective measures was introduced as prices collapsed still further. Although tariffs and quotas were used in some cases, support for agriculture generally took the form of subsidies and marketing schemes. This was partly as a result of government desires to keep food prices low, but it also reflected the policy of imperial preference. If Britain was to obtain access to Empire markets for industrial exports, then Empire farmers had to have access to the British market for agricultural produce. Hence Brown (1987: 118) sees protection as a great disappointment to British farmers.

As during World War I, Britain was able to survive blockade by Germany during World War II (Olson, 1963: 140). During the later 1930s, as the prospect of war approached, the government made preparations for the expansion of agricultural output, and this was achieved much more rapidly during World War II than during World War I (Brown, 1987: 125-146). Again, it was the possibility of expansion on the grasslands combined with the flexibility of the British service sector that proved decisive (Olson, 1963: 146).

The trans-World War II period saw an increase in the share of the labour force employed in agriculture and industry, which went against the trend since the mid-nineteenth century. Within the context of a controlled economy, capital as well as labour inputs were directed into manufacturing, mining and agriculture on strategic grounds. Yet, as Matthews et

al. (1982: 235-236) point out, the increase in total factor input growth was offset by a decrease in TFP growth, suggesting a tendency to diminishing returns.

3. After World War II

Protection for agriculture and industry continued after World War II, although at a lower level than during the 1930s. The proportion of the labour force in manufacturing continued to rise until 1960, as post-war governments sought to encourage exports and avoid balance of payments problems while maintaining a fixed exchange rate (Matthews et al., 1982: 221). Many restrictions on openness, including quotas, tariffs and exchange controls, were needed to maintain external equilibrium with the over-expanded agricultural and industrial sectors (Foreman-Peck, 1991).

Whereas the encouragement of agricultural production during World War I was followed by the virtual elimination of support during the “Great Betrayal” of 1921, World War II was followed by the reinforcement of support in the 1947 Agriculture Act (Holderness, 1985: 12-13). However, the British system of agricultural protection did not involve the sacrifice of low food prices for consumers. Building on the pre-war schemes, farmers received deficiency payments when market prices fell below guaranteed prices. This was less damaging than the variable levy system, which raises the price to consumers as well as producers (El-Agraa, 1994: 212-214). However, Britain adopted the Common Agricultural Policy of the EEC in 1973, based upon the variable levy system. The scale of support for agriculture during the 1970s and 1980s was considerable, and this can be seen in the return of Britain to self-sufficiency in many agricultural products. Even in wheat, where imports accounted for 77 percent of consumption in 1936-39, imports had fallen to 23 per cent of consumption by 1980-81 (Holderness, 1985: 174). Nevertheless, agriculture is now such a

small part of the economy that its impact on the overall level of productivity is relatively insignificant.

V. AGRICULTURE'S SHARE OF ECONOMIC ACTIVITY AND PER CAPITA INCOME IN EUROPE

So far, attention has been focused largely on the experience of Britain compared with the United States and Germany. However, the lessons from this experience have implications for the wider European experience. Development economists and economic historians have always emphasised the importance of structural transformation as an integral part of the growth process (Lewis, 1954; Fei and Ranis, 1964). As late as the mid-nineteenth century, most European countries still had between half and three-quarters of the labour force in agriculture, so that the key structural transformation during the following century and a half was the shift of labour from agriculture into industry and services. The countries that moved out of agriculture most rapidly also enjoyed the most rapid economic growth. Accordingly, we see a strong negative relationship between the level of GDP per capita and the percentage of the working population in agriculture across countries at any point in time, and also over time within a particular country. Table 5 reports a simple OLS regression of the log of GDP per capita on the percentage of the working population in agriculture, which yields an R^2 of 0.795 and a negative slope coefficient that is highly statistically significant.

The time path of the release of labour from agriculture in the main regions of Europe can be seen in Table 6. While agriculture still accounted for almost half of the labour force in Western Europe in 1870, it accounted for substantially more than half in Southern Europe and more than two-thirds in Eastern Europe. By 1992, the proportions were down to about 5 per cent in Western Europe, a little more than 15 per cent in Southern Europe and still nearly

25 per cent in Eastern Europe. This pattern is suggestive of a “core”, consisting of the West European countries and a “periphery” consisting of the South and East European countries, as noted by Prados de la Escosura et al. (1993).

