Soviet National Income and the Burden of Defence, 1937 and 1940-1944.

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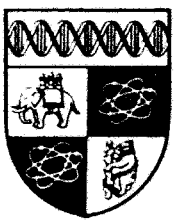

DEPARTMENT OF ECONOMICS

UNIVERSITY OF WARWICK
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Abstract

This paper presents a new measure of the real national income of the Soviet Union on the eve of World War II and during the war years. The new measure is compared with existing official and independent estimates. The heavy weight of the wartime Soviet defence burden is confirmed by the standards both of peace time and of other powers engaged in World War II. The Soviet commitment of labour resources to the war was also very heavy, but does not seem so impressive by international wartime standards. This reflects, in part, a real underlying constraint on Soviet wartime mobilisation rooted in the labour requirements of a large, low productivity agricultural sector.

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Soviet national income and the burden of defence, 1937 and 1940-1944

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I

Introduction

In a recent article I attempted to provide comparable estimates of the national income of four great powers (the UK, USA, USSR and Germany) and its mobilisation for defence purposes during World War II.[1] The Soviet data were derived loosely from studies of wartime national income by sector of origin and end use, in constant 1937 roubles, published in the 1960s by Abram Bergson, Richard Moorsteen and Raymond P. Powell.[2] These comparisons suggested three outstanding features of the Soviet war record:

a Between 1940 and 1942 the Soviet national income dropped by 43 per cent, in sharp contrast with the economic expansion enjoyed by the other powers; as late

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1 Mark Harrison, `Resource mobilization for World War II: the USA, UK, USSR and Germany, 1938-1945', *Economic History Review*, 2nd ser., xli, no. 2 (1988), 184-5.

2 Abram Bergson, *The real national income of Soviet Russia since 1928* (Cambridge, Mass., 1961); Richard Moorsteen and Raymond P. Powell, *The Soviet capital stock, 1928-1962* (Homewood, Ill., 1966); Raymond P. Powell, `The Soviet capital stock and related series for the war years', in `Two supplements to Richard Moorsteen and Raymond P. Powell, *The Soviet capital stock, 1928-1962*' (The Economic Growth Center, Yale University, 1968).

as 1944 there was still a shortfall of one fifth below the prewar benchmark.

b The burden of defence on the Soviet economy peaked in 1942-3 when three quarters of the national income was expended on the war. When the role of mutual aid in easing war finance is taken fully into account, the worst year was 1942 when 66 per cent of the Soviet national income was utilised for war; in 1943 there was some relaxation, the defence share falling to 58 per cent.

c The 1943 mobilisation of Soviet national income far exceeded that of the western Allies. It was comparable with that of Germany in 1943 (and remained comparable when the role of transfers from occupied territories in easing Germany's war finance is taken into account). The difference was that in 1943 the Soviet economy was retreating from the excessive domestic mobilisation of 1942, whereas in 1943 the German economy was moving in the other direction, towards excessive mobilisation and economic collapse in 1944-5.

My subsequent research has suggested the need for a new look at Soviet wartime national income. There are two reasons for this. One is the understatement of wartime munitions output growth, which originated in Soviet statistical practices (especially the valuation of output using the so-called constant prices of `1926/27), and which was unwittingly perpetuated in the postwar American

estimates. (Bergson and the rest were perfectly well aware of the potential for distortion involved in `1928/27' prices, but did not apply their knowledge to the Soviet index of wartime munitions output.) When the understatement is eliminated, Soviet munitions output, industrial production and national income are all shown to have been higher than previously thought at the peak of the war effort.

Another reason is that my original comparison contrasted the defence shares in national income of the four powers, using national income at current factor costs for the USA, UK and Germany but national income at constant factor costs of 1937 for the USSR. Income shares at current and constant prices show different things. From relative shares calculated in prices of some base year, one may judge the relative changes over time in the volume of output used for different purposes. Relative shares calculated in current prices show national priorities in resource allocation, and also indicate `the possible gains and losses to different use categories that might result from resource reallocations.'[3] Noting this at the time, I assumed, on the basis of the American example, that relative price effects in all countries would be small.[4] Consequently, Soviet national income shares would not be significantly biased by

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3 Bergson, *Real national income*, 235.
4 Harrison, `Resource mobilization', 182n, 183.

use of constant cost series. But the evidence will show that this assumption could not have been more misleading.

Perhaps I would have done better to bear in mind Raymond Powell's disclaimer; his own estimates (he wrote) 'are not intended for, and could not possibly sustain, analysis of the economy's World War II performance as such, much less its capacity in general to mount a large-scale military effort.'[5] I might have recalled (and the reader may do so below) what Ely Devons wrote almost 40 years ago:

> And yet it is the failing of the majority of human minds ... to assume that anything expressed in figures must necessarily be precise. It was a common error to impute to figures a greater accuracy and reliability than the basis on which they were arrived at could warrant on the most generous interpretation. And once the figures were called 'statistics', they acquired the authority and sanctity of Holy Writ. The veneration paid to figures increased when they were neatly presented in well-laid-out tables, and reached its height if these tables were printed.[6]

Having said these things, I think that my present estimates of wartime national income and the defence burden are significantly improved and do represent a basis for

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5 Powell, 'The Soviet capital stock', 2.

6 Ely Devons, *Planning in practice: essays in aircraft planning in war-time* (Cambridge, 1950), 155.

preliminary evaluation of year to year trends in Soviet economic structure and performance.

II

National income at constant prices of 1937

(A) 1937 and 1940

I begin by revising the Moorsteen-Powell estimate of national income by sector of origin for the years 1937-45. Results are shown in Table 1 (A) - in billion 1937 roubles, and (B) - index numbers based on 1937.

I adopt the Moorsteen-Powell 1937 rouble value weights intact; I also take their index numbers for 1937-40 with only two sets of revision, both minor in effect, and both deflationary. First, I replace their index of munitions output with my own, which runs from 1937 through 1944. The latter gives 1940 munitions output as 244 per cent of 1937, instead of 280 per cent according to Moorsteen-Powell and Bergson. Second, I deflate the Moorsteen-Powell entries for health, education and government administrative services (based on budgetary data in current roubles) by an index of public sector hourly earnings based on 1937.

(B) 1940-1944

For the war years I revise Moorsteen-Powell with a freer hand. Even so, much of the original remains intact. Sector by sector, I proceed as follows.

Agriculture. I keep Powell's index, which was cobbled together from diverse sources and interpolated between 1940 and 1945 entries from the original Moorsteen-Powell study. An alternative would be the official index of gross agricultural production,[7] which runs parallel to Powell's until 1942, after which it falls significantly short. Casual inspection suggests that the official index may exclude wartime changes in livestock herds attributable to net investment, as opposed to enemy action and the movement of the front line. Powell's index includes net investment in livestock in the measure of output; most of the decline in livestock, 1940-2, is attributed to military action, but all of the increase in livestock, 1942-4, is attributed to investment. This is rough and ready, but better than nothing.

Industry. For 1937-40 Moorsteen and Powell estimated net output of civilian and military branches separately, but for 1941-4 Powell estimated industry as a whole, munitions output being submerged in the machine building and metal working branch. For the war period I continue separate

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7 *Istoriya Velikoi Otechestvennoi voiny Sovetskogo Soyuza 1941-5*, vi (Moscow 1965), 45.

estimation of munitions output, and set beside it my own index of wartime civilian industry production. The result for industry as a whole is a significant upgrading of wartime performance with 1944 output estimated at 20 per cent above the 1940 level rather than Powell's 18 per cent below. Despite the size of this discrepancy, I have no hesitation in prefering my own estimate.

Construction. Powell retained a wartime valuation calculated in the original Moorsteen-Powell study, and I do too.

