1 The economics of World War II: an overview

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Introduction: economic factors in the war

This book deals with two issues in the economics of twentieth-century warfare. First is the contribution of economics to victory and defeat of the great powers in World War II. Second is the impact of the war upon long-run economic trends and postwar institutions in the economies of the great powers.[1]

What was the contribution of economics to the outcome of the war? As far as this first question is concerned, the authors share a broad understanding of 'economics', which comprises the national requirements of the war, the quantity and quality of resources, their availability and mobilization, and the institutions and policies which mobilized them for wartime purposes. As for resources, we understand them to include not only physical resources such as minerals, materials, and fixed capital assets, and financial stocks and flows, but also the human resources represented by the working population, its health and literacy, its degree of skill, training, and education, as well as assets represented by scientific knowledge and technological know-how.

How important were these economic factors in deciding who won the war, and who lost? In answering this question it has always made sense to distinguish two periods of the conflict. In the first period, economic considerations were less important than purely military factors. This was the phase of greatest success for the powers of the Axis, and it lasted roughly until the end of 1941 or into 1942 (the exact turning point differed by a few months among the different regional theatres). In this first period, the advantages of strategy and fighting power enabled Germany and Japan to inflict overwhelming defeats upon an economically superior combination of powers. The factors of strategic deception and surprise, speed of movement, skill in the concentration of forces and selection of objectives, martial tradition, and *esprit de corps* were all on their side.

Of course, economic factors were not entirely absent. If Germany or Japan had been poor, agrarian nations the size of Liechtenstein, neither would have launched war against the most powerful industrial economies in the world. Nonetheless, despite significant economic inferiority, the Axis powers made substantial progress towards their war aims and at times appeared to be on the verge of complete success. Their outstanding generalship and the combat qualities of their armies had created a catastrophic situation for the Allies; 'On the face of things', writes Richard Overy, 'no rational man in early 1942 would have guessed at the eventual outcome of the war.'[2] It was also largely the military failures of the Axis powers, not their economic weakness, which brought this first period of the war to an end without the decisive victory which had previously appeared within their grasp.

In the second period of the war, which began in 1942, economic fundamentals reasserted themselves. The early advantages of the Axis were dissipated in a transition period of stalemate. A war of attrition developed in which the opposing forces ground each other down, with rising force levels and rising losses. Superior military qualities came to count for less than superior GDP and population numbers. The greater Allied capacity for taking risks, absorbing the cost of mistakes, replacing losses, and accumulating overwhelming quantitative superiority now turned the balance against the Axis. Ultimately, economics determined the outcome.[3]

Population, territory, and GDP

The prewar balance

There is considerable evidence to support this view, but its scope must be nearly global in coverage and requires some explanation. A first balance can be struck for the alliance system which existed prior to the outbreak of the world war. Table 1.1 gives basic indicators for the prewar coalitions based on the frontiers of 1938 – population, territory, and GDP. The military-economic significance of GDP and population may be obvious; they set the upper limit on the production and personnel potentially available for war. Territorial expanse was also of importance; it helped to determine the quantity and diversity of available natural resources such as metallic ores and mineral fuels, and the degree to which each coalition could expect to form a self-sufficient economic bloc under conditions of wartime disruption of international trade.

On one side was the Anglo-French alliance system which, when the respective colonial empires are taken into account, comprised nearly 700 million people – one third of the globe's population – and 47.6 million square kilometres. On the other side were the powers of the Axis – Germany

Table 1.1. *Population, gross domestic product, territory, and empires of the Allied and Axis powers within contemporary frontiers, 1938*

	Popul-ation, million 1	Territory, sq. km		GDP, international dollars and 1990 prices	
		total, thou. 2	per thou. people 3	total, $ bn 4	per head, $ 5
Allied powers					
UK	47.5	245	5	284.2	5,983
France	42.0	551	13	185.6	4,424
UK dominions	30.0	19,185	639	114.6	3,817
Czecho-Slovakia	10.5	140	13	30.3	2,882
Poland	35.1	389	11	76.6	2,182
French colonies	70.9	12,099	171	48.5	684
UK colonies	453.8	14,994	33	284.5	627
Allied total	689.7	47,603	69	1,024.3	1,485
of which, great powers only (UK and France)	89.5	796	9	469.8	5,252
Axis powers					
Germany	68.6	470	7	351.4	5,126
Austria	6.8	84	12	24.2	3,583
Italy	43.4	310	7	140.8	3,244
Japan	71.9	382	5	169.4	2,356
Japanese colonies	59.8	1,602	27	62.9	1,052
Italian colonies	8.5	3,488	412	2.6	304
Axis total	258.9	6,336	24	751.3	2,902
of which, great powers only (Germany Austria, Italy, and Japan)	190.6	1,246	7	685.8	3,598
China (exc. Manchuria)	411.7	9,800	24	320.5	778
Allies/Axis	2.7	7.5	2.8	1.4	0.5
Great powers only	0.5	0.6	1.4	0.7	1.5
China/Japanese empire	3.1	4.9	1.6	1.4	0.4

Notes:

Countries and groups of countries are ranked under each subheading in descending order of their GDP per head. 'Colonies' include League of Nations mandates and other dependencies. Figures are given for territory within 1938 frontiers, except as noted below.

UK dominions: Australia, Canada, New Zealand, Union of South Africa. Canada includes Newfoundland and Labrador.

Czecho-Slovakia: including the Sudetenland (annexed by Germany in September 1938).

French colonies: mainly in the Near East, Africa, and Indo-China.

Notes to Table 1.1 (*cont.*)

UK colonies (including joint Anglo-French and Anglo-Egyptian colonies): many countries in the Near East, south and southeast Asia, Africa, the Caribbean, and Oceania.

Germany: the geographical entity of the Versailles treaty, excluding the Sudetenland and Austria.

Japanese colonies: Korea, Formosa (Taiwan), and Manchuria.

Italian colonies: mainly Libya and Abyssinia (Ethiopia).

Sources:

Population

All figures from Maddison (1995), appendix A, except that Czech-Slovakia, Poland, Germany, China (except Manchuria), Manchuria itself, and various colonial populations, all within contemporary frontiers, are taken from League of Nations (1940), 14–19.

GDP

Population multiplied by GDP per head (for Czecho-Slovakia, GDP per head of 1937).

GDP per head

All figures from Maddison (1995), appendix D, except as follows.

UK dominions: for South Africa, the white population (20 per cent of the total, from League of Nations (1940), 14–19) is assigned the same GDP per head as the average for Australia, New Zealand, and Canada, and the black and coloured population is credited with the African regional average.

French colonies are divided among Indo-China, Algeria, and other (mainly African) colonies. The GDP per head of French Indo-China is based on that of Vietnam (see above), and that of Algeria is derived in the same way. France's other colonies are credited with a GDP per head based on the African regional average.

UK colonies are divided among south Asia, Africa, and other. The GDP per head of south Asian colonies is a weighted average of that for 1938 of Burma, India, Pakistan, and Bangladesh within modern frontiers.

The GDP per head of African colonies is taken as that of Maddison's African regional average, and that of other (mainly southeast Asian colonies, but also of those in the Pacific, and Caribbean) is based on the Asian regional average.

Italian colonies: the weighted average of GDPs per head of Libya and Ethiopia, derived as above.

Japanese colonies: for Korea and Formosa, GDPs per head are those given by Maddison for South Korea and Taiwan; that of Manchuria is based on his China average.

Territory

League of Nations (1940), 14–19. All figures are within boundaries of 1938, except that Germany excludes Austria and the Sudetenland; the frontiers of Czecho-Slovakia are those of the beginning of the year.

Territory per thousand

Territory divided by population.

(now including Austria), Italy, Japan, and the much smaller colonial empires of Italy in Africa and Japan in east Asia; these amounted to 260 million people and a little more than 6 million square kilometres. Thus the Allies outweighed the Axis by 2.7:1 in population and 7.5:1 in territory. In the Far East, Japan was also at war with China, the population and territory of which exceeded those of Japan and its existing colonies by 3.1:1 and 4.9:1.

For each country or region the table lists GDP as well as population and territory. Population and territory can be measured without much ambigu-

ity, and the researcher need worry only about measurement error. GDP is different because it requires a complex process of evaluation of each country's real product in a common set of prices. For table 1.1 I rely mainly on Angus Maddison's historical time series which are expressed in present-day dollar values and extrapolated back over long periods. This in itself allows many opportunities for error. In addition many of the countries (especially the relatively poor colonial possessions) represented in the table are assigned GDP values on the basis of indirect evidence. Therefore the GDP figures may be taken as indicative, but not precise. According to table 1.1 the Allies of 1938 with their empires disposed of more than $1,000 billion of real product, compared with the $750 billion of Axis GDP, an Allied advantage of 1.4:1. China also outweighed Japan and its colonies in GDP by a similar margin. In every major respect, therefore, the Axis disadvantage was strongly marked, though less in GDP than in population or territory.

The potential advantage of the Allies was greater in population, and still more in territory, than in GDP. This is explained by the adherence to the Allied bloc of great low-income regions in Africa and Asia – the British and French empires. Thus the territorial expanse per head of the Allied population was nearly three times that available to the Axis population. But the average Allied income level was less than $1,500 per head, half the Axis level of $2,900. The same imbalance is present in the comparison of China with the Japanese empire: Japan was poor by west European standards, and its colonies were poorer, but China was poorer still, with less than half the income per head of the Japanese empire.

Suppose we narrow the focus to the great powers alone – the UK and France on one side, Germany (excluding Austria), Italy, and Japan on the other. When the lesser powers and colonial empires are excluded, the balance of size shifts against the Allies; although richer in resources and GDP per head, they were smaller than the Axis powers, with only half their population, 60 per cent of their territory, and 70 per cent of their GDP.

The balance in wartime

Under the impact of war, the balance changed. Two factors were at work. One was the accession of new allies to each side as the war became a global conflict. Between 1938 and 1942 the Axis powers were joined by Finland, Hungary, and Romania, the Allies by the USA and USSR. China, already at war with Japan in 1938, was also becoming an Ally, although one of doubtful military value, not least because of its internal civil war of nationalists versus communists. The Allies were the principal beneficiaries of globalization of the war – just in population, for example, the USA and USSR represented more than 300 million people compared with the gain to the Axis of the 28.5 million combined population of Finland, Hungary, and

Romania. The other process was the changes in *de facto* jurisdiction arising mainly, though not exclusively, from Axis expansion. By 1942 the Allies of 1938 had lost territories on which there had resided before the war some 260 million people. Partly on this account, and partly at the expense of previously neutral countries and colonial populations, the Axis powers had brought under their own control territories in Europe and Asia with a prewar population of nearly 350 million people. Indeed, to change the balance in their own favour was a principal strategic objective of Axis expansionism; each of the Axis powers aimed to achieve self-sufficiency within a colonial sphere expanded at the expense of the Allied and neutral powers.

