Chapter 2

Why the Wealthy Won: Economic Mobilization and Economic Development in Two World Wars

Mark Harrison

> "It's the economy, stupid" (James Carville, managing Bill Clinton's US presidential election campaign in 1992).

The study of total war suggests two themes that might be of common interest to both economists and historians.[1] One is to evaluate the contribution of economic factors to the outcomes of wars. The other concerns the effects of wars on long-run economic development. Both topics are worthy and have attracted substantial attention in the literature (Milward, 1977; Hardach, 1977; Ránki, 1993; Overy, 1995; Harrison, 1998a; Chickering and Förster, 2000). This paper deals only with the first.

The pattern of military and economic mobilization in World War II suggests five stylized facts (Harrison, 1998a). First, victory went to the side that supplied the greatest quantity of military resources to the theatres

This chapter was first published by Editions Economica under the French title "Pourquoi les riches ont gagné: Mobilisation et développement économique dans les deux guerres mondiales" in Deux guerres totales 1914–1918 − 1939–1945: La mobilisation de la nation (edited by Dominique Barjot), 135–179. © Ed. Economica 2012.

[1]This paper was first presented to the conference on "La mobilisation de la Nation à l'ère de la guerre totale, 1914–1945: Armer, produire, innover, gérer" organized by the Département d'Histoire de l'Armement of the French Ministry of Defense and held in Paris, 26–28 October 2004. I thank the organizers and participants for comments. I have discussed the issues raised in this paper with Stephen Broadberry over many years and I have gained more than I can say from his advice.

of war. Second, superiority in military resources was based on superior wealth: the richer countries had a systematic, disproportionate advantage in their ability to supply the front with troops and military equipment. Third, are the qualifications: time and geography mattered. The richer countries needed time to make superior resources count. The countries that were closer to the front line tried harder. Fourth, the significance of other non-economic factors like leadership, organization, discipline, and morale was largely conditional on wealth, geography, and time. Given superior resources and the need and opportunity to apply them, the richer countries could solve other problems that defeated the poorer ones. Fifth, these were rules for market economies. In World War II, Stalin broke them by inventing a new kind of command economy that could produce military power out of proportion to its economic weight.

Since our project on World War II, Stephen Broadberry and I have organized a similar project on World War I which is nearly complete (Broadberry and Harrison, 2005a; 2005b). In this paper, I will pool the evidence from both wars and I will suggest that the empirical support for the predominant importance of economic factors in the first war is just as strong if not stronger than in the second.

I do not intend to narrate the story of economic mobilization in total war, but there is one aspect of the narrative that I will take for a starting point, and it is my first retreat from unbridled economic determinism. Economics would *not* have played an important role if either war had gone according to the aggressors' plan of attack. These plans were invariably for a short campaign ending in a speedy victory. The calculations made in Berlin, Rome, Vienna, and Tokyo at different times all gambled on the expectation that purely military superiority and strategic advantages would be enough to defeat the enemy long before economic factors had time to come into play. Often enough economic factors were not even considered. This mindset was not always wrong. It was almost right when Germany attacked France in 1914. It was exactly right from Japan's attack on China in 1937, and the German occupation of Czechoslovakia in 1938, through the fall of France in 1940, to the spread of German power through the Mediterranean and the Balkans in the spring of 1941. But in both world wars, a point came where it lost its relevance. It was at this point, the Battle of the Marne in 1914 and the Battle of Moscow in 1941, that economic factors began to exert their power. This is why time generally limited the role of economic factors in the two world wars: the economic factors played their part once circumstances had given them time to enter the game.

In Part 1 of the paper I will lay out the facts of the Allied superiority in military resources in two world wars. Part 2 does the same for the quantity and quality of the two sides' aggregate resources and production before the war, and also shows that each country's success in wartime production mobilization is largely explained by its pre-war starting point. Part 3 completes the triangle by showing that its pre-war starting point also largely explains each country's success in fiscal mobilization, military mobilization, and armament for capital-intensive warfare. In Part 4 the reasons underlying the strong relationship between prewar economic development and the success, or failure, of a country's wartime mobilization are considered. Part 5 concludes.

1. *Military Superiority*

In both world wars the side won that fielded the greatest quantity of men and military equipment. While this alone does not explain the outcome of either, the figures in Tables 1 and 2 certainly leave a strong impression.

In World War I, the Allied armies outnumbered those of the Central Powers by 60 per cent; the Central Powers produced more field guns and nearly as many rifles but the Allies out produced them substantially in the machine guns that dominated the infantry engagement and in the aircraft and tanks that would eventually break the defensive stalemate of the trenches. In World War II, the Allied armies outnumbered those of the Axis

Table 1. Allies vs Central Powers: Soldiers and Equipment in World War I.

	Allies (1)	Central powers (2)	Ratio, 1:2 (3)
Soldiers Mobilized, million	41.0	25.6	1.6
Weapons Produced:			
Guns, thousand	59.9	82.4	0.7
Rifles, million	13.3	12.1	1.1
Machine Guns, thousand	656	319	2.1
Aircraft, thousand	124.5	47.3	2.6
Tanks	8919	100	89.2

Source: Broadberry and Harrison (2005a: 16–17).
Note: Under Allies, soldiers mobilized cover USA, UK, France, Italy, Russia, and Serbia; the coverage of weapons produced is limited to USA, UK, France and Russia. Under Central Powers, soldiers mobilized cover Germany, Austria-Hungary, Bulgaria and Turkey; weapons produced cover only Germany and Austria-Hungary.

Table 2. Allies vs Axis: Soldiers and Equipment in World War II.

	Allies (1)	Axis (2)	Ratio, 1:2 (3)
Combatant-years, million	106.4	76.9	1.4
Weapons Produced:			
Rifles and carbines, million	25.3	13.0	1.9
Combat aircraft, thousand	370	144	2.6
Machine Guns, thousand	4827	1646	2.9
Guns, thousand	1357	462	2.9
Armoured vehicles, thousand	216	51	4.3
Mortars, thousand	516	100	5.1
Major naval vessels	8999	1734	5.2
Machine pistols, thousand	11604	1185	9.8
Ballistic missiles	0	6000	—
Atomic weapons	4	0	—

Source: Harrison (1998b: 14–16) except that numbers in the French armed forces in 1940 are corrected as noted by Harrison (2005). The number of ballistic missiles is an approximate upper limit based on Ordway and Sharpe (1979: 405–7). Of the four bombs produced by the Manhattan Project one was tested at Alamogordo, two were exploded over Japanese cities, and one remained unused.
Note: Allies are USA, UK, France, and USSR. Axis powers are Germany, Austria, Japan and, for soldiers mobilized and weapons produced other than rifles or machine pistols for which data are lacking or unreliable, Italy. Combatant-years are calculated as the cumulative sum of the strength of the armed forces of each country in each year multiplied by the proportion of that year in which the country was at war on the side of its respective coalition. For countries other than Italy, wartime supply is calculated as annual output adjusted for the number of months of wartime in each year; combatant-years are calculated similarly. For this reasons totals may differ slightly from those calculated in the source. For Italian munitions, wartime totals only are available. "Armoured vehicles" are tanks and self-propelled guns. For Germany, "major naval vessels" are submarines.

by a somewhat smaller margin, 40 per cent.[2] But in weapons and military equipment, roughly speaking, 2:1 was the *minimum* Allied advantage; the one component of military strength in which the Allied armies and navies did not dominate was in ballistic rocketry, used mainly against civilians, this was eventually offset by the American nuclear monopoly of 1945.

An objection to the weight I give these figures is that they omit the moral factor in warfare. Numbers are not the same as fighting power.

[2]I write about the "Allies" as if there was seamless continuity between the two world wars. This is convenient rather than accurate. The membership of the Allied camp in the two wars overlaps but the match is not perfect. In World War I, the United States was an Ally only by a gentlemen's agreement since no formal treaty was signed.

History has many cases when superior morale enabled a smaller army to defeat a much larger one. Not many of these come from the two world wars, however.

When we look at warfare from the point of the view of the individual we may conclude that the moral factor is the *only* thing that matters. The problem is that the collective rationality of the army differs from that of the individual. Brennan and Tullock (1982) suggest that we should think of each rival army not as a unit but as a network of individuals each bound by a moral calculus that the adversary must disrupt to win. In this calculus there are two arguments, the probabilities that my enemy will fight against me and that my comrade will fight with me. When the general has deployed his soldiers and guns his remaining problem is to convince both the enemy and each one of his men that all his men will fight, and there are various well-established mechanisms by which he can do these things. By them he strengthens the morale of his army and weakens that of the enemy.