Transport, commerce. I replace Powell's estimate, which was constrained by the necessity of being consistent with the Moorsteen-Powell entry for 1945, with the original official index of freight transport upon which Powell's estimate ultimately relied.

Trade, catering. Powell assumed that the net output of trade and catering would vary directly with the volume of retail trade. I replace Powell's estimate, which again was constrained by the necessity of being consistent with the 1945 Moorsteen-Powell entry, with the original official index of state and cooperative retail trade on which Powell's estimate was based.

Housing. Housing services, based on housing stocks, are as from Moorsteen-Powell.

Finance. Financial services, interpolated on total public sector employment in the war years, are as from Moorsteen-Powell.

Services, civilian. For the war years health, education and government services are taken from Powell but deflated (as for the prewar years) by the change in public sector hourly earnings. I take 'other' services not elsewhere specified as a residual entry in 1940 and interpolate entries for the war years in proportion to the total of listed civilian services output. Powell based his series for domestic services (5.0 billion roubles in 1937) on the crudest rule of thumb; I have subsumed this heading under 'other' services, on the grounds that it adds nothing of independent significance to the dynamic of output as a whole.

Services, military. This series is based on numbers of military personnel. According to authoritative reports published subsequently, Powell greatly understated military personnel in 1942 (by nearly 3 million) and overstated the same in 1944 (by nearly one million). I correct these entries, and interpolate missing years.

Depreciation. As from Moorsteen-Powell.

(C) Summary

My estimate of Soviet national income growth at 3.8 per cent annually, 1937-40, is less than the 5.3 per cent of Moorsteen and Powell, because of my lower estimates of expansion of munitions output and of some civilian services. I estimate 1940 Soviet NNP at roughly 4 per cent less than Moorsteen and Powell's original figure. After 1940 my estimate diverges, much more strikingly, in the opposite direction.

Table 2 shows three alternative stories of Soviet national income in war time. The Soviet official series is, of course, based on different accounting concepts (the material product system) and a different price set (that of `1926/27'). It shows a decline of one third in national income between 1940 and the 1942 trough, followed by a partial recovery to 1944 when the national income (net material product) stood at 88 per cent of the prewar level.

The Powell series shows a far more pessimistic picture. By 1942 Soviet NNP had fallen by 43 per cent, and was still 20 per cent short of the 1940 benchmark by 1944. The main reason for the gap between Powell's and official results is probably as follows. Using `1926/27' prices, the official index would have greatly *overstated* the relative *level* of munitions output in 1940. For subsequent years, the *growth*

of munitions output would have been *understated*.[8] Powell's revision implicitly reduced the base year weight of munitions output and corrected the official overstatement of its peacetime level. But Powell did not correct the understatement of munitions output growth after 1940, and for the war years his national income measure underperforms reality.

My own revision corrects both the overstated level of prewar munitions output and its understated growth in subsequent years. As a result, my NNP index, although mimicking Powell in 1940-1941, shows much higher national income thereafter. In fact, for 1940 and 1942-4 it is a near match for the official material product index.

Both sets of coincidences - with Powell in 1941, and with the official index thereafter - are accidental (if pleasing), and do not enhance the reliability of my estimate which must stand or fall on its own merits.

III

The defence burden: constant prices of 1937

The real burden of Soviet war outlays can now be weighed against national income. The comparison is shown in

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8 Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), 21.

Table 3. Defence spending is allocated between three main headings: munitions, personnel, and the costs of military operations and construction. External resources, supplied in mutual aid, contributed to Soviet defence spending on munitions, and also on military operations and construction. Operating and construction costs are estimated inclusive of foreign supply. Imported munitions are counted separately.

When the contribution of net imports is large (as it was for all of the major powers in World War II, but for the United States of America with a negative sign), the weight of defence spending in national income can be evaluated in two ways.[9] The conventional measure is the ratio of officially reported or estimated defence expenditures to national income. It shows the *national utilisation* of resources supplied to the war effort, irrespective of origin, in proportion to the national product. This is the measure appropriate to study of national priorities.

An alternative measure is the share in national income of military spending after deduction of net imports. It shows the *domestic finance* of resources supplied to the war effort, irrespective of utilisation, in proportion to the national product. It is based on the assumption that domestic supply of resources to the military budget was eased by the full amount of net imports; even if not all net

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9 Harrison, `Resource mobilization´, 183-4. The U.S. economy, with its large net exports, is treated a little differently from the case to be described.

imports consisted of military goods, the net import of civilian goods freed domestic resources for military supply. This is the measure appropriate to the study of domestic resource mobilisation.

When real Soviet war outlays are summed, the total shows a tenfold expansion between 1937 and 1944. Since, in 1937, defence spending already amounted to nearly 9 per cent of NNP, and since national income in 1944 fell a little short of the level achieved in 1937, an apparently remarkable result is observed: in 1944, the USSR devoted more than 90 per cent of its national income to the war, leaving scarcely anything for civilian public and private consumption and net investment. The same had been true in 1942 and, in the intervening year, 1943, the national income share of defence spending had been even greater - 101 per cent.

When the role of net imports in easing the military burden is taken into account, the share of domestic resources claimed by finance of the Soviet war effort still exceeded four fifths in both 1942 and 1943, falling to three quarters only in 1944. (The valuation of Soviet net imports in war time is discussed in Appendix A.) Since, in 1942-4, civilian consumption and investment were not only positive but clearly greater than capital depreciation and net imports together, this result appears meaningless, both in itself and for purposes of international comparison.

What actually happened is as follows. Table 3 is denominated in the prices of 1937, but in 1944 Soviet national income was allocated between its different uses in prices of the current year, not those of 1937. Between 1937 and 1944 a colossal change in relative prices took place. The prices of munitions had slumped, while the prices of foodstuffs, industrial materials and civilian machinery had climbed steeply. As a result real expenditures on the war effort in 1944, which were indeed absolutely stupendous from the standpoint of prewar values, were eased by the absolute cheapening of some war goods (although others became more expensive); at the same time, the rising costs of civilian supply necessitated the retention of a positive and significant share of the national income, in nominal terms, for nonwar uses.

The next step, therefore, is to convert both national income and defence spending in each year from 1937 roubles to current prices, and to show how this changes the evaluation of the defence burden.

IV

The defence burden: current prices

At this stage I take the components of Soviet national income by branch of origin in each year, 1937-44 (Table 1), and multiply them by appropriate indices of change in

product prices. The set of deflators available to me is shown in Table 4. The outstanding features of this set are as follows:

Nonconsumption goods. Prices of products of the main branches of material production are represented directly by indices based on the work of Harrison (munitions) or Bergson (civilian industrial goods, construction, transport).

Consumer goods. Prevailing prices in retail trade are represented by a Paasche index of prices in official and unofficial (kolkhoz) markets. I refer to Chapman for prewar years, and chain onto 1940 Zaleski's cost of living index (excluding consumer services) for Moscow in the war years.

I also provide a deflator for material consumption under the title of 'approximate factor costs'. The meaning and use of this index is discussed separately below.

Services. The price of services to the national economy is approximated by average earnings in the public sector - hourly earnings for civilian services, monthly earnings for services supplied by military personnel.

Only in the case of munitions prices and prices prevailing in retail markets are all years represented in the primary data available to me. For other series I have had to interpolate entries for 1941-3 between 1940 and 1944 benchmarks (in one case, the benchmarks are 1940 and 1945). In deriving hourly from monthly earnings, further

assumptions are required about hours worked in 1941 and 1943-4.