The changing balance is illustrated in table 1.2, which recalculates the resources on each side within the boundaries of 1942 when the Axis empires had reached their greatest extent. However, for many regions wartime population and GDP indicators are unreliable or non-existent. Therefore, the table is based not on incomes and populations of 1942 but on the 1938 aggregates already used in table 1.1; it shows the purely territorial effect of change in the boundaries of control, holding GDP and population constant, and does not take into account the fact that by 1942, for example, the USA was much richer or the USSR much poorer than in 1938 within constant frontiers.

Table 1.2 shows that by 1942 the economic odds had shortened greatly in favour of the Axis. Using 1938 indicators, by 1942 the *ex ante* advantage of the Allies had fallen to 1.9:1 in population (but still 7:1 in territory, a figure reflecting the vast north American prairies and Siberian steppe) and only 1.3:1 in GDP. If China is excluded, the equivalent figures are 1.2:1 and 1.1:1. In other words, by 1942 the Axis powers were no longer economically inferior to the Allies, and were on more or less equal terms in overall GDP of 1938.

The assumptions underlying table 1.2, in particular the use of 1938 income levels, correspond in a certain sense with the expectations of Axis military-economic policy. Before the war German and Japanese decision makers looked at the colonial spheres of their adversaries and saw them to be rich sources of labour and materials, which they expected to be able to take over intact and exploit to the full. At the same time, when they looked at their adversaries' home territories, they did not anticipate any very vigorous economic mobilization in response to Axis expansionism. In short, they did not expect their enemies to become very much richer than before the war or their colonial annexations to become very much poorer in consequence of the war itself. In fact, however, wherever the Axis powers conquered, incomes fell and the difficulty of extracting resources from the conquered territory increased. At the same time their enemies mobilized their resources and became, on average, richer and economically more powerful than before the war.

Table 1.2. *National and colonial boundaries of 1942, showing populations and GDPs of 1938*

	Popul-ation, million 1	Territory, sq. km		GDP, international dollars and 1990 prices	
		total, thou. 2	per thou. people 3	total, $ bn 4	per head, $ 5
Allied powers					
Allied total, 1938	689.7	47,603	69	1,024.3	1,485
China, 1938 (exc. Manchuria)	411.7	9,800	24	320.5	778
Net gain, 1938–42	93.8	20,401	—	724.5	—
Allied total, 1942	1,195.2	77,803	65	2,069.3	1,731
excluding China	783.5	68,003	87	1,748.8	2,232
of which, great powers only (UK, USA, and USSR)	345.0	29,277	85	1,443.5	4,184
Gains, 1938–42					
USA	130.5	7,856	60	800.3	6,134
USSR	167.0	21,176	127	359.0	2,150
US colonies	17.8	324	18	26.5	1,495
Near East and North Africa	38.6	6,430	167	52.1	1,351
Losses, 1938–42					
France	42.0	551	13	185.6	4,424
Czecho-Slovakia	10.5	140	13	30.3	2,882
Poland	35.1	389	11	76.6	2,182
Occupied USSR	62.4	978	16	134.2	2,150
US colonies	15.9	296	19	23.9	1,497
French colonies	70.9	12,099	171	48.5	684
UK colonies	23.2	933	40	14.4	621
Axis powers					
Axis total, 1938	258.9	6,336	24	751.3	2,902
Net gain, 1938–42	375.7	4,834	—	800.7	—
Axis total, 1942	634.6	11,169	18	1,552.0	2,446
of which, great powers only (Germany and Austria, Italy, and Japan)	190.6	1,246	7	685.8	3,598
Gains, 1938–42					
Denmark	3.8	43	11	20.9	5,544
Netherlands	8.7	33	4	44.5	5,122
Belgium	8.4	30	4	39.6	4,730
France	42.0	551	13	185.6	4,424
Norway	2.9	323	110	11.6	3,945

Table 1.2 (*cont.*)

	Popul-ation, million	Territory, sq. km		GDP, international dollars and 1990 prices	
		total, thou.	per thou. people	total, $ bn	per head, $
	1	2	3	4	5
*Axis Gains (*cont.*)*					
Finland	3.7	383	105	12.7	3,486
Czecho-Slovakia	10.5	140	13	30.3	2,882
Greece	7.1	130	18	19.3	2,727
Hungary	9.2	117	13	24.3	2,655
Poland	35.1	389	11	76.6	2,182
Baltic states	6.0	167	28	12.9	2,150
Occupied USSR	62.4	978	16	134.2	2,150
Bulgaria	6.6	103	16	10.5	1,595
US colonies	15.9	296	19	23.9	1,497
Yugoslavia	16.1	248	15	21.9	1,360
Romania	15.6	295	19	19.4	1,242
Dutch colonies	68.1	1,904	28	77.4	1,136
Thailand	15.0	518	35	12.5	832
UK colonies	23.2	933	40	14.4	621
French colonies	24.1	740	31	10.9	452
Losses, 1938–42					
Italian colonies	8.5	3,488	412	2.6	304
Allies/Axis, 1942	1.9	7.0	3.7	1.3	0.7
exc. China	1.2	6.1	4.9	1.1	0.9
great powers only	1.8	23.5	13.0	2.1	1.2

Notes:

The Allied powers

Between 1938 and 1942 the UK was joined by the USA, USSR, and China in the alliance which would eventually become the United Nations.

USA: including Alaska and Hawaii.

USSR: the territory of 1938, excluding the annexations of 1939–40 (eastern Poland, Bessarabia and northern Bukovina from Romania, a strip of Finnish territory, Estonia, Latvia, Lithuania).

US colonies: Philippines, Puerto Rico.

China: China, already partially dismembered by Japan, was a doubtful military asset, being as much a battleground (with its own continuing civil war as well) as a power. In the table, Allied totals are computed with and without China.

Allied gains and losses

Over the period between 1938 and 1942, the following changes transpired in terms of military defeat, occupation, and annexation.

Near East and North Africa: the British took effective control of the former Italian colonies as well as Egypt, Iran, and Iraq.

France, Czecho-Slovakia, and Poland were defeated and occupied directly or (in the case of Vichy France) incorporated into the German economic space.

The latter aspect of the war is captured in table 1.3, which shows the GDPs of the great powers from 1938 through to 1945 (see also figure 1.1). The table makes some allowance for the fact that both France and Italy changed sides during the war (twice in the French case), but the spirit of the table is to look at the changing economic strength of the great-power coali-

Notes to Table 1.2 (*cont.*)

Occupied USSR: shown here is only that part (see above) which had been subject to Soviet jurisdiction in 1938; the rest is counted elsewhere.

US colonies: the Philippines were lost to Japan.

French colonies: in wartime these fell technically under the jurisdiction of the Vichy regime, but (apart from French Indo-China, dealt with below) were mostly remote from the Axis economies and played little role in the war efforts of either side. In the same way, although the Allies were joined by the governments-in-exile of Belgium and the Netherlands, Belgian and Dutch colonies were either seized by Japan (the Dutch East Indies) or lost to both sides.

UK colonies: Burma, Borneo, Hong Kong, and Malaya were lost to Japan.

Axis gains and losses

Between 1938 and 1942, Germany was joined on the eastern front by Finland, Hungary, and Romania.

Germany and her allies conquered Denmark, Netherlands, Belgium, France, Norway, Czecho-Slovakia, Greece, Poland, the Baltic states and other Soviet territories, Bulgaria, and Yugoslavia.

Japan seized the Phillippines from the United States, the Dutch East Indies, Thailand, the British colonies in East Asia listed above, and French Indo-China.

By the end of 1942, however, Italy had lost its African empire.

Sources:

In most respects, as for table 1.1. However, some new countries enter the table, and some have to be taken in parts.

US colonies: the weighted average for Puerto Rico and the Philippines. For Puerto Rico, GDP per head in 1950 is interpolated on the South American regional average for sample countries in 1938 given by Maddison (1995), 212 (the same procedure, using the African and Asian regional averages, is used below for Zaire, Algeria, Vietnam, Libya, and Ethiopia, and in table 1.2 for Egypt, Iran, and Iraq).

Thailand: GDP per head and population are taken from Maddison (1995), appendices A and D.

Egypt, Iran, and Iraq: population and GDP per head, given for 1950 by Maddison (1995), appendix F, are interpolated on his African and Asian regional averages respectively for 1938.

USSR: 1938 population within contemporary frontiers is from Andreev, Darskii, Khar'kova (1990), 41 (converted to mid-year), and GDP per head as in Maddison.

In 1941–2 the USSR lost 1,926,000 square kilometres of territory occupied on Jan. 1, 1939 by 84,852,000 people (TsSU (1959), 39) – say, 84 million as of mid-1938. However, in 1938 other jurisdictions (Polish, Latvian, Lithuanian, Estonian, Romanian, etc.) had covered more than 21.5 million of the 84 million, who must therefore be excluded to avoid double counting. The same applies to 948,000 of the 1,926,000 square kilometres. It is assumed that the 1938 GDP per head of the occupied territories was the same as for the USSR as a whole.

Dutch colonies: the GDP per head of the Dutch East Indies is based on that of Indonesia.

Table 1.3. *Wartime GDP of the great powers, 1939–1945, in international dollars and 1990 prices (billions)*

	1938	1939	1940	1941	1942	1943	1944	1945
Allied powers								
USA	800	869	943	1,094	1,235	1,399	1,499	1,474
UK	284	287	316	344	353	361	346	331
France	186	199	82	—	—	—	—	101
Italy	—	—	—	—	—	—	117	92
USSR	359	366	417	359	318	464	495	396
Allied total	1,629	1,721	1,757	1,798	1,906	2,223	2,458	2,394
Axis powers								
Germany	351	384	387	412	417	426	437	310
France	—	—	82	130	116	110	93	—
Austria	24	27	27	29	27	28	29	12
Italy	141	151	147	144	145	137	—	—
Japan	169	184	192	196	197	194	189	144
Axis total	686	747	835	911	903	895	748	466
Allies/Axis	2.4	2.3	2.1	2.0	2.1	2.5	3.3	5.1
USSR/Germany	1.0	1.0	1.1	0.9	0.8	1.1	1.1	1.3

Sources: For 1938, see table 1.1. Other years are interpolated on index numbers as follows: UK, table 2.1 (col. 4); USA, table 3.1 (col. 4); Germany, table 4.1 (col. 1); Italy, table 5.1 (col. 3); Japan, table 6.1 (col. 1); USSR, table 7.7, part (A). Figures for the USSR for 1939 are interpolated on population within 1938 frontiers on the assumption that GDP per head remained unchanged compared with 1938 (for evidence on this score see Harrison (1994), 269; Maddison (1995), 200). For France and Austria see Maddison (1995), appendix B.

tions as they existed in 1942. The prewar GDP of the combined Allied powers exceeded that of the Axis powers by 2.4:1. Subsequently the ratio moved somewhat against the Allies, falling to 2:1 in 1941, because the Axis economies expanded while the resources of France, knocked out of the Allied coalition in 1940, became available to Germany. In 1941 Soviet GDP was also beginning to fall under the impact of German attack. But 1941 was the Allied low point.

