

**LESSONS LEARNED? BRITISH MOBILISATION FOR
THE TWO WORLD WARS**

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14 January 2014

File: WarHarrisonFestschrift1

Draft paper for conference to honour Mark Harrison: Economic History of Coercion and State Formation, University of Warwick, 31 March-1 April 2014.

1. INTRODUCTION

Although a vast amount has been written about Britain during the two world wars, the economic history of these important episodes remains neglected. Economic historians tend to write only about the pre-World War I, interwar and post-World War II periods, while war historians focus largely on military strategy. As a result, there is surprisingly little published work on the economic history of Britain during the two world wars, beyond the official histories commissioned shortly after each war. The official studies after World War II are organised around administrative issues and provide a wealth of detail, but little in the way of an organising framework for understanding the key economic issues. The histories of World War I were commissioned by the Carnegie Endowment for International Peace, and formed part of an international project, but are equally heavy on administrative detail and light on analytical clarity. We attempted to make a start on plugging this gap with two papers on the British economy during World War II (Broadberry and Howlett, 1998) and during World War I (Broadberry and Howlett, 2005). These papers were part of an international comparative project that was initiated by Mark Harrison, to compare the major combatant economies in the two world wars. In writing these papers, we were therefore conscious of the need to focus on contrasts between Britain and the other major combatants in each war considered separately. However, by adopting a similar framework of analysis for each war, we laid the foundations for a study comparing the performance of the British economy during the two world wars. This is the issue which we now tackle in this paper.

The framework adopted here is to compare the two war economies, asking to what extent performance improved in World War II as a result of lessons learned from the experience of World War I. The main areas covered are: (1) the scale of mobilisation (2) fiscal and

financial management (3) managing the external account (4) the reliance on planning versus market mechanism and (5) the impact on wealth.

2. THE SCALE OF MOBILISATION

2.1. War spending

We begin our analysis of the British economy by examining the path of real GDP in World War I compared to World War II. Feinstein (1972: Table 6) provides separate estimates based on the expenditure and income sides of the national accounts, which he averages to produce a compromise estimate of real GDP and it is this which is reported in Table 1. The general pattern of real GDP growth was similar in both wars, expanding until reaching a peak after five years and then declining. However, whereas in World War I the compromise estimate of real GDP rose to a peak in the last year of the war that was 13.2 per cent above the 1913 level and then dropped back close to the 1913 level when the war ended, in World War II the peak in 1943 was 27 per cent above the prewar level (that is, rising by more than twice the rate achieved in World War I) and in 1946 was still 11.5 per cent above the prewar level. It should also be noted that in 1938 real GDP was 27.6 per cent higher than in 1913. The growth of real GDP in wartime was a significant factor in the financing of the war effort; for example, Harrison (1988: 185) estimated that the growth of real GDP in World War II helped to provide more than half of the domestic finance for war expenditure.

War is waged by the state and therefore one simple measure of wartime mobilisation is the increase in state expenditure as a percentage of GDP. This is shown in Table 2, again drawing on Feinstein (1972: Table 5). In both conflicts there was a very rapid expansion in government expenditure in the first two years of war: it almost quadrupled as a percentage of real GDP in World War I and almost trebled in World War II. However, there was a ten

percentage point difference in the peaks of the share of Government expenditure, it being higher in World War II where for four years (1941-1944) almost half of GDP was accounted for by state expenditure. The government share did fall dramatically in the first year of peace (and more sharply in the case of World War II) but perhaps coincidentally in both cases the share in the immediate post-war year was approximately ten percentage points higher than the share in the immediate prewar year. In both wars the expansion in government expenditure came primarily at the expense of consumption expenditure but the bite of wartime austerity was much deeper in World War II: the share of consumption expenditure fell from 77.2 per cent in 1913 to a low of 60.2 per cent in 1917 compared to a decline from 78.8 per cent in 1938 to a low of 51.9 per cent in 1943; put another way, the consumption share in four years during World War II was less than the low point in World War I (Broadberry and Howlett, 1998: 47; 2005: 210).

Figure 1 demonstrates the unprecedented scale of the surge in government spending during World War I, which was dramatically higher than that seen during the Boer War at the turn of the century, and only slightly lower than during World War II. It is easy to understand why World War I has been seen as the first “total war” (French, 1982).

2.2. Labour mobilisation

Another measure of mobilisation for war is the proportion of those employed who are drafted into the armed forces, as shown in Table 3. In these terms, the expansion of the armed forces followed a very similar trajectory in both wars (the more rapid expansion in 1914 compared to 1939 can be explained by the fact that World War I began in July 1914 whilst World War II began in September 1939). However, if we consider the level of total employment we find that whilst total employment at its 1918 peak was 5.8 per cent larger than it had been in 1913,

in World War II the 1943 peak was 16.6 per cent above its 1938 level; this meant that there were almost 3.5 million more people in the total employment peak in World War II compared to World War I and approximately 700,000 more in the Armed Forces (Feinstein, 1972: Table 57). One reason for the larger expansion in total employment compared to the prewar level in World War II was that the pool of unemployment was much larger in 1938 compared to 1913. From a mobilisation perspective the size of the working population is a better indicator than total employment and here there was not a significant difference: the World War I peak in 1918 was 5.2 per cent larger than it had been in 1913, whereas in World War II the 1943 peak was 6.4 per cent above its 1938 level (Feinstein, 1972: Table 57). In both wars, the increase in the size of the working population was partly due to population increase but the main factor was the mobilisation of women (*History of the Ministry of Munitions*, Vol. VI, part IV; Howlett, 2004: 18-19).

2.3. Output of specific goods and services

Britain was a relatively rich country in the first half of the twentieth century, so that devoting nearly 40 per cent (in World War I) or nearly 50 per cent (in World War II) of national expenditure to the war resulted in a formidable war effort. To see what this meant in more concrete terms, it is helpful to examine the output of selected items in Table 4, covering agriculture and services as well as industry, since fighting a total war requires more than producing munitions.

2.3 (A) Agriculture

In both wars the main task facing agriculture was to replace lost imports. In the five-year period 1909-1913, imports had accounted for 79 per cent of wheat and flour consumed in Britain, 74 per cent of cheese consumption, 56 per cent of cereals and pulses, 43 per cent of

butter, 36 per cent of meat (Beveridge, 1928: 359); prior to World War II imports had accounted for 70 per cent of Britain's prewar food requirements (Murray, 1955: 242). War severely curtailed the volume of those imports: between 1939 and 1942, for example, imports of animal feedstuffs fell by 94 per cent, imports of butter by 69 per cent, sugar by two-thirds and wheat by a third (Central Statistical Office, 1951: 167). Given the need to produce enough calories to sustain the population, in both wars resources were diverted from the livestock to the arable sector. However, agricultural policy was slow to change in World War I, since it was widely expected that the war would be over quickly; the shift to the arable sector only started in 1916 (Beveridge, 1928: 105) and, as Table 4A shows, only had a significant impact in 1918. The Corn Production Act of 1917 provided the incentives to make the changes, by guaranteeing minimum prices for a five-year period (Whetham, 1978: 94-95). However, in what became known in the farming community as the "Great Betrayal", the price guarantees, which had been confirmed in the Agriculture Act of 1920, were quickly repealed in 1921 when prices started to fall sharply (Whetham, 1978: 139-141). Hence the prewar distribution of the land between pasture and crops was quickly restored. In World War II, partly as a result of the World War I experience, the shift started almost immediately and the impact on output in the agricultural sector can be seen in Table 4A, with grain and potato production increasing by 81 per cent and 96 per cent respectively between 1939 and 1943, while meat production fell by 36 per cent.