When national income is revalued on this basis, we find the picture reported in Table 5. In nominal terms defence outlays in 1944 now stood at more than 11 times the 1937 level (munitions had become cheaper, but other categories of expenditure now cost more). But national income at current prevailing prices had more than trebled. In the early part of the war, the defence burden had climbed steeply, reaching more than half national income in 1942 on a national utilisation basis, or two fifths of domestic resources when mutual aid is taken into account. But the subsequent inflation of prices of civilian goods had been so rapid that, by 1944, on a national utilisation basis, the defence share had fallen to less than 30 per cent. On the basis of domestic finance, the burden of military spending had fallen to only 14 per cent of national income - less than in 1940.

This series is, in my view, still more meaningless than the one reported in Table 3. When output and expenditure are reported in constant prewar prices the defence burden is exaggerated, but when current prevailing prices are used the result is just as surely an understatement. The reason is the distortion of relative prices by imperfectly repressed inflation. By 1944 budget deficits and monetary expansion had built up an impressive excess of aggregate money demand over real supply. Given the administrative control of

official prices, the full weight of this excess bore upon the unofficial retail market. By 1943, kolkhoz market prices for foodstuffs were 12-13 times their 1940 level,[10] which was already significantly above that of official prices. At the same time, prevailing official prices for industrial goods and productive services rose by a fraction or even (in the case of munitions) fell.

Table 4 shows the two extremes. If we compare 1944 with 1940, then the prevailing average price level for consumer goods in general, relative to prices of munitions, had risen nearly twelve times.

But these measures surely exaggerate the change in factor costs of consumer goods relative to the factor cost of nonconsumption. The factor cost of material supplies for the consumer certainly rose, and rose faster than the cost of supplying industry and the army, but *it did not rise to the level indicated by the relative change in prevailing prices*. This conclusion is also suggested by the dynamic of consumer prices. Average prevailing prices of consumer products rose in each year of the war up to 1944, not only absolutely but *relative to the prices of other goods and services*. Yet the real costs of supplying consumer goods were not higher in 1944 than in 1943 or 1942.

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10 N.A. Voznesensky, *War economy of the USSR in the period of the Patriotic War* (Moscow, 1948), 102.

Unit labour requirements of different branches of output provide a rough guide to the true change in relative costs in real terms. It seems likely that by 1944 unit labour requirements in munitions had fallen to little more than half the level of 1940.[11] In food production, where consumer prices rose most steeply, unit labour requirements may have been no greater in 1944 than in 1940, and may even have been less by some small margin (see further Appendix B). The evidence of average productivities, therefore, suggests that a relative cost effect of less than two (not twelve) would be more realistic.

In my view it would be a mistake to take retail prices averaged across the various official and unofficial markets as a good guide to marginal factor costs of material consumption. In particular the unofficial market was not unconstrained on the supply side, since events in the official sector, which was so constrained, determined the availability of both labour and intermediate goods (regardless of their price) to unofficial producers. The prices formed in the unofficial market, while unregulated, speak more of constrained output and a rising imbalance of aggregate monetary demand over real supply than of the influence of smoothly differentiated supply curves and given factor prices. I do not believe that unofficial producers were in a position to ascend their marginal cost curves in response to rising prices of output. Instead, rising prices

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11 Mark Harrison, `Total output´, Table 9.

cleared the retail market as a whole, without significantly relaxing supply bottlenecks.

Instead, I try to estimate the likely change in factor costs of material consumption from the change in factor productivities in the branches supplying material consumption, compared to that found in other branches of the economy.

V

The defence burden: 'approximate factor costs'

To arrive at approximate factor costs I first estimate unit labour requirements in the branches supplying material consumption and the rest of the economy separately (I call the latter the 'nonconsumption' sector for short, although it includes government consumption and consumer services). I compare them with evidence on price trends in the nonconsumption sector. From these I calculate an estimate of how the prices of consumer goods would have changed, if they had maintained the same relativity to unit labour requirements as is observed in the rest of the economy. The estimate covers 1940 and 1942-4. (Sources, methods and further justifications are detailed in Appendix B.)

I call this the 'approximate factor cost' of material consumption, and the result is reported above in Table 4. It suggests that the factor cost of material supplies for the

consumer was at least one third above the 1940 level in 1942, with some improvement in subsequent years. After 1942 the material consumption cost index falls below those applying to the nonindustrial, nonagricultural branches; this reflects the observation that in the latter branches labour productivity continued its downward trend throughout the war period, whereas in the material consumption sector it recovered to the prewar level.

When applied to national income as a whole, 'approximate factor cost' means the estimated factor cost of material consumption, and prevailing prices of everything else. National income can be recalculated at approximate factor costs, and the defence burden can be revalued on this basis. When this is done, we find the picture shown in Table 6. The measure of defence spending in Table 6 is the same as in Table 5, but the measure of nominal NNP is scaled sharply down. The share of defence spending in national income is now set at three quarters or a little less in 1942-4 on a national utilisation basis - two thirds or a little less in terms of domestic finance, when the contribution of mutual aid is deducted. Below, I take these ratios as internationally comparable with similar ratios derived from other nations' national accounts measured conventionally at current factor cost.

However, I should make clear that all I have done in these tables is give numerical expression to the prior

opinions with which I started. I knew that the Soviet economy did not devote literally all its available resources to combat, so that Table 3 was misleading, but nor did it devote the overwhelming bulk to civilian uses (Table 5). Faced with two unacceptable extremes, I built a third measure which lay between them, which lay closer in spirit to Table 3 than to Table 5, but which represented a plausible result.

A noteworthy feature common to Tables 3, 5 and 6 is that, regardless of the prices used to evaluate output and expenditure, 1942 emerges as the year of greatest domestic strain. By that year the Soviet war effort had by no means reached its maximum in terms of the sheer numbers of soldiers and weapons of weapons deployed. These would expand significantly in 1943 before rising to the peak in 1944. But the domestic resources required, in proportion to the national income, were never greater than in 1942. The idea of 1942 as the worst year of the war, economically speaking, is therefore to this extent sustained.[12] No matter how bad the imbalances were in the second half of 1941, in 1942 they got worse. After 1942, with the recovery of both territory and civilian output (in total and per worker), and with increasing access to foreign supply, things got better. In 1943, the Soviet authorities would commit a bigger share of the total resources available (including net imports) to the

12 On the idea of excessive Soviet economic mobilisation in 1942, see Harrison, `Resource mobilization´, 187-8.

war, but the domestic mobilisation would be to some degree relaxed.

In the foregoing evaluation of Soviet national income and expenditure, evidence of the labour requirements of the war, and of labour costs and productivities, has played an important part. It seems logical to me, therefore, to proceed next to the question of the changing structure of Soviet employment and the direct measurement of the war effort's labour requirements.

VI

The absorption of labour into the war effort

First, Soviet employment in war time has to be estimated. Even the major elements of the industrial structure are not known with certainty in every (sometimes, in any) year, but they can be pieced together and summed for a reasonable approximation to the Soviet Union's total working population in war time. This is shown in Table 7, the most notable feature of which is the collapse of *every* employment category in 1940-2 with the exception of the specialised munitions workforce.

Net output by branch of origin, at constant prices (Table 1), can then be compared with employment in order to calculate output per worker in the different branches of the economy (Table 8). The latter table also incorporates

estimates of output per worker in military and civilian sectors of industry calculated independently (but on a consistent basis) in my previous work. Here, the outstanding properties of the table are the branch dynamics and interbranch differentials.

In war time output per worker rose in military industry, and fell in all other branches; in civilian industry and agriculture there was a recovery before the war's end, but in construction, transport and services the trend was essentially downwards.

The differentials between output per worker in the economy's various branches, already large before the war, widened markedly in war time. In 1940 output per worker in industry (in 1937 roubles) was three times that registered in agriculture; by 1942 the gap had widened to a factor of nearly six, and still stood at perhaps 4.5 in 1944.