From 1942 onwards the ratio moved steadily in the Allied favour. First, the United States economy, already by far the largest among the great powers in GDP terms, embarked on a huge quantitative mobilization drive; by 1944, US GDP stood at nearly twice its 1938 level. Second, the Soviet economy, although hit hard by invasion in 1941 and harder still in 1942, was subsequently stabilized and then mobilized to a higher level of output. Third, Italy was knocked out of the Axis coalition in 1943. Fourth, the

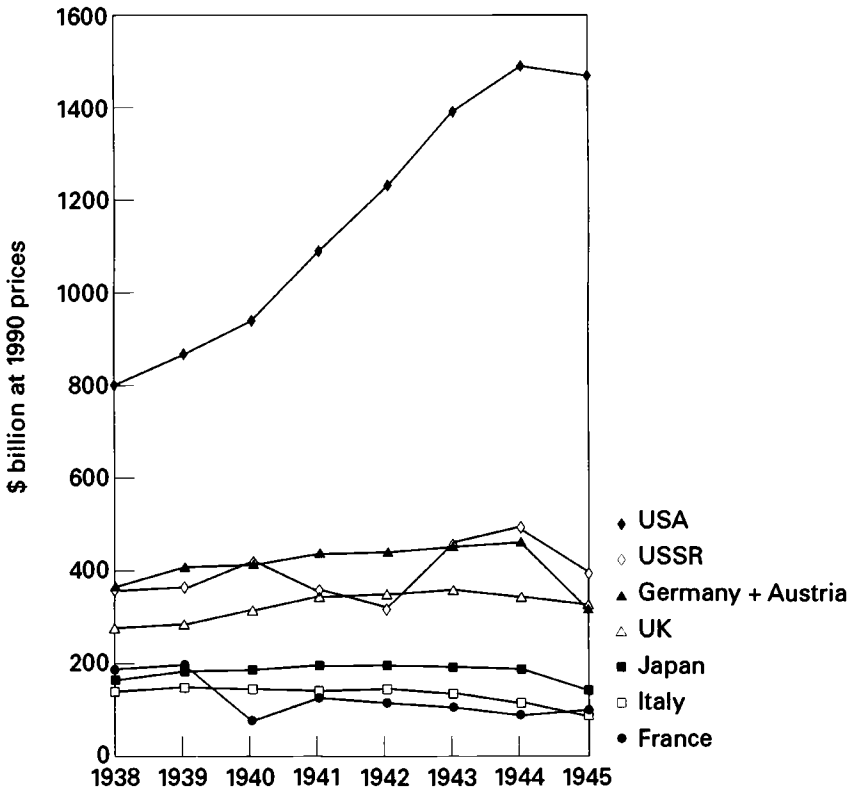

Figure 1.1 Real GDPs of the great powers, 1938–1945
Source: table 1.3

GDP of occupied France fell steadily year by year. Fifth, by the end of 1944, the German and Japanese economies were collapsing. Thus, in 1942 and 1943 the great-power economic balance moved strongly in favour of the Allies and even before the economic collapse of Germany and Japan had already reached 3.3:1 in 1944.

Only on the eastern front did the Allies not possess the advantage. The Soviet Union had more than twice Germany's population and many times its territory, but, with 1938 per capita income at 40 per cent of the German level, was roughly the same size in GDP terms. Because the German economy grew under the stimulus of increasing mobilization, while the Soviet economy collapsed under the weight of German attack, by 1942 rough parity had been transformed into a substantial German advantage. Still relatively untroubled by Allied bombing and the threat of a second front in the west, Germany was able to devote nearly all of its military

resources to the war in Russia. The war in eastern Europe was therefore much more closely fought than in other theatres where the Allies always held the upper hand economically speaking. With recovery in 1943 the Soviet economy was able to reestablish a narrow advantage, but it remained a finely balanced thing until 1945.

In another respect as well the Allies retained an important overall advantage, even in the worst periods of setback and defeat. This lay in the bloc of trading partners available to each side, illustrated in table 1.4. Allied naval supremacy limited Germany and Italy to overland trade with their neutral neighbours and the neutrals adjacent to occupied Europe; together these constituted a zone with a prewar population of 70 million people and GDP of $150 billion. But this was little more than half the size of the bloc available to the Allies made up by the Irish Republic, the neutral neighbour of the UK, and the countries of central and south America, several of which eventually declared war on Germany in early 1945. Again, trade with neutrals principally benefited the western Allies, and was turned to Soviet benefit only indirectly through the medium of Allied aid to the USSR.

Table 1.5 reveals that by 1944 the five great powers still in the game were fielding more than 43 million soldiers (probably more than one-third of their combined prewar male population of working age), with two-thirds of them wearing Allied uniform. Thus the table also shows how the advantages of size were translated into numerical superiority of military personnel. Before the war the combined forces of the Anglo-French alliance just outweighed those of Germany, though not of the Axis powers taken together. In 1940 and 1941, despite the rapid war mobilization of the UK, the French surrender and Italian entry into the war ensured that the Allied (from mid-1940 to mid-1941 the British alone) forces became numerically inferior to their enemies. With 1941, however, German attention switched to the east. From 1942 onwards, despite Japanese entry into the war, with American mobilization now added to the Soviet war effort, the forces of the Axis were always outnumbered in the main theatres of conflict. By 1944 the Allied advantage stood at almost 2:1 on the eastern front as in the west and the Pacific.

The quantitative disadvantage of the Axis powers was even greater in munitions than in men, as the data in table 1.6 suggest.[4] The raw figures are summarized in table 1.7 which shows, first, the astonishing quantities of weapons produced in the period of most intense global conflict, 1942–4: nearly 50 million rifles, automatic weapons, and machine guns, more than 2 million guns and mortars, more than 200,000 tanks, more than 400,000 combat aircraft, nearly 9,000 major naval vessels. But by far the greater part of this vast flow emerged from Allied factories and shipyards. As table 1.7 reveals, in every broad category of ground and air munitions Allied produc-

Table 1.4. *The main neutral-country trading blocs of the wartime coalitions, showing population and GDP of 1938*

	Population million 1	GDP, international dollars and1990 prices	
		total, $ bn 2	per head, $ 3
Allied trading bloc			
Ireland	2.9	9.2	5,126
Independent states of Central and South America	126.7	250.3	1,975
Allied total	129.7	259.4	2,001
Axis trading bloc			
Switzerland	4.2	26.4	6,302
Sweden	6.3	29.8	4,725
Spain	25.3	51.1	2,022
Portugal	7.6	12.9	1,707
Turkey	17.0	23.1	1,359
Portuguese colonies	9.5	7.0	735
Spanish colonies	1.0	0.7	714
Axis total	70.8	151.0	2,133
Allies/Axis	1.8	1.7	0.9

Notes:
Ireland, although neutral, could scarcely avoid a high degree of commercial integration into the British war economy. The only significant neutral trading partners of the wartime Allies were in Central and South America, but the colonial dependencies are already accounted for or otherwise dealt with in table 1.2, so only the independent states remain to be dealt with here: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, Uruguay, Venezuela.

Spanish colonies: mainly Spanish Guinea, Spanish Morocco, and Spanish Sahara.

Portugese colonies: mainly Angola and Mozambique, but also territories elsewhere in Africa, India, and east Asia.

Sources: As tables 1.1 and 1.2. Populations are taken from League of Nations (1940) where not given by Maddison (1995). GDPs per head are from Maddison (1995), except that, where not available for the territories specified, the regional average is assumed, weighted where necessary (as in the case of Portuguese colonies) by population.

Table 1.5. *Armed forces of the great powers, 1939–1945 (thousands)*

	1939	1940	1941	1942	1943	1944	1945
Allied powers							
USA	—	—	1,620	3,970	9,020	11,410	11,430
UK	480	2,273	3,383	4,091	4,761	4,967	5,090
France	5,000	7,000	—	—	—	—	—
USSR	—	5,000	7,100	11,340	11,858	12,225	12,100
Allied total	5,480	14,273	12,103	19,401	25,639	28,602	28,620
Axis powers							
Germany	4,522	5,762	7,309	8,410	9,480	9,420	7,830
Italy	1,740	2,340	3,227	3,810	3,815	—	—
Japan	—	1,630	2,420	2,840	3,700	5,380	7,730
Axis total	6,262	9,732	12,956	15,060	16,995	14,800	15,560
Allies/Axis:							
eastern front	—	—	1.1	1.5	1.4	1.9	2.3
western and Pacific fronts	1.2	0.8	0.9	1.1	1.9	1.9	1.6

Notes:

The Allied and Axis totals sum the preceding rows in each column; however, the Axis total is based on the average of the alternative Japanese series. The ratios of Allied to Axis forces on each front are calculated as follows.

Western and Pacific fronts: for 1939 UK and France versus Germany. In 1940, the French and Italian forces are included, each with a 50 per cent weight since Italy joined the war in mid-year, at the same time as the French surrendered. In 1942–3, USA and UK versus one-tenth of the German armed forces, plus Italy, plus Japan (the average of the alternative series), but in 1943 the Italian forces are given a weight of two-thirds corresponding to the eight months of fighting before the Italian surrender. In 1944–5, USA and UK versus one-third of the German armed forces, plus Japan.

Eastern front: USSR versus Germany, assuming that Germany allocated 90 per cent to the eastern front in 1941–3, but only two-thirds in 1944–5.

Sources:

USA, table 3.11 (col. 3).

UK, table 2.13.

France: according to Kedward (1995), 401, there were 'just under 5 million' in the French army after mobilization in September 1939, with 'a further two million possible soldiers available in the Empire', which I assume to have been mobilized by 1940.

USSR, as table 7.8.

Germany: Förster, Messenger and Petter (1995), 468.

Italy: personal communication (Vera Zamagni).

Japan, table 6.9 (the rounded average of cols. 1, 2).

