Resource Mobilisation for World War II: A Comparative View of the Soviet Productive Effort, 1938-45

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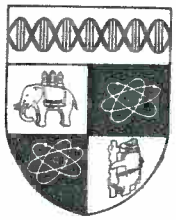

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Resource mobilisation for World War II: A comparative view of the Soviet productive effort, 1938-45[1]

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I
Introduction

By the end of World War II the USSR had become the strongest nation in Europe and a first rate military power. Behind Soviet victory lay her economic achievement, sustaining not only a 12 million strong army but also defence industries which mass produced modern weapons on a scale unimaginable in 1940. Table 1 shows that Soviet munitions output, already at a high level before the war, increased rapidly under in wartime conditions; taking the war years as a whole, cumulative Soviet defence output was exceeded only by that of the United States.[2]

How may the Soviet productive effort of World War II be compared with that of her main allies and principal adversary? The raw materials for an answer to these questions have been available for some time but, apart from

1 A first draft of this paper was presented to the Annual Conference of the British National Association for Soviet and East European Studies (Cambridge, March 1987) and the Colloquium of the Centre for Russian and East European Studies, University College of Swansea (Gregynog, April 1987). I am grateful to the participants, especially Wlodzimierz Brus (Oxford) and Peter Wiles (LSE), and also to Sir Alec Cairncross (Oxford), for helpful comments and advice. The paper is a report of work in progress and is circulated for discussion purposes.

2 Real defence output of the great powers is shown in greater detail in Appendix A, Table A-1.

TABLE 1

VOLUME OF COMBAT MUNITIONS PRODUCTION OF THE MAJOR BELLIGERENTS, 1935-44
(annual average expenditure in $ billion, US 1944 munitions prices)

	1935-9	1940	1941	1942	1943	1944
USA	0.3	1.5	4.5	20	38	42
Canada	0	0	0.5	1	1.5	1.5
UK	0.5	3.5	6.5	9	11	11
USSR	1.6	5	8.5	11.5	14	16
Germany	2.4	6	6	8.5	13.5	17
Japan	0.4	1	2	3	4.5	6

Source:

Raymond W. Goldsmith, "The Power of Victory: Munitions Output in World War II", *Military Affairs*, Spring 1946, p. 75.

Notes:

For explanation of Goldsmith's sources and methods, and for discussion of reliability of his estimate of Soviet munitions output, see Appendix A.

the comparison of a few war production figures, no systematic answer has been attempted before. While several Western researchers have contrasted the economic war efforts of the United States, Great Britain and Germany,[3] that of the Soviet Union has remained undetermined within the overall equation. The main reason is that official release of significant detail relating to the Soviet war effort was delayed for many years after the war.[4] Thus, when British and American historians were researching the histories of

3 Nicholas Kaldor, "The German War Economy", *Review of Economic Studies*, no. xiii (1945/6); W.K. Hancock and M.M. Gowing, *The British War Economy* (London 1949); Burton H. Klein, *Germany's Economic Preparations for War* (Cambridge, Mass. 1959); Berenice A. Carroll, *Design for Total War: Arms and Economics in the Third Reich* (The Hague-Paris 1968). At the end of the war United States researchers made at least a couple of attempts to incorporate the USSR into an overall picture; see for example materials cited in President Truman's *Twentieth Report to Congress on Lend-Lease Operations* (Washington, D.C. 1945), p. 41, and estimates published by Raymond W. Goldsmith (formerly director of economics and planning at the U.S. War Production Board), "The Power of Victory: Munitions Output in World War II", *Military Affairs* (Spring 1946). These comparisons were picked up and commented on by British official historians - see Hancock and Gowing (1949), pp. 369-70 and H. Duncan Hall, *North American Supply* (London 1955), pp. 420-1. More recently Alan S. Milward, *War, Economy and Society 1939-1945* (London 1977) (mainly chs. 2, 3) has introduced the Soviet economy into a comparative perspective, but his information is very limited. Some remarks limited to comparison of workforce controls and measures of resource mobilisation can also be found in Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), pp. 153-4, 185-91.

4 In 1947 a sparse account was published in Moscow by N.A. Voznesensky, the wartime planning chief, as *Voennaya ekonomika SSSR v period Velikoi Otechestvennoi voiny* (an official translation appeared in 1948, entitled *War Economy of the USSR in the Period of the Patriotic War*). After this nothing much happened until the revival of scholarly research on the wartime period was authorised under Khrushchev's Thaw. The main significant events to follow were publication of the 6-volume *Istoriya Velikoi Otechestvennoi voiny Sovetskogo Soyuza 1941-1945* (History of the Great Patriotic War of the Soviet Union) (Moscow 1961-5) and the still more detailed, but ideologically somewhat more conservative 12-volume *Istoriya Vtoroi Mirovoi voiny 1939-1945* (History of the Second World War) (Moscow 1973-82). For a short account of the phases of Soviet historiography up to 1982 see Harrison (1985), pp. 235-42.

the British, American, German and Japanese war economies in the late 1940s and early 1950s, relevant Soviet materials were still on the secret list. When they began to appear in the 1960s and 1970s, historians of other countries had perhaps already lost interest.

In this paper I shall attempt to outline some aspects which ought to comprise a comparative study of resource mobilisation in the Soviet wartime economy. These include war preparations and mobilisation needs (Section II), political leadership and the central coordination of resources (Section III), and the intensity of resource mobilisation (Section IV). There are other subjects on which more sustained comparison does not yet seem possible, for example the role of industrial management in the different war economies; wartime research and innovation; war finance and inflation[5]; war losses to population and material assets;[6] and static and dynamic efficiency of resource use in wartime.

5 See however James R. Millar, "Financing the Soviet Effort in World War II", *Soviet Studies* (January 1980).
6 See however B. Urlanis, *Wars and Population* (Moscow 1973); James R. Millar and Susan J. Linz, "The Cost of World War II to the Soviet People: A Research Note", *Journal of Economic History* (December 1980).

II
War preparations and mobilisation needs

By the late 1930s Germany was able to deploy formidable military assets. These assets depended only partly on her economy. A crucial ingredient in her military successes up to 1942 was her aggressive strategy of surprise and preemption in combined arms operations. The *Blitzkrieg* strategy helps to explain how Germany was able to overrun half of Europe without major military loss.[1]

How cheap was Germany's early military success? Germany's economic preparations were still very substantial. By 1938 Germany's war expenditures were already claiming one sixth of her national income, more than twice the British proportion (in the United States military spending remained negligible).[2] Table 1 showed that in the middle to late 1930s only the Soviet Union had spent on rearmament at anything approaching Germany's rate. Thus Germany had to devote significant resources to her war effort, even while she was still beginning her trail of victories. Nonetheless her successes were cheap in at least two senses: first, because rearmament had helped to power Germany's return to full employment, so that the resources employed for war would otherwise have lain idle; second, because the resources devoted to war were employed with great

1 Whether or not Germany's *Blitzkrieg* strategy was a deliberate design is discussed by R.J. Overy, "Hitler's War and the German Economy: A Reinterpretation", *Economic History Review* (May 1982).
2 For calculation of war expenditures in relation to the national income of the great powers see Appendix B.

efficiency, and Germany's conquests would bring major economic returns.

Germany's opponents could not expect to deter or defeat her so inexpensively in war, for Germany wielded the crucial advantages of the offensive. To deter German aggression or (which may have come to the same thing) to be sure of defeating it without major expenditure of forces, they would have had to rearm on a far larger scale than Germany. Until 1939 Britain and France rearmed at a low level while seeking to regulate Germany's behaviour through negotiation. Only the Soviet Union tried to build an effective military counterweight. In Soviet rearmament was mirrored Germany's drive toward a mass army possessing military-technical superiority, backed up by the mass production facilities of modernised and specialised defence industries.