The prewar structure and its wartime trends would have an important influence on Soviet labour mobilisation during the war years. Most important was the need to maintain a large residual of low productivity workers in agriculture in order to meet the food requirements of soldiers, war workers and civilian producers and consumers. In spite of this constraint, in 1942-3 the Soviet economy was employing more than half of its shrunken workforce on the direct waging of war - in combat, in war production, and in supplying the

operational and construction requirements of the armed forces.

In Table 9, the available data are recombined to show this. To the number of soldiers in uniform are added, first, the estimated number of workers directly and indirectly engaged in the domestic production of munitions at every stage (not just the last, specialised stages of fabrication but also producing the required intermediate goods and services) and, second, those estimated to have been employed in supplying the means of military construction and operations.

Some part of the latter means may have been met out of mutual aid resources; when this is taken into account, the domestic labour requirements of the war effort in 1942-4 may have been scaled down (in 1944, by up to two millions). Nonetheless, at the peak, the claims of the war on the Soviet workforce still exceeded one half, whatever assumption is made.

In Table 9, in distinction from previous tables, the year of biggest commitment of domestic resources emerges as 1943, not 1942. The reason for this is that 1943 saw the beginnings of recovery of output per worker in civilian employment. This made it possible to commit a still higher proportion of the workforce to defence requirements in that year than in 1942.

VII

International comparisons

The new estimates of wartime burdens on Soviet national income and employment can be compared with existing estimates for the other major powers. Comparisons are shown in Tables 10 and 11.[13] In national income terms the international picture is changed in detail, but not in substance. The Soviet Union is still shown to have mobilised her resources for war to a very high degree, with two thirds of her domestic resources committed to military spending at the 1942 peak. After 1942 the domestic burden was relaxed although, when all available resources (including net imports) are taken into account, the claims of war would climb further, to nearly four fifths in 1943. This record was at least comparable to that of Germany, and exceeded the mobilisation reported by the western Allies.

A different picture emerges when workforce comparisons are undertaken. For comparability, I use a narrower classification of war employment than that found in Table 9. This is the British classification - military personnel *plus* employment in Group I industry, the latter comprising munitions, machine building and metal working, and chemicals. Group I industry includes only specialised

13 Original versions of these tables are to be found in Harrison, `Resource mobilization´, 184, 186.

munitions workers, and leaves out many of those supplying intermediate goods and services to the munitions sector; it excludes most of those supplying military construction and operations.

Table 11 shows that, by 1943, the major European powers each maintained between a fifth and a quarter of their working population in uniform (for the United States the proportion was lower). Much bigger differences are observed when the mobilisation of workers into war industries is examined. The United Kingdom and Germany both entered the war with relatively large numbers already engaged in Group I employment. In the United Kingdom, the proportion rose from 18 to 23 per cent between 1939 and 1943; in Germany it remained unchanged, at 14 per cent in both years. In the United States the initial share of Group I employment was lower - 8 per cent in 1940, but this percentage more than doubled, rising to 19 per cent by 1943. In the USSR the 1940 employment share of Group I industries was lowest of all - only 6 per cent. And between 1940 and 1943 this share rose only from 6 per cent to 10 per cent.

The paradox is, therefore, that the country with the biggest apparent wartime commitment of national income to military spending - the Soviet Union - by this measure mobilised a smaller share of her workforce for war production than any other power. And this was in spite of

the Soviet policy emphasis on a high level of mechanisation and modernised equipment for a mass army.[14]

Two factors explain this paradox.

First, Group I employment comprises, for the most part, only those elements of Soviet war employment where output per worker was relatively high in 1940, and where output per worker rose most rapidly after 1940 in comparison with output per worker in other branches. (The sharp rise of labour productivity in Soviet munitions work after 1940 nearly matched the German record, and considerably exceeded that of the United Kingdom).[15] Group I employment excludes a large tail of Soviet war workers engaged in the production of intermediate goods for war production, and in supplying the operational and construction needs of the armed forces, where output per worker was either low to begin with or fell sharply after the outbreak of war. Thus, the British definition of `who is a war worker' tends to minimise both the level of war employment in 1940, and its growth after 1940, in the Soviet economy.

Second, the Soviet ability to mobilise workers into the war effort was limited by the prewar legacy of a large, low productivity agricultural sector. The relative levels of industrial mobilisation of the major powers in 1943, shown in Table 11, are strikingly in reverse order of the prewar

14 Harrison, `Resource mobilization', 174-6.
15 Harrison, `Total output', 29.

share of agriculture in the total employment of each country.

Table 12 suggests how Soviet agriculture formed a deadweight limiting the wartime mobilisation of the workforce in the USSR. Prewar productivity in Soviet agriculture was low relative to the rest of the Soviet economy. (This pattern was common to the economies of all the major powers but, taking the average for the Soviet economy as a whole, prewar output per Soviet worker was also low in international comparison.) Moreover, the share of agriculture in prewar Soviet employment was particularly high, compared to the situation in the economies of the other major powers. Other countries with smaller agricultural sectors, especially Britain and Germany, could continue to make largescale food imports in war time. The Soviet Union could not.

The need to continue to employ large numbers of low productivity workers on food production constrained the Soviet workforce mobilisation; it made it all the more important to generate additional military resources by raising output per worker rather than relying on continuous increases in munitions employment.

VIII

Conclusions

This paper gives rise to three main findings.

First, the real national income of the Soviet Union fell sharply when war broke out, bottoming out at less than two thirds of the prewar level in 1942. By 1944, full recovery had not yet been accomplished, but the shortfall in comparison with 1940 had been cut to a little more than one tenth. These results tend to confirm the realism of the Soviet official index of national income (material product); however, the latter's usefulness is largely accidental, being the result of offsetting biases in its sources and methods. Raymond Powell's index, although a second-best improvement over the Soviet index in methodology, is found to be too pessimistic.

Second, the military burden of the war has been measured in proportion to national income at constant prices of 1937, at current prevailing prices and at current 'approximate factor costs'. Strong relative price effects, in particular the inflation of prices of consumer goods and the cheapening of munitions, have a powerful effect on the results. At constant prewar prices the defence burden of the war years is greatly overstated, but at current prevailing prices there is an opposite, and absurd, understatement. Measured at approximate factor costs, the Soviet defence burden emerges as a very heavy one by the standards both of

peace time and of other powers engaged in World War II. It peaked in 1943 in terms of its share in all the resources available (including mutual aid); when the easing role of net imports is taken into account, the year of greatest domestic strain emerges as 1942.

Third, the Soviet commitment of labour resources to the war was also very heavy, rising to more than 50 per cent in 1942-3. However, it does not seem so impressive by international wartime standards, when converted to the narrower classification conventionally used for the other powers. This is partly a statistical phenomenon, but it also reflects a real underlying constraint on Soviet wartime mobilisation rooted in the Soviet economy's agrarian structure. The ability to commit workers to the war effort was limited by the irreducible labour requirements of a large, low productivity agricultural sector.