Clearly, resources did not uniquely determine the outcome on the battlefield. It is more reasonable to claim, first, that resources decided the outcome on the battlefield when other things such as leadership, organization, and morale were equal on both sides; second, in the two world wars these other things were very often nearly equal in fact, or if they were not equal at first they tended to become roughly equal given time, so that in practice resources *did* determine the outcome on the battlefield. A well-supplied army that was losing because of deficient morale could be stiffened and defeat usually had a competitive stiffening effect; on the other hand soldiers who lacked food and ammunition would eventually be pushed back even though their morale remained high.

The evidence for the stiffening effect of defeat is that in two world wars there were so few cases of a failure of morale. Morale failed in the Russian, French, and Italian armies in 1917, 1940, and 1941 respectively; the French army also came close in 1917 and the Soviet army in 1942. The more usual case is that defeat was stiffening; the commanders on both sides proved generally successful in holding their armies together and responded to setbacks and losses with imagination and resilience. Most remarkable was the way that the German and Japanese armies of World War II were held together through years of withering losses and continuous defeats. Without the competitive stiffening effect both wars would not have lasted so long and cost so many lives.

For present purposes there is a simple implication: the Allies did not win either war because their armies were better motivated or better led or

had stumbled on some clever formula for undermining the morale of the enemy. They prevailed on the battlefield because of material superiority. Our western culture has provided us with a thousand legends of individual heroism leading to victory against the odds. No doubt this happened occasionally. The prosaic norm, however, is that when British or American troops met the armies of the Axis on equal terms, man for man, and gun for gun, they often lost; when they fought on bravely despite being cornered, outnumbered, and outgunned, they were usually killed or taken prisoner.

In addition it may be objected that material superiority was not enough because it still had to be applied correctly. The choice of the *Schwerpunkt* had to be right, and this required strategic vision. But with material superiority even bad strategy could eventually prevail. Without material superiority, on the other hand, a single bad decision could lead to disaster. The Allies could afford a Gallipoli, but the Axis could not afford a Stalingrad.

A still wider objection to the sums in Tables 1 and 2 is that one should not add up the resources in different national armies without taking into account the cooperation between them. Just as international specialization and trade increase the joint value of the economic resources of different countries, in the same way military cooperation increases the fighting power of men and weapons. Just as a rabble of a thousand men is not an army whatever their uniform, half a dozen national armies without a common strategy do not make an alliance regardless of treaties and signatures. From this point of view it is probably important that in both world wars the Allies eventually pooled their economic resources and their military decision making to a greater degree than the coalition that opposed them. If so, then the ratios of Allied superiority shown in Tables 1 and 2, if anything, underestimate the true Allied advantage.

2. *Economic Superiority*

The military advantage of the Allies in two world wars was based to a much higher degree than is sometimes recognized on prewar economic advantage. A narrative account of either war necessarily begins with a detailed account of the plans and preparations of both sides. Taking a broader view, however, it appears that plans and preparations had little identifiable influence on the resources that a country actually supplied to the fighting front. By far the most important factor was its prewar size and level of economic development. To put it another way, the best way that

a country could prepare for war was to arrange to be large and generally prosperous beforehand. Compared to this, nothing else mattered much.

The size of each side is measured by adding up the populations, territories, and gross domestic products of the territories at war. Populations limited the numbers of men and women available in each country for military service or war work. Territories limited the breadth and variety of natural resources available for agriculture and mining; the wider the territory, the more varied the soil types and the minerals beneath the soil tended to be. GDPs limited the volume of weapons, machinery, fuel, and rations that could be made available to arm and feed the soldiers and sailors on the fighting front. The larger the population, territory, and GDP of a country, the easier it would be for that country to overwhelm the armed forces of an adversary.

GDP was more important than either territory or population, however: A poor country might have a large population, but if most of the adults were engaged in low-productivity subsistence farming then there would be little real possibility of transferring many of them out of agriculture to the armed forces or war industry since the remaining farmers would be unable to produce enough food to keep everyone alive. Equally, a poor country might have a large territory but, without a high level of development of roads and railways, would be unable to exploit it economically or defend it militarily. Finally, a poor country typically lacked efficient government and financial services of the kind necessary to account for resources and direct them into national priorities. In short, a relatively high level of economic development was essential if territory and population were to count in war. The economic development of a country can be measured by its GDP per head of the population.

For simplicity, I will omit consideration of trade, aid, and lending between allies, and the role of trade with neutrals. These were of unquestionable importance. Economic specialization and cooperation added value to economic resources in wartime just as military cooperation increased the fighting power of military resources. In both world wars, the Allies probably maintained better economic integration than their adversaries and this increased their overall economic superiority above what the figures will show, but space is lacking to deal with this topic in any detail.

Table 3 adds up the resources on each side at the outbreak of World War I. The figures listed in the table are those reported for each territory in the year 1913. In reality, populations and outputs changed year by year during the war but for many countries and colonies we do not know by

Table 3. The Alliances in World War I: Resources of 1913.

		Territory		Gross domestic product	
Population, million		million sq. km	ha. per head	$ billion	per head, $
Allies:					
November 1914					
Allies, total	793.3	67.5	8.5	1 093.6	1 379
UK, France, and Russia only	259.0	22.6	8.7	622.8	2 405
November 1916					
Allies, total	853.3	72.5	8.5	1 210.5	1 419
UK, France, and Russia only	259.0	22.6	8.7	622.8	2 405
November 1918					
Allies, total	1 271.7	80.9	6.4	1 760.6	1 384
UK, France, and USA only	182.3	8.7	4.8	876.6	4 809
Central Powers:					
November 1914					
Central Powers, total	147.9	5.9	4.0	366.8	2 480
Germany and Austria-Hungary only	117.6	1.2	1.0	344.8	2 933
November 1915					
Central Powers, total	152.7	6.0	3.9	374.2	2 450

Source: Broadberry and Harrison (2005a: 8–10).
Notes: Figures show populations, territories, and incomes for the year 1913. Unless otherwise specified, totals include all lesser powers, colonies, and dependent territories. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

how much. The table does show how the volume of resources on each side changed purely as a result of different countries entering and leaving the war. In the first phase of the war Russia, France, and the United Kingdom were allied as the powers of the Triple Entente. They brought with them their dependencies and colonies. Other countries joined in too: Serbia and the other Yugoslav states, the British Dominions, Liberia, and Japan with her colonies. During 1915/16 a second wave of countries joined the Allies: Italy, Portugal, and Roumania. In the third wave of 1917–18 Russia dropped out but the United States joined in, bringing its own possessions, most of Central America and Brazil. Greece, Siam, and China also joined. By the end of this process governments representing 70 per cent of the world's prewar population and 64 per cent of its prewar output had declared war on the Allied side.

The bare totals on the Allied side do not give any idea of their heterogeneity. The British empire will do for illustration since it comprised some of the richest and poorest regions in the world. Britain had a prewar

population of 46 million with an average income per head of nearly $5,000 (at 1990 prices). Its colonies, excluding the Dominions, had a prewar population of 380 million, mostly Indians, with an average income of less than $700. As a result, a colonial population eight times that of Britain produced a similar volume of income. However, this income was far less available than Britain's for fighting Germany for three reasons: it was hundreds or thousands of miles away from the theatre of war, the level of development of colonial government and financial services made it hard to tax, and most of it was already committed to the subsistence needs of the colonial populations. In short, the mere possession of low income territories was of little value to a great power in the war. If India helped Britain in the war it was to enable British trade and commerce rather than because Britain could mobilize Indian resources in any meaningful sense. And the trade that really mattered to the British economy in the war was with rich America and Canada, not with poor India.

The changing resources of the Central Powers, also shown in Table 3, can be described more briefly. Austria-Hungary began the war, joined immediately by Germany and soon by the Ottoman Empire. In 1915 the Central Powers were joined by Bulgaria, although not by Italy which reneged on its prewar treaty obligations. At its maximum extent, the alliance of the Central Powers comprised little more than 150 million people, but their relative lack of success in accumulating low-income colonies made them relatively well off with an average income per head of $2,450, comparable to that of Italy on the Allied side.

Table 4 compares the resources on each side at three benchmark dates: November 1914, 1916, and 1918. This table strikes a balance for each alliance as a whole, and also counting great powers only. The rationale for the latter is very simple: if low-income colonies did not count much, how do the figures look if we do not count them at all? There is some imprecision here, of course. For example, Russia is included as a great power, but much of its territory was little more developed than that of India, which is excluded; the British Dominions are also excluded although they were much richer than Russia. Still, singling out the great powers has the merit of simplicity.

Even in the first stage of the war the Allies had access to five times the population, eleven times the territory, and three times the output of the Central powers. This access was limited by relatively low average incomes across the colonial empires of Britain and France, and low incomes in Russia; we see that the average level of GDP per head on the Allied side

Table 4. Allies versus Central Powers: Resource and Development Ratios.