The South European lag is also visible in the data on productivity in agriculture provided by O’Brien and Prados de la Escosura (1992) and summarised here in Table 7. Output per worker has remained substantially lower in the South European countries of Italy and Spain, while the North European countries can be seen as converging on UK levels of output per worker. It is interesting to note that the high levels of labour productivity achieved in the UK did not depend on high levels of land productivity. Indeed, output per hectare was substantially higher in the rest of Northern Europe, particularly the Netherlands, and did not even lag in most South European countries. The low labour productivity in South European agriculture thus appears to owe more to low levels of land per worker than to low levels of land productivity. This suggests a need to look at organisational and institutional factors to explain the slowness of the release of labour from agriculture in the European periphery.

On organisation, O’Brien and Keyder (1978: 127-137), point to the importance of peasant proprietorship with family labour in underpinning relatively low land-labour ratios in France. By contrast, the system of large aristocratic landowners and their tenants is seen as underpinning relatively high land-labour ratios in Britain. On institutions, Broadberry (1997c) points to the contrast between agricultural protection in Germany and free trade in Britain, while O’Rourke (1997) analyses the different policy responses of European countries to the US grain invasion of the late nineteenth century.

VI. CONCLUSION

This chapter has used the experience of Britain compared with the United States and Germany over the period since 1870 to explore the role of agriculture in economic growth and productivity performance. In 1870, whereas less than a quarter of the UK workforce was employed in farming, agriculture still accounted for around half of all employment in both the United States and Germany. Since agriculture was a low value added activity compared with industry and services, this gave Britain an early advantage in overall labour productivity and per capita incomes, but it was an advantage that was bound to disappear as agriculture declined in importance in all three countries. By 1990, agriculture accounted for 2 or 3 per cent of employment in all three countries. This dramatic decline in the share of agriculture in economic activity was inevitable, given the relatively low income elasticity of demand for food, and in the long run governments could do nothing to stop it. Over shorter periods, however, it was possible for governments to slow down the rate of decline through the use of protectionist policies, and these policies did have important effects on comparative productivity performance. Most notably, the shift of resources out of agriculture was delayed by protectionist policies in Germany. However, as Olson (1963) notes, these policies did not provide Germany with food security during the two World Wars,

Some readers may be surprised at the important role attributed to structural change in this chapter, given the small role that is normally allowed for structural change in shift-share analysis of productivity growth. This chapter shows that conventional shift-share analysis is based on restrictive assumptions, the most important of which is that the very rapid productivity growth achieved in agriculture during the twentieth century could have been achieved without a substantial release of labour. Under more realistic assumptions, a modified shift-share calculation shows that much of the US and German overtaking of Britain can be attributed to the “catching-up” in the release of labour from agriculture.

The final section of the chapter applies the lessons from the experience of Britain, the United States and Germany to the wider European economy, noting that there is a very close relationship within Europe between the share of the labour force in agriculture and the level of per capita GDP. Within Europe, at least, it was essential for a country wishing to attain high levels of overall labour productivity and living standards, to reallocate labour from agriculture to industry and services. Countries which failed to do that remained poor.

TABLE 1: Comparative US/UK and Germany/UK labour productivity levels by sector, 1869/71 to 1990 (UK=100)**A. US/UK**

	Agriculture	Industry	Services	Aggregate economy
1869/71	99.5	154.2	86.5	95.2
1889/91	123.0	139.6	64.3	83.3
1909/11	118.7	150.9	71.6	90.5
1919/20	133.1	158.3	92.1	108.2
1929	118.0	187.8	92.0	112.7
1937	119.2	161.2	89.1	105.9
1950	132.6	217.6	110.2	138.1
1973	125.9	202.2	120.6	137.4
1990	138.8	157.3	119.8	125.3

B. Germany/UK

	Agriculture	Industry	Services	Aggregate economy
1871	58.4	90.5	67.2	61.6
1891	59.8	91.6	65.5	63.2
1911	71.6	106.1	76.4	75.4
1925	57.0	92.9	83.6	74.3
1929	59.3	96.0	90.0	78.5
1935	59.6	97.1	88.8	78.2
1950	44.7	89.4	89.3	76.2
1973	48.1	105.7	127.6	108.6
1990	65.4	98.5	139.0	116.5

Sources: Derived from Broadberry (1997b; 1997c).