Table 1.6. *War production of the great powers, 1939 to August 1945 (units)*

	1939	1940	1941	1942	1943	1944	1945	Total
USA								
No. of months	—	—	1	12	12	12	8	45
Thousands								
Rifles, carbines	—	—	38	1,542	5,683	3,489	1,578	12,330
Machine pistols	—	—	42	651	686	348	207	1,933
Machine guns	—	—	20	662	830	799	303	2,614
Guns	—	—	3	188	221	103	34	549[a]
Mortars	—	—	0.4	11.0	25.8	24.8	40.1	102.1
Tanks and SPG	—	—	0.9	27.0	38.5	20.5	12.6	99.5
Combat aircraft	—	—	1.4	24.9	54.1	74.1	37.5	192.0
Units								
Major naval vessels	—	—	544	1,854	2,654	2,247	1,513	8,812
UK								
No. of months	4	12	12	12	12	12	8	72
Thousands								
Rifles, carbines	18	81	79	595	910	547	227	2,457
Machine pistols	—	—	6	1,438	1,572	672	231	3,920
Machine guns	19	102	193	284	201	125	15	939
Guns	1	10	33	106	118	93	28	390
Mortars	1.3	7.6	21.7	29.2	17.1	19.0	5.0	100.9
Tanks and SPG	0.3	1.4	4.8	8.6	7.5	4.6	2.1	29.3
Combat aircraft	1.3	8.6	13.2	17.7	21.2	22.7	9.9	94.6
Units								
Major naval vessels[a]	57	148	236	239	224	188	64	1,156
USSR								
No. of months	—	—	6	12	12	12	8	50
Thousands								
Rifles, carbines	—	—	1,567	4,049	3,436	2,450	637	12,139
Machine pistols	—	—	90	1,506	2,024	1,971	583	6,174
Machine guns	—	—	106	356	459	439	156	1,516
Guns	—	—	30	127	130	122	72	482
Mortars	—	—	42.3	230.0	69.4	7.1	3.0	351.8
Tanks and SPG	—	—	4.8	24.4	24.1	29.0	20.5	102.8
Combat aircraft	—	—	8.2	21.7	29.9	33.2	19.1	112.1
Units								
Major naval vessels	—	33	62	19	13	23	11	161

Table 1.6. (*cont.*)

	1939	1940	1941	1942	1943	1944	1945	Total
Germany								
No. of months	4	12	12	12	12	12	4	68
Thousands								
Rifles, carbines	451	1,352	1,359	1,370	2,275	2,856	665	10,328
Machine pistols	40	119	325	232	234	229	78	1,257
Machine guns	20	59	96	117	263	509	111	1,176
Guns	2	6	22	41	74	148	27	320
Mortars	1.4	4.4	4.2	9.8	23.0	33.2	2.8	78.8
Tanks and SPG	0.7	2.2[b]	3.8	6.2	10.7	18.3	4.4	46.3
Combat aircraft	2.3	6.6	8.4	11.6	19.3	34.1	7.2	89.5
Units								
Submarines	15	40	196	244	270	189	0	954
Italy								
No. of months	—	6	12	12	8	—	—	38
Thousands								
Rifles, carbines	—	—	—	—	—	—	—	—
Machine pistols	—	—	—	—	—	—	—	—
Machine guns	—	—	—	—	—	—	—	125
Guns	—	—	—	—	—	—	—	10
Mortars	—	—	—	—	—	—	—	17.0
Tanks and SPG	—	—	—	—	—	—	—	3.0
Combat aircraft	1.7	3.3	3.5	2.8	2.0	—	—	13.3
Units								
Major naval vessels	40	12	41	86	148	—	—	327
Japan								
No. of months	4	12	12	12	12	12	8	72
Thousands								
Rifles, carbines	83	449	729	440	634	885	349	3,570
Machine pistols	—	—	—	—	—	3	5	8
Machine guns	6	21	43	71	114	156	40	450
Guns	1	3	7	13	28	84	23	160
Mortars	0.5	1.6	1.1	1.5	1.7	1.1	0.3	7.8
Tanks and SPG	0.2	1.0	1.0	1.2	0.8	0.4	0.2	4.8
Combat aircraft	0.7	2.2	3.2	6.3	13.4	21.0	8.3	55.1
Units								
Major naval vessels	21	30	49	68	122	248	51	589

Notes:

[a] Small calibre naval and aviation weapons accounted for roughly half this number.

[b] Including armoured cars.

Sources:

Ground and air munitions (SPG are self-propelled guns), except Italy: IVMV, vol. XII (1982), 168, 181, 183, 200, 202.

Major naval vessels (excluding landing craft, torpedo boats, and other auxiliary craft), except Italy: Overy (1995), 1060.

Italy, all figures: personal communication (Vera Zamagni).

Table 1.7. *War production of the great powers, 1942–1944*

	Rifles, carbines (thou.)	Machine pistols (thou.)	Machine guns (thou.)	Guns (thou.)	Mortars (thou.)	Tanks (thou.)	Combat aircraft (thou.)	Major naval vessels
The Allied powers								
USA	10,714	1,685	2,291	512	61.6	86.0	153.1	6,755
UK	2,052	3,682	610	317	65.3	20.7	61.6	651
USSR	9,935	5,501	1,254	380	306.5	77.5	84.8	55
Allied total	22,701	10,868	4,154	1,208	433.4	184.2	299.5	7,461
The Axis powers								
Germany	6,501	695	889	262	66.0	35.2	65.0	703
Italy	—	—	83	7	11.3	2.0	8.9	218
Japan	1,959	3	341	126	4.3	2.4	40.7	438
Axis total	8,460	698	1,313	395	81.6	39.6	114.6	1,359
Allies/Axis	2.7	15.6	3.2	3.1	5.3	4.7	2.6	5.5
eastern front	2.3	11.9	2.1	2.2	7.0	3.3	2.0	—
western and Pacific fronts	3.1	22.9	4.0	3.8	3.4	6.6	3.0	—

Source: Calculated from table 1.6. Two-thirds of Italian production between mid-1940 and mid-1943 is assumed to have taken place within the period 1942–4. For ground and air munitions, two-thirds of German war production are assigned to the eastern front. No account is taken of the contribution of the western Allies to Soviet munitions supply, or of the Italian contribution to Axis forces in Russia.

tion dominated by a margin of at least 5:2 (rifles, combat aircraft), and in some case by much more (3:1 for guns and machine guns, 5:1 for tanks, mortars, and warships, 15:1 for machine pistols). The Allies held the upper hand on every front – in the east almost as much as in the west and the Pacific. On both main fronts the Allied advantage was greater in every category of weapons than in men, reflecting the higher level of equipment per soldier of the Soviet, British, and United States armies.

Size and development

It would be a mistake to interpret these figures as meaning that size was the only economic factor of importance. Also of great significance was the level of economic development, which, for present purposes, we will measure by GDP per head.[5] Here again the picture is complicated. Thus table 1.1 showed that the advantage of the Allies was larger in population than in GDP. Average incomes of the prewar Allies were little more than half the Axis level. There was still a significant gap (although a smaller one) in 1942. But it is very important to note that GDP was distributed much more unequally among the Allied territories than within the Axis. By 1942 the Allies included the richest major power (the United States) as well as the poorest (China, or, if China is discounted, the USSR), in addition to the populous low-income colonial territories of the British empire in India and Africa. It is of great significance, therefore, that if we confine our attention to the core territories of each coalition, it was the Allies which held a roughly 1.2:1 advantage in prewar development level.

Development level could be regarded as significant in the following sense. The experience of two world wars showed that, when poor countries were subjected to massive attack, regardless of size, their economies tended to disintegrate. The exact mechanism of disintegration varied, but was typically already present in peacetime, in a low-productivity, poorly commercialized agriculture, and a general lack of resource diversity. The latter was influenced not only by lack of size, but also by poverty, since poor economies – even large ones – relied too heavily upon agriculture and could not afford a wide assortment of other activities. Mobilization disrupted trade internally and externally; the more industry was concentrated upon war production, the less was left to sell to peasants and foreigners alike in exchange for their food and oil, and the more rapidly imports and domestic food supplies disappeared from the urban economy. Poor countries also lacked the commercial and administrative infrastructure which modern governments could use to foster the objectives of wartime economic policy. Mobilization was therefore either ineffective or else self-limiting; if mobilization was achieved it could not be sustained, and tended if anything

to accelerate economic collapse. In World War I this happened first to Russia, then to Austria-Hungary, finally to Germany itself – the poorest first, in inverse order of development level.

In World War II it was China which demonstrated first the weakness of a low-income great power. As table 1.1 revealed, China outweighed Japan in every economic dimension but GDP per head. Attacked by Japan in 1937, the Chinese economy disintegrated. China was saved from immediate destruction only because it was too large for Japan to swallow whole, while the part which Japan occupied was 'too poor and rebellious to exploit systematically'.[6] The USSR was another low-income power; the Soviet economy provides the exception to the rule because it did not collapse under massive attack in 1941, although every historical precedent suggested that it should have done so. Among the Axis powers Japan was the poorest, then Italy, with Germany at an income level comparable with the British. When it was the turn of the Axis powers to go down, defeat came to Italy in 1943, then Japan in 1945, in that order not because Italy was poorer than Japan, but because that was the order in which the Allies attacked them. Italy and Japan suffered most from disruption of external rather than internal supply, bringing deprivation of imports. In 1945 the wealthier German economy also collapsed at last, but only at the point when heavy bombing was combined with massive attack overland from both east and west.

Thus it may be argued that in general terms the outcome of the war was decided by size (the economically larger coalition won), but, nevertheless, if a large population and a large GDP were both highly desirable, a large GDP was better because of the developmental advantages which came with a higher level of GDP per head. The Soviet exception proves the rule, because it displayed a capacity for military mobilization characteristic of a much more highly developed economy, despite its relatively low income level.

Table 1.8 shows percentages of national income mobilized by the six great powers. Such percentages may be calculated at both current and constant peacetime (prewar or postwar) prices, and mean something slightly different in each case. The degree of mobilization measured in current values takes into account changing relative scarcities of guns versus butter and their current priorities relative to each other, whereas a constant-price measure reflects their changing relative volumes from a peacetime welfare standpoint. For present purposes constant prices are more useful, but are not available in every case. Nominal relative values are shown in the first part of the table for every country except the USSR. The second part of the table shows constant-price measures for the USA, Germany, and the USSR. For the USA and Germany the

different standards of valuation make little or no difference, and we can infer that the same would be true for the UK from the fact that the British GDP deflator and retail price index (table 2.9 below) followed a nearly identical wartime path (i.e. the relative prices of consumption and non-consumption goods, most of which were war goods, did not change). For the USSR this would certainly not be true; as is shown in chapter 7, the cheapening of weapons and rise in food prices meant that the nominal defence burden fell far below the defence burden measured at prewar prices. For Japan and Italy there is no information on this point, and no way of knowing whether the nominal military burden may under- or overstate the real burden.

Table 1.8 shows that, however the military burden is measured, the Germans followed a path of ever-strengthening mobilization; nearly one quarter of German GNP was devoted to the war effort already in 1939, and this proportion probably reached three-quarters in 1944 before economic collapse ensued. In 1939 Japan's nominal share of national resources committed to the war (22 per cent) was similar to Germany's, although at that time Japan was confronted only by weak enemies. But in the next two or three years the Japanese struggled to raise this share by even a few percentage points until 1943, when its life-or-death struggle with the two most powerful industrialized countries in the world was already going badly. By 1944 Japan too was devoting three-quarters of GDP to the war, but Japan's final mobilization was much more of a sudden, last-ditch effort than Germany's, and ended the same way in economic collapse. As for the Italian mobilization, its failure is obvious by the fact that at its wartime peak it barely matched the prewar efforts of Italy's Axis partners, and stagnated or declined as the war turned against Italy.