2.3 (B) Munitions Industry

The expansion of munitions in World War I was at first relatively slow, with the modest increase in shell production leading to the "Great Shell Scandal" of 1915 and the formation of the Ministry of Munitions under Lloyd George (Wrigley, 1982: 32). As the private sector-oriented "business as usual" philosophy gave way to direct government control, the Ministry

of Munitions expanded its role to cover a wide range of economic activities reaching a long way back in the supply chain. The range of activities covered by the Ministry of Munitions by the end of the war included: artillery guns, shell manufacture, explosives, anti-aircraft supplies, trench warfare supplies, chemical warfare supplies, optical munitions and glassware, rifles, machine guns, small arms ammunition, aircraft, aerial bombs, tanks, mechanical transport vehicles, railway materials and ropeways and agricultural machinery (*History of the Ministry of Munitions*). The gains in output of the key munitions later in the war, shown here in Table 4B, were impressive, and it is not difficult to see why contemporaries drew the conclusion that state control was better than private pursuit of profit in securing munitions output. However, this conclusion will be examined more critically in Section 5.

The huge expansion of munitions production that was to form the centrepiece of the war effort in World War II required also an increase in the production of machine tools, the output of which peaked in 1942 at nearly 100,000, compared with less than 20,000 in 1935 (Central Statistical Office, 1951: 207). The strain was eased by the import of machine tools from the United States, particularly during the early years of the war, with US imports peaking at more than 33,000 in 1940. The new tools were used to increase munitions output dramatically. To take one important example, whereas in 1938 a mere 2,828 aircraft were produced with an average structure weight of 3,472 lb., by 1941 more than 20,000 aircraft were produced with an average structure weight of 4,342 lb., and by 1944 output had risen to 26,461 aircraft with average weight leaping to 7,880 lb., mainly as a result of heavy bomber production coming on line. Impressive gains in the production of tanks, mortars, rifles and machine guns can also be seen in Table 4B.

2.3 (C) Other Industry

Table 4C shows a significant decline of coal output at the beginning of World War I from a peak of 287 million tons in 1913 to 253 million tons in 1915. One problem was a serious loss of manpower, as miners left to join the armed forces, with employment in mining falling from 1.134 million in 1914 to 0.953 million in 1915 (Mitchell, 1988: 253). However, although the loss of manpower was reversed and employment returned to more than a million in 1917, output continued to decline, falling to just 227.7 million tons in 1918. The declining output and labour productivity occurred in an atmosphere of bitter relations between mine owners and miners (Kirby, 1977: 25-30). This led to increasing government involvement in the industry, starting with price controls and export licensing in 1915 and ending with virtual nationalisation of the mines by 1918 (Redmayne, 1923: 257-269; Supple, 1987: 79-86). During World War II, Britain also experienced a continuous and significant decline of coal output from 231 million tons in 1939 to 183 million tons in 1945. There were a number of reasons for this decline, including disruption to transport facilities caused by German bombing, the loss of experienced workers to the armed forces, poor industrial relations, the curtailment in the supply of vital materials such as timber and steel, and shortages of mechanical cutting and conveying machinery (Supple, 1987: 497-590).

The increased demand for munitions led to an expansion of steel output during World War I, reaching 9.7 million tons in 1917, more than 25 per cent above the 1913 level. However, the expansion of capacity to 12 million tons, much of it completed only during 1919-20, saddled the industry with excess capacity during the 1920s (Burnham and Hoskins, 1943: 45). The increment to output was largely of basic steel, making use of phosphoric ores from the East Midlands (Burn, 1940: 350; Hatch, 1919: 120). Nevertheless, a decline in the output of iron ore in the rest of the country more than offset the expansion of east Midlands ores, so that

overall output of iron ore declined. Since it was not possible to increase imports of iron ore, the increase in steel output was made possible by an increase in the use of scrap iron (Hatch, 1919: 32). The Ministry of Munitions gave a stimulus to collective research in the steel industry, in the search for new high-grade steels and alloys for use in aircraft, tanks and other armaments (Burn, 1940: 369). Annual steel making capacity had reached approximately 13 million tons during the 1930s, and this proved sufficient for World War II needs (apart from additional specialist steel capacity), with steel production fluctuating around this level throughout the war. In particular, this level of production struck a balance between the availability of local ores and the possibility of importing steel from the United States. As Burn (1961: 10) notes, if the imported steel had been replaced by the same tonnage of imported iron ore, less steel would have been available in the crucial years.

While the output of munitions expanded during both world wars, the output of civilian goods declined. Although merchant shipbuilding decreased sharply at the beginning of World War I as shipyards switched to warship production, concern at shipping losses led the government to bring merchant shipbuilding under state control from the end of 1916 (Fayle, 1927: 2019-210). Nevertheless, shortages of skilled labour and steel, together with continuing Admiralty demand for warships, prevented merchant shipbuilding from regaining prewar levels (Fayle, 1927: 239-254). In contrast to World War I, merchant shipbuilding increased at the start of World War II, reaching a peak in 1942 substantially above the depressed level of the interwar period (Broadberry, 1997).

Raw cotton consumption is conventionally used as an indicator of real output for the cotton textile industry (Robson, 1957: 6). On this measure, shown in Table 4C, output in cotton textiles fell relatively gently at the beginning of World War I as demand for textiles for

military use replaced lost export markets (Singleton, 1994: 606). As government controls over the economy tightened, the cotton industry contracted further. Under the Cotton Control Board, established in June 1917, imports of American cotton were cut back sharply to save valuable shipping space, while the proportion of spindles (in the Egyptian section) and the proportion of looms worked was limited (Henderson, 1922: 14-27). As Singleton (1994) points out, however, a considerably larger reduction in cotton textiles output was achieved during World War II. Although some consumer industries, such as clothing and footwear, saw an increase in demand from the military, overall they declined as civilian demand was severely curtailed through rationing and the introduction of utility specifications (Hargreaves and Gowing, 1952: 424-440).

Given the obvious need for the new construction of army camps, training establishments, defence works, storage depots and other types of military installations, plus the need to make good bomb damage, it may seem surprising that the value of construction did not increase substantially, even in nominal terms during both world wars, and even fell substantially in the later stages of both wars despite substantial inflation (Bowen, 1951: 122). As in the coal industry, there was a loss of experienced labour to the armed forces and a shortage of key materials. Nevertheless, again as in the coal industry, there have also been criticisms of the efforts of managers and workers in the industry (Working Party Report, 1950).

2.3 (D) Services

Table 4D provides a number of indicators of transport and financial services, which also made an important contribution to the war effort. Shipping arrivals fell sharply at the beginning of World War I due to the massive dislocation of international trade and the requisitioning of merchant ships and port facilities for military use (Fayle, 1927: 33-48). The

decline gathered pace from the autumn of 1916 as the intensification of the U-boat campaign drove neutral shipping away (Hardach, 1977: 41-43). Although ships had been requisitioned on an *ad hoc* basis since the beginning of the war, from the start of 1917 the whole merchant marine was placed under the authority of a Shipping Controller (Salter, 1921: 38-86). Although precautionary measures such as convoy sailings helped to reduce sinkings, they adversely affected the efficiency of those ships that did continue to arrive at British ports (Fayle, 1927: 274-291). In World War II shipping arrivals again fell sharply at the beginning of the war as the east coast ports were closed to larger vessels, congestion increased at west coast ports, and ships had to travel in convoy (Hancock and Gowing, 1949: 248-268). Shipping arrivals continued to decline until the submarine menace was brought under control from March 1943 (Hancock and Gowing, 1949: 417).