The Soviet effort was not, however, a precise mirror image of Germany's. There were substantial differences between Soviet and German rearmament, expressing the much greater pressure of needs on resources in the Soviet context. In terms of needs, Soviet rearmament confronted the more difficult task - to build a defence against an uncertain adversary (in the early 1930s Britain, France or the United States, then militarist Japan; only belatedly Nazi Germany), in which the adversary would exercise choice between peace and war and, in the latter event, over both timing and field of battle. Therefore, where German rearmament tended to emphasise the production of particular weapons and accumulation of particular combat stocks for

immediate campaigns, Soviet rearmament tended to display an all-round, long-range character, mass production of modern weapons being combined with investment in military plant, with military-technical innovations and military reorganisations, aimed at maximising Soviet military power across the board in some future year.

However, the relatively low-level economic basis for Soviet efforts, and the already overfull employment of the economy,[3] meant that after a head start over Germany in the very early 1930s the scale of the Soviet effort tended to lag behind. The unprecedented Soviet force expansion and modernisation of 1938-40 fell well short of German efforts over the same period. Thus, by 1940 Germany was allocating more than one third of her national income to war purposes and was maintaining more than 6 million of her 70 million population under arms; the Soviet armed forces of 1940 stood at a little over 4 million out of her much larger (194 million) population, while defence absorbed one seventh of her material product.[4]

In this comparison, however, there was one essential German weakness and Soviet strength. This was that Germany's rising military commitments of aggression and occupation were forcing her military effort to rely more and more upon personnel; Table 2 shows that by 1940 the Soviets were

3 "Overfull employment" means that the economy was under strain at a macroeconomic level. Microeconomic responses to permanent shortage, especially the hoarding of inputs, meant the maintenance of a considerable degree of slack within enterprises. But the nature of this slack was such that the resources it represented were normally inaccessible to planners and policy makers.

4 See Appendix B.

TABLE 2

THE COMPOSITION OF MILITARY SPENDING:
GERMANY AND THE USSR, 1939-45

Ratio of spending on armament to spending on military pay:

	Germany[a]	USSR[b]
1939	1.90	-
1940	1.00	1.75
1941	0.80	-
1942	0.94[c]	2.08
1943	-	3.00
1944	-	2.18
1945	-	2.57

Notes and sources for Table 2:

[a] Ratio of internal Wehrmacht expenditures on munitions to military pay, when both are measured in 1939 Reichsmarks; calculated from Burton H. Klein, *Germany's Economic Preparations for War,* (Cambridge, Mass. 1959), p. 91.

[b] Ratio of share in national income available, measured in current roubles, of spending on armament (*vooruzhenie*) to share of spending on material consumption of military personnel; calculated from officially reported income shares cited in Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), p. 151.

The budget defence allocation of the Red Army for 1941-5, derived by Frank Doe, *Understanding the Soviet View of Military Expenditures* (U.S. Defence Intelligence Agency: Washington, D.C. 1982), p. 10, yields a different ratio of spending on armaments and combat materiel to spending on military pay and allowances as follows:

1941	1942	1943	1944	1945
1.78	1.38	1.31	1.36	0.71

This ratio is much lower than that given in Table 3 on the basis of national income shares, and only a little higher than the German ratio for comparable years.

On the surface this lower ratio may seem more comparable with the German series, since both are obtained from budgetary sources. However, in the Soviet case budgetary spending on munitions may be understated (and the discrepancy between budgetary and national income proportions explained) by the practice of including in explicit budgetary spending only the *net* increment to the stock of armament; see Peter Wiles and Moshe Efrat, *The Economics of Soviet Arms* (London 1985); Wiles and Efrat believe that use of the "weapons write-off" to understate military spending became marked in the early 1960s, but may well have been practised since the Revolution (pp. 72-4). In wartime the weapons write-off, and the gap between gross and net weapons acquisition were naturally exceptionally large. So is the gap between the role of Soviet weapons acquisition measured in the two sources. The gap is at its widest in 1945 when the Soviet armed forces (and also, presumably, their combat stocks) contracted rapidly. I conclude that the budgetary source understates the cost of Soviet munitions procurement and prefer the national income source as providing greater comparability with German data.

[c] During the war German military agencies began to procure significant quantities of industrial goods in occupied territories; their inclusion would increase the 1942 ratio of spending on armament to spending on military pay to approximately 1.2; see Klein (1959), p. 92.

spending nearly twice as much on combat munitions as on military pay, whereas Germany was spending roughly similar amounts on each. (Soviet soldiers were probably paid much less than German soldiers, but Soviet defence output was subsidised; in the two countries, therefore, the proportions between weapon prices and soldiers' wages may not have been dissimilar.) Thus, the Soviets were probably supplying a much higher level of industrial reequipment per soldier.

Behind Soviet emphasis on industrial supply of defence lay the buildup of industrial capacity in the Soviet defence sector. And here was one of the keys to Soviet wartime economic resilience. The Soviet defence sector had not only modernised and expanded its specialised industrial plant, but had also spread experience of war production widely through civilian industry through a complex web of subcontracting of defence orders. Much of the civilian metal, engineering and chemical industries represented a reserve capacity for war production in the event of war.[5]

At the same time, as is well known, Soviet contingency plans for war in 1940-1 suffered many defects. The central aim of Soviet military policy was to deter aggression or at least to postpone the outbreak of war as long as possible. Since the likelihood of war was constantly postponed to the future, and the country's full military-economic potential was to be realised only on that future date, the task of war

5 See J.M. Cooper, "Defence Production and the Soviet Economy, 1929-1941", Soviet Industrialisation Project no. 3 (Centre for Russian and East European Studies, University o Birmingham 1976); Stephen M. Tupper, "The Red Army and Soviet Defence Industry 1934-1941" (unpublished PhD thesis, University of Birmingham 1982).

avoidance in the present rested upon the deterrent value of existing forces which, in turn, depended upon a bluff. Moreover, this bluff was flawed, almost fatally so, since it proved more effective upon Soviet policy makers than upon their German opposite numbers. The bluff was that, in the event of war, Soviet forces were poised to repel the invader and carry the war onto enemy territory. In defence of this bluff its domestic critics had been silenced and terrorised in the Red Army purges of 1937; planning for its failure had been strictly prohibited.

As a result Soviet industrial contingency plans for war were pitched upon the requirements of an offensive war for a speedy victory. Soviet defence industries and combat stocks were located too close to Western frontiers; plans for evacuation and other dimensions of a protracted defence in depth did not exist. Even German industries, ironically (for Germany did not expect to be invaded), were better prepared than this, possessing developed evacuation plans. In general, the likely resource costs to the Soviet economy of a real war with Germany were heavily underplayed, while the short run ability of the Soviet economy to supply wartime needs was exaggerated.[6] Meanwhile, Germany's leaders were not deceived.

6 Harrison (1985) pp. 59-62.

III
Leadership and central coordination

Why did Hitler's plan *BARBAROSSA* not succeed? The quality of Soviet political leadership was central to both the disasters and the accomplishments of 1941-2, but less important thereafter, and even in the first phase of the war it was not all-important. German military success in 1941 depended on stunning and paralysing the Soviet military-economic machine with a colossal blow. Of the reasons for its failure some are circumstantial. For example, one reason why the Soviet Union survived where Poland, France, the Scandinavian and Balkan countries were overrun was that it was a very large country with a substantial hinterland within which its forces, not only military but also economic, could retreat and regroup. Another celebrated reason was the harshness of the Russian winter climate; both armies had to fight through the same mud and frosts, but German supply of winter provisions broke down.[1] These circumstantial factors, although important, are insufficient on their own to explain how Soviet workers and soldiers were able to fight the enemy to a standstill.