Table 1. *Soviet national income by sector of origin, 1937 and 1940-4*

(A) 1937 roubles, billions

	1937	1940	1941	1942	1943	1944
Agriculture[a]	63.0	69.9	42.3	25.3	30.4	45.0
Industry[b]	65.4	76.0	73.8	67.7	80.2	91.3
civilian[b]	60.4	63.8	54.4	29.1	32.2	38.1
military[b]	5.0	12.2	19.4	38.6	48.0	53.1
Construction	10.5	10.6	6.9	3.2	3.4	4.4
Transport, commerce[c]	16.8	19.3	17.8	10.2	11.8	13.7
Trade, catering[c]	10.4	11.1	9.3	3.8	3.5	4.1
Housing	2.1	2.4	2.4	2.0	2.0	2.0
Finance	1.9	2.6	2.2	1.4	1.5	1.7
Services	32.8	35.1	28.7	31.3	32.6	35.6
health[d]	3.2	3.2	2.2	1.9	2.2	2.3
education[d]	9.8	9.3	5.7	3.4	3.9	5.4
government administration[d]	3.1	2.8	1.9	1.4	1.5	1.8
military[e]	3.4	6.8	9.5	17.6	17.9	18.1
other[f]	13.3	12.7	8.1	5.6	6.2	7.9
NNP	202.9	226.7	182.2	143.7	164.4	197.8
Depreciation	9.4	13.6	14.0	11.7	11.8	11.7
GNP	212.3	240.3	196.2	155.4	176.2	209.5

(Continued.)

Table 1 (continued). *Soviet national income by sector of origin, 1937 and 1940-4*

(B) Index numbers, 1937 = 100

	1940	1941	1942	1943	1944
Agriculture[a]	110.9	67.2	40.2	48.3	71.5
Industry[b]	116.2	112.9	103.6	122.6	139.5
civilian[b]	105.6	90.0	48.2	53.2	63.2
military[b]	244.1	388.7	772.5	959.9	1062.4
Construction	101.0	65.8	30.7	32.0	41.7
Transport, commerce[c]	115.1	105.9	61.0	70.2	81.7
Trade, catering[c]	106.6	89.5	36.2	34.1	39.4
Housing	116.6	114.6	93.4	94.9	96.3
Finance	135.8	115.5	75.6	76.8	91.1
Services					
health[d]	100.2	68.1	60.4	67.3	72.2
education[d]	94.5	58.5	35.1	39.7	55.4
government administration[d]	91.9	60.9	45.0	48.1	58.5
military[e]	200.0	279.8	519.0	526.2	533.3
other[f]	95.1	60.9	42.0	46.8	59.3
NNP	111.7	89.8	70.8	81.0	97.5
Depreciation	144.7	148.9	124.5	125.5	124.5
GNP	113.2	92.4	73.2	83.0	98.7

(Continued.)

Table 1 (continued). *Soviet national income by sector of origin, 1937 and 1940-4*

Source: The accounting framework, 1937 values and much else are taken from Richard Moorsteen and Raymond P. Powell, *The Soviet capital stock, 1928-1962* (Homewood, Ill., 1966, 622-3, and Raymond P. Powell, 'The Soviet capital stock and related series for the war years', in 'Two supplements to Richard Moorsteen and Raymond P. Powell, *The Soviet capital stock, 1928-1962*' (The Economic Growth Center, Yale University, 1968), 31. Deviations from this rule are noted below.

Notes:

a An alternative would be the official index of gross agricultural production found in *Istoriya Velikoi Otechestvennoi voiny Sovetskogo Soyuza 1941-5*, vi (Moscow 1965), 45. The official index runs parallel to Powell's until 1942, after which it falls significantly short. The main reason is that Powell includes investment in livestock in the measure of output. Most of the decline in livestock, 1940-2, is attributed to military action, but all of the increase in livestock, 1942-4, is attributed to investment.

b Both the official and (still more) Powell's revised indices of industrial production significantly understate wartime performance. The main reason is undervaluation of munitions output after 1940. The munitions index used here, 1937-44, is from Mark Harrison, 'The volume of Soviet munitions output, 1937-1944: a reevaluation', Warwick Economic Research Paper no. 312 (University of Warwick, 1989), Table 6. The index of civilian industry output is from Moorsteen and Powell, *The Soviet capital stock*, for 1937-40 and, after 1940, from Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Table 6.

c After 1940 I insert official indices of freight transport and of state and cooperative retail trade respectively from *Istoriya Velikoi Otechestvennoi voiny Sovetskogo Soyuza 1941-5*, vi (Moscow 1965), 45. I do not try to reconcile index numbers for 1945 with Moorsteen and Powell's 1945 estimates.

d Moorsteen and Powell use budgetary data in current roubles. I deflate these using an index based on average hourly earnings in the public sector derived in Table 4 below.

e I replace the estimate of military personnel, 1940-4, suggested by Powell, 'The Soviet capital stock', 33, with data for 1940, 1942 and 1944 from P.V. Sokolov, *Voenno-ekonomicheskie voprosy v kurse politekonomii* (Moscow, 1988), 215. For 1941 I assume the 1940 level for half the year, and a figure midway between that and the 1942 level for the other half (military recruitment was admittedly rapid throughout 1941, but in this way I hope to take into account the appalling losses of the first months of the campaign). For 1943 I take a figure midway between the 1942 and 1944 entries:

Thousands	*1940*	*1941*	*1942*	*1943*	*1944*
Powell	4 200	5 000	8 000	11 000	12 000
Harrison	4 200	5 875	10 900	11 050	11 200

f For 1937 this is total services output *less* output under listed headings. For subsequent years I estimate this residual category in constant proportion to listed nonmilitary services.

Table 2. *Soviet national income, 1941-5: alternative estimates*
(1940 = 100)

	1941	1942	1943	1944
National income (material product) in `1926/27´ rouble prices, Soviet official data[a]	92	66	74	88
Net national product in 1937 rouble prices:				
Powell[b]	81	57	66	80
Harrison[c]	80	63	73	87

Notes and sources:

a *Istoriya Velikoi Otechestvennoi voiny Sovetskogo Soyuza 1941-5*, vi (Moscow 1965), 45.

b Raymond P. Powell, `The Soviet capital stock and related series for the war years´, in `Two supplements to Richard Moorsteen and Raymond P. Powell, *The Soviet capital stock, 1928-1962*´ (The Economic Growth Center, Yale University, 1968), 7.

c From Table 1, recalculated to show 1940 = 100.

Table 3. *Soviet national income at constant prices and the burden of defence, 1937 and 1940-4*

	1937	1940	1941	1942	1943	1944
DEFENCE SPENDING AND NNP (billion 1937 roubles)						
Munitions, domestic output[a]	10.0	24.4	38.9	77.3	96.0	106.2
from mutual aid[b]	0.0	0.0	0.0	7.2	12.1	12.6
Military personnel[c]	3.4	6.8	9.5	17.6	17.9	18.1
Operating and construction costs[d]	4.2	9.8	15.2	32.1	39.6	43.0
Total defence spending[e]	17.6	41.0	63.6	134.1	165.5	180.0
NNP[f]	202.9	226.7	182.2	143.7	164.4	197.8
DEFENCE SPENDING (per cent of NNP)						
On basis of: national utilisation[g]	8.7	18.1	34.9	93.3	100.7	91.0
domestic finance[h]	8.7	18.1	34.9	83.8	82.4	73.5
NET IMPORTS (per cent of NNP)						
Mutual aid, total[i]	-	-	-	9.5	18.3	17.5

Notes and sources:

a Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Appendix E, Table E-4.

b Appendix A, Table A-2.

c Table 1.

d Calculated as 23.8 per cent of total defence spending, this being the proportion written into the 1941 national economic plan according to Abram Bergson, *The real national income of Soviet Russia since 1928* (Cambridge, Mass., 1961), 366.

e Munitions (domestic output of munitions *plus* munitions supplied in mutual aid) *plus* military personnel *plus* operating and construction costs.

f Table 1.

g Total defence spending, per cent of NNP.

h Total defence spending *less* net imports, per cent of NNP.

i Net imports (Appendix A, Table A-2), per cent of NNP.