Data on passenger and freight movements on the railways during World War I are unavailable, but a comparison of the years immediately before and after the war suggests an increase in the number of passengers carried and a decline in the freight tonnage. This would be consistent with increased troop movements and a reduction of freight imports. A more complete picture of the utilisation of the railways during World war II can be gleaned from the data in Table 4D. Although the number of passenger journeys did not increase, the average distance travelled rose as service personnel were spread around the country, so that passenger miles increased substantially. Similarly, the increase in rail freight ton miles arose principally from an increase in the average distance of a freight journey rather than from an increase in the tonnage moved, despite zoning arrangements to reduce unnecessary mileage (Hancock and Gowing, 1949: 480-485).

In financial services, the decline in bank loans from 1914 to 1916 reflected a decline in demand as special arrangements were made for financing government contracts (Morgan, 1952: 245). Note that as a result of wartime inflation, the level of advances continued to decline in real terms until the end of the war, despite the increases in nominal terms from 1917 (Feinstein, 1972: Table 61). As a result, an increasing share of clearing bank assets was held in the form of long term government debt (Sheppard, 1971: 29, 118). Similar developments can be seen during World War II, as private sector demand declined and the government ensured that savings were channelled into government loans (Sayers, 1956; Broadberry, 2006).

2.4. Lessons learned

The scale of mobilisation was very high during World War I, certainly when compared with previous experience. However, it was substantially higher again during World War II: for example, we have seen that the peak share of government spending in GDP during World War II was 49.7 per cent in 1943, more than 10 percentage points higher than the World War I peak of 38.7 per cent in 1917.

There were significant differences between how the state approached the war economy in both conflicts. For example, in World War I the government wished to maintain “business as usual”, a principle that was gradually chipped away as the war became more protracted and extensive, whereas even before World War II began, in March 1938, the British state explicitly abandoned this principle with regards to the rearmament programme as early as March 1938 (Hancock and Gowing, 1949: 70). Indeed, the ability to learn from the experience of World War I was crucial to the transition of the economy in World War II.

During World War I, Britain had to face for the first time the economic and social dilemmas posed by fighting a total war. It was an administrative learning experience, at times a painful one, whereby state controls were introduced in a piecemeal fashion (Tawney, 1943). State management of the economy until 1917 tended to be *ad hoc*, and reactive rather than proactive, and only in the last eighteen months of the war did a more coherent system of planning and economic control evolve (Lloyd, 1924; Broadberry and Howlett, 2005: 222-224). Crucially, however, the British state used the experience of World War I to draft plans in the 1930s which could be implemented in the event of another large-scale conflict. Although such extensive pre-war preparations did not mean that state management and control of the economy in the war proceeded without problems, it greatly reduced the administrative friction and disruption caused by moving from a peace time economy to a war economy, which in turn helped with gaining public acceptance of the measures taken. For example, by the time Britain declared war on Germany in September 1939, 50 million ration books were ready for issue (Zweiniger-Bargielowska, 2000: 16-17).

Many of the measures introduced in the first eighteen months of World War II had been adopted or were refinements of measures first adopted in World War I and one of the most important lessons that was learnt from that experience, by the state, capital and labour, was the need for the state to evolve a co-ordinated and comprehensive management of the wartime economy (Hancock and Gowing, 1949: 45-72). The Emergency Powers (Defence) Act, passed on 24 August 1939, was an enabling act that gave the British state extensive immediate powers and the potential to extend them if necessary. Significantly, this bill was passed before Britain declared war on Germany. Initially financial planning held centre stage in wartime planning, necessitating a strong export drive to pay for vital war stores being bought in the USA and for increasingly expensive imports (Sayers, 1956: 257). However, when Churchill became Prime

Minister in May 1940 financial planning was replaced by physical planning and the Treasury was displaced as the most important state body by a series of War Cabinet committees concerned with the allocation of materials, labour and other physical resources (Scott and Hughes, 1955; Hancock and Gowing, 1949: 88-95; Howlett, 1993: 361-378).

3. FISCAL AND FINANCIAL MANAGEMENT

3.1. War Finance

War always causes the government to increase its expenditure and thus to seek the extra funding to finance that expenditure. The exceptional nature of the expansion in government expenditure in both wars has already been noted and this in turn required the state to engage in exceptional fund raising exercises. Generally the state can raise funds by increasing taxation, increasing borrowing or printing more money and, as shown by Table 5, during both wars the British state did all three.

Revenue did increase in both wars as the state increased its tax take using very similar methods in both conflicts, such that in both wars there was a marked relative shift away from indirect taxation to direct taxation (Broadberry and Howlett, 2005: 215-217; Howlett, 2004: 13-15). Income tax revenue was boosted by raising the rate of tax and by pulling more people into the tax net, either directly by lowering the exemption limit or indirectly via inflation.

In World War I the standard income tax rate was doubled to 12 per cent in the first war budget of November 1914, and was then raised progressively throughout the war, finally reaching 30 per cent in 1918/19. The exemption limit was reduced from £160 to £130 in 1915, which combined with wage and price inflation to increase the number of tax-payers from 1.1 million prior to the war to 3.5 million in the final year of the war (Mallet and

George, 1929: 322-328, 395-398). Most of these new taxpayers were wage earners who became liable for tax between 1916 and 1918 (Balderston, 1989: 236-237). In World War II the standard rate of income tax doubled from 25% in 1937/38 to 50% in 1941/42 (Sabine, 1970: 304). More importantly, the proportion of the population paying tax was greatly widened through such measures as the introduction in 1943 of the Pay-As-You-Earn scheme (Sayers, 1956: 112-113).

A significant wartime fiscal innovation in World War I was the Excess Profits Duty and it was again used in World War II. It was the first tax to be levied on companies as opposed to their shareholders. Introduced in the September 1915 budget it taxed profits in excess of a stipulated peacetime standard. The rate was initially 50 per cent but was increased to 60 per cent in April 1916 and then 80 per cent in May 1917. In World War II the Excess Profits Tax was initially set at a rate of 60%, and raised in 1940 to 100% (Sabine, 1970: 158-159; 168-169). There is no doubt that it was subject to much evasion and fraud in both wars but even so it was spectacularly successful as a revenue generator: by 1918/19 it was raising £285 million for the exchequer, almost a third of total revenue, making it the single most important tax wielded by the state; in World War II it was relatively less important but at its peak in 1943 it still generated £482 million (Broadberry and Howlett, 2005: 217; Sayers, 1956: 223).

Despite the impressive increase in government revenue, Table 5 shows that in both conflicts the onset of war quickly overwhelmed revenue capacity: in 1914/15 revenue funded only 40 per cent of expenditure and in 1940 only 35 per cent. Hence, the government had to turn to other sources of finance to cover the budget deficit. In both wars long term domestic borrowing was the most significant factor: in World War I about 60 per cent of the deficit was financed this way and in World War II the proportion was slightly higher, financing

about two-thirds of the deficit. Short-term floating debt, principally in the form of Treasury Bills and Treasury Deposit Receipts was another important source of financing the deficit (Kirkaldy, 1921: 153-162; Sayers, 1956: 223). In World War I another important source of finance was borrowing from abroad, particularly from the United States (Kirkaldy, 1921: 175-183); of course, the United States was even more important to the war effort in World War II via Lend-Lease aid, which is not captured in Table 5.

To a limited extent, the government also financed the deficit by allowing an inflationary expansion of the money base, more so in World War I (Capie and Wood, 1994: 232-234). Goodhart (1986) sees the sharp increase in the money base (M0) during the first few months of World War I as necessary to meet a run to cash by UK residents. However, historians generally agree that the injection of liquidity was too large and went on for too long, and was thus a contributing factor to wartime inflation (Capie and Wood, 1994: 233-234). There has been no formal attempt to measure the success of anti-inflation policy during World War I along the lines of Capie and Wood's (2002) study of World War II. However, we see from Table 6 that the GDP deflator, the retail price index and the money supply (measured by broad money, M3) all approximately doubled between 1918 and 1945. Between 1939 and 1945, by contrast, although the money supply approximately doubled, the GDP deflator and the retail price index increased only by around 50 per cent.