The underlying reasons were partly to do with the reactions and initiatives of Soviet leaders from above, and partly to do with those of Soviet people at a lower, less discernible level. At the highest level the Soviet military-economic machine was momentarily stunned, in the sense of a sudden discontinuity in many of its central intellectual,

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1 Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton*, (Cambridge 1977), p. 174.

logical and control functions. Of the few that maintained continuous operation, some pursued inappropriate courses; for example, USSR Gosplan rapidly revised the 1941 third quarter national economic plan, but the result was obsolete before it was implemented, being based on understated force losses and replacement needs and overstated available capacities as the enemy sliced away at Soviet military and economic assets.[2]

At the highest level, first clearsighted Soviet responses to the economic emergency can be found in the struggle for evacuation of Soviet industries. This involved rapid transformation of Stalin's "scorched earth" decree into a more positive programme for wholesale evacuation and relocation of threatened industrial assets. It was this programme which saved Soviet specialised defence plant and provided essential context for the economywide mobilisation of war production. Such early high-level initiatives to grapple seriously with the threatened economic catastrophe depended heavily on the quality of leading individuals; leaders in the pure Stalinist mould could be seen at both their worst and best - for example Beriya, Malenkov, Molotov or Kaganovich.[3] The contribution of others - for example Kosygin and Voznesensky - seems to have remained merely undistinguished until a temporary institutional framework had been laid down.

Soon the individualisation of authority and responsibility, reinforced by dictatorial powers, became a

2 Harrison (1985) p. 87.
3 On Kaganovich see further Harrison (1985) pp. 177-8.

leading principle of wartime administration in the first eighteen months.[4] It was reflected for example in the division of labour within the GKO (State Defence Committee), Stalin's war cabinet, where Beriya was responsible for armament and ammunition procurement, Malenkov for the aircraft industry, Molotov for tankbuilding, Kaganovich for railway transport and so on. This adaptation of the Soviet political system to new tasks had peacetime precedents in previous emergencies of confrontation with the peasantry and food shortage, of international tension, and of industrial and defence mobilisation. However, in 1941-2 it was carried to a new extreme.

Thus in 1941 the central functions of the Soviet military-economic apparatus were incompletely stunned; nor were its limbs paralysed. Even in the first, comparatively leaderless days, the conversion and mobilisation of the economy for war production were carried on in full swing. This mobilisation was not strictly spontaneous, since it relied heavily upon prewar contingency plans and mobilisation exercises at the ministerial, municipal and enterprise levels; when war broke out the resulting reflexes were brought into play, although no one had telephoned through from the Kremlin to authorise it. People knew what they were supposed to do and did it without having to be told directly. It mattered more that they did something, than whether or not what they did was optimal under the

4 Sanford R. Lieberman, "The Evacuation of Industry in the Soviet Union During World War II", *Soviet Studies* (January 1983) and "Crisis Management in the USSR: The Wartime System of Administration and Control", in Susan J. Linz, ed., *The Impact of World War II on the Soviet Union* (Totowa, N.J. 1985); Harrison (1985) pp. 93-100.

circumstances. At this level, people were neither stunned nor paralysed. This was a fact of colossal significance.

The evacuation process was not backed up by years of planning and exercises; nonetheless it, too, did not depend exclusively on controls superimposed from above. The evacuation of rural communities and farm assets depended almost wholly upon low-level initiative. In industry, also, the evacuation of much industrial plant was carried out without permission from Moscow or Moscow's representatives. These were spontaneous responses, not programmed by prewar preparations. A full account of the balance between centralised and decentralised evacuation, and of their relative effectiveness, has yet to be drawn up.[5]

In summary, there were two elements in Soviet economic resilience in 1941-2. One was the capacity of Soviet leadership for high-level initiative and individual improvisation, enforced by decrees and dictatorial powers, in the face of emergency. The other was the popular response from below. This combined response was sufficient for survival in the short term, when everything depended upon industrial capacity to supply the front with guns, shells, tanks and aircraft. It did not, however, add up to a fully centralised and coordinated war economy. Rather, in the first period of the war control was exercised from the

5 This is the research topic of a PhD student, Iona Kogan, at the Department of History, University of Warwick. At the present time it seems that most agricultural assets were lost or perished on route; from Moscow's point of view decentralised evacuation of industrial assets tended to disrupt the imposition of centralised priorities for transport facilities and factory space in the interior. See further Harrison (1985), pp. 74-5.

centre over a few fundamentals, and the rest of the economy was instructed to show initiative and rely on "local resources". Thus the key sectors controlled from the centre were not systematically coordinated with the supporting civilian infrastructure. Nor were they systematically coordinated with each other, because of the system of divided personal responsibilities. Coordination was a matter of crash programmes and emergency measures to rectify imbalances only at the point where they became intolerable.

Individual initiative based on rule by decree was not, however, sufficient for a protracted resource mobilisation, requiring central coordination of the whole economy at maximum stretch for years at a time. For this task it was not enough to simplify priorities to guns, shells, tanks and aircraft alone. This is convincingly demonstrated by the state of the Soviet economy at the end of 1941. Defence plant had been saved and defence output multiplied. But everything else was in an utter shambles - metallurgy and the power sector, transport, construction and food supplies. These profound imbalances soon became a vital threat to continuation of the war effort. Steel, coal, electricity, machinery and freight capacities, workers to staff them, housing and food for the workers all became priorities of equal weight to war production. The resulting complex allocation problem could only be resolved by reassertion of bureaucratic order; "rule by decree" had to give way to law-governed administration.

By the end of 1942 this transition had been achieved. Victory at Stalingrad was in sight, and with it the prospect of recovering significant assets from enemy control. The relocation of industry had been completed, and Lend-Lease supplies were building up. The decline of the basic and engineering industries had been halted; workforce controls and supply planning had been stabilised and centralised. Within the GKO the responsibility for economic priorities formerly divided between leading individuals had been centralised in a new Operations Bureau.[6] From now on the role of political leadership was no longer crucial to Soviet survival, for the system as a whole was now fully mobilised for a war which it could no longer lose. (The nature, extent and cost of victory, however, were not yet predetermined.)

How did Soviet political leadership compare with that of other war economies? The UK economy also went through a phase of rapid reorientation for war. It differed from the Soviet experience both in starting point (less than full employment of both labour and fixed assets) and process (there was no invasion of British territory and no substantial decline in the real national product). While it was marked by indispensible political change at the top (the collapse of the Chamberlain administration and its replacement by Churchill's coalition in May 1940), personal leadership was relatively unimportant in managing the economic conversion process. As far as the economy was concerned, the rule was to fight the war by committee.

6 Harrison (1985), pp. 175-85.

The outstanding example of individual leadership based on personal responsibility in the British war economy was that of Beaverbrook. Churchill's friend and ally over many years, Beaverbrook was Minister of Aircraft Production from 1940-1, then Minister of Supply (responsible for tankbuilding) and briefly Minister of Production in 1942. Strenuously opposed to formal hierarchies and programmes, his watchwords were "Committees take the punch out of war" and "Organisation is the enemy of improvisation". He has been frequently credited with the central role in mobilising resources, first for fighter production in the Battle of Britain (when his influence was described by Churchill as "surprising" and by Air Chief Marshal Dowding as "magical"), then for the mobilisation of resources into tank and antitank weaponry in mid-1941 as the economy passed from full employment to intense shortage on every front.

Dispassionate analysis suggests, however, that Beaverbrook's personal influence on the dynamic of aircraft production may have less important than that of more objective factors - the administrative programmes, production capacities and aircraft types created under his predecessors, the shock of defeat in France, the threat of invasion and the political crisis which provided the context for his appointment. His influence on the supply of resources to other sectors may also have been negative and

disruptive.[7] Moreover, Beaverbrook's example does not find a parallel in other sectors of the British economy. Otherwise than in the case of the aircraft industry, the coordination of British resources for war was exercised from within a bureaucratic system of centralised controls,[8] presided over by Sir John Anderson, Lord President and then Chancellor of the Exchequer (of whom Angus Calder writes: "Before the computer was perfected, Anderson made a tolerable substitute").[9]

Germany's war economy presents the opposite case, where personal authority (the *Führerprinzip)* and divided responsibility were the rule, reinforced by traditional *Gauleiter* resistance to centralisation of priorities. Thus (for example) Göring was responsible for the aircraft industry and for import competing capacities formed under the Four Year Plan of 1936-40, Funk for the civilian economy under the Economics Ministry, Thomas for Wehrmacht military procurement under OKW and Todt, then Speer for the Ministry of Armaments. This system sufficed while the industrial requirements of Germany's *Blitzkrieg* fell short of fullscale

7 A.J. Robertson, "Lord Beaverbrook and the Supply of Aircraft, 1940-1941", in Anthony Slaven and Derek H. Aldcroft, eds., *Business Banking and Urban History: Essays in Honour of S.G. Checkland* (Edinburgh 1982). And, in connection with his appointment as Minister of Supply, it is recorded drily that Beaverbrook "set about the task with his habitual hustle. If, in spite of his endeavours, the Army's demands for tanks still remained unsatisfied and British tank production did not come up to what was needed, this was not due to any lack of attention on the part of the Ministry or any lack of effort on the part of the industry." See M.M. Postan, *British War Production* (London 1952), p. 118.