Table 4. *Soviet national product deflators, 1937 and 1940-44*
(1937 = 100)

	1940	1941	1942	1943	1944
Munitions[a]	120	101	80	74	72
Civilian machinery[b]	106	107	108	109	110
Basic producer goods[b]	121	123	125	126	128
Construction[c]	126	132	139	146	154
Transport[b]	156	165	175	185	196
Consumer goods					
prevailing prices[d]	133	133	426	769	840
approximate factor costs[e]	133	-	180	172	151
Services: earnings from public sector employment					
hourly[f]	133	141	149	157	166
monthly[g]	133	157	182	192	203
NNP:					
prevailing product prices[h]	132	133	207	299	350
approximate factor costs[i]	132	-	142	139	137

Notes and sources:

a For 1937 and 1940, Abram Bergson, *The real national income of Soviet Russia since 1928* (Cambridge, Mass., 1961), 367. For 1940-4, Mark Harrison, 'The volume of Soviet munitions output, 1937-1944: a reevaluation', Warwick Economic Research Paper no. 312 (University of Warwick, 1989), 13n, revised in Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Appendix E, Table E-1.

b For 1937, 1940 and 1944, Bergson, *Real national income*, 367-8; for 1941-3 I use a geometric interpolation.

c I combine an index of prices of building materials in 1937, 1940 and 1944 (with geometric interpolation for 1941-3) from Bergson, *Real national income*, 350, with labour costs represented by the index of hourly earnings in public sector employment in this table. I assign a weight of 70 per cent to labour costs.

d For 1937-40 I take Chapman's estimate of the total change in household purchases in official and kolkhoz markets at current and constant 1937 prices from Bergson, *Real national income*, 307, 312. For 1941-4 I chain on an index of the cost of purchases in official and kolkhoz markets in Moscow compiled by Eugène Zaleski, *Stalinist planning for economic growth, 1933-1952* (London and Basingstoke, 1980), 452 (Table 118, row 19).

e The index is the same as for prevailing prices until 1940. For 1941-4 I chain on the index which is shown as the bottom line of Appendix B, Table B-2.

f According to Bergson, *Real national income*, 422, the annual earnings of public sector employees were 3,038 roubles in 1937 and 4,054 roubles in 1940. I assume no change in hours worked, 1937-40. According to A.V. Mitrofanova, *Rabochii klass SSSR v gody Velikoi Otechestvennoi voiny* (Moscow, 1971), 498, monthly earnings of public sector employees grew from 330 roubles in 1940 to 434 roubles in 1945. Again, I assume that by 1945 hours worked had fallen back to the 1940 level. For 1941-4 I use a geometric interpolation.

g I assume that hours worked in 1942-4 were 22 per cent in excess of those worked in 1940 and 1945, on the basis of N.A. Voznesensky, *War economy of the USSR in the period of the Patriotic War* (Moscow, 1948), 91. Incidentally, this yields an estimate of the excess of average monthly earnings in the public sector in 1944 above the level of 1940 of 52 per cent. This is almost exactly equal to the 53 per cent increase in monthly earnings in industry in 1944 over 1940 claimed by Voznesensky, *War economy*, 94.

h NNP at current prevailing prices (Table 5), divided by NNP at constant 1937 prices (Table 1).

i NNP at approximate current factor costs (Table 6), divided by NNP at constant 1937 prices (Table 1)

Table 5. *Soviet national income at current prices, and the burden of defence, 1937 and 1940-4*

	1937	1940	1941	1942	1943	1944
DEFENCE SPENDING AND NNP (billion current roubles)						
Munitions,						
domestic output[a]	10.0	29.3	39.4	61.8	70.5	78.0
from mutual aid[a]	0.0	0.0	0.0	5.7	8.9	9.0
Military personnel[b]	3.4	9.1	14.9	32.1	34.3	36.8
Operating and construction costs[c]	4.2	13.8	22.6	50.3	65.5	75.2
Total defence spending[d]	17.6	52.2	76.9	149.8	179.2	197.0
NNP[e]	202.9	298.1	242.9	296.8	491.7	692.2
PER CENT OF NNP						
Defence spending, on basis of:						
national utilisation[f]	8.7	17.5	31.7	50.5	36.5	28.5
domestic finance[g]	8.7	17.5	31.7	43.1	18.1	13.9
Mutual aid, total[h]	-	-	-	7.4	18.4	14.6

Notes and sources:

a Expenditure on munitions (from domestic output, and from mutual aid) at 1937 prices (Table 3) *times* the munitions deflator (Table 4).

b Expenditure on military personnel at 1937 prices (Table 3) *times* the index of monthly earnings of public sector employees (Table 4).

c Expenditure on military construction and operations at 1937 prices (Table 3) *times* the unweighted mean of the deflators for construction and transport services (Table 4).

d Munitions (domestic output of munitions *plus* munitions supplied in mutual aid) *plus* military personnel *plus* operating and construction costs.

e NNP at 1937 prices (Table 1) is disaggregated into 1937 rouble values of net output in each year under the following headings: military MBMW, civilian MBMW, basic industrial goods, construction, transport, material consumption, civilian services, military services. These are multiplied by corresponding deflators shown (in the same order) in Table 4. The division of industrial production between military and civilian MBMW, basic goods and material consumption follows the branch indices and weighting scheme employed in construction of the industrial production index, on which see Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Tables 3, 4, 5. On the method of division of output of industrial branches 'not elsewhere specified' between material consumption and other civilian branches, see Appendix B, Table B-1, note [e].

f Total defence spending, per cent of NNP.

g Total defence spending *less* net imports at current prevailing prices (Appendix A, Table A-4), per cent of NNP.

h Net imports at current prevailing prices (Appendix A, Table A-4), per cent of NNP.

Table 6. *Soviet national income at approximate prevailing factor costs, and the burden of defence, 1937 and 1940-4*

	1937	1940	1941	1942	1943	1944
DEFENCE SPENDING AND NNP (billion roubles)						
Total defence spending[a]	17.6	52.2	76.9	149.8	179.2	197.0
NNP[b]	202.9	298.1	-	203.1	228.0	270.5
PER CENT OF NNP						
Defence spending, on basis of:						
national utilisation[c]	8.7	17.5	-	73.8	78.8	72.8
domestic finance[d]	8.7	17.5	-	66.5	63.5	59.0
Mutual aid, total[e]	-	-	-	7.3	15.1	13.8

Notes and sources:

a Table 5.

b As Table 5, except that material consumption in 1937 roubles is multiplied by the index of 'approximate factor costs', not of prevailing prices.

c Total defence spending, per cent of NNP.

d Total defence spending *less* net imports at current approximate factor costs (Appendix A, Table A-4), per cent of NNP.

e Net imports at current approximate factor costs (Appendix A, Table A-4), per cent of NNP.

Table 7. *The structure of Soviet employment, 1940-4*
(thousands)

	1940	1941	1942	1943	1944
Working population[a]	73 570	66 910	46 590	47 480	55 500
Armed forces[b]	4 200	5 880	10 900	11 050	11 200
Employed population[c]	69 370	61 030	35 690	36 430	44 300
public sector[d]	33 930	30 340	19 620	20 620	25 030
industry[e]	13 080	11 830	8 110	8 410	9 240
military MBMW (lower bound)[e]	2 100	2 450	3 370	3 700	3 840
civilian branches (upper bound)[e]	10 980	9 380	4 750	4 710	5 400
sovkhozy, MTS[f]	2 700	2 340	1 230	1 210	1 470
nonindustry, nonagriculture[g]	18 140	16 170	10 280	11 010	14 320
kolkhozy[h]	35 450	30 690	16 070	15 810	19 270
Subtotal: kolkhozy, sovkhozy, MTS[i]	38 150	33 030	17 300	17 020	20 740

Notes:

a Armed forces *plus* the employed population.

b Table 1, note [e].

c Public sector employment *plus* the able bodied adult kolkhoz population.

d For 1940, *Narodnoe khozyaistvo SSSR v 1965 g.* (Moscow, 1966), 558. This figure, based on the 1965 reclassification, includes employment in industrial producer cooperatives (*arteli promkooperatsii*); see further Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Appendix D. After 1940, employment in industry *plus* sovkhozy and MTS *plus* public sector nonindustry, nonagriculture.

e Harrison 'Total output', Table 7. Upper and lower bounds reflect limiting assumptions used to derive employment in military MBMW and (as a residual) in civilian branches.

f For 1940, *Narodnoe khozyaistvo SSSR v 1965 g.*, 558. After 1940, public sector employment in sovkhozy and MTS is interpolated on the kolkhoz population.

g For 1940, public sector employment *less* employment in industry, sovkhozy and MTS, from *Narodnoe khozyaistvo SSSR v 1965 g.*, 558. After 1940, employment under this heading is interpolated as follows.