3.2. Lessons learned

Whilst we have noted that there were some broad similarities in terms of how the state raised revenue during the two world wars, there was a significant difference in the ethos of fiscal policy in the two conflicts. In World War II the state took an earlier and more explicit

approach to managing the financial resources of the economy, mainly to better control inflation.

At least until 1917, British fiscal policy in World War I was governed by the “McKenna Rule”, which saw the duty of fiscal policy as raising enough revenue to pay for normal peacetime expenditure plus the interest on war loans (French, 1982: 106). This policy has been criticised for being too cautious and for stoking wartime inflation (by not mopping up excess expenditure in the economy). However, it has also been argued that political, social and practical constraints meant that it would have been difficult for the state to pursue a more vigorous policy (Peden, 1985: 40-44; Balderston, 1989: 222-224).

At the heart of the new approach in World War II was an economist, John Maynard Keynes. The traditional account usually places Keynes’s contribution to the conduct of fiscal and monetary policy close to the centre of the story (Sayers, 1956; Pollard, 1992). Keynes developed the idea of an “inflationary gap” to analyse the problem of war finance (Keynes, [1939]). He viewed the orthodox “Treasury View” of calculating how much tax revenue would be available on the principle of how much people would be willing to pay as a recipe for inflation. He argued, rather, that the government needed first to calculate national income, so as to assess the war potential of the economy, and then set taxes at the level needed to bring about the necessary transfers from the taxpayers to the government. The extra wartime taxes could be treated as forced savings or deferred pay to be repaid after the war. This had the additional advantage of building up potential purchasing power that could be released in the event of a postwar slump, as well as financing the war effort. To the extent that the government failed to achieve the required levels of taxation or forced savings, there would be an inflationary gap, since the excess of aggregate demand over aggregate supply would bid

up prices. In making this analysis, Keynes was influenced by his work in the Treasury in World War I and in “How To Pay For The War” he made explicit reference to the inflationary experience of World War I (Keynes, [1939]: 422-425). The 1941 Budget made explicit use of the national accounts and the idea of the inflationary gap: the Keynesian Revolution (albeit in the peculiar setting of total war) had arrived (Broadberry and Howlett, 1998: 48-49). Whilst embracing a Keynesian approach to limit demand-pull inflation, this budget also utilised cost of living subsidies to tackle cost-push inflation (Sayers, 1956: 90).

Another tool in the state armoury for controlling demand was rationing. In World War I rationing was not introduced until 1918, although some localised rationing had begun in November 1917, and eventually covered sugar, meat, butter, margarine, bacon, ham and lard (Beveridge, 1928: 206-207; Barnett, 1985: 146). In World War II, however, rationing was used from the start and eventually far more extensively: by the spring of 1945, rationing covered about one half of consumer spending on goods at prewar values and about one third of consumer spending on goods and services (Mills and Rockoff, 1987: 209).

In conclusion, the state was more successful during World War II in controlling the price level, which Capie and Wood (2002) attribute to taxation policy, bond finance and, in contrast to World War I, the widespread use of ration coupons. The inflationary consequences of the expansion of the money base were also muted by the extensive controls exercised over the banking sector, thus limiting the money multiplier effects.

4. MANAGING THE EXTERNAL ACCOUNT

4.1. The impact of war on the on the external account

There is a marked contrast in the experience of the British economy in the two world wars when we consider the balance of payments (see Table 7). In World War I, merchandise exports, whilst not exceeding their 1913 value, remained relatively stable between 1914 and 1918, whereas in World War II they slumped by almost half between 1939 and 1943. It should be noted, however, that these values are in current prices; export prices increased by 153 per cent between 1913 and 1918 and by 85 per cent between 1938 and 1945, so that real exports fell substantially during both conflicts (Feinstein, 1972: Table 64). At the same time, merchandise imports rose in both wars in current prices, although this was due to a substantial increase in import prices, with imports in constant prices falling. The overall result was a deficit on the balance of trade measured in current prices in every war year. However in World War I this did not lead to a current account deficit in most war years due to the resilience of invisible earnings, which rose from £315 million in 1914 to £580 million in 1918; the overall current account for the period 1914-18 was, just, in surplus. In contrast, in World War II invisibles were much weaker, and from 1943 exacerbated the merchandise deficit, with the result that the current account was in deficit in every year and the overall deficit for the period 1939-45 was £10 billion.

The difference between the two conflicts can also be seen in the capital account. For example, the fact that in World War I the external account was not a serious threat to the war effort meant the government felt confident enough to loan more to allies than it borrowed from them in all years apart from 1918. Total overseas borrowing by the government during the war amounted to £1,365 million by the end of the financial year 1918/19, with 75 per cent coming from the United States, but this was more than offset by wartime government overseas loans which, by the end of the financial year 1918/19, totalled £1,741 million (Morgan, 1952: 317, 320-321). In contrast, in World War II government borrowing exceeded

government lending in each year and net borrowing, primarily from the United States, for the war period amounted to £5.4 billion. In World War II the external situation deteriorated far more rapidly and with potentially far more serious consequences than in World War I: external liabilities more than doubled between December 1939 and December 1941, by mid-1940 assets in North America were being sold off cheaply in a desperate attempt to pay for American goods, and by the beginning of 1941 hard currency reserves had been exhausted (Sayers, 1956: 438-64). To a large extent the situation was rescued by the passing of the Lend-Lease Act in the United States in March 1941; this would prove to be the single most important method of financing the current account external deficit in World War II. The introduction of lend-lease considerably relaxed the external constraint and allowed a much greater degree of specialisation by Britain on war work than would otherwise have been possible (Allen, 1946). The deficit was also covered by the £1.1 billion sale of investments (the equivalent figure for World War I was £236 million) and the accumulation of £3.4 billion of liabilities (Broadberry and Howlett, 1998: 52-53).

Although Britain was effectively off the gold standard during World War I, the authorities did attempt to keep sterling at the pre-war parity of \$4.86. However, the pound depreciated during 1915, reflecting the deterioration in the trade balance, reaching a low of \$4.49 in October. The entry of the United States into the war saw the exchange rate recover to \$4.76, where it more or less remained until Britain formally left the gold standard in April 1919 (Pollard, 1992: 27). In World War II, despite the massive current account imbalance, the exchange rate was maintained at a fixed parity of \$4.03, about 20 per cent below the old gold standard parity, protected by a system of import controls and foreign exchange restrictions (Pollard, 1992: 178).

4.2. Lessons learned

From the perspective of the external account, the issue is not primarily “lessons learned” but one of legacy: Britain’s experience in World War I weakened its long term international position and that in turn meant that behaviour was more constrained during World War II.

In 1914 central gold reserves were £34 million, other monetary gold stood at £123 million and dollar securities totalled £535 million (Pollard, 1992: 27). However, World War I was a watershed for the international economy and the central role of Britain in the pre-1914 world economy was lost (Wrigley, 2000). The problems for the British economy were to be long term: the sale of overseas assets, the postwar external changes which exposed the wartime overseas borrowing policy, and, it is argued, the inability to defend the value of sterling weakened the external position of the economy in the interwar period and saw supremacy in international trade and finance pass to the United States (Burk, 1985). Thus, whilst it was the rise in domestic debt which dominated the dramatic rise in the national debt during the war (less than a fifth of the national debt of £7,280 million in March 1919 was accounted for by foreign debt) the weakening of Britain’s international situation, which was a direct consequence of the war, did reduce the capacity of the economy to service the debt in the interwar period.

Hence, as we have seen, whereas the balance of payments position permitted the British government to act as a net lender to the Allies during World War I, a substantial current account deficit during World War II made the British government a major net borrower on capital account. Perversely, though, loan defaults after World War I put significant pressure on the interwar British economy, whereas the massive British borrowing during World War II

had a less severe economic impact in the medium term because of the forgiving of American Lend-Lease aid.