The Soviet economy, although much poorer than the Italian, and comparable with the Japanese in terms of income per head, did not collapse despite its initial loss of wealth and income. It mobilized rapidly, shifting 44 per cent of GNP from civilian to military uses in two years (1940–2); maximum two-year shifts for other countries were 15 per cent for Italy, 29 per cent for Germany, 38 per cent for the UK (all in 1939–41), 31 or 32 per cent for the USA (1941–3), and 43 per cent for Japan (but only when it was too late in 1942–4). The Soviet economy went on to devote three-fifths of its national income to the war effort, a little below the German and Japanese peaks, but the Soviet peak came earlier in the war and proved more sustainable for a variety of reasons (including Allied aid). The Soviet success by comparison with other poorer countries was partly a matter of size; the Soviet Union was bigger than Japan or Italy in population and GNP, and far bigger in territory, and was already virtually self-sufficient before the war. But the precedents of disintegration and collapse of Russia

Table 1.8. *The military burden, 1939–1944 (military outlays, per cent of national income)*

	1939	1940	1941	1942	1943	1944
At current prices						
Allied powers						
USA	1	2	11	31	42	42
UK	15	44	53	52	55	53
USSR	—	—	—	—	—	—
Axis powers						
Germany	23	40	52	64	70	—
Italy	8	12	23	22	21	—
Japan	22	22	27	33	43	76
At constant prices						
Allied powers						
USA	1	2	11	32	43	45
UK	—	—	—	—	—	—
USSR	—	17	28	61	61	53
Axis powers						
Germany	23	40	52	63	70	—
Italy	—	—	—	—	—	—
Japan	—	—	—	—	—	—

Sources:

USA (per cent of GNP at current and 1958 prices): table 3.1 (cols. 3, 6).

UK (per cent of net national expenditure at current prices): table 2.6 (col. 2).

USSR (per cent of GNP at 1937 factor cost): table 7.11.

Germany (per cent of GNP at current and 1939 prices): calculated from table 4.16. For war outlays at 1939 prices the same deflator is assumed as for government outlays generally; by 1943, war outlays accounted for 96 per cent of the latter.

Italy (per cent of GDP at current prices): table 5.14 (col. 22) shows real military outlays divided by real GDP, both converted from current values by the same GDP deflator.

Japan (per cent of GDP at current prices): table 6.11 (col. 5).

in World War I, and of China in World War II, remind us that size was not sufficient for economic survival under attack.

The success of the British economic mobilization testifies eloquently to the importance of development level by comparison with size and self-sufficiency. In terms of the scale factors shown in table 1.1, Britain was smaller than Japan in population and territory, smaller than Germany in GDP and territory, and the smallest of all the Allied powers by any measure. Being a highly open economy, exceptionally highly industrialized, the British economy also relied heavily on imported food and fuels. Despite

being neither large nor self-sufficient, the British economy was comprehensively mobilized without major breakdowns of food or power supplies. Possessing the highly developed commercial, transport, and administrative infrastructure that comes with a high GDP per head, the British were able to expand the home production of calories, and ration fuel and energy efficiently. It was also easier for the British to supply their economy with food and fuels from across the world than for the Axis powers to exploit effectively the less industrialized, low-income colonial areas into which they expanded in the course of the war.

The link between development level and mobilization capacity is further illustrated in the contrasting results of German occupation in northwestern and eastern Europe. Northwestern Europe was the one high-income, industrialized region into which the Axis powers expanded. France provided Germany with as much food as all of the occupied USSR, *and* more industrial materials – an outcome which would have been viewed ironically from a prewar perspective, because it was the occupation of *eastern* Europe which was intended to make Germany self-sufficient in such deficit commodities, while the occupation of France was an accidental by-product of the evolution of the war.[7] German occupation policies successfully extracted 30–40 per cent of the wartime national products of France, the Netherlands, and Norway (and a similar proportion from the industrialized region of Bohemia-Moravia in the east), but obtained resources at much lower or negligible rates of extraction from the low-income, agrarian territories of eastern Europe.[8]

Part of the Allied success in mitigating simultaneously the British disadvantage of small size, and the Soviet disadvantage of low development level, lay in the pooling of Allied resources. The United States shared its capital-intensive, high-technology resources with Britain and the USSR (and Britain, at a lower level, also contributed to Soviet aid). The USSR and, to a lesser extent, Britain used their territory to provide forward bases for the assault upon Germany, and also bore the brunt of the fighting. In this way the Allied war effort formed an economically integrated whole – certainly in comparison with the war efforts of the Axis powers, each of which evolved independently, each relying on its own isolated colonial sphere.

The determinants of mobilization

Mobilization was essential to the war strategy of each of the powers. Nonetheless, understanding its importance requires a distinction between the different powers and the different theatres of the war. The Axis powers mobilized their economies first, before the world war broke out, aware of

the risks of reliance on purely military advantage to bring easy successes. When the quick victories evaporated, they continued economic mobilization in a hopeless race with an economically superior enemy. The Soviets also began to mobilize in peacetime, in order to insure themselves against the likelihood of aggression, whereas the western Allies mobilized their economies only from the time when war was perceived as inevitable. Once this point was reached, the British, Americans, and Russians alike mobilized their economies knowing that only quantitative effort could neutralize the qualitative advantage of the Axis powers.

The precise degree of mobilization was much more important for the Russians than for the much richer British and Americans, and was more important to the outcome on the eastern front than in the Pacific and the Mediterranean. The Italian and Japanese GDPs were so small relative to combined Anglo-American resources that it simply did not matter that the Italians mobilized only 20 per cent or that the Japanese mobilized as much as 70 per cent of their national income for the war. Even a high percentage of a small quantity was still a small quantity. On the eastern front, on the other hand, the degree of mobilization was very important, because the German and Soviet economies were more evenly matched in terms of total output; if the Germans mobilized 60 per cent, and the Soviets only 30 per cent, then the Germans would win. On the western front the percentage of resources mobilized mattered less because the Anglo-American margin of superiority in combined resources over Germany was so great.

What underlying factors influenced the degree of mobilization? At one time most attention was accorded to two factors – distance from the main theatres of fighting, and the wartime economic system. Both rested on a rough comparison of the Soviet, British, and American experiences. As far as the first is concerned, these economies could be ranked in the same order both in terms of the degree of mobilization (from highest to lowest), and in terms of distance from the front line (from nearest to farthest).[9] It was the nearness of combat conditions, and the blurring of the distinction between the fighting front and the home front, which stimulated national feeling and promoted economic mobilization.

The other factor which received much attention was the wartime economic system. Again a comparison of the Soviet, British, and American experiences ranked these economies in the same order as before in terms of the degree of planning (from most to least centralized). It was also believed that the German economy, hindered by party interests vested in economic slack, and by bureaucratic infighting which prevented effective coordination, remained relatively unmobilized until heavy Allied bombing, the invasion of France from the west, and the approach of the avenging Russians

from the east, enabled national feeling to overcome these obstacles – but by this time, it was too late.[10]

These generalizations now appear to be inaccurate. As far as distance from the main theatres of combat is concerned, the Italian and Japanese economies remained at a low level of mobilization through 1943, despite the adverse turn of the Pacific War for Japan and the incursion of the front line into the Italian homeland.

As far as the degree of planning is concerned, the Japanese economy became highly centralized, but success in terms of the degree of mobilization was belated, and was swiftly followed by collapse. In both Japan and Italy it was the denial of imports which shackled the mobilization process and ensured, in the case of Japan, that success was self-destructive. The British economy became highly mobilized under centralized administrative controls. But the Soviet economy became even more highly mobilized despite a context of administrative shambles; only after the tide had been turned did centralized administration reassert itself. In the German case, likewise, it now appears that the civilian economy had become relatively highly mobilized by an early stage in the war, notwithstanding the defects of the political and administrative system. If there was slack, it was tied up in wasteful intermediate uses within military industry, not in household consumption.[11]

What was important was not so much to have detailed economic controls as to be able to maintain economic integration under intense stress. This capacity is what Italy and Japan lacked. Their economies were small in global terms, heavily dependent on international trade, far from self-sufficient in fuels and other industrial resources. Their development level was insufficient to compensate. What ensured the failure of their economic mobilization, regardless of the growing threat to vital national or régime interests, and despite intense efforts at economic control, was the disruption of overseas trade, the intensity of Allied blockade, the interruption of supplies of coal, oil, or crucial war materials, and the obstacles to effective sharing of resources among the Axis powers which were never overcome.

The USSR, another low-income, newly industrializing economy, was able to avoid this fate. Offsetting its poverty were advantages of size, access to Allied resources, and, above all, an effective system of economic integration; these gave it resilience under the kind of pressure which destroyed the old Russian empire in World War I, and the contemporary Japanese and Italian empires in World War II. The Soviet economy was held together by coercion, by leadership, by national feeling, by centralized planning and rationing, and by a system for food procurement which ensured that farmers could not deny food to the towns.

Quantity and quality

When the authors of this volume examine the wartime mobilization of the great powers' economies, their main aim is to understand what quantity of resources was delivered to the front, by what means, and with what results for economic life. The military qualities of the resources supplied, and what use the generals made of them, would be entirely beyond our scope, were it not for the fact that the relationship between qualities and quantities was interactive.

It would be tempting to conclude from the experience of World War II that, since ultimately the powers of the Axis were overwhelmed by quantity, quality did not really matter. Since the quantity of military resources was limited by overall resources, it was the fact that the Allies' total GDP was greater than the total GDP of the Axis which decided the outcome of the war.

But the question of the military value of resources cannot be avoided. For one thing, the quantities do not explain why German and Japanese leaders deliberately undertook acts of war against economically more powerful adversaries, or how they achieved such success in the early stages. It was the very high quality of their military assets, the fighting power of their armies and navies, which, in the first years of the war, was almost decisive. In 1939–41 Germany and Japan achieved sweeping military gains and conquered huge territories in spite of economic disadvantage, because of the military qualities of their soldiers and the highly effective use made of very limited resources. Indeed the Axis leaders saw the warlike qualities of their military assets as providing a military substitute for productive powers, a means of neutralizing the quantitative advantages of the enemy, and an expansionist solution to their countries' position of economic weakness. Germany and Japan deployed superior combat organizations which, if quantities had been held equal on both sides, would have remained capable of defeating the opposing forces throughout the war.[12] However, the Red Army, too, unexpectedly displayed some elements of superior fighting power, and these qualities increased in the course of the war.