	Population	Territory	Territory per head	Gross domestic product	GDP per head
November 1914					
Total	5.4	11.5	2.1	3.0	0.6
Great Powers only	2.2	19.4	8.8	1.8	0.8
November 1916					
Total	5.8	12.3	2.1	3.3	0.6
Great Powers only	2.2	19.4	8.8	1.8	0.8
November 1918					
Total	8.6	13.7	1.6	4.8	0.6
Great Powers only	1.6	7.5	4.8	2.5	1.6

Source: Calculated from Table 3.
Note: Figures show ratios of Allies to Central Powers in populations, territories, and incomes for the year 1913. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

in 1914 was not much more than half that of the Central Powers. If we consider great powers only then the Allied advantages in population and output shrink to twice; the Allied advantage in territory actually increases, reflecting the German and Turkish propensities to colonize sandy deserts in Africa and the Middle East.

As the war continued, the Allied powers' advantage in output grew. The decisive year was 1917. When America displaced Russia, the Allied population and territory declined but its output multiplied; the average development level of the Allied powers rose above that of the Central Powers for the first time.

Table 5 covers World War II on the same lines as Table 3. It shows the resources on the territories on either side that are reported for 1938. The territories on each side changed during the war as different countries joined the war, left it, or changed sides. So too the economic potential of each alliance changed. The Allied powers were always economically more developed than the Axis powers, but again the bare totals give little idea of the heterogeneity on each side. The within-coalition variation was greater on the Allied side because it included some of the richest and poorest countries in the world: Australia and India, for example. In contrast the Axis powers were middle-countries that tended to invade other middle-income countries.

The balance of resources is made explicit in Table 6. This balance is struck twice, in 1938 as the Axis powers contemplated their options, and in 1942 when their conquests had reached their greatest extent and their global power was at its peak. It shows the tempting target presented by the prewar

Table 5. The Alliances in World War II: Resources of 1938.

		Territory		Gross domestic product	
Population, million		million sq. km	ha. per head	$ billion	per head, $
1938					
Allies, total	689.7	47.6	6.9	1 024	1 485
UK and France only	89.5	0.8	0.9	470	5 252
1942					
Allies, total	783.5	68.0	8.7	1 749	2 232
UK, USA, and USSR only	345.0	29.3	8.5	1 444	4 184
1938					
Axis, total	258.9	6.3	2.4	751	2 902
Germany, Austria, Italy, and Japan only	190.6	1.2	0.7	686	3 598
1942					
Axis, total	634.6	11.2	1.8	1 552	2 446
Germany, Austria, Italy, and Japan only	190.6	1.2	0.7	686	3 598

Source: Harrison (1998b: 3–9).
Notes: Figures show populations, territories, and incomes for the year 1938. Unless otherwise specified, totals include all lesser powers, colonies, and dependent territories, but China is omitted throughout. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

Table 6. Allies Versus Axis: Resource and Development Ratios.

	Population	Territory	Territory per head	Gross domestic product	GDP per head
1938					
Total	2.7	7.5	2.8	1.4	0.5
Great Powers only	0.5	0.6	1.4	0.7	1.5
1942					
Total	1.2	6.1	4.9	1.1	0.9
Great Powers only	1.8	23.5	13.0	2.1	1.2

Source: Calculated from Table 5.
Note: Figures show ratios of Allies to Axis in populations, territories, and incomes for the year 1938. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

empires of Britain and France with nearly three times the population and nearly eight times the territory of the Axis powers' sway. The temptation appears all the greater when set beside the initial inferiority of the Allied powers themselves in everything but metropolitan development level. But

the success of the Axis powers that followed aroused the forces that would combine to defeat them.

By 1942, Germany and Japan appeared to stride the world. This is shown in the fact that by 1942 the overall balance of populations and GDPs on each side had become almost equal. Even the huge Allied advantage in territory had shrunk somewhat. In total war, however, the control of far-flung empires was still less important than the size and development level of metropolitan resources. Thus, Germany extracted more food from industrialized France than from the agrarian Ukraine, while Britain was fed from the United States and Canada, not India (Milward, 1977; Liberman, 1996). When it came to metropolitan resources, the decisive facts were the adhesion of the US and Soviet economies to the Allied side. The result was that even in 1942 the Allied powers out produced the Axis by 2:1.

The figures in Tables 1 to 4 are based on the assumption that in wartime, the real output of a given territory did not change. While we cannot track the changes for all countries, the figures available suggest in both wars the wartime changes in output favoured the Allies. In each case there could be an interesting national story to tell. In World War I, for example, the British and American economies expanded. Australia and New Zealand marked time. It is true that Russia began to collapse in 1916 and France in 1917, and this emphasises still more forcefully the extent to which the Allies were saved by the American entry into the war. On the side of the Central Powers, however, the dismal failure of wartime production mobilization was evident from the outset: for much of the war period the German and Austrian economies flatlined at 20 to 25 per cent below their prewar benchmarks for real output. Wartime information is unreliable for Italy and lacking for the Ottoman Empire and Bulgaria.

Figure 1 shows that wartime economic success can be largely explained on the basis of each country's prewar economic development level measured by GDP per head. Moreover, the same pattern is evident in World War II from Figure 2. Pooling the figures for twenty countries in two wars we find that three fifths of the total variation in wartime production can be explained by the prewar economic development level, leaving only two fifths of the story to be told on the basis of national peculiarities of policy, governance, and morale (regression results are reported in Appendix, Table A-1).

Finally, in economic as in military decisions the richer powers could afford mistakes. It seems likely that every country made similar mistakes in the government direction of investment. Uncontrolled mobilization led to

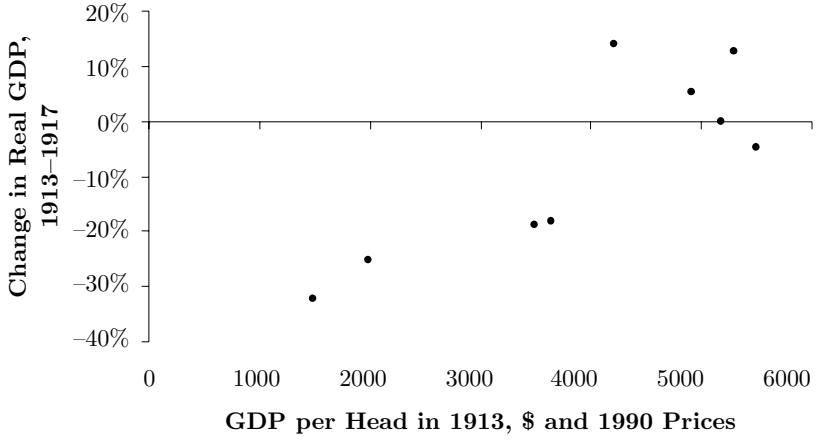

Fig. 1. Production Mobilization: Nine Countries, 1913–1917.
Source: Broadberry and Harrison (2005b).
Notes: Observations from left to right are Russia, Austria-Hungary, France, Germany, Canada, UK, New Zealand, USA, and Australia. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

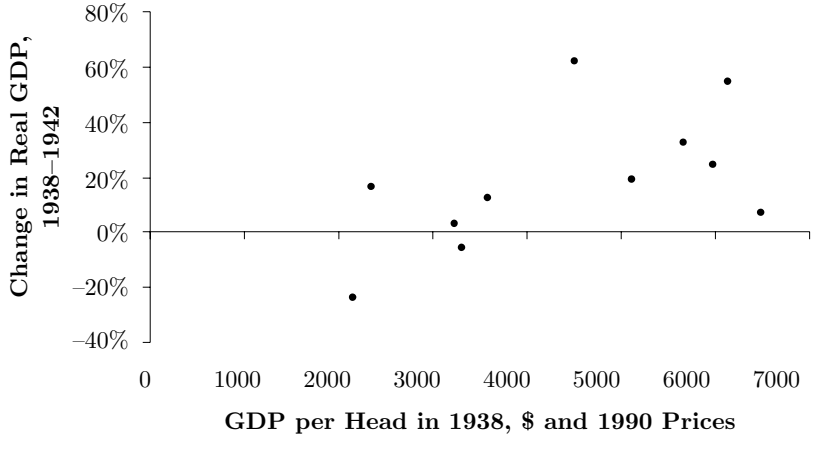

Fig. 2. Production Mobilization: Eleven Countries, 1938–1942.
Source: Harrison (1998b: 10), after correction of a spreadsheet error in the source affecting Soviet GDP as noted by Harrison (2005), and supplemented by figures from Maddison (1995: 180–3 and 194–7).
Note: Observations from left to right are the Soviet Union, Japan, Italy, Finland, Austria, Canada, Germany (excluding Austria), Australia, UK, USA, and New Zealand. Territories are measured within contemporary frontiers. Currency units are international dollars at 1990 prices.