5. PLANNING VERSUS THE MARKET

5.1. The growing role of government controls during World War I

In the previous sections, we have noted that the government was slow during World War I to appreciate the need for large scale intervention and coordination when fighting a total war. However, it would be wrong to characterise the economy in the early years of the war as operating as if peacetime conditions still held. It was not “business as usual” because from quite early on the state was intervening in markets and the war was encroaching on normal economic practice. However, state intervention in and management of the economy was relatively *ad hoc* in approach until 1917 and tended to be reactive rather than proactive (Lloyd, 1924: 260). The spread of government controls was generally slow, because the economic and material burden of the war was initially underestimated. Pre-war plans had envisaged a strategy based on naval blockade with an army of about 130,000 troops, plus the financing of European allies (Ministry of Munitions, 1923, Vol. I, part I: 7-45). The rapid expansion of the armed forces therefore initially overwhelmed the capacity of the economy to equip them, although Trebilcock (1975) doubts whether even an army of 130,000 could have been equipped. Until Lloyd George became Prime Minister in December 1916 intervention in the economy was for very specific purposes; there was no attempt before that date for the state to take general control of the economy.

The most significant embodiment of the spread of government influence was the creation on 9 June 1915 of the Ministry of Munitions with a key role in the co-ordination of war production (Ministry of Munitions, 1923; Wrigley 1982). This had two main functions: to

supply munitions and stores to the Army and the Admiralty, and to control the supply of materials that were deemed crucial to war production. The Ministry was given wide powers and was not constrained by financial controls from the Treasury. The government softened the blow to the private sector by recruiting many prominent businessmen to run and advise the Ministry. Indeed, businessmen were co-opted by the state in many other areas, so that although the state was displacing the market, it was not necessarily displacing business. In this sense, there was still “business as usual”.

Even though government intervention in the economy was extensive by the end of the war, it spread at a slow pace until 1917. Although there were internal and external controls on capital, the control of labour was quite limited compared to the experience of World War II. Indeed, even army conscription was not introduced until March 1916. The government did try to placate labour by negotiating a deal on industrial arbitration and dilution in 1915 and by appointing the trade union leader John Hodges as a Minister of Labour in 1916. The state built its own factories, the National Shell factories, and took control of the railways, shipping, collieries (from December 1916), flour mills (April 1917) and the Irish distilleries (May 1918) as well as 125 other privately owned factories. It requisitioned the output of several industries (such as jute, flax and glycerine) or used its powers to restrict output or distribution in many other industries (including building, cotton spinning, beer, sugar, timber, fertiliser, iron and steel, and paper) via licensing or by regulating the amount of materials or labour allocated to the industry. It became the main, or only, purchaser of important raw materials (such as sugar, meat, imported wheat, wool, jute, indigo, Russian flax and Italian sulphur) whilst price fixing was used to restrict war profiteering (Morgan, 1952: 46-57; Lloyd, 1924).

As with most government intervention, policy in the area of food was reactionary. By the end of 1916 growing shortages and rising prices were causing domestic unrest. This led to the gradual expansion of state control over domestic food production and imports such that by the end of the war the Ministry of Food was responsible for 85 per cent of the food supply (Beveridge, 1928: 57). Rationing was not introduced until 1918, although some localised rationing had begun in November 1917, and eventually covered sugar, meat, butter, margarine, bacon, ham and lard (Beveridge, 1928: 206-207; Barnett, 1985: 146). Differential dietary requirements were met by bread, which had been subsidised since September 1917 and was freely available (Zweiniger-Bargielowska, 2000: 12-13).

5.2 Controls during World War II

As noted in section 2.4, governments during the approach to war in the 1930s made extensive preparations to move more quickly to a total war footing, in the belief that controls had been adopted too slowly and on an ad hoc basis during World War I (Hancock and Gowing, 1949: 45-72). In addition to the macroeconomic measures to close the inflationary gap discussed in section 3, the government also used a barrage of microeconomic measures to ensure that the demand for individual goods was brought into line with supply, including: (1) overall central planning to set priorities; (2) rationing to curtail consumer demand; (3) production quotas and the concentration of production in large units in civilian industries (4) central manpower budgeting to allocate labour across sectors; and (5) central allocation of scarce resources such as steel and capital (Wiles, 1952: 125-158).

Although there were mechanisms of control and planning during World War I and during rearmament, Wiles (1952) argues that rational overall planning only really began with World War II. The War Cabinet discussed strategic issues, and overall priorities were fed through a

production committee to the supply departments, although the details of the structure changed during the course of the war (Howlett, 1993: Chester, 1952). At the departmental level, new Ministries of Supply, Home Security, Shipping, Food, Economic Warfare and Information quickly appeared at the outbreak of war, reflecting the changed priorities of the war economy (Hopkins, 1952: 1-4). In the formulation and co-ordination of economy policy, the newly established Economic Section of the War Cabinet secretariat and the Central Statistical Office came to play an increasingly important role (Chester, 1952: 14-19).

A number of items were rationed from the outbreak of war and rationing gradually spread to more consumer goods and services (Zweiniger-Bargialowska, 2000: 9-59. By the spring of 1945, rationing covered about one half of consumer spending on goods at prewar values and about one third of consumer spending on goods and services (Mills and Rockoff, 1987: 209). Initially, rationing operated on a coupon basis, with consumers entitled to fixed amounts of rationed items (Hancock and Gowing, 1949: 446). From 1941, however, a more flexible points system was introduced, whereby coupon points could be spent on a limited number of goods, thus allowing consumers some scope for substitution in line with preferences (Hancock and Gowing, 1949: 329-332; Reddaway, 1951: 182). It has been argued that the rationing system operated more effectively in Britain than in other countries. Although some writers see this as reflecting a greater spirit of voluntary compliance in Britain, Mills and Rockoff (1987) attribute it mainly to the greater scale of resources devoted to the issue, with a fuller array of controls backed up by both financial and legal resources, ensuring a strict supervision of both production and distribution.

Much civilian production was cut back severely at the beginning of the war, particularly through Limitation of Supplies Orders (Wiles, 1952: 151; Hancock and Gowing, 1949: 117-118). In many consumer industries, the state also implemented a temporary wartime concentration of production drive to gain economies of scale and standardisation. Figures from the Federation of British Industries suggest that this drive released 255,900 workers and 61.2 million square feet of capacity for munitions and related industries (Howlett, 1994: 144).

One aspect of the mobilisation of labour for the war effort was the need to bring about an overall increase in labour supply by securing increased female participation to replace males recruited into the armed forces. An additional boost to labour input came from the elimination of the mass unemployment of the 1930s. However, in addition to increasing the labour input, it was necessary to reorient civilian labour supply away from group III industries producing inessential civilian items and into the essential group I industries producing war supplies, while maintaining employment and output in essential group II non-war industries such as fuel and power. Although during the early stages of the war labour problems appeared mainly in the form of bottlenecks with skilled labour, as time went on the general supply of labour was seen as a constraint. From December 1942, with the first Manpower Budget, the problem of the allocation of labour between the production programmes of the different government departments was tackled directly (Hancock and Gowing, 1949: 146). “Manpower” was the term coined in that bygone age, less gender-conscious than our own, but in wartime the most rapidly growing element was “womanpower”. The government had wide powers of labour compulsion which it used to control the supply of labour to both the armed forces and industry, although where possible it relied on voluntarism and co-operation (Robinson, 1951: 50).