The quick victory which Germany and Japan sought was frustrated by two factors. One was the unanticipated will to resist which became apparent at different stages in London, Moscow, and Washington. The other was the unexpected military capacity of the Allied powers to delay defeat and win time, a precious breathing space within which superior Allied resources could be mobilized and brought to bear.

Once the quick victory which Germany and Japan sought had been frustrated, qualitative factors continued to exercise a major influence over the course of the war. It was the quality, not the quantity, of German and

Japanese military resources which postponed their defeat for so long, forcing their wealthier adversaries to accumulate a vast quantitative advantage in personnel and weapons before the defeat of the Axis could be assured. It is true that, in the closing stages of the war, both Germany and Japan were able to delay defeat by using the advantages of the terrain, for example in Italy where it was hard for the Allies to turn their flank, or on Okinawa in the Pacific.[13] But it was also a qualitative feature of the German and Japanese soldiers that they consistently maximized these advantages, even when hampered by huge material inferiority.

The responses of the two sides to Axis qualitative superiority were illustrated in tables 1.5 and 1.7. In the western front and the Pacific, the British and Americans used 1942 and 1943 to accumulate a three-to-one advantage over the opposing forces, while the Russians fought harder on more finely balanced, fiercely contested terms. With the Anglo-American invasion of France, and the increasing likelihood of an Allied invasion of the Japanese islands, the Japanese mobilized millions of additional soldiers, while the Germans transferred part of their forces from east to west. As a result, in 1944, although the Axis cause was already lost, the contest had become more even again, with Allied burdens more evenly shared between east and west.

The qualitative development of weaponry was very important in the evolution of the war, the development of war production, and the mobilization of industry. But this qualitative development cannot be understood in purely national terms. The technological improvement of weaponry was a global process, in which all the military powers participated. Table 1.9 suggests that each country produced at least some high quality weapons, although probably only Germany was able to do so across the board. They were stimulated to do so by the development of the battlefield, as each country strove to keep at least one step ahead of the adversary. The evolution of the tank in armament, armour, and speed of movement clearly illustrates this process. In Russia in 1941, the Germans encountered superior tanks, and were driven to fresh efforts of innovation. By 1943 the new German tanks were better than existing Soviet models, and Soviet designers now had to run faster to keep up. The same process was visible in the design of fighter aircraft, in the rivalry to match and exceed the enemy's speed, manoeuvrability, armament, and radar.

Strategic choice also played a role. The German and Japanese strategy relied on quality of armies and armament to compensate for their deficiencies in the quantity of overall resources. At sea the Germans tried to compensate for the Allied surface fleet predominance by means of submarine technology. The British and Americans failed to produce good tanks, but compensated with fast-moving, well-supplied infantry sup-

ported by excellent means of tactical air power. The Russians did not compete in strategic air or naval power, but they did not need to do so.

Thus, not every country produced high quality weapons, but there was no strong correlation with economic development level. The Soviet Union had an excellent defence industry, despite being poor by European standards. Japan and Italy, the one a relatively poor country, the other nearer to Germany than Russia or Japan in development level, both produced high-quality ships and aircraft, only their number was deficient. Germany produced most weapons better than America, although America was the richest of the great powers. If the Russians made a priority out of tank design, and if it was the design of aircraft and ships that came first for the British, Italians, and Japanese, then the Germans made the quality of weapons in general their priority; Germany, as a medium sized industrial power, could not compete in quantity, but was still well enough developed to be able to compete in quality across the board.

In leaving the subject of quality, it is important to stress that quantity was essential to the Allied strategy. The Allies knew they could not make better soldiers than the Germans or Japanese. They could not make better guns, ships, or airplanes, but they could make more of them. While the British and Americans devoted major resources to the atomic bomb project, there was no guarantee of ultimate success. Until the bomb was available, there was no alternative to a stress on quantity. In the west the Axis powers could only be beaten by an immense numerical advantage. This is what the Allies accumulated in 1942–3, and directed first against Italy, then in 1944–5 against Germany and Japan. On the eastern front the Russians also enjoyed a quantitative advantage over Germany, but the fighting power of the Red Army meant that they could beat Germany with a smaller quantitative edge than the western Allies required.

Winning the war, losing the peace

Postwar convergence

Over the postwar decades the general pattern among the former wartime allies and enemies was one of catching up and convergence. *Catching up* refers to the gap between the productivity leader, the United States, and the followers. *Convergence* is of two kinds. In the literature β-convergence requires an inverse relationship between initial income levels and subsequent growth, whereby poorer countries grow faster; σ-convergence takes place when the cross-country inequality of income levels diminishes.[14] Table 1.10 illustrates catching up and both kinds of convergence, but also

Table 1.9. *Weapons systems of the great powers in World War II: military-technical specifications*

(A) Fighter aircraft	Engines, no. × horse power	Max. speed, km per hour	Max. altitude, m	Time required (minutes) for ascent to 3,000m	Time required (minutes) for ascent to 5,000m	Range, km	Armament, no × cal. (mm) cannon	Armament, no × cal. (mm) machine guns
USA								
P-40k Warlike	1×1,215	550	11,700	4.8	7.3	>2,000	—	6×12.7
F-4	1×1,200	530	8,500	3.6	—	1,800	—	6×12.7
P-39q Aerocobra	1×1,325	620	10,500	3.4	5.8	1,200	1×37	4×12.7
P-51b Mustang III	1×1,300	700	9,100	3.0	—	3,600	—	4×12.7
UK								
Hurricane IIb	1×1,435	550	11,150	—	8.4[a]	1,260	—	12×7.69
Spitfire IX	1×1,600	657	13,100	—	6.7[a]	1,365	2×20	4×7.69
Mosquito II	2×1,450	596	10,700	—	7.0[b]	—	4×20	4×7.69
USSR								
La-5	1×1,700	630	10,000	—	5.2	581	2×20	—
Yak-7b	1×1,210	593	10,000	—	5.7	750	1×20	2×12.7
Yak-9	1×1,210	597	10,400	—	5.5	1,400	1×37	1×12.7
Germany								
Me-109g	1×1,555	630	11,400	—	6.0[c]	820	1/3×20	2/4×7.92
Me-110	2×1,150	545	11,500	—	8.4	1,400	1×20	5×7.92
FW-190a3	1×1,760	625	12,000	—	6.8	840	2/4×20	2×7.92
Japan								
I-01 Nakajima	1×1,130	515	10,500	—	6.2	2,000	2×20	2×12.7
I-02 Mitsubishi	1×1,320	605	10,500	—	4.2	1,250	2×20	2×12.7
I-02 Kawasaki	2×1,060	547	10,000	—	7.0	1,500	2×20	1×7.7 2×12.7

Notes:
[a] To 6100m.
[b] To 4600m.

(B) Bombers	Engines no. × horse power	Max. speed, km per hour	Max. altitude, m	Range, km	Armament, no.×cal. (mm)		Payload, kg
					cannon	machine guns	
USA							
B-25J Mitchell	2×1,700	458	7,620	2,900	—	13×12.7	1,450
A-20b Havoc	2×1,600	510	7,000	3,300	—	3×12.7 3×7.62	908
B-17g Flying Fortress	4×1,200	466	10,900	3,870	—	13×12.7	5,800
B-24d Liberator	4×1,200	466	9,500	5,600	—	10×12.7	5,800
UK							
Halifax XV	4×1,280	419	6,400	3,060	—	9×7.69	<5,900
Wellington III	2×1,370	410	5,950	3,530	—	8×7.69	<2,040
Lancaster III	4×1,300	435	5,800	<3,800	—	10×7.69	<6,360
USSR							
Pe-2	2×1,050	540	8,800	1,315	—	4×7.62	600–1,000
Tu-2	2×1,850	550	9,500	2,250	2×20	3×12.7	1,000–3,000
Il-4 (Db-3f)	2×1,100	425	10,050	3,300	2×20	3×7.62	1,000–2,500
Pe-8	4×1,700	405	9,000	5,800	2×20	3×7.62	<6,000
Germany							
Ju-87	1×1,200	395	8,100	850	1×15	2/4×7.92	700
Ju-88	2×1,200	465	8,500	2,000	1×20	5/7×7.92	1,200
He-111	2×1,500	408	7,350	1,760	1×20	5/7×7.92	2,800
He-177	2×2,700	480	6,900	3,000	2×20	3/5×7.92	4,000
Japan							
Sb-97 Mitsubishi	2×1,490	475	9,500	2,250	1×20	4×7.7 1×12.7	<2,000
Sb-99 Kawasaki	2×1,105	367	9,700	2,250	—	3×7.7 1×12.7	750

Table 1.9 (*cont*)

(C) Tanks	Muzzle velocity of shell, m/sec	Armament, no.× cal. (mm)		Shells in magazine	Max. depth of armour, mm	Combat weight, tons	Speed km/hr	Range of travel, km
		cannon	machine guns					
USA								
M5 A1	880[a]	1×37	3×7.62	147	<38	16.9	<60	270
M3 A4 Grant	880[a]	1×37	4×7.62	179	57	29.0	40	140
	620[a]	1×75		50				
M4 A2 Sherman	620[a]	1×75	2×7.62	97	100	34.2	46	180
			1×12.7					
UK								
Valentine Mk III	810[a]	1×40	1×7.69	—	60	16.5	25	225
			1×7.92					
Churchill Mk IV	815[a]	1×57	1×7.69	81	150	45.0	25	245
			2×7.92					
USSR								
T-70	760[a]	1×45	1×7.62	70	45	10.0	45	250
T-34	750[a]	1×76	2×7.62	100	52	30.9	55	300
KV-1s	750[a]	1×76	3×7.62	114	82	42.5	43	250
Germany								
T-III (modernized)	823[a]	1×50	2×7.92	78	50	22.3	40	175
	1,198[b]							
T-IV (modernized)	925[a]	1×75	2×7.92	87	<50	24.0	40	200
	1,120[b]							
T-V Panther	925[a]	1×75	3×7.92	79	100	45.0	46	177
	1,120[b]							
T-VI Tiger	810[a]	1×88	2×7.92	92	100	55.0	38	100
Japan								
Model 95 Kani	—	1×47	1×7.7	160	16	7.7	50	400–200
Model 97	—	1×57	2×7.7	80	47	15.4	40	160
Model 99	—	2×37	2×7.7	—	40	30.0	—	150

Notes:
[a] Armour-piercing shell.
[b] Sub-calibre shell.