overinvestment. The efficiency of investment was reduced by misallocation across sectors and over time, as bureaucrats misjudged the requirements of the war and its likely duration. The similarity between the pathologies of the German economy in 1917 and the United States in 1942 is striking and amounts to a syndrome of excessive mobilization that affected a number of economies at total war in the twentieth century:[3]

"The [production] programme was decreed by the military without examining whether or not it could be carried out. Today there are everywhere half-finished and finished factories that cannot produce because there is no coal and there are no workers available. Coal and iron were expended for these constructions, and the result is that munitions production would be greater today if no monster programme had been set up but rather production had been demanded according to the capacities of those factories already existing" (German Interior Minister Karl Helfferich in June 1917, cited by Feldman, 1966: 273):

"If we continue as at present, we shall have plants standing useless for lack of equipment or raw materials, or other things. Other plants will be turning scarce materials into items which cannot be used to oppose the enemy because of the lack of other things which should have been made instead. We shall have guns without gun sights, tanks without guns, planes without bomb sights, ships held up for lack of steel plates, planes which we cannot get to the field of battle because of lack of merchant bottoms" (US Army officers to the Army-Navy Munitions Board in March 1942, cited by Higgs, 2004: 507).

The consequences of these mistakes were quite different for the two countries, however. For Germany in 1917, the misallocation of investment was part of a downward economic spiral that fatally eroded the ability to maintain its armies on the eastern and western fronts. For the United States in 1942, it was a minor detriment to a spending bonanza that successfully projected its military power across two oceans at once.

To conclude, the military superiority of the Allies was matched by their economic superiority. We have measured this superiority in various

[3]On excessive mobilization in the British economy in World War II see Robinson (1951: 42–43), and in the Soviet economy Harrison (1998c, 2005: 272–4).

ways, particularly in terms of the size and development level of the great powers. On its own, this does not mean that the two were connected. The connection between a large wealthy economy in peacetime and the ability to field a large, well equipped army in war might be no more than an interesting accident. Thus, it remains to analyze the connection between the military and the economic aspect in more detail.

3. *Mobilization and the Economy*

In this section, I examine the extent to which wartime success in fielding military resources can be traced to the level of prewar economic development. The evidence will show that the comparative success of the various economies in mobilizing their resources for the war effort depended on a few factors that varied independently. The main variable was, as before, their prewar level of economic development. In the first war another factor was geography, or proximity to the front line. In the second war geography mattered less, but a new kind of economic system proved unexpectedly important.

It is convenient to start with mobilization capacity. A simple way of measuring the mobilization capacity of a country is to look at its ability to shift resources rapidly from private to public uses in time of emergency. I measure this in World War I by the shift from private to public uses of resources in each country in the first full year of warfare, and in World War II by the shift from civilian to military uses over the same period.

Figures 3 and 4 plot this shift for eight countries in World War I and six countries in World War II against their prewar development levels. In both wars, there is a group of countries among which we see a strict linear correlation, and there are some outliers. In both wars, the richer countries gained this advantage despite having tended to spend a smaller share of their national income on defense in peacetime (Eloranta 2003). Thus, their ability to transfer resources rapidly from peacetime to wartime uses was perhaps even greater than the figures imply. Finally it should be recalled that in both wars the wealthy American economy, although distant from the fighting, mobilized substantial resources for use by others, not only on its own account; it provided a further five per cent of its GDP in war loans to its Allies in World War I, and a similar proportion as military-economic aid in World War II.

The outliers in each figure are critical to establishing the sign and significance of the influence of prewar development. From Figure 3, we

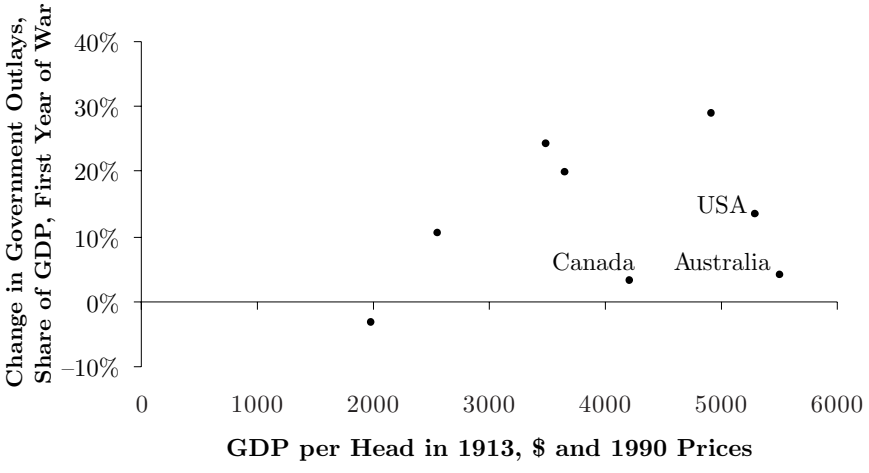

Fig. 3. Fiscal Mobilization in World War I: Eight Countries.
Source: Broadberry and Harrison
Notes: Observations not labelled within the figure are, from left to right, Austria-Hungary, Italy, France, Germany, and UK. The vertical axis measures government outlays as a share of GDP at current prices in the first full year of fighting, less the share in the previous year; for Austria-Hungary, military outlays only are counted. For France, Germany, Canada, the UK, and Australia, 1915 is compared with 1914; for Austria-Hungary, 1915/16 with 1914/15; for Italy, 1916 with 1915; for the United States, 1918 with 1917.

learn that in World War I distance mattered, so that Canada, Australia, and the United States, separated from the conflict by oceanic distances, were clearly on a different curve from the Europeans. In World War II, in contrast, the United States mobilized its economy as vigorously as others. That distance mattered in World War I, and mattered less or not at all in World War II, is not a surprise; during the twentieth century the world was shrinking continually. In Figure 4, there is a real surprise, however: although relatively poor, the Soviet Union mobilized its resources several times faster than one would predict and in fact more rapidly than any other country.

To summarize, there is a clear pattern. The prewar level of economic development powerfully influenced the capacity of economies to mobilize resources in wartime. Controlling for other variables, there was a strong positive relationship that spanned two world wars. Other variables were limited in number. Trans-oceanic distance weakened the impulse to mobilize.

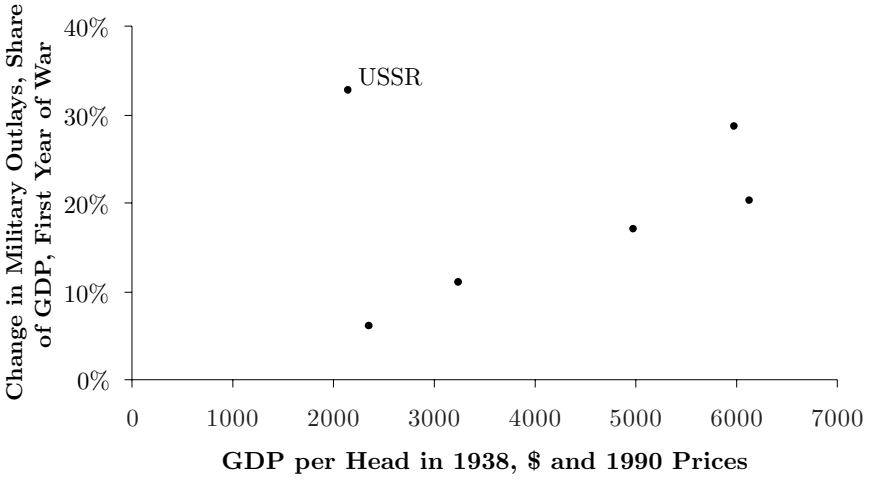

Fig. 4. Fiscal Mobilization in World War II: Six Countries.
Source: Harrison (1998b: 21).
Notes: Observations are, from left to right, the Soviet Union, Japan, Italy, Germany, the UK, and the USA. The vertical axis measures military outlays as a share of GDP or GNP in the first full year of fighting, less the share in the previous year; for the UK the net national product is the denominator; figures are at currently prevailing prices except for the USSR where constant factor costs of 1937 are used. For Germany and the UK 1940 is compared with 1939; for Italy, 1941 with 1940; and for the USA, USSR, and Japan, 1942 with 1941.

In World War II a new variable, the command system, played a big role. Controlling for these few variables we explain more than four fifths of the total variation in fiscal mobilization across fourteen countries in two wars (see Appendix, Table A-2).