TABLE 2: Sectoral shares of employment in the United States, the United Kingdom and Germany, 1870-1990 (%)

A. United States			
	Agriculture	Industry	Services
1870	50.0	24.8	25.2
1910	32.0	31.8	36.2
1920	26.2	33.2	40.6
1930	20.9	30.2	48.9
1940	17.9	31.6	50.5
1950	11.0	32.9	56.1
1973	3.7	28.9	67.4
1990	2.5	21.8	75.7

B. United Kingdom			
	Agriculture	Industry	Services
1871	22.2	42.4	35.4
1911	11.8	44.1	44.1
1924	8.6	46.5	44.9
1930	7.6	43.7	48.7
1937	6.2	44.5	49.3
1950	5.1	46.5	48.4
1973	2.9	41.8	55.3
1990	2.0	28.5	69.5

C. Germany			
	Agriculture	Industry	Services
1871	49.5	29.1	21.4
1913	34.5	37.9	27.6
1925	31.5	40.1	28.4
1930	30.5	37.4	32.1
1935	29.9	38.2	31.9
1950	24.3	42.1	33.6
1973	7.2	47.3	45.5
1990	3.4	39.7	56.9

Source: Derived from Broadberry (1997b; 1997c; 1998).

TABLE 3: Comparative US/UK and Germany/UK total factor productivity levels by sector, 1869/71 to 1990 (UK=100)**A. US/UK**

	Agriculture	Industry	Services	Aggregate economy
1869/71	98.4	153.8	86.3	95.1
1889/91	122.9	139.7	64.3	83.3
1909/11	117.8	151.1	71.7	90.5
1919/20	132.4	158.4	92.2	108.2
1929	117.6	187.8	92.0	112.7
1937	118.8	161.1	89.1	105.9
1950	132.5	218.0	110.2	138.1
1973	127.2	202.4	120.6	137.5
1990	142.0	157.5	119.9	125.5

B. Germany/UK

	Agriculture	Industry	Services	Aggregate economy
1871	58.3	86.0	69.7	61.6
1891	59.8	86.1	71.9	63.2
1911	71.4	102.6	83.2	75.3
1925	57.1	98.0	85.5	74.3
1929	59.4	100.5	92.2	78.5
1935	59.7	97.1	89.6	78.3
1950	44.6	93.3	89.2	76.2
1973	48.1	112.4	118.0	108.2
1990	65.4	103.5	134.3	116.1

Sources: Derived from Broadberry (1997b; 1997c).

TABLE 4: The contribution of structural change to labour productivity growth (% per annum)

	Aggregate labour productivity growth	Internal labour productivity growth	Structural change
A. Basic Shift-Share			
UK, 1871-1990	1.13	1.12	0.01
US, 1869-1990	1.43	1.63	-0.20
Germany, 1871-1990	1.75	1.70	0.05
US - UK, 1869/71-1990	0.30	0.51	-0.21
Germany - UK, 1871-1990	0.62	0.58	0.04
B. Modified Shift-Share			
UK, 1871-1990	1.13	0.88	0.25
US, 1869-1990	1.43	0.71	0.72
Germany, 1871-1990	1.75	0.95	0.80
US - UK, 1869/71-1990	0.30	-0.17	0.47
Germany - UK, 1871-1990	0.62	0.07	0.55

Source: Broadberry (1998:400).

TABLE 5: Regression analysis of the relationship between GDP per capita and the share of labour in agriculture

	Coefficient	t-statistic
Constant	9.47	(166.62)
Agricultural share of labour	-0.032	(-23.69)
R ²	0.795	

Sources: GDP per capita from Maddison (1995; 2003); sectoral allocation of labour from Mitchell (1998).

Notes: The dependent variable is the log of GDP per capita in 1990 Geary-Khamis dollars.

TABLE 6: Percentage of the working population in agriculture, 1870-1992

	1870	1913	1929	1938	1950	1973	1992
W. Europe	49.8	39.5	31.9	30.9	24.6	10.5	5.2
S. Europe	57.3	51.6	52.5	50.7	46.2	30.3	16.1
E. Europe	69.8	65.4	65.6	65.2	61.8	55.5	23.4
All Europe	52.5	48.0	44.8	43.8	38.7	26.4	12.2

Source: Derived from Mitchell (1998).

Note: Figures are unweighted country averages within each region.

TABLE 7: Productivity in European agriculture, 1890-1980 (UK=100)***A. Output per worker***

	1890	1910	1930	1950	1970	1980
UK	100	100	100	100	100	100
Netherlands	82	90	94	94	92	124
Denmark	44	107	127	97	108	108
Germany	63	68	55	42	61	75
France	52	55	58	51	62	69
Italy	28	30	30	22	32	39
Spain	33	31	41	20	27	33

B. Output per hectare

	1890	1910	1930	1950	1970	1980
UK	100	100	100	100	100	100
Netherlands	192	237	282	310	384	525
Denmark	140	202	270	228	217	188
Germany	148	205	218	176	208	194
France	128	136	153	111	128	127
Italy	146	161	180	134	156	151
Spain	58	55	61	46	59	70

Source: O'Brien and Prados de la Escosura (1992: 532).

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