8 E.A.G. Robinson, "The Overall Allocation of Resources", in D.N. Chester, ed., *Lessons of the British War Economy* (Cambridge 1951).

9 Angus Calder, *The People's War: Britain 1939-1945* (London 1969), p. 119.

mobilisation of her economy, and while Germany could draw readily on the resources and slave labour of her occupied territories.

After 1941 German economic leaders like Minister of Armaments Speer understood that this was no longer enough, and began to try to persuade Hitler of the need for full centralisation of controls on resource allocation.[10] Ultimately, however, they were unable to secure it; in particular, Speer could not extend his influence over German labour, under the protection of Nazi traditionalists like Sauckel (the protégé of Hitler's personal secretary Bormann) of the Reichs Labour Office. At the height of Germany's economic mobilisation the principle of divided responsibilities meant that her economy remained full of untouched reserves - of industrial capacity, of female labour, of Himmler's SS resources - which Speer could not touch.[11]

Comparison of Hitler's Germany and Stalin's Russia as convergent systems, whether "totalitarian" or "shapeless", may fail to throw light on differences in their styles of wartime resource mobilisation. German leaders failed to secure centralised coordination of resources for a protracted war; Soviet leaders were not finally frustrated

10 Speer's attempt to centralise controls over input allocations should not be confused with his policy (inherited from Fritz Todt) of decentralisation of management of the procurement process from military administrators to industry-based production committees. See Alan S. Milward, *The German Economy at War* (London 1965), pp. 59-63.

11 See especially Klein (1959), chs. V, VI; Carroll (1968), chs. XI-XIII; Milward (1965), chs. IV, VI.

by similar ideological and institutional barriers to productive effort. The Soviet path to a fully centralised and coordinated war economy was not a straight line and took eighteen months to negotiate, but local traditions and bureaucratic interests did not prevail against it.[12] The Soviet and German paths did not converge.

The qualities of Stalin, Churchill and Hitler also bear upon this theme. Each shared a taste for strategy and enthusiasm for interference in operational decisions; each was often dictatorial towards subordinates and intolerant of correction by them. The consequences were quite different for their respective countries. For Hitler to make a single false step was a disaster for Germany, since everything depended on Germany's securing military victory before the potential anti-German coalition could mobilise its full resources. Much smaller risks were attached to the quality of Churchill's judgement - after the battle of Britain, anyway. For the Soviet Union Stalin's mistakes were of diminishing importance after 1941; after the battle of Stalingrad, they could no longer affect critically the outcome of the war, which from now on depended mainly on superior Soviet and Allied resources.[13]

12 Thus, unlike Himmler's SS, Beriya's NKVD resources were coordinated with the requirements of the war economy and were not held apart as a "state within a state"; see Harrison (1985), pp. 190-1.

13 Seweryn Bialer, ed., *Stalin and His Generals: Soviet Military Memoirs of World War II* (London 1970), pp. 42-4.

IV
The intensity of resource mobilisation

The economic war efforts of the main Allied nations, in proportion to their national incomes, all peaked in 1943. For Germany the peak may have come in 1944, but 1943 is the last year for which reliable national income data are available. Table 3 shows, for each nation, two measures of the mobilisation of its national income both at the outbreak of war and in 1943. The difference between the two measures stems from the important role of international resource transfers in financing the war efforts of the European Allies and of Germany. For Germany the source of these transfers was her conquered territories in both Western and Eastern Europe; for the UK and the USSR the source was North American supply, especially from the United States.

Measure (I) ("national" mobilisation) shows the utilisation of resources, irrespective of origin, for supply of spending on national war aims in proportion to the national product. This is the measure appropriate to study of national priorities. For the UK, USSR and Germany it is the ratio of officially reported defence expenditures to national income, and constitutes an upper bound of national income mobilisation. For the USA it means deducting those defence expenditures which supplied the war effort of other nations, and is a lower bound of measured resource mobilisation.

Measure (II) ("domestic" mobilisation) shows the utilisation of domestically produced resources for supply of

TABLE 3

THE MOBILISATION OF NATIONAL PRODUCT FOR WAR:
USA, UK, USSR AND GERMANY, 1939/40 and 1943
(per cent of national income)

		Measure (I): "National" mobilisation	Measure (II): "Domestic" mobilisation
USA	1940	1	2
	1943	48	54
UK	1939	15	10
	1943	55	46
USSR	1940	15	15
	1943	67	55
Germany	1939	25	24
	1943	76	60

Notes and sources:

See Appendix B.

military spending, on the assumption that domestic supply of military spending was eased by the full amount of net imports (for the USA it means crediting her domestic war effort in full with the resources transfered to her allies' fighting strength). For the UK, USSR and Germany net imports are deducted from reported military spending, resulting in a lower bound to measured national income mobilisation; for the USA reported defence expenditure is used, resulting in an upper bound.

Table 3 shows that the percentage of net national income mobilised for war by the United States and the United Kingdom was roughly comparable. Just less than half the United States national income was used up in supplying her own war effort at the peak, but when supply of the war efforts of the UK and USSR is included the proportion rises to 54 per cent.[1] A similar share (55 per cent) of UK national income was allocated to her own war effort in 1943, but the role of North American supply meant that just less than half of domestic production was used up in this way. The USSR showed a higher level of economic mobilisation at the peak. By 1943, after discounting fully the role of external supply, roughly 55 per cent of the Soviet national

1 A lower figure of 40 per cent for United States war outlays in relation to national income in 1943-4 is often used in comparison with those cited for the UK to suggest a lower level of US economic mobilisation - see for example Carroll (1968, p. 184). In this case the US national income measure is GNP at market prices, while UK national income is measured as NNP at factor cost; United States defence production transfered to the UK through Lend-Lease is double-counted by inclusion in the war outlays of both countries. The resulting comparison is quite misleading. On this and other problems of cross-country comparison see further Appendix B.

income was being allocated to her war effort. When external resources are included, the proportion rises to two thirds.

In the case of the United Kingdom and United States the mobilisation of outputs was assisted by the maintenance or significant increase in the real national product in wartime. Table 4 shows that between the outbreak of war and the peak of her war effort, US national income grew by about one third in real terms; the increase was sufficient to supply all but one sixth of the increase in war outlays. The UK faced a somewhat more difficult task: the resources for combat had to be found from within a national income which at first tended to decline, and which only just exceeded prewar levels at the peak of the war effort in 1943. Much the worst position was faced by the USSR, the real national income of which fell by one third in 1940-2 under the impact of invasion and territorial loss.

Table 5 shows that the intensity of mobilisation of labour also differed sigpificantly between the three Allies. On the British definition of fighting strength plus war-related industrial employment in the metal, chemical, engineering and defence industries, by 1943 the United States had diverted one third of its working population to the common war effort.[2] The UK and USSR had achieved a higher degree of mobilisation - about 45 per cent either in uniform or in war work.

2 On a broader definition of war-related employment, by June 1944 40 per cent of the United States workforce had been absorbed into the armed forces and war work compared to 55 per cent for the United Kingdom at the same time - see Hancock and Gowing (1949), p. 370.