These relationships persist when we turn to measure the results of mobilization in soldiers and military equipment. Figures 5 and 6 show soldiers and Figures 7 and 8 show munitions. For the first war, the widest comparisons are available on the basis of cumulative totals of soldiers mobilized during the conflict, and these are shown in proportion to the number of males aged 15–49 in each country before the war. For the second war, we have better data for the armed forces of various countries in each year than for cumulative mobilization totals, so I measure mobilization by the peak wartime number of soldiers in the armed forces as an annual average and per cent of the prewar population.

The measures in Figures 5 and 6 differ, therefore, but the patterns are similar. Figure 5 divides the countries into three distance bands. The first

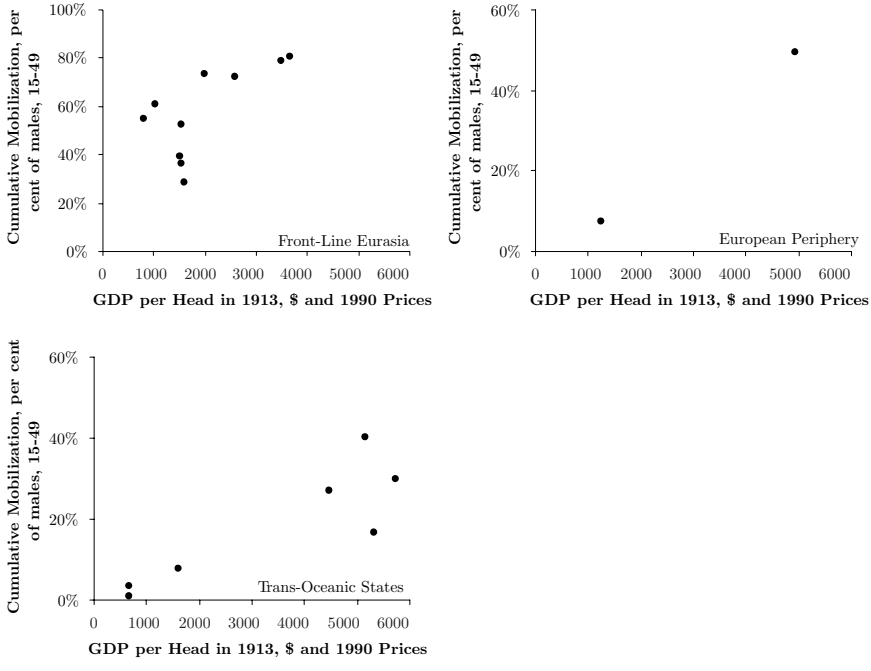

Fig. 5. Military Mobilization in World War I: Eighteen Countries and the French Colonies.
Sources: GDPs per head in 1913 from Tables 1 and 2 or, if not listed there, from Maddison (2001: 185); cumulative mobilization rates, 1914–1918, from Urlanis (1971: 209).
Note: Observations, reading from left to right in order of increasing GDP per head are as follows. Front line Eurasia: Turkey, Serbia, Russia, Bulgaria, Roumania, Greece, Austria Hungary, Italy, France, and Germany. European periphery: Portugal and UK. Non-European States: French colonies, India, South Africa, Canada, New Zealand, USA, Australia.

band comprises the front-line Eurasian states on whose territory or borders the war was fought. The second band is for the countries on the European periphery, separated from the war by land or sea, with only two members: Britain and Portugal. The third band includes countries that joined the war from oceanic distances. Within each band, i.e. controlling for distance, the figures show a strong positive dependence of the proportion mobilized in each country on its prewar income level. The distance band then controlled the height of the curve, so that dropping a band lowered the proportion substantially.

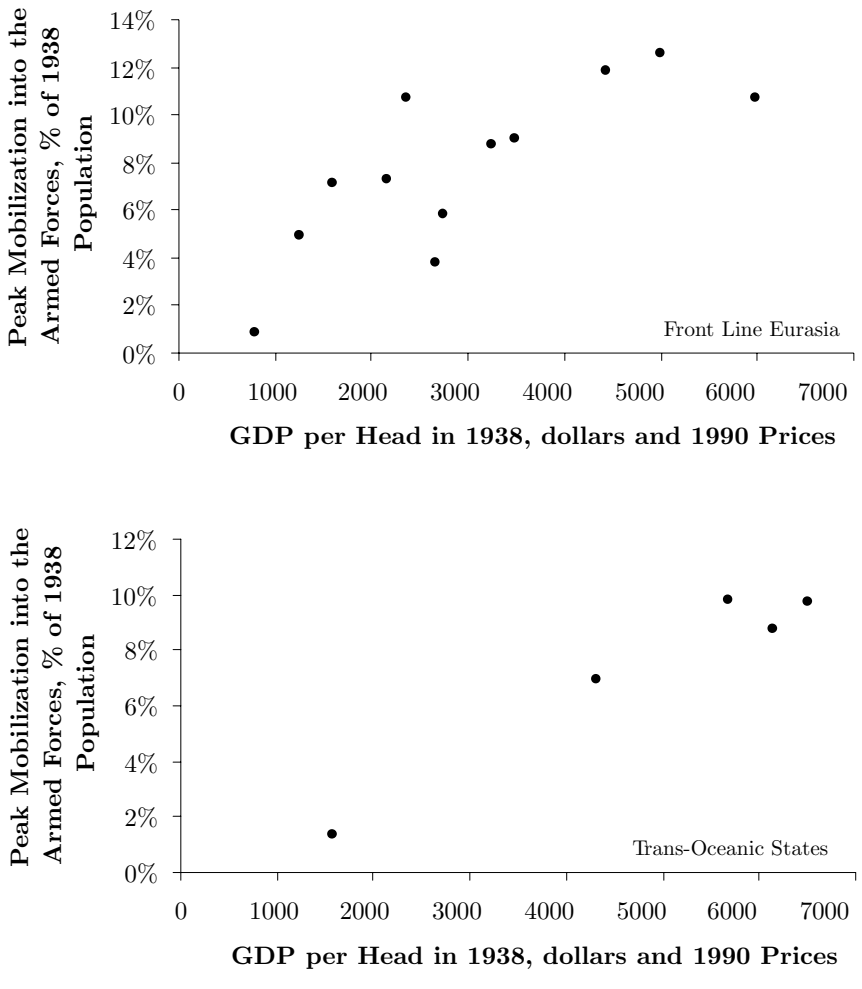

Fig. 6. Military Mobilization in World War II: Seventeen Countries.

Sources: Harrison (1998b: 3–9 and 14), supplemented by figures for wartime military personnel and pre-war populations from the Correlates of War dataset, version 2.1, at http://www.umich.edu/∼cowproj. This dataset is further described by Singer (1979; 1980).

Note: The vertical axis measures the wartime maximum of the annual average level of military personnel in proportion to the 1938 population. Observations, reading from left to right in order of increasing GDP per head are as follows. Front line Eurasia: China, Roumania, Bulgaria, USSR, Japan, Hungary, Greece, Italy, Finland, France, Germany, and UK. Trans-Oceanic States: South Africa, Canada, Australia, USA, and New Zealand.

In World War II, we see the same general relationship: controlling for distance, mobilization depended strongly on prewar economic development. It is true that, when it came to mobilizing men, as distinct from resources in general, distance still mattered. Distance mattered less than in World War I because there was no longer a distinction between the European front line and periphery, an understandable result of strategic aviation. But the trans-oceanic states are still banded separately and for given development level they conscripted fewer soldiers than the front line states.

There are statistical obstacles to the pooling of results across the 36 countries represented in two world wars. Considering each war separately, we explain roughly three quarters of the total variation in military mobilization on the basis of these limited economic and geographic variables (see Appendix, Table A-3), leaving one quarter to be explained otherwise.

A notable feature of Figure 6 is the lack of Soviet exceptionalism with regard to mobilizing men (and women). It was no easier for the Soviet Union to spare workers for fighting than for any other poor or middle-income country; the idea of Russia's limitless demographic resources was just a myth. The reason was the high cost of fielding a large army on the basis of a low productivity economy that required so many workers just to feed and clothe them, let alone supply them with weapons and fuel.

Finally, the richer countries were not only able to mobilize more men. Regardless of distance, they also supplied them better. Capital-abundant economies supported capital-intensive warfare. Figures 7 and 8 plot cumulative war production in units per thousand men mobilized in wartime and per year of the war.

In World War I, we see from Figure 7 that in each case, supply rose strongly with the prewar development level of the country. The same relationship is there in World War II, but Figure 8 suggests that it is looser than before. The main reason is the reappearance of Soviet exceptionalism: during the war the Soviet economy provided equipment for its ground and air forces at the same intensity as other countries with twice or three times its income level. The same was not true of its naval shipbuilding, however. In some kinds of weapons, for example aviation, but not others, Japan also approached this performance; but then, unlike the Soviet Union, Japan was not seriously attacked until 1944.