Other inputs of vital materials and capital were also controlled by the government. For vital materials such as steel, each government order or licensed private order for a product requiring steel carried with it a right to the required amount of steel. This right, known as an “M form” could be cashed at a steelworks. This was administratively complex and led on occasions to “coupon inflation” when too many M forms were chasing too little steel (Wiles, 1952; 148-149). The Capital Issues Committee controlled all new issues on the capital market, but this is not the same as control over physical investment. Although building, and at times machine tools, were subject to close control, most investment was controlled only indirectly through the controls on labour and materials (Wiles, 1952: 144).

5.3. Markets, planning and economic performance

The standard approach to the economic history of Britain during the two world wars, reflected in the literature surveyed above, has been to stress the limitations of reliance on market forces, the slowness of governments in World War I to learn that lesson, and the benefits of the swift transition to a planned economy during World War II. Is it possible, however that the lessons were learned too well in Britain, and that the belief in the efficacy of government controls went too far? And could this be a factor in the relatively poor performance of the British economy during the postwar period? To answer the first question, it is necessary to consider the role of market forces in the successful conduct of the British war economy. And to answer the second question, we need to consider the impact on Britain’s productivity performance of the restrictions on competition which were consolidated during World War II, and continued into the postwar period, 1945-1979.

Few historians are likely to be persuaded that the achievements of the British war economy can be put down to the smooth operation of market forces during the war itself. But did policy-makers under-estimate the positive effects of Britain's liberal politico-economic inheritance compared to her main rivals, and therefore over-estimate the contribution of government intervention and planning? Britain was, along with the United States, the most developed market economy in the world in the first half of the twentieth century, and had a political, administrative and financial history that strengthened her ability to wage war successfully. Olson (1963: 73-116) has made this point strongly in discussing food supply. Prior to World war I, Britain was far more dependent than Germany on imported food supplies and during the war, Germany waged a (militarily) successful submarine campaign to disrupt and destroy British food imports. But the campaign did not succeed in starving Britain to surrender. Olson argues that this was because Britain's prewar free trade policy had greatly reduced the size of the agricultural sector, which in turn gave it a capacity for substitution and flexibility that allowed farmers to respond to the German blockade. Also, unlike Germany, which had boosted its agricultural sector to provide a defence against potential wartime blockade, Britain had not attempted to allow strategic motives to distort its economic advantages in those years. Finally, when the food situation did deteriorate in the war and state intervention became necessary, Olson argues that "its relatively unified electorate and generally efficient civil service" allowed Britain to impose controls and execute them effectively.

In a similar vein, Balderston (1989: 224) argues that the development of London as the leading financial centre in the world, and the capacity of the capital market to absorb public debt was extremely important for the British war economy. It provided an efficient mechanism for financing the war effort and acted more generally as "a powerful stabilising

agent on the short-term behaviour of the British economy". The inheritance of a strong market economy, together with the financial clout of the City interacted together with a strong public administration and (for the time) a well-developed democratic accountability, to provide an economic and political capacity and flexibility that would help to ensure victory. A comparison between Britain and Germany brings Britain's advantage into sharp relief (Olson, 1963; Ferguson, 2000). It is important not to be mesmerised by Germany's rapid industrialisation from the mid-nineteenth century on the basis of protectionism, state intervention and universal banks (Gerschenkron, 1962). Britain's steadier, more-market-oriented development made for a more flexible economy which was better able to stand the strains of total war.

The generally positive evaluation of economic planning during World War II reinforced a disenchantment in some quarters with reliance on market forces that had grown out of the mass unemployment of the Great Depression. Although the Labour Party, which formed a majority government for the first time in 1945, rejected a wholesale move to a planned economy in favour of a mixed economy with an emphasis on the achievement of full employment through Keynesian demand management, there remained in government circles a distrust of competitive market forces, which permeated economic policy (Broadberry, 2002). A number of important industries were nationalised, including coal, steel and the railways, while in other industries restrictions on competition which had been strengthened during the war were allowed to continue as a result of "light-touch" competition policy (Broadberry and Crafts, 1996). Broadberry and Crafts (2003) argue that these policies were damaging for Britain's productivity performance during the postwar period, lasting until the change of regime beginning with the first Thatcher government.

6. THE IMPACT ON WEALTH

6.1. The accounting framework

Broadberry and Howlett (1998) developed an accounting framework for evaluating the long run impact of war on wealth, which they applied to the case of Britain during World War II. They then applied the same framework to Britain during World War I, making possible a comparison of the two wars (Broadberry and Howlett, 2005). The first important distinction is between stocks and flows in the system of national accounts. Issues concerned with the scale of mobilisation, which have been dealt with in the preceding sections, are best tackled by looking at flows of income, expenditure and output, and asking what proportion of those flows was devoted to the war effort. However, the long run impact of the war can best be assessed by looking at the effects on national wealth, defined here to include human as well as physical capital, intangible as well as tangible capital and net overseas assets (Goldsmith et al., 1963; Revell, 1967; Kendrick, 1976).

Tangible physical capital is the conventional form of capital, consisting of buildings, equipment and inventories. Intangible physical capital is cumulated expenditure on R&D, which is seen as improving the quality of the tangible physical capital. Tangible human capital is the spending required to produce an uneducated, untrained worker, i.e. basic rearing costs. Intangible human capital is mainly spending on education and training to improve the quality of the human capital, although it also includes other items such as spending on health and safety and mobility costs. In an open economy, the impact of the war on net overseas assets must also be taken into account.

We believe that this accounting framework deals with the main objections of writers such as Hardach (1977: 286) and Milward (1984: 9-27) to previous attempts to quantify the impact of

war on the economy. In particular, note that: (1) a clear distinction between stock and flow concepts is maintained throughout (2) all nominal values are converted to a constant price basis so that values for different years can be added together (3) human capital calculations take account of the fact that people consume as well as produce (4) the fact that postwar birth rates rise does not alter the fact that the human capital embodied in those killed by warfare is lost; this has a negative impact on national wealth as much as any destruction of physical capital, which is usually followed by increased investment to make good war losses (5) technological change stimulated by the war can be seen as having a positive impact on intangible physical capital, and can be captured by cumulating any increase in R&D above the prewar level (6) social spending stimulated by the war can be seen as having a positive impact on intangible human capital, and can be captured by cumulating the increase in social spending above the prewar level.

6.2. The impact of the World Wars on Britain's wealth

Table 8 presents an assessment of the effects of both World Wars on Britain's wealth using the Broadberry and Howlett (1998) framework. Note that although the values are in constant prices for both wars, they are in 1913 prices for World War I and 1938 prices for World War II. Comparison therefore needs to be made in terms of the percentages of national wealth in the last two lines of Table 8.

Dealing first with losses to physical capital, it is important to include not just losses on land, but also losses arising from the sinking of ships and their cargoes, as well as external disinvestment via the sale of overseas investments, government borrowing abroad and net exports of gold and silver. Expressing these losses as a share of prewar national wealth, defined narrowly in terms of physical capital, yields losses of 14.9 per cent of wealth during

World War I and 18.6 per cent during World War II. On this basis, World War I was a major setback to national wealth, but not on the same scale as World War II, consistent with the flow data on government spending in Figure 1.

However, this calculation leaves out losses of human capital, which have also been valued in Table 8, taking account of tangible (i.e. basic rearing costs) and intangible human capital (largely education) embodied in the average British casualty. Since the level of casualties was much higher in World War I than in World War II (755,000 compared with 360,000), the inclusion of human capital in the calculations makes the loss of wealth in the two wars much more equal than if attention is confined to physical capital (11.0 per cent in World War I compared with 12.3 per cent in World War II).

In the context of “lessons learned”, it is perhaps worth noting that there was much more discussion of the costs of the war after World War I than after World War II. Thus, for example, Bogart’s (1920) detailed calculation of the costs of World War I for all the major combatant countries was not repeated after World War II. This can be seen at least partly as a result of a shift in attitudes towards reparations, since the calculation of war costs lends itself easily to the victors presenting a bill to the defeated nations. Since wrangling over reparations was widely seen as a contributory factor to World War II, much less effort was made after 1945 to make the defeated Axis Powers pay.