TABLE 1

REAL NATIONAL PRODUCT: USA, UK, USSR AND GERMANY, 1939-45

	USA	UK	USSR	Germany
	GNP[a] (1939 = 100)	NNP[b] (1939 = 100)	NI[P] [c] (1940 = 100)	GNP[d] (1939 = 100)
1939	100	100	-	100
1940	108	91	100	100
1941	125	93	92	102
1942	137	97	66	105
1943	149	102	74	116
1944	152	102	88	-
1945	-	101	83	-

Notes and sources:

a Gross national product at 1939 market prices from *American Industry in War and Transition, 1940-1950*, Part II, *The Effect of the War on the Industrial Economy* (U.S. War Production Board: Washington, D.C. 1945), p. 27.

b Net national product at current factor cost (see Appendix B, Table B-2) is deflated by an index of wholesale prices based on August 1939 = 100 for year-ends 1940-5, with appropriate adjustment to annual averages, from W.K. Hancock and M.M. Gowing, *The British War Economy* (London 1949), pp. 77, 349.

c National income produced at "comparable" prices; the official index, cited in Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), p. 151.

d Gross national product at 1939 market prices, calculated from Burton H. Klein, *Germany's Economic Preparations for War* (Cambridge, Mass. 1959), p. 257.

TABLE 5

THE MOBILISATION OF THE WORKFORCE FOR WAR:
USA, UK, USSR AND GERMANY, 1939/40 and 1943
(per cent of working population)

		Group I[a] industry	Armed forces	Total war-related
USA[b]	1940	8.4	1.0	9.4
	1943	19.0	16.4	35.4
UK[c]	1939	15.8	2.8	18.6
	1943	23.0	22.3	45.3
USSR[d]	1940	(8)	5.9	(14)
	1943	(22)	23.4	(45)
Germany[c]	1939	14.1	4.2	18.3
	1943	14.2	23.4	37.6

Notes and sources for Table 5:

a Group I industry on the British definition comprised mainly the armament, shipbuilding, engineering, metalworking and chemical industries.

b Employment shares are calculated from *American Industry in War and Transition, 1940-1950*, Part II, *The Effect of the War on the Industrial Economy* (U.S. War Production Board: Washington, D.C. 1945), pp. 34-5; employment in Group I industries on the British definition was only slightly less than war employment by the War Production Board classification (*ibid.*, p. 36).

c Employment shares are calculated from Burton H. Klein, *Germany's Economic Preparations for War* (Cambridge, Mass. 1959), p. 144.

d In 1940 manual workers in engineering and metalworking (including the defence industries), metallurgy and chemicals amounted to 36.3 per cent of the manual workforce in industry - see *Promyshlennost' SSSR* (Moscow 1961), p. 24 - and employment in industry and construction amounted to 23 per cent of total civilian employment in the economy. No such breakdown of Soviet industrial employment by branch or ministry exists for the war years; the figure given for 1943 is the lower bound of an estimate for the workforce share of direct war workers. For this and for Soviet army force levels in relation to the working population see Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), p. 162n.

The course of German wartime economic mobilisation was different from any of these. Table 4 shows that the mobilisation of Germany's national product for war mounted steadily until 1943 (after which national accounts are no longer reliable), when the requirements of domestic mobilisation had already claimed 60 per cent of her national income. When externally financed war expenditures are included, the proportion rises to three quarters. Supply of the war effort was eased by the fact that in Germany, as in the USA, the years 1939-43 saw substantial national income growth; up to one third of the increase in military spending was financed in this way. Yet Table 5 shows that, at the same time, the industrial mobilisation of labour remained at a relatively low level compared to either the UK or the USSR.[3] Paradoxically, while Germany devoted the largest proportion of her national income to war (when compared to other nations), the composition of her industrial workforce remained largely untouched at this aggregate level and its measured mobilisation was less than that of other countries.

Part of the explanation is surely that, as in the UK, the years 1939-43 saw a substantial switch from civilian to war employment within Germany's Group I industrial classification. But the German failure to expand Group I

3 Moreover, the hours of work of German workers, and the participation in work of German women, remained virtually unchanged in 1942 compared to 1939 - a striking contrast to the British and Soviet records of labour mobilisation. On Germany and Britain see Klein (1959), pp. 136-46; on the USSR see Harrison (1985), pp. 137-42. However, R.J. Overy in the *Times Literary Supplement* (April 11, 1986), p. 393 has pointed out that the share of women in the German workforce on the eve of war was already higher than Britain's wartime peak.

employment as a whole is in striking contrast to other countries's success, and also to Germany's outstanding record of mobilisation of her national income. This paradox must correspond to the fact that increasingly the bulk of Germany's war effort was going to maintain a privileged and bloated contingent of military personnel, at the expense of its equipment and industrial supply. In contrast to the German record, Table 2 showed that by 1943 the Soviets were spending three times as much out of their defence allocations on weapons procurement as on soldiers' pay. The high index of German national income mobilisation is therefore misleading since behind it lay a disproportion between soldiers, war workers and civilian employment which was ultimately unsustainable.[4]

All the major combatants of World War II faced difficult problems of balancing the armed forces and military supply against civilian needs. For the UK and USSR the war took the form of a constant struggle to avoid excessive mobilisation for war. The threatened excessive mobilisation was a consequence of the drive to divert resources from supply of the economy to the immediate requirements of combat. In the Soviet case this threat was particularly acute in the frontline regions in 1941-2, where unrestricted mobilisation of industrial workers and even skilled workers in the defence industries into both regular forces and the home guard militia was practised at critical

4 This criticism could be applied, for example, to R.J. Overy's view (in opposition to Klein and Milward, and based partly on his own and Berenice Carroll's estimates of national income mobilisation) that the Nazi mobilisation of industry for war production was of a comprehensive character; see Overy (1982), p. 283.

moments.[5] In both Britain and the Soviet Union the maximum degree of mobilisation consistent with sustained effort seems to have been reached with each soldier matched roughly by one worker in the defence industries and two more workers retained in the civilian economy producing food, clothing and other necessities for the war worker and soldier. Any further recruitment for fighting threatened to leave the war worker without necessities or the soldier without the means of combat. In the British case the threat was averted by rapid implementation of a complex, centralised system of rationing labour between economic priorities, and by Churchill's March 1941 imposition of a 2 million ceiling on the size of the ground forces.[6] In the Soviet case the same limits on mobilisation had been imposed by November 1942, but the process of establishing them was more costly, complex and pragmatic.[7]

The other threat of excessive mobilisation arose from the temptation to aim too far into the future in expanding the country's defence plant capacity. In the UK economy this temptation was reflected in the wartime establishment of new defence plant which, upon commissioning, could not be operated because of unforeseen shortages of labour or materials. A Soviet equivalent was the evacuation of defence plant which, upon relocation, could not be operated for the same reasons. In each case, the effort of capital formation or capital evacuation and relocation had been wasted; had it

5 Harrison (1985), pp. 143-4.
6 Hancock and Gowing (1949) p. 289 call this "a landmark of manpower history". Later the ceiling was raised slightly to 2.4 million. See also pp. 57-9, 300-14.
7 Harrison (1985) pp. 185-91.

been redirected into current production, more means of national survival and defence would have been created. The evidence suggests, however, that these cases were not typical. In each country wartime investment was successfully restricted and redirected to match defence priorities.[8] In Germany, in contrast, the private interests of capital goods producers ensured a relatively high commitment of resources to capital formation despite the intensified struggle.

United States resources were such that the point of excessive mobilisation was never approached. The German economy, on the other hand, passed almost directly from undermobilisation to overmobilisation in 1944. Until D-Day the Reich Labour Office successfully resisted all pressures to impose centralised controls and national service obligations on German workers, prefering the option of importation of slave labour from Germany's occupied territories; after D-Day Wehrmacht conscription of German armament workers began.[9] From now until Hitler's March 1945 order to destroy remaining economic installations the unwinding of German economic mobilisation was virtually predetermined.

How important were external resources to the Soviet war effort? In fact, all the major combatants other than the United States relied heavily on external supply. Table 6 shows that Britain's heaviest reliance on foreign sources was in 1940-1 when they supplied 13 per cent of her national

8 On British investment controls and results see Robinson (1951), pp. 42, 53-4. On the Soviet record see Harrison (1985) pp. 133-5.
9 Milward (1965), pp. 178-81.