(D) Self-propelled guns	Based on tank type	Calibre of weapon, mm	Weight, tons	Max. depth of armour, mm	Armament penetration (mm) at range		Shells in magazine	Range travel, km
					500 m	1 km		
USA								
USA								
M7 Priest (1942)[a]	M3	105	<24	57	—	—	69	265
USSR								
SU-76 (1942)[b]	T-70	76	10.5	35	<70/90[c]	<60	60	320
SU-122 (1942)[a]	T-34	122	<40.0	45	<140[c]	<140[c]	40	400–600
SU-152 (1942)[d]	KV-1	152	45.5	60	<132	<125	20	165–300
Germany								
Assault cannon (April 1942)[b]	T-III	75	24	80	<90	<80	99	105
Assault howitzer (March 1943)[a]	T-III	105	30.4	100	—	—	—	200
Naschorn anti-tank cannon (Feb. 1943)[b]	T-IV	88	24	30	<180	<160	40	200

Notes:
[a] Howitzer.
[b] Cannon.
[c] Hollow-charge projectile.
[d] Howitzer-cannon.

Table 1.9 (*cont*)

(E) Artillery systems	Weight in combat position kg	Weight of shell, kg	Muzzle velocity, m/sec	Range of fire, km	Armour penetration at range		Rapidity of fire, per minute	Speed of travel, km/h
					500m	1,000m		
USA								
57mm M1a	1,220	2.84	823	6.5	<66	<58	<30	—
76.2mm M5[a]	2,210	7.0	792	—	<81	<72	<12	—
105mm M2A1[b]	1,920	15.0	473	11.2	—	—	<4	—
114.3mm M1[a]	5,600	25.1	693	18.3	—	—	<3	—
155mm M1[b]	5,430	43.1	564	15.1	—	—	<3	—
106.7mm M1A1[d]	134	10.4	175	2.2	—	—	<20	—
UK								
57mm[a]	1,130	2.85	702	—	—	<65	10–15	—
87.6mm[a]	1,800	11.3	520	12.0	36	30	4	20–25
114.3mm[a]	5,370	24.9	685	18.7	—	—	—	15–18
182.9mm[b]	10,000	91.6	518	15.45	—	—	—	—
106.7mm[d]	120	9	175	3.74	—	—	—	—
USSR								
45mm M-42 (1942)[a]	570	0.85–2.1	<1,070	5	<80	<50	<20	25–60
57mm (1941/43)[a]	1,150	1.79–3.75	<1,270	6.6	<147	<101	<25	25–60
76mm ZIS-3 (1942)[a]	1,116	3.02–6.21	<950	13.2	<90	<75	<25	10–50
122mm M-30 (1938)[b]	2,400	13.3–21.8	<515	11.8	<140	<140	5–7	35–50
122mm A-19 (1931/37)[a]	7,250	25	810	19.8	<155	<145	3–6	20
152mm ML-20 (1937)[c]	7,270	43.6–56.0	655	17.2	—	—	3–5	20
152mm D-1 (1943)[b]	3,650	40.0	<508	12.4	—	—	2–5	20–40
152mm Br-2 (1935)[a]	18,200	48.5	880	<25.1	—	—	1–2	8–15
120mm (1938)[d]	280	15.9	272	5.7	—	—	12–5	15–60
(1943)[d]	256							

Germany								
50mm (1938)[a]	986	2.06	823	9.4	<58	<50	15	—
75mm (1942)[a]	1,425	6.8	<933	—	<95	<84	12–14	—
105mm Model 18/40[b]	1,800	14.8	<540	12.3	—	—	<6	—
105mm Model 18/40(42)[a]	5,620	15.1	910	21	—	—	<6	<15–20
150mm Model 18[b]	5,510	43.5	<520	13.3	—	—	<4	15–20
150mm (1939)[a]	12,200	43	<865	24.8	—	—	<2	<15
105mm (1940)[d]	785	8.65	130–310	6.2	—	—	—	—
Japan								
37mm Model 94[a]	324	0.7–0.8	800	4.5	30[e]	—	10–12	—
47mm Model 01[a]	800	1.54	820	3.7	—	<40	15–20	—
75mm Model 95[a]	1,497	6.4	500	11	—	—	10–12	—
105mm Model 92[a]	3,730	15.8	760	18.2	—	—	6–8	—
105mm Model 91[b]	2,000	16.0	544	10.5	—	—	6–8	—
105mm Model 96[b]	4,100	31.1	540	12	—	—	3–4	—

Notes:
[a] Cannon
[b] Howitzer
[c] Howitzer-cannon
[d] Mortar
[e] at 300m
Source: IVMV, vol. VI (1976), 354–62.

Table 1.10. *GDP per head of the great powers, 1938–1987 (selected years)*

	1938	1950	1973	1987
GDP per head, dollars and 1990 prices				
USA	6,134	9,573	16,607	20,880
UK	5,983	6,847	11,992	15,265
Germany	5,126	4,281	13,152	17,032
France	4,424	5,221	12,940	16,366
Italy	3,244	3,425	10,409	14,659
Japan	2,356	1,873	11,017	16,101
USSR	2,150	2,834	6,058	6,943
Catching up with the United States: GDP per head, per cent of US GDP per head:				
UK	98	72	72	73
Germany	84	45	79	82
France	72	55	78	78
Italy	53	36	63	70
Japan	38	20	66	77
USSR	35	30	36	33
β-convergence: Spearman rank correlation coefficient of income growth over the previous period with income level in the previous period				
Seven countries	—	0.29	−0.75	−0.11
exc. USSR	—	0.71	−0.94	−0.77
σ-convergence: coefficients of variation of income level (per cent):				
Seven countries	36	50	25	25
exc. USSR	30	37	16	13
exc. USA, USSR	31	39	9	5

Source: Taken or calculated from Maddison (1995), appendix D.

suggests their limits. The results are already well known, and are reported here to illustrate the particular outcomes for the major powers.

According to table 1.10, there was no catching up over the transwar period (1938–50); in this period every other major power fell back relative to the United States. This was partly because the US economy had a much higher stock of unutilized capacity in 1938 than the others; this was mobilized in wartime, and contributed to the very high US growth rate up to 1950. There was no catching up in the case of Japan and Germany also because of the war's negative impact which was still strongly felt. Over the next quarter of a century, however, the continental west Europeans and Japan restored the lost ground and closed some of the gap. By the late 1980s, all were within 70–80 per cent of the US benchmark; this was also

the British case but for Britain it did not mark an improvement over the past. In the Soviet case the gap remained a yawning chasm.

Under the heading of β-convergence we see that between 1938 and 1950 the growth of the wartime powers was *positively* associated with initial income level, as shown by its positive Spearman coefficient (0.29). This mainly reflected the great expansion of the richest economy (the United States) and the collapse of the poorest (Japan). But once the war was over a strong, negative, β-convergent association of growth with initial income set in (-0.75 for 1950–73, but a much weaker -0.11 for 1973–87). Significantly, however, the USSR did not participate in β-convergence, the evidence for which becomes much stronger when the Soviet economy is omitted. This is particularly so after 1973, when Soviet incomes, already lowest among the major powers, were falling further behind.

As for σ-convergence, the dispersion of income levels among the major powers was greater in 1950 than in 1938 (the coefficient of variation rising from 36 per cent to 50 per cent), but much less by 1973 (a coefficient of variation of 25 per cent). Much of the remaining income inequality is provided by the Soviet Union's failure to converge, so when the Soviet case is excluded a sharp increase in the rate of convergence is shown. Finally, the process is shown to have been regionally rather than globally convergent (the regional focus being western Europe and Japan) when the USA is omitted as well, which leaves us with the well-known uniformity of incomes achieved by Britain, France, Germany, Italy, and Japan by the late 1980s.

Thus slow postwar economic growth was common to the United States, Britain, and the Soviet Union, while the growth of Germany, Italy, and Japan was more rapid, in inverse ratio to their initial GDP per head. In other words, the former Allies, although victorious in wartime, were now on the 'losing' side in postwar growth terms. The cliché that 'those who won the war lost the peace' therefore contains a grain of truth.[15] At the same time (like all clichés) its validity is strictly limited. Britain and America grew more slowly after the war mainly because they were already immensely rich and had suffered relatively little. The losers grew more rapidly, mainly because they had been relatively poor to begin with and also had to make up substantial wartime losses. Only the Soviet economy began poor, lost significantly, and remained poor in relative terms despite reasonable postwar growth (hence the 'defeated victor' of chapter 7).

The influence of the war

In what ways did wartime experience influence these long-run trends and the postwar institutions which presided over them? Every country tried to

draw something positive from the ordeal of the war, but what this was differed according to national circumstances. Most widespread were conclusions regarding an integrated world economy, capital accumulation, and mass production.

Global economic integration

First, the cause of an integrated world economy received a decisive boost from the outcome of the war. American thinking found one of the causes of World War II in the interwar disintegration of the world economy, and the spread of great-power protectionism within trading blocs based on colonial lines. Italian and Japanese wartime experience (and German experience too, if to a lesser extent) showed the impossibility of autarkic mobilization, and convinced the postwar leaders of these countries that each must find its place in a new worldwide division of labour. Thus the Americans and their former enemies plunged eagerly back into the world market. Italian and Japanese participation, although heavily regulated at first, was nonetheless genuine. All these countries became active participants in the multinational institutional framework of the postwar global economy – the IMF, IBRD (later the World Bank), and GATT. There was no turning back to the economics of the German *Grossraumwirtschaft* or the Japanese Greater East Asia Co-prosperity Sphere.

Only the British and Soviet empires survived the war. The Soviet empire was soon greatly augmented by the adherence of the east European satellites, whereas the British would preside over the dissolution of theirs, in some cases willingly, too often grudgingly. Both would eventually pay the price for clinging to empire trade, the British first.

Capital accumulation

Second, the war imposed great losses of both human and physical capital upon the great powers. Precise comparisons are still difficult, but available measures are summarized in table 1.11. They show direct war losses in proportion to prewar stocks. Wartime disinvestment and birth deficits (the demographic equivalent of disinvestment) are not taken into account; nor is wartime investment, which in the case of industrial fixed capital sometimes exceeded war damage and depreciation combined. The two poorest countries, the USSR and Japan, suffered the greatest losses. The losses of physical capital typically outweighed those of human capital, at least in percentage terms (except in the case of the United States, where both were negligible). Thus, the direct effect of warfare was to bring about a relative shortfall of physical assets.