In an alternative perspective, Figure 8 prefigures the Cold War. It shows that there were two countries that proved capable of pursuing capital

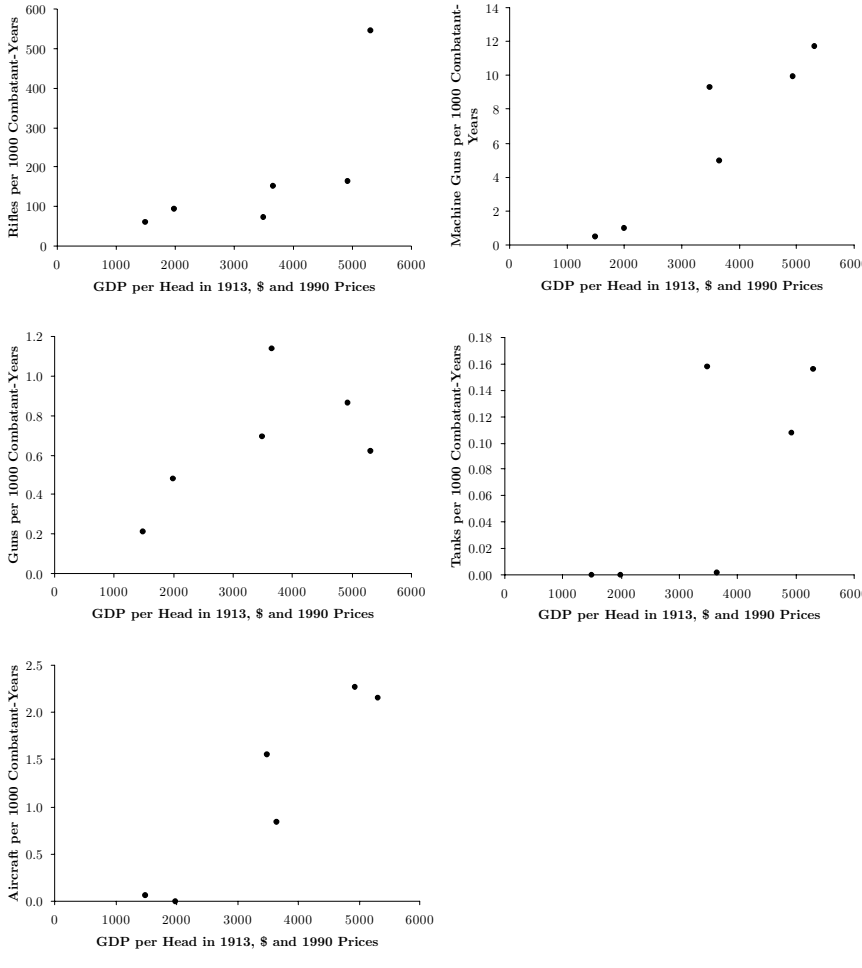

Fig. 7. The Capital Intensity of World War I: Six Countries.
Sources: As Tables 1 and 3.
Note: For each country "combatant years" are numbers mobilized multiplied by years of engagement in the war rounded to 1.5 years for the USA, 3.5 years for Russia, and 4.25 years for the others. Observations, reading from left to right in order of increasing GDP per head are Russia, Austria-Hungary, France, Germany, the United Kingdom, and the United States.

intensive warfare on a broad front in World War II: the Soviet Union and the United States. The rest were also-rans.

To summarize, the Allies fielded armies that were systematically bigger and better equipped than their adversaries in two world wars. They were

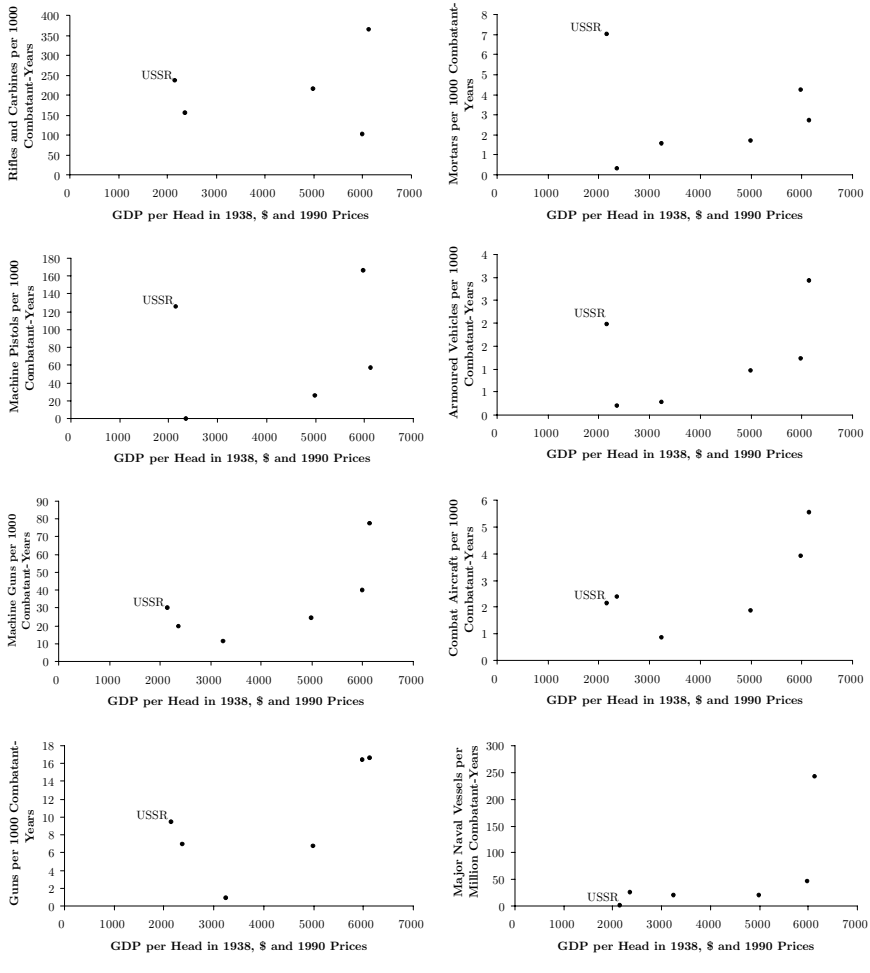

Fig. 8. The Capital Intensity of World War II: Six Countries.
Source and notes: As Tables 2 and 4. Observations, reading from left to right, are the Soviet Union, Japan, Italy, Germany, UK, and USA.

also systematically richer. The correlation of these two facts is no accident; in fact, the high prewar level of economic development of the Allied powers provides the single most powerful explanation of Allied success in wartime mobilization. It was not the only factor. Geography and the invention of the command economy also played a role; that of geography was diminishing and that of the command economy was increasing. Once these influences are taken into account, there is little left to explain in terms of national

peculiarities of prewar or wartime leadership, governance, organization, or culture.

4. *Why the Poor Lost*

Countries like Russia and Austria-Hungary were large and before World War I no one doubted for a moment that they were first-rate military powers. The war showed, however, that their power was built on third-rate economic foundations. Given that they were large, why did it matter so much that they were also poor? The reason lay in agriculture: these were countries that ran short of food long before they ran out of guns and shells (Offer, 1989).

One of the most striking attributes of relative poverty was the role of subsistence farming. Contemporary observers were aware of these differences and interpreted them as follows: when war broke out, a country such as Russia would have an immediate advantage in the fact that most of its population could feed itself; moreover, the ability to divert food supplies from export to the home market would actually increase Russia's advantage. In contrast Britain would quickly starve (Gatrell and Harrison, 1993). This diagnosis could not have been more wrong. In practice the presence of a large peasantry proved to be a great disadvantage when it came to the mobilization of resources for war. Peasant agriculture behaved very much like a neutral trading partner. Why should Netherlands trade with Germany given the latter's reduced ability to pay, except under threat of invasion and confiscation? Peasant farmers made the same calculation. Thus, the Russian economy looked large, but if the observers of the time had first subtracted its peasant population and farming resources they would have seen how small and weak Russia really was. Meyendorff (cited by Gatrell, 2005: 245) described what happened in Russia as "the Russian peasant's secession from the economic fabric of the nation". And not only from Russia, for Italy, Austria-Hungary, the Ottoman Empire, and Germany all had large peasant populations that proved extremely difficult to mobilize for much the same reason.

The pattern of the peasant's secession is clearly visible from a comparison of the richer and poorer countries' experience. When war broke out British and American farmers boosted production because they were offered higher prices and responded normally to incentives. The fact that British farming had already contracted to a small part of the economy made its wartime expansion easier: there were plentiful reserves of land

unused or little exploited, and the high productivity of farm labor meant that substantial increases in farm output could be achieved with relatively little extra effort (Olson, 1963).