TABLE 6

THE EXTERNAL SUPPLY OF RESOURCES: USA, UK, USSR AND GERMANY, 1938-45

	USA	UK	USSR	Germany
Net exports, per cent of:	NNP	NNP	NI_P	NNP
1938	2	-1	-	1
1939	1	-5	-	-1
1940	2	-13	-	-7
1941	2	-13	-	-12
1942	4	-9	-6	-17
1943	6	-8	-12	-16
1944	6	-8	-12	-
1945	-	-10	-	-

Notes and sources:

For national income measures and net imports see Appendix B.

income, but her reliance was little less in 1942-4; by 1944 almost 40 per cent of Britain's armament came from overseas.[10] Over the war years as a whole, Britain imported net resources valued at almost one year's prewar national income. Her main source of credit was, of course, the United States Lend-Lease programme which amounted to about 15 per cent of US military spending and up to 6 per cent of her national income through the war years.

The USSR was also significantly dependent on US Lend-Lease, although certainly no more than the UK. Lend-Lease supplies may have made up about one tenth of the Soviet national income available in 1943-4. While an overall measure of the role of external supply in Soviet arms availability is not possible, it is estimated that overseas sources contributed up to one quarter of Soviet aircraft supplies (this was the peak recorded in late 1943) and up to one fifth of tank supplies (in 1942); throughout the war the Soviets were able to meet their own armament and shell needs, but later on, American shipments of trucks, tractors and tinned food provided the Red Army with decisive mobility in its westward pursuit of the retreating Wehrmacht.[11] Thus British and Soviet dependence upon external supplies were roughly comparable, but British dependence was greatest in the earlier stages.

Germany, too, imported major resources from abroad. These mounted rapidly as German control spread through Europe, and by 1942-3 stood at about one sixth of her

10 Hancock and Gowing (1949), pp. 357-78.
11 Harrison (1985), Appendix 3.

national income. Not counted in the net balance of resource transfers is another way in which Germany relied upon her conquests, by the presence of millions of labourers imported by force from France and from Eastern Europe - 4 millions already by 1942.[12]

12 Klein (1959), p. 137. The Soviet economy, too, benefited from the forced labour of up to 3 million German prisoners of war from 1943 to 1945 and beyond.

V
War as a test of economic systems

The idea of war as a test of a nation's political, social and economic system is common to the main traditions of European military-political thought, whether Marxist or non-Marxist. Commenting on this idea in November 1943, Stalin declared: "The lessons of the war show that the Soviet system proved not only the best form of organizing the economic and cultural development of the country in the years of peaceful construction, but also the best form of mobilizing all the forces of the people for resistance to the enemy in time of war."[1]

The idea of war as a "test" may be understood in different ways. For example, in both Stalinist and fascist ideology, this idea sometimes acquired Social Darwinian connotations. Nations were portrayed as engaged in an evolutionary struggle for survival of the fittest; war winnowed out the weak and unfit qualities and elements of a nation, and nations which sought to conserve such qualities and elements would be destroyed by those more ruthless nations which adapted themselves more thoroughly to the needs of warfare. War was seen as a test of good and bad, and the nations which passed this test were seen to be better nations than those which failed it.

I have no intention of deploying such undertones here. I use the idea of war as a "test" in its strictly empirical

1 Joseph Stalin, *The Great Patriotic War of the Soviet Union* (New York 1945), p. 100.

sense. Wars may show which societies were better equipped to engage in warfare, but victory in war does not carry an automatic moral value with it. A society which proved to be good at winning wars was not necessarily a better society to live in.

If war is a test of a nation's organisation (as well as of its resources), then its criterion is multi-faceted. The economic aspect of this test can itself be subdivided. In comparing the economic performance of different nations in wartime, as in peacetime, two aspects are of principal significance: the *efficiency* and the *intensity* of resource use.[2] Neither is sufficient on its own - a nation may be highly efficient at transforming inputs into outputs, yet "fail" the test of mobilisation because of the high proportion of inputs and capacities left idle or devoted to nonwar tasks; on the other hand a nation may pour resources into its war effort, yet fail the efficiency test because the effort does not produce results in terms of ability to resist or overcome the enemy.

In this paper I have addressed only the dimension of resource mobilisation - the intensity, rather than the efficiency of the use of resources for warfare. By this standard, Soviet wartime economic performance was superior to that achieved by Nazi Germany; the Soviet mobilisation of industry and labour was more intense and the Soviet mobilisation of the national product, although lower, was

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2 See Philip Hanson, "East-West Comparisons and Comparative Economic Systems", *Soviet Studies* (January 1971) pp. 332-3.

more sustained. And this was in spite of the major demographic and territorial loss imposed by Germany upon the Soviet Union; under comparable circumstances (in 1944-5) German resources swiftly became over-mobilised and military-economic collapse followed.

The Soviet mobilisation of resources was so much more intense than that of the United States that further comment is not really necessary. Soviet performance may also have been superior to that of the British economy in terms of the mobilisation of products; in workforce terms it was roughly comparable. At the same time the "tests" imposed by Germany upon the British and Soviet economies were not the same; that faced by the USSR was much more severe. Both economies had to reallocate resources to war from within a diminished national income, but in UK experience the decline was slight and temporary; for the USSR the fall in national economic activity was literally catastrophic, being forced by the loss of territory, assets and population on a huge scale. The UK suffered only aerial bombardment and attempted blockade, and the United States encountered neither of these. The Soviet Union was, after all, the only country of World War II to survive the test of invasion as a nation state.

In measuring the intensity of resource mobilisation for war the share of resources devoted to war is insufficient on its own. Also of relevance is the intensity of use of the resources produced in combat. According to the postwar estimate of Raymond Goldsmith, the Germans produced over $50

billion of weaponry for use on the eastern front, compared to Soviet supply (including external resources) totalling about $60 billion. On the western front, in contrast, the Allies disposed of well over $100 billion worth of munitions (excluding those supplied to the USSR) for use against Germany and Italy which, in their turn, disposed of only about $40 billion of munitions in the western theatres.[3] This corresponds to well known data on the balance of personnel along the two fronts. Thus, in the years from mid-1941 to mid-1944 Soviet resources were employed in the cause of Germany's military defeat with far greater intensity than those of Great Britain or North America.

Mark Harrison
May 1987

3 Goldsmith (1946), pp. 76-7.

Appendix A

Real Soviet munitions output in comparative perspective, 1935-44

Table 1 above shows Raymond Goldsmith's estimate of the real munitions output of major belligerents before and during World War II. In the Soviet case this estimate was compiled 20 years before official publication of an index of munitions output; official publication of Soviet wartime munitions output in physical units was even longer delayed.

Under the circumstances, reexamination of Goldsmith's sources and methods, and comparison of his results with subsequently available information, are clearly in order.

Goldsmith reached his estimates as follows. First, the volume of each nation's overall combat munitions output relative to United States output in 1944 was estimated on the basis of comparing real output of principal munitions types. Second, each nation's real munitions output, expressed as a percentage of US 1944 munitions output, was extrapolated back over preceding years. For the USA, Canada, the UK and Germany backward extrapolation was based on time series of real output of principal munitions types; for Japan and the USSR such data were currently unavailable, so budget expenditure on munitions (an unofficial estimate in the case of Japan) deflated by an estimate of domestic price changes was used instead. Third, the resulting index was multiplied by US 1944 budget expenditure on munitions.