A first estimate of nonindustrial public sector employment on the pre-1965 classification, excluding employment in industrial producer cooperatives (*arteli promkooperatsii*), in 1940 and 1942-4, is available from A.V. Mitrofanova, *Rabochii klass SSSR v gody Velikoi Otechestvennoi voiny* (Moscow, 1971), 437, 439, as follows:

	1940	*1941*	*1942*	*1943*	*1944*
Millions	20.2	-	11.2	11.9	15.4

The 1940 figure can be expressed more exactly as 20,225,000 from comparable data in *Narodnoe khozyaistvo SSSR v 1964 g.* (Moscow, 1965), 190.

From this I deduct employment in sovkhozy and MTS. The latter is given for 1940 on a consistent basis in ibid., 190, as 2,290,000. For years after 1940 I interpolate this series on the kolkhoz workforce.

This gives public sector nonindustrial, nonagricultural employment on the pre-1965 classification as follows:

	1940	*1941*	*1942*	*1943*	*1944*
Thousands	17 940	15 990	10 160	10 880	14 160

For present purposes this series is adjusted to the 1965 reclassification by a correction factor based on the two 1940 totals (18,140,000:17,940,000).

h The adult, able bodied kolkhoz population on 1 January of each year, 1941-5, is given in 'Uchastie kolkhoznikov v obshchestvennom khozyaistve kolkhozov za gody Otechestvennoi voiny', *Istoricheskii arkhiv*, no. 6 (1962), 21-68:26. Kolkhoz family members engaged full time in sideline employment on family allotments are included. I estimate annual averages from the January population as follows: 1940 - the 1 January 1941 figure (I assume that any natural increase in the village population over the year was absorbed by industrial and military recruitment). 1941 and 1942 - a weighted average of figures for 1 January of the current year and 1 January of the next year, with the earlier figure carrying a weight of 0.75 (taking into account that in each year population losses were concentrated in the

second half). 1943 and 1944 - the unweighted mean of figures for 1 January of the current year and 1 January of the next year

i Employment in sovkhozy and MTS *plus* the able bodied adult kolkhoz population.

Table 8. *Output per worker, 1940-4*
(roubles)

	1940	1941	1942	1943	1944
Industry[a]	5 810	6 240	8 350	9 540	9 880
military MBMW (upper bound)[b]	5 810	7 930	11 480	12 980	13 840
civilian industry (lower bound)[b]	5 810	5 800	6 130	6 830	7 060
Agriculture[c]	1 830	1 280	1 480	1 790	2 170
Civilian nonindustry, nonagriculture[d]	4 080	3 500	3 210	3 260	3 030
NNP[e]	3 080	2 720	3 090	3 460	3 570

Notes and sources:

a Mark Harrison, `Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Table 8; also, net output of industry as a whole in 1937 prices (Table 1), *divided by* the industrial workforce (Table 7).

b Harrison, `Total output', Appendix E, Table E-3. Upper and lower bounds reflect limiting assumptions used to derive output per worker in military MBMW and (as a residual) in civilian branches.

c Net output of agriculture in 1937 prices (Table 1), *divided by* the workforce in kolkhozy, sovkhozy and MTS (Table 7).

d NNP, *less* net output of agriculture, industry and military services, in 1937 prices (Table 1), *divided by* the workforce in public sector nonindustry, nonagriculture (Table 7).

e NNP, including military services, in 1937 prices (Table 1), *divided by* the working population, including military personnel (Table 7).

Table 9. *Soviet war employment, 1940-4*
(millions)

	1940	1941	1942	1943	1944
Military personnel[a]	4 200	5 875	10 900	11 050	11 200
Munitions workforce[b]	4 200	5 180	7 260	7 540	7 690
Construction, operations:					
upper bound[c]	1 980	3 270	6 860	7 840	8 520
lower bound[d]	1 980	3 270	6 370	6 590	6 560
War employment, total:[e]					
upper bound	10 380	14 320	25 020	26 420	27 410
lower bound	10 380	14 320	24 530	25 120	25 450
Per cent of working population:[f]					
upper bound	14.1	21.4	53.7	55.7	48.4
lower bound	14.1	21.4	52.6	53.0	45.9

Notes and sources:

a Table 1, note [e].

b Employment in military MBMW, from Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Table 7, *plus* employment in the production of intermediate goods and services for military MBMW, calculated as follows. The volume of 'interbranch inputs supplies to military MBMW', in 1937 roubles (ibid., Appendix E, Table E-4), is divided by output per worker in civilian industry, also in 1937 roubles (ibid., Appendix E, Table E-3). This is a first approximation, since not all inputs into military MBMW were industrial goods - some may have originated in agriculture, and some were services.

c For upper bound, expenditure on military construction and operations, in 1937 roubles (Table 3), *divided by* the unweighted mean of net output per worker in civilian industry and in public sector nonindustry, nonagriculture (Table 8).

d For lower bound, expenditure on military construction and operations, *less* industrial goods supplied in mutual aid, in 1937 roubles (Table 3), *divided by* the unweighted mean of net output per worker in civilian

industry and in public sector nonindustry, nonagriculture (Table 8).

e Employment of military personnel *plus* the munitions workforce *plus* numbers employed in supplying military construction and operations (upper and lower bounds).

f Total war employment (upper and lower bounds) as per cent of the working population (Table 7).

Table 10. *National income and the military burden: the Soviet record in international comparison, 1937-44*
(per cent of NNP at current factor cost)

	USA		UK		USSR		Germany	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1937	-	-	-	-	9	9	-	-
1938	-	-	7	2	-	-	17	18
1939	1	2	16	8	-	-	25	24
1940	1	3	48	31	18	18	44	36
1941	13	14	55	41	-	-	56	44
1942	36	40	54	43	74	67	69	52
1943	47	53	57	47	79	64	76	60
1944	47	54	56	47	73	59	-	-

Key:

(I) National utilisation of resources supplied to the war effort, regardless of origin: military spending (for the United States, *less* net exports) as share of national product.

(II) Domestic finance of resources supplied to the war effort, irrespective of utilisation: military spending (for the UK, USSR and Germany, *less* net imports) as share of national product.

Source: For the USA, UK and Germany, Mark Harrison, 'Resource mobilization for World War II: the USA, UK, USSR and Germany, 1938-1945', *Economic History Review*, 2nd ser., xli, no. 2 (1988), 184. For the USSR (at 'approximate factor cost'), Table 6.