In the poorer countries, in contrast, wartime mobilization began by taking resources away from farming, particularly young men and horses for the army. Once in the army these young men and horses still needed to be fed, of course, which implied a diversion of food supplies from rural households to government purchasers. But at the same time the motivation for farmers in the countryside to sell food was greatly reduced. These were subsistence farmers who grew food partly for their own consumption; what they sold, they took to the market mainly to buy manufactured commodities like textiles and metal goods that they needed for their families. But war dried up the supply of manufactures to the countryside. The small industrial sectors of the poorer countries were soon wholly concentrated on supplying the army with weapons and equipment, uniforms and rations. There was no capacity left to supply the countryside, which faced a steep decline in supplies. Consequently, peasant farmers retreated into subsistence activities. As the market supply of food dried up, in the towns food prices soared.

The economy began literally to disintegrate: there might still be plenty of food, but it was in the wrong place. The farmers preferred to eat it themselves than sell it for a low return. The government had to feed the army at all costs for a simple reason: hungry soldiers will not fight. Between the army and the peasantry, the urban workers were caught in a double squeeze. There was still enough food for everyone to have enough to eat; the famines that arose were localized and stemmed from the urban society's loss of entitlement (Sen, 1983; Offer, 1989), not from the decline in aggregate availability.

Aware of the unequal distribution of food, public opinion might blame unpatriotic speculators or incompetent officials, but the truth was that a poor country had few real choices. The scope for policy to improve the situation was usually more apparent than real, and government action typically made things worse: for example the Russian, Austrian, and German governments all began to ration food to the urban population, while attempting to buy up food from the countryside at purchasing prices that were fixed low for budgetary reasons. To repeat: in richer countries the government paid *more* to the food producers, and this worked, but in poorer countries the government wanted to pay *less* and this had entirely

predictable results. The willingness of farmers to participate in the market was still further undermined.

Finally, the government stepped in and tried to hold prices down, creating excess demand and scope for a black market in each country. To the extent that such controls were effective, output and consumption tended to fall further. To the extent that they failed there was scope for black marketeers to step in and capture rents; as long as the rents were competed away production and consumption could both recover but popular respect for law and government would inevitably suffer in the process.

It may seem surprising to find Germany classified among the countries that lost because they were poor. Pre-1914 Germany has entered the economic history textbooks as a developed economic power, but its modernization was highly unbalanced. High levels of productivity in heavy industry co-existed with much lower productivity in light industry, and much of the service sector was also characterized by low productivity, despite Gerschenkron's (1962) focus on the modernized railways and the universal banks (Broadberry, 1998). But perhaps the most obvious sign of Germany's relative backwardness was the high share of the labor force engaged in low productivity agriculture. Germany paid a high price during the two world wars for protecting its agriculture in peacetime (Olson, 1963).

In summary, to be poor when World War I broke out was to suffer the consequences of a peasant agriculture, which was essentially a dead weight on the mobilization efforts of the country concerned. For this purpose I include Germany. The process that resulted had its inexorable conclusion in urban famine, revolutionary insurrection, and the downfall of emperors.

The story of World War II shows similarities and one difference. A similarity was that once again the poorer countries could not hold their economies together when seriously attacked. Italy and Japan remained in the war as long as the Allies were preoccupied with Germany. The Allies began to apply serious military pressure to Italy in 1943 and Japan in 1944. In each case, this pressure was quickly followed by economic disintegration and collapse. Another similarity was that peasant agriculture again proved its capacity to resist mobilization. This was particularly evident in Germany's failure to make good the deficiencies of its own low-productivity subsistence farmers at home by exploiting even lower-productivity subsistence farming in eastern Europe. I have already noted

that Germany extracted more food from industrialized France than from the agrarian Ukraine, but it is also true that Britain was fed from the United States and Canada, not India.

The difference from World War I was what happened when Germany attacked Russia. Judged by its size and development level alone, the Soviet Union should have been defeated during 1942. In the two decades that separated the two conflicts, Soviet leaders had more than enough time to reflect on the disaster that had befallen Russia and its old regime in the first war. In the 1920s Stalin determined to avert a repetition. The outcome was forced industrialization based on collectivized farming which destroyed the ability of the peasants to withdraw from the market when put under pressure.

Although a disaster from the point of view of peacetime economic development, the control over agriculture that this gave him enabled Stalin to keep the economy together when war returned. In World War I, the Russian peasants had fed themselves first and fed much of the rest to their livestock or buried it in the ground while the soldiers and war workers had to fight over the scraps. In World War II, the Red Army and the war workers were fed first and the peasants became the residual claimant on available food supplies. As a result, the Soviet economy was able to mobilize itself to a degree that matched the richest of the rival powers, not the poorest. Its ability to repress consumption more generally also allowed the Soviet Union to punch militarily far above its economic weight for the rest of the twentieth century.

Conclusions

Introducing this paper, I suggested five stylized facts about military and economic mobilization in World War II. The first of these is that victory went to the side that supplied the greatest quantity of military resources to the theatres of war. Second, superiority in military resources was based on superior wealth: the richer countries had a systematic, disproportionate advantage in their ability to supply the front with troops and military equipment. Third, time and geography also mattered. Fourth, the influence of all other factors was largely conditional on wealth, geography, and time. Fifth, in World War II the patterns of mobilization in market economies were broken by an exceptional Soviet performance based on the command economy.

When we introduce the evidence from World War I, we find the first four of these patterns present in full force. When subjected to superior force, poor economies eventually crumbled. Against this historical background, the Soviet achievement in World War II appears even more remarkable.

These patterns should not be generalized too far. Broadberry and Harrison (2005a) suggest that the power of these simple ideas about the relationship between economic and military performance is confined to a relatively short historical period. The era of "total war" from 1914–1945 seems to have been unique. In both world wars, the main combatants were able to devote more than half of their national income to the war effort. This is likely to have been impossible before 1914 because until then most people were too poor to be taxed at such rates; most economies had the bulk of their resources locked up in forms of subsistence agriculture that were resistant to mobilization; before mass literacy and the telegraph, typewriter, and duplicator, commercial and government services were too inefficient to do much about it. In short, in earlier stages of global development, total war could not be staged because too many people were required to labor in the fields and workshops just to feed and clothe the population, and it cost too much for government officials to count, tax, and direct them into mass combat.

Since 1945 the economic factors in warfare may have lost significance again. This is because after the advent of nuclear weapons any rich country however small, or any large country however poor, could acquire devastating military force for a few billion dollars. Hence, the marshalling of economic resources may have played a much more vital role in the outcome of the two world wars than was likely in any period before or since.

Appendix

The regressions seek to isolate the influences of pre-war economic development, the economic system, geography, and the passage of time between the wars on the extent to which the economies in the sample could mobilize production, fiscal resources, and soldiers in wartime. In each case the regression is a strong test because it assumes for simplicity that the slope coefficients of the economic and geographic independent variables unchanged across the interwar period. For the countries included in each regression, data sources, and other remarks see the notes under the figures to which each regression relates.

Dependent Variables

Production Mobilization	The change in real GDP from 1913 to 1917 or 1938 to 1942, per cent of the initial year.
Fiscal Mobilization	The share of military or total government outlays in GDP in the first full year of warfare, less the share of the same in the preceding year.
Military Mobilization	*Cumulative Military Mobilization* (World War I) is the cumulative total of soldiers mobilized in wartime, per cent of males aged 15 to 49 in the prewar population. *Peak Military Mobilization* (World War II) is the peak value of the annual average number of military personnel, per cent of the prewar population.

Independent Variables

LnGDPC	GDP per head in 1913 or 1938, measured in dollars and 1990 prices, logarithmically transformed.
War	Equals 1 for World War II, 0 for World War I.
TransOceanic	Equals 1 for Australia, Canada, French colonies, India, New Zealand, South Africa, USA, 0 for other countries.
Peripheral	Equals 1 for the UK and Portugal, 0 for other countries.
Command	Equals 1 for the USSR in World War II, 0 for other countries including Russia in World War I.

Significance

The significance level of a statistic is denoted as follows.
* Significant at 10%
** Significant at 5%
*** Significant at 1%
**** Significant at 0.1%.

Table A-1. Dependent Variable: Production Mobilization.