In the Soviet case, Goldsmith estimated Soviet 1944 munitions output to be about 40 per cent of United States output in the same year. He also proposed an index (1944 = 100) for Soviet munitions output which behaved as follows:

1938	1939	1940	1941	1942	1943	1944
12	20	30	53	71	87	100

Is Goldsmith's estimate for real Soviet munitions output consistent with subsequent officially published data? Let us take first the suggestion that Soviet 1944 munitions output was about 40 per cent of the United States level. Table A-1 shows that in 1944 Soviet production of armour and artillery firepower turns out to have substantially exceeded US output; tanks and self-propelled guns were produced at 141 per cent of US 1944 output, and there was also an imbalance in the Soviet favour for artillery both heavy (1700 per cent) and light (861 per cent) and artillery shells (138 per cent in 1943). However, Soviet infantry machine guns (55 per cent) and rifles and carbines (71 per cent) were produced at lower rates. In the case of military aircraft, one of the most complex and costly branches of arms manufacture, numbers produced by Soviet industry in 1944 reached only 35 per cent of United States output, and a lower ratio would be appropriate for comparison of value added since Soviet aircraft were on average smaller and lighter. Lastly, Soviet wartime shipbuilding (not shown in the table) was negligible compared to the huge United States

effort in this direction - the USSR built only 74 ships of all types in 1941-4, more than half of them in 1941.

What about Goldsmith's view of Soviet munitions output growth? Rebased on 1940 = 100, Goldsmith's index can be compared with an official index of the combined real munitions output of four main commissariats (aircraft, tank, armament and ammunition industries) as follows:

	1940	1941	1942	1943	1944
Goldsmith	100	170	230	270	320
Soviet	100	140	186	224	251

Goldsmith's index thus suggests a rather more ambitious increase for 1944 over 1940 than the official Soviet index.

Since Goldsmith's index is end-year weighted, the discrepancy cannot be explained by a "Gerschenkron effect". However, there is good reason to think that the Soviet index substantially understates the true increase in real munitions output. For example, the number of military aircraft produced in 1944 represented a much greater increase over 1940 than either index would allow (400 per cent: see Table A-1), and the same was true for numbers of tanks and self-propelled guns (1036 per cent), artillery pieces (heavy artillery: 630 per cent over 1939, light artillery: 780 per cent), shells and mines (943 per cent in 1943) and infantry machine guns (385 per cent). Of the major lines of munitions output, only rifles and carbines (167 per cent) and shipbuilding (not shown in the table), which declined, fell below the 1944 performance suggested by either index.

Only in the case of aircraft production does a change in the composition of output from more to less complex and costly types seem likely to explain even a part of this kind of discrepancy (see further Harrison, 1985, pp. 118-121). Thus, a serious question mark hangs over the official Soviet index of munitions output.

In summary, there is no absolutely compelling reason to reject Goldsmith's estimate of Soviet 1944 dollar spending on munitions on grounds of either level or rate of change. The level of munitions output implied is plausible. As a growth index it is probably more satisfactory than the official one; however, neither the official nor Goldsmith's index is likely to prove free of major defects.

TABLE A-1

WAR PRODUCTION FOR SUPPLY OF THE GROUND AND AIR FORCES OF THE USA, UK, USSR AND GERMANY, 1940-4

	1940	1941	1942	1943	1944
Military aircraft, thou.					
USA	23.2[a]		47.8	85.9	96.3
UK	15.0	20.1	23.6	26.2	26.5
USSR[b]	8.3	12.4	21.7	29.8	33.2
Germany	10.2	11.0	14.2	25.2	39.6
Tanks and self-propelled artillery, thou.					
USA	4.2[a]		27.0	38.5	20.5
UK	1.4	4.8	8.6	7.5	4.6
USSR	2.8	6.6	24.4	24.1	29.0
Germany	1.6	3.8	6.3	12.1	19.0
Heavy artillery (75 mm and over), thou.[c]					
USA[d]	0[a]		0.6	2.7	3.3
UK	1.9	5.3	6.6	12.2	12.4
USSR[e]	(8.9)[f]	-	49.1[g]	48.4	56.1
Germany	6.3	7.8	13.6	38.0	62.3
Light artillery (20-74 mm), thou.					
USA[d]	4.7[a]		20.5	19.1	7.7
UK	2.8	11.4	36.4	25.8	3.6
USSR	(8.5)[f]	-	77.9[g]	81.9	66.3
Germany	-	3.4	9.6	8.1	8.4
Infantry machine guns, thou.					
USA[h]	87[a]		662	830	799
UK	30	46	1510	1650	730
USSR[h]	(114)[e]	-	356	459	439
Germany	170	320	320	440	790
Infantry rifles and carbines, mn.					
USA	0.4[a]		1.5	5.7	3.5
UK	0.1	0.1	0.6	0.9	0.5
USSR	1.5	-	4.0	3.4	2.5
Germany	1.4	1.4	1.4	2.2	2.6

[continued]

TABLE A-1 [continued]

WAR PRODUCTION FOR SUPPLY OF THE GROUND AND AIR FORCES OF THE USA, UK, USSR AND GERMANY, 1940-4

	1940	1941	1942	1943	1944
Artillery shells, mn.					
USA		3[a]	77	92	96
UK[i]	10	23	50	37	22
USSR	14	–	73	132	–
Germany[i]	–	35	99	108	133

Sources for Table A-1:

For Germany and the UK see Nicholas Kaldor, "The German War Economy", *Review of Economic Studies*, no. xiii (1945/6), pp. 45-6. For the USSR see Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), p. 250. For the USA see *War Production Achievements and the Reconversion Outlook* (U.S. War Production Board: Washington, D.C. 1945), pp. 106-9.

Notes:

a July 1940-December 1941
b Combat aircraft only.
c Excluding naval artillery
d Calibre not specified in source.
e Over 76 mm.
f 1939 (1940 is not available).
g This figure is not consistent with quarterly data.
h All machine guns.
i Over 20 mm.

Appendix B

The mobilisation of national product for war: USA, UK, USSR and Germany, 1938-45

Comparison of national income mobilisation for war in Germany, the United States and the United Kingdom has previously been attempted by Berenice A. Carroll, *Design for Total War: Arms and Economics in the Third Reich* (The Hague-Paris 1968), p. 184. Carroll's results differ markedly from those shown here. Four mistakes appear in her use of source materials (*ibid.*, p. 263).

First, UK military spending for early years is inflated by inclusion of "capital" spending (i.e. repayment of previously issued defence loans).

Second, UK military spending is distorted throughout in relation to NNP because NNP is measured by calendar year, military spending by fiscal year (with a four-month lag).

Third, in comparing United States military spending with that of her allies, double counting of United States Lend-Lease expenditure must be borne in mind. This apparently arose in the following way. The provision of military goods to her allies was counted by the United States as her own military spending (for 1942-5 about 15 per cent of the US military budget was allocated in this way, and up to 6 per cent of the United States national income). However, recipients of United States military aid included Lend-Lease first in budget revenues, then in budget expenditures on the war. Thus, all the partners in the wartime coalition simultaneously claimed the credit for allocating United States transfers to the common military cause.

Fourth, German military spending is compared to Klein's measure of "total available output", (i.e. GNP + net imports), not GNP as claimed, and in 1939-43 Germany's net absorption of foreign resources added substantially to her national product.

Correcting the first and second of these distortions is easy. The third and fourth raise major difficulties of interpretation. If our objective is to measure each economy's domestic resource mobilisation, then in principle foreign supply should be netted out of military spending as well as out of national income. In the case of the United States, Lend-Lease transfers should be attributed to United States military spending, not those of her allies. On the other hand, if our objective is to measure each country's willingness and capacity to divert resources available from any source, domestic or foreign, to its own accumulation of national military assets, then the utilisation of foreign supply for military purposes should be included in military spending.

In the case of the USA, UK and USSR, however, there is no obvious method for determining what proportion of each

country's net imports was used to supply military spending. Each country imported both military and civilian goods in wartime, but civilian goods were often crucial to military supply or, if intended for civilian utilisation, they helped to free domestic resources for military purposes.

In practice, for each country in each year I have chosen to calculate two measures of national income mobilisation. Measure (I) ("national" mobilisation) shows the utilisation of resources, irrespective of origin, for supply of spending on national war aims in proportion to the national product. This is the measure appropriate to study of national priorities. For the UK, USSR and Germany it is the ratio of officially reported defence expenditures to national income, and constitutes an upper bound of national income mobilisation. For the USA it means deducting those defence expenditures which supplied the war effort of other nations, and is a lower bound of measured resource mobilisation.