7. CONCLUSIONS

We conclude briefly by summarising the similarities and differences between the two world wars and the extent to which lessons learned from World War I were used profitably in World War II:

(1) Although the scale of mobilisation was very high during World War I, certainly when compared with previous experience, the state built on that experience to mobilise an even greater share of the nation's resources for World War II. In contrast to the slow spread of government controls during World War I, plans were prepared during the 1930s and implemented quickly in 1939.

(2) Lessons were also learned in war finance, which was less inflationary during World War II. Although the money supply doubled during both wars, price controls and rationing meant less inflation during World War II.

(3) The issue in managing the external account was more one of legacy than lessons learned. Whereas the balance of payments position permitted the British government to act as a net lender to the Allies during World War I, a substantial current account deficit during World War II made the British government a major net borrower on capital account. Perversely, though, loan defaults after World War I put significant pressure on the interwar British economy, whereas the massive British borrowing during World War II had a less severe economic impact in the medium term because of the forgiving of American Lend-Lease aid.

(4) The literature on World War I emphasises the slowness of the government in appreciating the need for large scale state intervention and co-ordination when fighting a total war. This view is summed up in the memorable phrase "business as usual". A similar tendency to idealise the benefits of state control and to denigrate the achievements of the market appears in the literature on World War II. However, there is a danger in such a view of neglecting the benefits that British planners enjoyed from the inheritance of a liberal market economy.

These benefits are most obvious when comparing Britain with Germany during both conflicts. In this case, the lessons of war may have been learned too well, with the state too ready to accept restrictions on the operation of market forces, with adverse effects on Britain's productivity performance

(5) The setback to national wealth was greater during World War II than during World War I. However, it makes a significant difference whether or not human capital is included. If attention is limited to physical capital, the scale of the wealth destruction was substantially higher during World War II. However, if human capital is also taken into account, the higher level of casualties during World War I means that the scale of the destruction was more similar. To the extent that calculation of the costs of war led naturally to demands for reparations, one lesson learned from World War I was the need to tread cautiously in this area, given the disastrous consequences of the Versailles settlement.

TABLE 1: Real GDP of the UK at constant factor cost, (per cent of prewar year)

World War I (1913=100)		World War II (1938=100)	
1913	100.0	1938	100.0
1914	101.0	1939	101.1
1915	109.1	1940	111.1
1916	111.5	1941	121.2
1917	112.5	1942	124.2
1918	113.2	1943	127.0
1919	100.9	1944	121.9
		1945	116.6
		1946	111.5

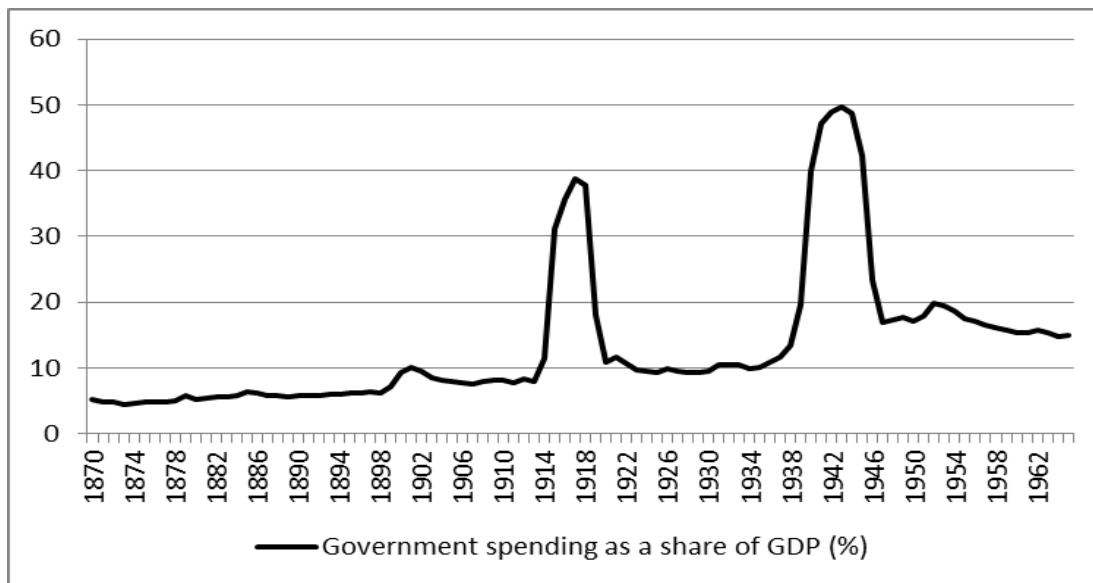
Source: Feinstein (1972: Table 6).

TABLE 2: Government expenditure as a share of GDP at constant market prices (%)

World War I (1913=100)		World War II (1938=100)	
1913	8.1	1938	13.5
1914	11.5	1939	19.6
1915	31.2	1940	39.9
1916	35.6	1941	47.2
1917	38.7	1942	49.0
1918	37.7	1943	49.7
1919	18.1	1944	48.8
		1945	42.2
		1946	23.3

Source: Feinstein (1972: Table 5).

FIGURE 1: UK government spending as a share of GDP at constant prices (%)



Source: Feinstein (1972: Table 5).

TABLE 3: Civilian employment and armed forces as % of total employment

	World War I			World War II	
	Civilian employment	Armed forces		Civilian employment	Armed forces
1913	98.0	2.0	1938	98.0	2.0
1914	96.0	4.0	1939	97.8	2.2
1915	88.1	11.9	1940	90.2	9.8
1916	83.5	16.5	1941	85.9	14.1
1917	80.1	19.9	1942	83.5	16.5
1918	79.4	20.6	1943	80.9	19.1
1919	89.9	10.1	1944	79.8	20.2
			1945	78.8	21.2
			1946	88.1	11.9

Source: Feinstein (1972: Table 57).

TABLE 4: Output of selected items, 1913-1919 and 1939-1945**A. Agriculture**

	Grains, 000 tons	Potatoes, 000 tons	Meat, 000 tons
1913	6,086	7,605	1,482
1914	6,221	7,476	1,443
1915	6,308	7,540	1,487
1916	5,876	5,469	1,500
1917	5,166	8,604	1,448
1918	8,574	9,223	948
1919	6,957	6,312	
1939	4,264	4,354	1,180
1940	5,231	5,375	1,072
1941	5,942	6,783	902
1942	7,113	8,162	772
1943	7,737	8,537	754
1944	7,445	8,026	783
1945	7,132	8,702	812

B. Munitions industry

	Aircraft, units	Tanks	Mortars, units	Rifles, 000	Machine guns, 000
1913	--	--		--	--
1914	245	--	12	120	0.3
1915	1,933	--	945	613	6.1
1916	6,149	150	5,192	953	33.5
1917	14,748	1,110	5,951	1,206	79.7
1918	32,018	1,359	6,473	1,062	120.9
1919	--	--	--	--	--
1939	7,940	969	2,822	44	18.2
1940	15,049	11,399	7,559	94	33.7
1941	20,094	4,841	21,725	85	46.7
1942	23,672	8,611	29,162	617	92.6
1943	26,263	7,476	17,121	949	100.3
1944	26,461	2,474	19,046	547	60.5
1945	--	--	--	--	--

Sources and notes: Part A: 1913-1919: grains (wheat, barley and oats harvested) and potatoes from *Statistical Abstract of the United Kingdom, 1910-1924*, Table 76; meat from Beveridge, 1928: 361); 1939-1945: grains (wheat, barley and oats harvested) and potatoes from CSO (1951: 59); meat (home killed) from CSO (1951: 68). Part B: 1913-1919: all items from Ministry of Munitions (1923): aircraft (vol.XII, part I: 173); tanks (vol. XII, part III: 93); mortars (vol. XI, part I: 130-131); rifles (vol. XI, part IV: 67); machine guns (vol. XI, part V: 27); 1939-1945: aircraft from CSO (1951: 152); tanks from (CSO, 1951: 148); mortars from CSO (1951: 143); rifles from CSO (1951: 144), machine guns from CSO (1951: 144).