	(1)	(2)	(3)
Observations	20	20	20
R-Squared	0.6940	0.7617	0.5952
F	8.5063****	8.9492****	12.4957****
Independent Variables:			
Intercept	−0.9754	−0.1898	−2.8424***
LnGDPC	0.0927	−0.0052	0.3372***
War	0.2717***	0.3165****	0.2164**
TransOceanic	0.2555**	0.2884**	—
Peripheral	0.2255	0.2601*	—
Command	—	−0.3236*	—

Sources and definitions: As Figures 1 and 2.
Explanation: On a first pass (column 1), *LnGDPC* or prewar GDP per head is not a significant influence on wartime production mobilization, but geography is. This result does not stem from failure to control for the economic system (column 2). The problem is that the countries that were further away also happened to be richer, so the distance variables *TransOceanic* and *Peripheral* are not independent of prewar GDP per head. When the distance variables are dropped (column 3) the coefficient on prewar economic development becomes positive and highly significant. The positive sign and significance of the *War* variable shows that between the two wars the mobilization capacities of all economies improved, controlling for their economic development level. The R-Squared in column 3 shows that this model explains about three fifths of the overall variation in production mobilization; this is somewhat less than in the preceding columns but its explanatory power (measured by the F of the regression) is much greater.

Table A-2. Dependent Variable: Fiscal Mobilization.

	(1)	(2)	(3)
Observations	14	14	14
R-Squared	0.4255	0.8167	0.8158
F	1.6664	7.1310***	9.9656***
Independent Variables			
Intercept	−0.7761	−2.0181**	−2.1028***
LnGDPC	0.1131	0.2680***	0.2788****
War	0.0410	−0.0249	−0.0266
TransOceanic	−0.1013	−0.1692**	−0.1770***
Peripheral	0.0700	0.0132	—
Command	—	0.3127***	0.3159***

Sources and notes: As Figures 3 and 4.
Explanation: The speed with which governments were able to mobilize resources into war spending was strongly influenced by prewar GDP per head and geography, but this effect is not apparent if the economic system is not taken into account for (column 1). Controlling for *Command* as well as distance variables (column 2), the role of *LnGDPC* emerges as strongly positive and significant. This pattern is confirmed when *Peripheral* is dropped, and it explains more than 80 per cent of the total variation in one-year fiscal mobilization. There appears to have been no significant change in fiscal mobilization capacities between the wars.

Table A-3. Dependent Variable: Military Mobilization.

	(1)	(2)
Observations	36	36
R-Squared	0.7443	0.7430
F	17.4681****	22.4092****
Independent Variables:		
Intercept	−0.6051**	−0.6113**
LnGDPC	0.1491****	0.1498****
War	−0.4106****	−0.4139****
TransOceanic	−0.2857****	−0.2837****
Peripheral	−0.2415***	−0.2398***
Command	−0.0555	—

Notes and sources: As Figures 5 and 6.
Explanation: In both wars the mobilization of men was strongly and positively associated with pre-war GDP per head. It fell significantly as we move from the frontline to the European periphery, and fell further as we move out to the states separated by oceanic distances. *Command* did not play a signficant role. The negative size and much of the significance of the coefficient attached to *War* are a statistical artefact arising from the fact that the military mobilization variable is not consistently calibrated; in World War II the numerator is a smaller concept and the denominator is a larger one than in World War I. As a result, the R-Squared may be inflated as a measure of the true variation that is explained by each model and the F of the regression may also be inflated. Given this, it is better to check for underlying patterns in each war separately.

Table A-3. continued. Dependent Variable: Military Mobilization.

	World War I	World War II	
	(3)	(4)	(5)
Observations	19	17	17
R-Squared	0.7795	0.7616	0.7473
F	17.6753****	13.8472****	20.7008****
Independent Variables:			
Intercept	−0.7121*	−0.3475****	−0.3256****
LnGDPC	0.1728***	0.0544****	0.0514****
War	—	—	—
TransOceanic	−0.4531****	−0.0344***	−0.0313**
Peripheral	−0.3529***	−0.0185	—
Command	—	—	—

Notes and sources: As Figures 5 and 6.
Explanation. Results are shown separately for World War I (column 3) and World War II (column 4 and, after dropping the insignificant *Peripheral* variable, column 5). The patterns suggested from the pooled results in columns 1 and 2 are still robustly in evidence for each war taken separately; it is indicated strongly, however, that distance played a smaller role in World War II. The variables shown continue to explain three quarters of the total variation in the dependent variable. While the R-Squareds and Fs of the regressions in columns 1 and 2 could not be relied on in theory, there is no sign that they were overstated in practice.

References

Adelman, JR (1988). *Prelude to the Cold War: The Tsarist, Soviet, and U.S. Armies in Two World Wars*. Boulder, CO, and London: Lynne Rienner.

Brennan, G and Tullock, G (1982). An Economic Theory of Military Tactics: Methodological Individualism at War. *Journal of Economic Behavior and Organization*, 3(2–3): 225–42.

Broadberry, S and Harrison, M (2005a). The Economics of World War I: An Overview. In: Broadberry S and M Harrison (eds.) *The Economics of World War I*. Cambridge: Cambridge University Press, pp. 276–309.

Broadberry, S and Harrison, M (2005b). *The Economics of World War I: A Comparative Quantitative Analysis*. Paper to the Annual Meeting of the Economic History Association, Toronto. Available at http://warwick.ac.uk/markharrison/papers/ww1toronto2.pdf (accessed 24 November 2006).

Broadberry, S (1998). How did the United States and Germany Overtake Britain? A Sectoral Analysis of Comparative Productivity Levels, 1870–1990. *Journal of Economic History*, 58(2): 375–407.

Chickering, R and Förster, S (eds.) (2000). *Great War, Total War: Combat and Mobilization on the Western Front, 1914–1918*. Cambridge: Cambridge University Press.

Eloranta, J (2003). *Responding to Threats and Opportunities: Military Spending Behavior of the Great Powers, 1870–1913*. Working Paper. University of Warwick, Department of Economics.

Feldman, GD (1966*). Army, Industry, and Labor in Germany, 1914–1918*. Princeton, NJ: Princeton University Press.

Gatrell, P (2005). Poor Russia, Poor Show: Mobilising a Backward Economy for War, 1914–1917. In: Broadberry S and Harrison M (eds.) *The Economics of World War I*. Cambridge: Cambridge University Press, pp. 235–275.

Gatrell, P and Harrison, M (1993). The Russian and Soviet Economy in Two World Wars. *Economic History Review,* 46(3), 425–452.

Gerschenkron, A (1962). *Economic Backwardness in Historical Perspective*. Cambridge MA: Harvard University Press.

Hardach, G (1977). *The First World War, 1914–1918*. Berkeley: University of California Press.

Harrison, M (ed.) (1998a). *The Economics of World War II: Six Great Powers in International Comparison*. Cambridge: Cambridge University Press.

Harrison, M (1998b). The Economics of World War II: An Overview. In: Harrison M (ed.) *The Economics of World War II: Six Great Powers in International Comparison*. Cambridge: Cambridge University Press, pp. 1–42.

Harrison, M (1998c). The Soviet Union: The Defeated Victor. In: Harrison M (ed.) *The Economics of World War II: Six Great Powers in International Comparison*, 268-301. Cambridge: Cambridge University Press, pp. 268–301.

Harrison, M (2005). The USSR and Total War: Why Didn't the Soviet Economy Collapse in 1942? In: Chickering R and Förster S (eds.) *A World at Total*

War: Global Conflict and the Politics of Destruction, 1939–1945. Cambridge: Cambridge University Press, pp. 137–156

Higgs, R (2004). Wartime Socialization of Investment: A Reassessment of U.S. Capital Formation in the 1940s. *Journal of Economic History*, 64(2): 500–520.

Liberman, P (1996). *Does Conquest Pay? The Exploitation of Occupied Industrial Societies*. Princeton, NJ: Princeton University Press.

Maddison, A (1995). *Monitoring the World Economy, 1820–1992*. Paris: OECD.

Milward, AS (1977). *War, Economy and Society, 1939–45*. London: Unwin.

Offer, A (1989). *The First World War: An Agrarian Interpretation*. Oxford: Clarendon Press.

Olson, M (1963). *The Economics of the Wartime Shortage: A History of British Food Supplies in the Napoleonic War and in World Wars I and II*. Durham, NC: Duke University Press.

Ordway, FI and Sharpe, MR (1979). *The Rocket Team*. London: Heinemann.

Overy, RJ (1995). *Why the Allies Won*. London: Pimlico.

Ránki, G (1993). *The Economics of the Second World War*. Vienna: Böhlau.

Robinson, EAG (1951). The Overall Allocation of Resources. In: Chester DN (ed.) *Lessons of the British War Economy*. Cambridge: Cambridge University Press, pp. 34–57.

Sen, AK (1983). *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Oxford University Press.

Singer, JD (ed.) (1979). *The Correlates of War I: Research Origins and Rationale*. New York: Free Press.

Singer, JD (ed.) (1980). *The Correlates of War II: Testing Some Realpolitik Models*. New York: Free Press.