Measure (II) ("domestic" mobilisation) shows the utilisation of domestically produced resources for supply of military spending, on the assumption that domestic supply of military spending was eased by the full amount of net imports (for the USA it means crediting her domestic war effort in full with the resources transfered to her allies' fighting strength). For the UK, USSR and Germany net imports are deducted from reported military spending, resulting in a lower bound to measured national income mobilisation; for the USA reported defence expenditure is used, resulting in an upper bound.

The difference between Measures (I) and (II) is quantitatively important for all four countries, rising to one tenth or more of British, Soviet and German national income at the wartime maximum.

Key to national income definitions:

USA, UK and Germany

GNP — Gross national product (goods and services) at market prices

NNP — Net national product (goods and services) at factor cost

NNP = GNP - capital depreciation - net indirect taxes

USSR

NI_P — National income (goods and intermediate services) produced at transfer prices

NI_P = NNP - final services + net indirect taxes

NI_A — National income (goods and intermediate services) available at transfer prices

$NI_A = NI_P$ - exogenous losses + net imports

TABLE B-1

THE MOBILISATION OF NATIONAL PRODUCT FOR WAR: THE USA, 1939-45

	$ billion:			Per cent of NNP:	
	NNP at factor cost	Military spending	Net exports	Resources mobilised for war	
				(I)[a]	(II)[b]
1939	70.8	1.4	0.9	1	2
1940	77.6	2.8	1.4	2	4
1941	96.9	13.3	1.8	12	14
1942	122.2	50.3	5.3	37	41
1943	149.4	81.3	9.3	48	54
1944	160.7	83.7	10.3	46	52
1945	161.0	69.0	-[c]	-[c]	43

Sources: For net national income and military spending see the *Federal Reserve Bulletin*, March 1946, p. 337. National accounts in this source give data for "cash" trade only, excluding military transfers to the European Allies. Net exports including the latter are given for 1939-44 in *American Industry in War and Transition, 1940-1950*, Part II, *The Effect of the War on the Industrial Economy* (U.S. War Production Board: Washington, D.C. 1945), p. 52.

Notes:

a Military spending minus net exports as share of NNP.

b Military spending as share of NNP.

c For 1945 the "cash" trade balance only, excluding military transfers to the European Allies, is available.

TABLE B-2

THE MOBILISATION OF NATIONAL PRODUCT FOR WAR:
THE UK, 1938-45

	£ million:			Per cent of NNP:	
	NNP at factor cost	Military spending	Net imports	Resources mobilised for war	
				(I)[a]	(II)[b]
1938	4707	327	70	7	5
1939	5075	763	250	15	10
1940	6066	2600	804	43	30
1941	6378	3643	816	52	44
1942	7652	3945	663	52	43
1943	8115	4452	680	55	46
1944	8310	4481	659	54	46
1945	8355	3827	875	46	35

Source: W.K. Hancock and M.M. Gowing, *The British War Economy* (London 1949), pp. 75, 347.

Notes:

a Military spending as a share of NNP.

b Military spending minus net imports as a share of NNP.

TABLE B-3

THE MOBILISATION OF NATIONAL PRODUCT FOR WAR: THE USSR, 1940 AND 1942-45

	Per cent of real 1940 national income produced:			Per cent of NI_P at current prices:	
	NI_P[a]	Military spending[b]	Net imports[c]	Resources mobilised for war	
				(I)[d]	(II)[e]
1940	100	15	-	15	15
1942	66	38	6	57-8	52
1943	74	50	12	67	55
1944	88	47	12	53	41

Notes and sources:

a The official index is cited in Mark Harrison, *Soviet Planning in Peace and War 1938-1945* (Cambridge 1985), p. 151. I make no attempt at conversion from Soviet NI_P to Western NNP. The reason is that the necessary adjustments would approximately offset each other. For example, the pay of employees providing military and civilian final services would add approximately one quarter to 1942 NI_P, while subtraction of indirect taxes would probably remove about the same amount.

b Officially reported military spending as a share of national income in 1940 (15 per cent) and 1942 (57-8 per cent) is cited in Harrison (1985), p. 152. I deduce that these are shares of national income produced (NI_P), not available (NI_A), from the fact that they are given together with other information, clearly intended to be comparable, on the mobilisation for war of national income by sector of origin (industry, construction, transport and agriculture). These are multiplied by the index of real NI_P to estimate real military spending in 1940 and 1942 as 15 and 38 per cent of 1940 NI_P respectively.

For 1943 and 1944 other information must be taken into account. Officially reported military spending *on munitions and military pay alone* (i.e. excluding the costs of military construction and operations), as a share of NI_A, is cited in Harrison (1985), p. 151 as follows:

1940	1942	1943	1944	1945
11	40	44	35	25

This can be translated into an index of real spending on military pay and munitions by multiplication with an index of real NI_A. The latter is obtained from the official index of NI_P, increasing it by 6 per cent in 1942 and 12 per cent in each of 1943 and 1944 to allow for the availability of net imports (see the next column in the table). NI_A and real spending on munitions and military pay are then found as follows:

	National income available	Spending on military pay and munitions, per cent of 1940 national income available
1940	100	11
1942	70	28
1943	83	37
1944	99	35

Comparing our 1942 estimates of real total military spending (38 per cent of 1940 national income) and spending on munitions and military pay alone (28 per cent) suggests a difference of 10 per cent of 1940 national income attributable to the cost of military construction and operations in 1942. Total military spending exceeded pay and munitions costs in the ratio of 1:1.35 (this is virtually the same as the ratio of 1:1.36 obtained from a 1940 comparison); real military spending in 1943 and 1944 is therefore estimated by adjusting pay and munitions costs in this proportion.

c These percentages are based on Abram Bergson's estimate (see Table 6 in the text) that in 1944 Lend-Lease deliveries reached 10-12 per cent of Soviet GNP; I have taken the upper limit of this estimate as meaning that Soviet NI_A was roughly 12 per cent in excess of NI_P in 1944, without making any other allowance for capital consumption or conceptual differences. The reasons for not making any adjustment from Western to Soviet national income concepts or back again are given above. The percentage adjustment is extrapolated back to 1942 on the basis of comparing the yearly dollar value of Lend-Lease deliveries with the index of NI_P.

I make no attempt to measure net imports in 1945. In 1945 Lend-Lease deliveries fell, then were abruptly curtailed; however, the gap between national income produced and available may have been maintained to some extent by the beginning of postwar reparations. I have not attempted to estimate their value. A much larger gap between national income (at 1940 prices) produced and available in 1944 and 1945 is suggested by rare national accounts published from archival data in *Po edinomu planu* (Moscow 1961), pp. 105-6, but since the implied behaviour of national income produced from 1940 to 1944-5 diverges greatly from the generally accepted official NI_P index (see Table 4) I would tend to regard the results as unreliable.

d Military spending as share of national income produced.

e Military spending minus net imports as share of national income produced.

TABLE B-4

THE MOBILISATION OF NATIONAL PRODUCT FOR WAR: GERMANY, 1938--43

	Reichsmarks, billion:			Per cent of NNP:	
	NNP at factor cost[a]	Military spending	Net imports	Resources mobilised for war (I)[b]	(II)[c]
1938	106	17	-1	17	18
1939	119	30	1	25	24
1940	121	53	9	44	36
1941	126	71	15	56	44
1942	132	91	22	69	52
1943	147	112	24	76	60

Source: Burton H. Klein, *Germany's Economic Preparations for War* (Cambridge, Mass. 1959), p. 256

Notes:

a GNP at market prices is adjusted to NNP at factor cost by a deduction of 8 per cent, representing the share of capital depreciation and indirect taxes in 1938 GNP within pre-1939 boundaries - see Klein (1959), p. 251. This is likely to result in overstatement of NNP relative to war outlays during the war years as a result of the increased burden of indirect taxation.

b Military spending as a share of NNP.

c Military spending minus net imports as a share of NNP.