The war itself saw significant industrial investment, certainly in the less industrialized powers, each of which became more industrialized in conse-

Table 1.11. *War losses attributable to physical destruction (per cent of assets)*

	Human assets 1	Physical assets: national wealth 2	Physical assets: industry fixed assets 3
Allied powers			
USA	1	0	—
UK	1	5	—
USSR	18–19	25	—
Axis powers			
Germany	9	—	17
Italy	1	—	10
Japan	6	25	34

Note:
Figures are war damage to fixed assets and war deaths amongst the working population; they take no account of wartime replacement of either fixed or human capital.
Sources:
Human assets
USA, Germany: total war deaths divided by prewar population from Urlanis (1971), 295.
UK: chapter 2 (p. 71).
USSR: table 7.13.
Italy: chapter 5 (p. 213).
Japan: excess deaths, 1941–5, compared with 1940 population, from table 6.8.
Physical assets
UK (physical destruction, per cent of 1938): table 2.20.
USSR: table 7.13.
Germany (war destruction in the postwar Anglo-American occupation zone, per cent of 1936): table 4.20.
Italy: chapter 5 (p. 211).
Japan (war damage, per cent of the sum of 1945 assets plus war damage): table 6.14 (col. 5).

quence. For the German economy, industrial fixed investment was an effective countermeasure to Allied bombing of the German war economy. In Germany, Italy, and Japan, the postwar stock of industrial fixed assets was not less than the prewar stock. Each of our six countries, and France as well, finished the war with a larger stock of machine tools than before.[16] Losses in residential structures, household durables, vehicles, and ships were more likely to have persisted. After the war, each country embarked on a further drive of physical accumulation to restore the war losses, and the general pattern was for domestic investment ratios to be substantially higher after World War II than in the interwar period.

Investment was stimulated everywhere by what Barry Eichengreen has termed the 'postwar settlement' between firms, workers, and the state.[17] Under this settlement firms pursued high investment policies in exchange for workers' high effort and wage moderation on one hand, and on the other, government activism to stabilize aggregate demand and the international trading environment. The same settlement was enforced under state socialism in the USSR and eastern Europe as was pursued more by consensus under capitalist arrangements in the west.[18]

Equally widespread were conclusions regarding the importance of human capital accumulation, and the network of social and political relationships which sustains it. But, as Stephen Broadberry has shown, precise perceptions differed.[19] German and Japanese industry emerged from the war with enhanced emphasis on job rights, craft training, and worker participation. There, human capital investment was directed towards skilled labour and apprenticeships. In Britain, wartime experience had also promoted the concept of human assets, and this was expressed in schemes for universal health care, secondary education, and social insurance which were implemented after 1945. These were advances, to be sure, but they still left British concepts of human capital half a century behind postwar continental practices. As the postwar period wore on, British practice increasingly emulated the American emphasis on unskilled labour for standardized mass production, at the same time lagging behind in adoption of the associated stress on management education.[20]

In the same way investment in R&D ('knowledge capital') was boosted everywhere, but in the United States, Britain, and the Soviet Union the process was more centralized, with more emphasis on national goals, particularly in defence fields with the additional implication of secrecy. In Germany, on the other hand, R&D spending was more oriented to diffusing innovation capabilities throughout industry by means of investment in supportive processes.

On average the defeated had lost more heavily than the victors, but from the point of view of the immediate setback to growth the Soviet Union had more in common with the losers. The German, Japanese, and Soviet economies were all traumatized. Tests for trend breaks in GDP per head applied by Nick Crafts and Terry Mills suggest that, for most countries of the present-day OECD there was no negative wartime shock to growth – but that there was such a shock in the cases of defeated Austria, Finland, France, Germany, and Japan. All these display marked declines in trend GNP growth over 1940–50 compared with 1920–39. In contrast, for neutral Switzerland, and victorious Australia, Canada, and the United States, 1940 initiated an acceleration phase.[21]

As for the long-run impact of the war on growth, for all the market economies but one in the Crafts/Mills sample, victors and vanquished alike, trend growth was more rapid after 1950 than before 1940. This was not just a matter of recovery to a prewar trend since, with minor exceptions (Finland, Sweden, and Switzerland) postwar OECD trend growth rates remained more rapid than before 1940 until 1989, long after any recovery effect had faded. Germany was technically also an exception, with trend growth in GDP per head at 3.12 per cent (1956–89) compared with 3.30 per cent (1920–39), 0.71 per cent (1940–50), and 13.89 per cent (1951–5); thus German growth after 1956 was slower than before 1939, but on the other hand by 1956 the level of German GDP per head was already roughly 30 per cent *above* the extrapolated prewar trend. Thus, despite the scale of wartime destruction, the losers did not suffer a lasting penalty. In contrast, on the evidence presented in chapter 7, by 1950 Soviet economic growth had either resumed its prewar trend at a lower level of GNP per head than before the war, or was undergoing temporary acceleration on a path of recovery to the prewar trend but with little evidence of permanent acceleration.

Mass production/flexible production

Third, one of the factors which differentiated losers from winners was the shared commitment of postwar American, British, and Soviet industry to an American model of technological leadership based on centralized, large-scale mass production. This model owed much to wartime experience. The Allied countries were each enormously impressed by the victory of American standardized mass production. The peacetime merits of the craft system more favoured by German and Japanese industrial tradition had evaporated in the heat of war mobilization. The Soviets, having moved towards an American mass production model in the interwar period, now intensified it uncritically. Postwar attitudes in British industry also shifted towards an Americanized way of thinking. The Americans themselves appeared poised to dominate the world supply of industrial products for decades to come.

In wartime as the Germans, Italians, and Japanese discovered, craft production did not work. The quantitative superiority of the Allies in weaponry was based on standardized products in a limited assortment, interchangeable parts, specialized factories and industrial equipment, an inexorable conveyor belt system of serial manufacture, and deskilled workers who had neither the qualifications nor the discretion to alter designs or specifications. As long as the German system emphasized the small firm, the artisan, and the continual improvement of the product,

German industry was condemned to low utilization, high costs, and small quantities.[22] Only in 1942–3 did the Germans begin to break with their own tradition and convert to a mass production technology, making substantial production gains in the process. The Japanese, too, found huge advantage in converting to mass production of weapons.[23] The failure of Italian war production was in part a failure of the Italian corporate structure based on the craft system (see also chapters 4, 5, and 6).

German, Italian, and Japanese industry did not forget about craft production, however, and reaped the benefits later. Whatever the merits of mass production for turning out huge numbers of identical weapons, they were overtaken increasingly by the advantages of the craft system for civilian production in the postwar period. These advantages were accentuated by the advances in information technology which made possible the emergence of 'flexible manufacturing'.[24] In the postwar decades it was flexible manufacturing which eventually brought global technological leadership to Germany and Japan. Thus the wartime losers 'won' the peace in the sense that they came to dominate the postwar global industrial economy and world trade in manufactures.

Notes

1 In considering these issues, the authors are happy to acknowledge the pioneering contributions of Alan Milward (1977) and Gyorgy Ránki (1993). Our ability to go beyond them has been made possible only by the passage of time, the opening of archives, and the advantages of international collaboration.
2 Overy (1995b), 15.
3 Goldsmith (1946), 69.
4 Compare the picture of relative under-capitalization of the Axis forces advanced by Harrison (1988), 175.
5 For discussion of this topic in a comparison with World War I, see Gatrell, Harrison (1993).
6 Liberman (1996), 112.
7 Milward (1977), 132–68.
8 Liberman (1996), 36–68.
9 Hancock, Gowing (1949), 368.
10 For examples see Kaldor (1946), Klein (1959), Milward (1965), Harrison (1988).
11 Overy (1994), esp. 343–75.
12 Van Creveld (1985), 5–6.
13 I thank Hugh Rockoff for making this point to me.
14 On catching up, see Maddison (1995), and on convergence Crafts, Toniolo (1995). On the two types of convergence see Barro, Sala-i-Martin (1991).
15 Thus Richard Overy (1995b), xi, writes: 'When people heard that the title of my next book was to be "Why the Allies Won", it often provoked the retort: "Did they?".'

16 For the USA, UK, Germany, France, and Italy, see Milward (1977), 334, and for Japan, table 6.14. In the USSR, according to TsSU (1972), 61, the stock of metal-cutting machine tools more than doubled between November 1940 and March 1951, but there are no figures for intervening dates.
17 Eichengreen (1993).
18 Crafts, Toniolo (1995).
19 Broadberry (1994, 1995).
20 Broadberry (1995), 85–7.
21 Crafts, Mills (1996), 425.
22 For a comparative summary see Overy (1995b), 180–207.
23 Sasaki (1994).
24 Broadberry (1995).

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6 In 1942 farming households saved 13.7 billion rubles, nearly two-fifths of their cash incomes, while non-farm households' accumulated savings fell (GARF, f. 687, op. 48, d. 5726, l. 183).
7 GARF, f. 3922/4372, op. 4, d. 115, ll. 50–3. For further discussion, see Harrison (1995).
8 Wheatcroft, Davies (1985).
9 Harrison (1985), 23–25.
10 Davies (1984, 1993).
11 Bergson (1953), 7–9n.
12 Khanin (1991), 14–28.
13 Wiles (1962), 226.
14 For recent discussion of the Gerschenkron effect and other issues, see Wheatcroft and Davies (1994).
15 Harrison (1993); Wheatcroft and Davies (1994).
16 Harrison (1995).
17 For full results see Harrison (1996a).
18 Raymond Powell, the pioneer of wartime Soviet GNP estimates, was forced to rely principally on these unreliable official index numbers of branch output; see Powell (1968).
19 A similar process was noted in Germany, and accounted for much of the belated surge of German war production between 1941 and 1944; see Overy (1994).
20 These alternative measures correspond with the concepts of '(I) national utilization', and '(II) domestic finance' of resources supplied to the war effort, outlined by the present author in Harrison (1988), 183–4. The figures given here supersede the somewhat higher wartime percentages reported in ibid., 184, table 3, which were based on crudely adjusted official data and guesswork.
21 Kaldor (1946), Klein (1959).
22 See Moskoff (1990), Barber and Harrison (1991).
23 Arutiunian (1970), Nove (1985).
24 Harrison (1996a), ch. 5.
25 Rybakovskii (1989), 96. Rybakovskii's own estimate (27–28 million) was little more than the new Goskomstat figures which were soon to appear.
26 Andreev, Darskii and Khar'kova (1990), 26–7.
27 Ellman and Maksudov (1994), 672.
28 Figures reported by Krivosheev (1993) are reviewed by Maksudov (1993).
29 For more detail, see Barber and Harrison (1991), 86–9.
30 This is not the first attempt to assess the war's long-run economic impact. See for example Millar, Linz (1978), Linz (1980, 1985).
31 On the persistence of the demographic shock, see Ellman and Maksudov (1994), 674. Moorsteen and Powell (1966), 243, investigating capital losses, and Syme (1994), investigating GNP losses, found by different means a permanent or near permanent shock to the levels of these variables (according to Moorsteen and Powell's figures the capital stock would have regained its prewar growth path after 140 years), with the loss represented by six to seven years' growth.
32 Harrison (1996a), appendix N.

33 Harrison (1996b).
34 Cooper (1988), 174–5.
35 Ibid., 176.
36 Crowfoot and Harrison (1990).
37 Hence the title of a recent article by Andrei Illarionov (1995): 'Pochemu pobediteli v voine proigrali mir?'
38 For a sceptical view of the growth effects of the defence burden see Easterly and Fischer (1995).
39 See for example Siegelbaum (1988).

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