TABLE 4 (continued): Output of selected items, 1913-1919 and 1939-1945

C. Other industry					
	Coal, m tons	Steel, m tons	Merchant ships, 000 gross tons	Cotton consumption, m lb	Construction, £m
1913	287	7.7	1,825	2,178	127
1914	266	7.8	1,683	2,077	130
1915	253	8.6	651	1,931	110
1916	256	9.0	608	1,972	91
1917	249	9.7	1,163	1,800	90
1918	228	9.5	1,348	1,499	90
1919	230	7.9	1,620	1,526	156
1939	231	13.2	--	1,317	442
1940	224	13.0	810	1,389	425
1941	206	12.3	1,156	965	470
1942	205	12.9	1,301	939	425
1943	199	13.0	1,204	885	350
1944	193	12.1	1,014	804	290
1945	183	11.8	--	717	290
D. Services and the whole economy					
	Ship arrivals, m net tons	Rail passengers, m	Rail freight, m tons	Bank loans, £m	Real GDP, 1913=100
1913	49.1	1,550	364	430.7	100.0
1914	43.1			454.1	101.0
1915	33.7			424.4	109.1
1916	30.1			413.4	111.5
1917	23.2			494.6	112.5
1918	23.2			520.0	113.2
1919	29.6	2,064	305	855.3	100.9
1939	13.8	1,226	288	994.0	128.9
1940	8.1	967	294	903.3	141.8
1941	6.4	1,023	287	802.7	154.7
1942	6.3	1,218	295	773.0	158.5
1943	6.8	1,335	301	741.7	162.0
1944	9.3	1,345	293	755.6	155.6
1945	8.5	1,372	266	809.2	148.8

Sources and notes: Part C: 1913-1919: coal from Mitchell (1988: 248-249); steel from Mitchell (1988: 288-289); merchant ships from Fayle (1927: 416); cotton consumption from Mitchell (1988: 332); construction from Feinstein (1972: Table 39); 1939-1945: coal from Mitchell (1988: 248-249); steel from Mitchell (1988: 288-289); merchant ships from CSO (1951: 135); cotton consumption from Mitchell (1988: 332); construction from Feinstein (1972: Table 39). Part D: 1913-1919: ship arrivals from *Statistical Abstract of the United Kingdom, 1910-1924*, Table 47; rail passengers and freight from Mitchell (1988: 547-548);

Bank loans from Sheppard (1971: 118); Real GDP (compromise estimate) from Feinstein (1972: Table 6); 1939-1945: ship arrivals from CSO (1951: 183); rail passengers and freight from Mitchell (1988: 547-548); Bank loans from Sheppard (1971: 118); Real GDP (compromise estimate) from Feinstein (1972: Table 6);

TABLE 5: Financing the UK central government deficit (£m)

	Total revenue	Total expenditure	Budget deficit	Increase in:			
				Domestic long debt	Domestic short debt	Money base	Other finance
1913/14	198	197	-1				
1914/15	227	561	334	391	64	73	-194
1915/16	337	1,559	1,222	458	510	27	227
1916/17	573	2,198	1,625	1,477	95	56	-3
1917/18	707	2,696	1,989	748	484	42	715
1918/19	889	2,579	1,690	1,019	247	123	301
1938	673	781	108	77	-179	18	192
1939	771	1,261	490	72	280	18	120
1940	1,158	3,273	2,115	983	517	70	495
1941	1,905	4,727	2,822	1,650	903	109	160
1942	2,314	5,223	2,909	2,100	476	191	142
1943	2,759	5,585	2,826	1,955	1,017	200	-346
1944	2,897	5,569	2,672	1,711	1,081	190	-310
1945	2,806	4,937	2,131	1,885	557	184	-495

Sources: World War I: Morgan (1952: 98, 107); World War II: CSO (1951: 202); Capie and Webber (1985: Table 1.1).

TABLE 6: UK money and prices (per cent of prewar year)

	M3	GDP deflator	Retail price index
1913	100	100	100
1914	108	101	101
1915	125	112	121
1916	138	127	143
1917	156	161	173
1918	190	191	199
1919	232	225	211
1938	100	100	100
1939	99	104	103
1940	109	113	117
1941	126	124	129
1942	142	133	137
1943	162	139	142
1944	184	147	145
1945	209	151	148

Sources: Capie and Webber (1985; Table 1.3); Feinstein (1972: Tables 61, 65).

TABLE 7: UK balance of payments (£billion)**A. Current account**

	Merchandise exports	Merchandise imports	Merchandise balance	Invisible balance	Net transfers	Current balance
1914	0.526	-0.696	-0.170	0.315	-0.020	0.125
1915	0.484	-0.852	-0.368	0.395	-0.050	-0.023
1916	0.604	-0.949	-0.345	0.520	-0.050	0.125
1917	0.597	-1.064	-0.467	0.575	-0.080	0.028
1918	0.532	-1.316	-0.784	0.580	--	-0.204
1919	0.963	-1.626	-0.663	0.605	--	-0.058
1939	0.440	-0.840	-0.400	0.200	0.0	-0.2
1940	0.411	-1.126	-0.715	0.215	-0.3	-0.8
1941	0.365	-1.132	-0.767	0.033	-0.3	-1.1
1942	0.271	-0.992	-0.721	0.021	-0.4	-1.7
1943	0.234	-1.228	-0.994	-0.806	-0.3	-2.1
1944	0.266	-1.294	-1.028	-1.372	-0.1	-2.5
1945	0.399	-1.053	-0.654	-0.546	-0.4	-1.6

B. Capital account

	Government lending	Government borrowing	Net government lending	Sale of investments	Other transactions
1914	--	--	--	--	-0.125
1915	-0.298	0.053	-0.245	0.043	0.225
1916	-0.530	0.319	-0.211	0.110	-0.024
1917	-0.563	0.532	-0.031	0.060	-0.057
1918	-0.297	0.381	0.084	0.023	0.097
1919	-0.137	0.057	-0.080	0.029	0.109
1939	--	--	--	0.0	0.2
1940	--	--	--	0.2	0.6
1941	--	0.3	0.3	0.3	0.5
1942	-0.1	1.2	1.1	0.2	0.4
1943	-0.7	2.1	1.4	0.2	0.5
1944	-0.8	2.6	1.8	0.1	0.6
1945	-0.5	1.3	0.8	0.1	0.7

Sources: World War I: Morgan (1952: 304, 341); World War II: CSO (1951: 142); Sayers (1956: 495, 499).

TABLE 8: National balance sheet calculation of the effects of the World Wars on the UK economy

	World War I (£m at 1913 prices)	World War II (£m at 1938 prices)
Physical capital losses:		
on land	360	860
shipping and cargo	384	380
Disinvestment	998	3,355
Total physical capital losses	1,742	4,595
Human capital losses:		
tangible	88	86
intangible	58	58
Total physical and human capital losses	1,888	4739
Prewar national wealth, excluding human capital	11,682	24,680
Prewar national wealth, including human capital	17,218	38,645
Physical capital losses as % of prewar national wealth, excluding human capital	14.9%	18.6%
Physical and human capital losses as % of prewar national wealth, including human capital	11.0%	12.3%

Sources: World War I: Broadberry and Howlett (2005: 228); World War II: Broadberry and Howlett (1998: 69-70).

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