Table 11. *Soviet war employment in international comparison* (per cent of working population)

		Armed forces	Group I[a] industry	Subtotal
USA[b]	1940	1.0	8.4	9.4
	1943	16.4	19.0	35.4
UK[b]	1939	2.8	15.8	18.6
	1943	22.3	23.0	45.3
USSR[c]	1940	5.7	6.1	11.8
	1943	23.3	10.0	33.2
Germany[b]	1939	4.2	14.1	18.3
	1943	23.4	14.2	37.6

Notes:

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

b Mark Harrison, 'Resource mobilization for World War II: the USA, UK, USSR and Germany, 1938-1945', *Economic History Review*, 2nd ser., xli, no. 2 (1988), 186.

c Armed forces and working population are as in Table 7; Group I employment is calculated from 1940 employment, branch output after 1940 and the change in output per worker in the military and civilian branches shown in Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Tables 3-8.

Table 12. *Agriculture in the prewar economic structure: the USSR in international comparison*

	US (1940)	UK (1938)	USSR (1940)	Germany (1938/9)
Employment in agriculture, per cent of total employment	17	8	52	26
Net output per worker in agriculture, per cent of net output per worker in nonagriculture	40	59	41	50

Sources: USA. The numbers of gainful workers in agriculture, forestry and fisheries, and in total, in 1940, are given in *Historical abstract of the United States: colonial times to 1957* (Washington, D.C., 1960), 74 (Series D 57-71). National income at current prices in total, and originating in agriculture, forestry and fisheries, in 1940, is from ibid., 140 (Series F 22-33).

UK. Employment in agriculture, forestry and fisheries, and in total, in 1938, is given in C.H. Feinstein, *Statistical tables of national income, expenditure and output of the United Kingdom, 1855-1965* (Cambridge, 1976), T129. GDP at current prices in total, and originating in agriculture, forestry and fisheries, in 1938, is from ibid., T26-T27.

USSR. Employment in agriculture, and in total, in 1940, is given in Table 7 above. NNP at 1937 prices in total, and originating in agriculture in 1940, is from Table 1.

Germany. Employment in agriculture, forestry and fisheries, and in total, in 1939 (within the frontiers of 1937), is given in B.R. Mitchell, 'Statistical appendix', in Carlo M. Cipolla, ed., *The Fontana economic history of Europe*, vi (2) (Fontana, 1976), 659. The share of GDP originating in agriculture in 1938 is from ibid., 751.

Appendix A. *Mutual aid to the Soviet economy, 1942-4*

Table A-1. *Mutual aid to the USSR, 1942-4*
($ millions)

	1942	1943	1944
Mutual aid, total[a]	1 550	3 310	3 930
Lend-Lease[b]	1 350	2 890	3 430
Of which, per cent:			
military goods	63.2	49.9	43.8
industrial goods	23.1	29.6	39.3
agricultural goods	13.7	20.5	16.9
Other mutual aid[c]	200	420	500

Notes and sources:

a United States Lend-Lease *plus* other mutual aid.

b Mark Harrison, *Soviet planning in peace and war, 1938-1945* (Cambridge, 1985), 259.

c The 1944 figure is from Abram Bergson, *The real national income of Soviet Russia since 1928* (Cambridge, Mass., 1961), 100n. For 1942 and 1943 I interpolate on United States Lend-Lease dollar values.

Table A-2. *Mutual aid to the USSR, 1942-4*
(billion 1937 factor cost roubles)

	Exchange rate[a]	1942	1943	1944
Mutual aid, total[b]	-	13.6	30.1	34.6
Lend-Lease:				
military goods[c]	8.4	7.2	12.1	12.6
industrial goods[c]	7.4	2.3	6.3	9.9
consumer goods[c]	14.0	2.6	8.3	8.1
Other mutual aid[c]	8.0	1.6	3.4	4.0

Notes and sources:

a These convert United States dollars of 1944 to Soviet roubles of 1937, on the basis supplied by Abram Bergson, *The real national income of Soviet Russia since 1928* (Cambridge, Mass., 1961), 99-100n:

Military goods. Bergson suggests a 1944 exchange rate of 6 roubles to $1. In 1944 Soviet munitions prices stood at perhaps 72 per cent of the 1937 level (Table 4), suggesting 8.4 1937 roubles to $1 of 1944.

Industrial goods. Bergson values $1,551 millions of civilian machinery and basic industrial goods in 1944 at 11.4 billion roubles, giving a 7.4:1 exchange rate.

Consumer goods. Bergson values $713 millions of agricultural and consumer goods in 1944 at 10.0 billion roubles (excluding trade margins and extra processing costs), giving a 14.0:1 exchange rate.

Other mutual aid. As Bergson.

These exchange rates differ from the ones used in Mark Harrison, 'Resource mobilization for World War II: the USA, UK, USSR and Germany, 1938-1945', *Economic History Review*, 2nd ser., xli, no. 2 (1988), Appendix C-3 (I misread Bergson).

b United States Lend-Lease *plus* other mutual aid.

c Current dollar values (Table A-1) *times* corresponding exchange rates.

Table A-3. *Deflators for imported goods, 1942-4*
(1937 = 100)

	1942	1943	1944
Military goods	80	74	72
Industrial goods[a]	116	118	119
Consumer goods:			
prevailing prices	426	769	840
approximate factor costs	180	172	151

Source: Table 4.

Note:

a The arithmetic mean of deflators for civilian MBMW and for basic industrial goods.

Table A-4. *Mutual aid to the USSR at prevailing prices and approximate factor costs, 1942-4*
(billion current roubles)

	1942	1943	1944
AT PREVAILING PRICES:			
Mutual aid, total[a]	22.0	90.3	100.7
Lend-Lease:			
military goods[b]	5.7	8.9	9.0
industrial goods[b]	2.7	7.4	11.8
consumer goods[b]	11.0	63.9	68.3
Other mutual aid[c]	2.6	10.1	11.6
AT APPROXIMATE FACTOR COSTS:			
Mutual aid, total[a]	14.8	34.5	37.4
Lend-Lease:			
military goods[b]	5.7	8.9	9.0
industrial goods[b]	2.7	7.4	11.8
consumer goods[b]	4.7	14.3	12.3
Other mutual aid[c]	1.7	3.9	4.3

Notes and sources:

a United States Lend-Lease *plus* other mutual aid.

b 1937 rouble values (Table A-2) multiplied by appropriate deflators (Table A-3).

c Calculated in the same proportion to total mutual aid as for each year in Table A-2.

Appendix B. *The approximate factor cost of Soviet material consumption, 1940-4*

Introduction. In this appendix I calculate an index for converting the net output of the production branches supplying the Soviet consumer from constant 1937 roubles to something near current factor cost.

I divide the economy into two sectors - material consumption and 'nonconsumption'. Material consumption comprises the output of agriculture, the light and food industries, and a share of the output of industries not elsewhere specified in the production branch classification underlying the index of industrial production. 'Nonconsumption' comprises the rest of the economy, except that military services are excluded; branches supplying civilian nonmaterial consumption (e.g. government, transport and household services) are included, however.

Below I designate these sectors by subscripts (c) and (nc) respectively.

Symbols.

Q	quantity produced (gross output), units
L	labour input (hours worked)
q	real output per worker (Q/L)
f	factor cost per unit of output
w	wage earnings per hour worked
n	cost per unit of nonlabour input
m	nonlabour input, quantity per hour worked

Procedure. In the absence of indirect taxes and subsidies,

$$f \cdot Q = (w + m \cdot n) \cdot L$$

and

$$f = (w + m \cdot n)/q \qquad [1]$$

Therefore:

$$f_c/f_{nc} = [(w + m \cdot n)_c/q_c]/[(w + m \cdot n)_{nc}/q_{nc}]$$

and

$$f_c = f_{nc} \cdot (q_{nc}/q_c) \cdot [(w + m \cdot n)_c/(w + m \cdot n)_{nc}] \qquad [2]$$

It has to be said that there is absolutely no way of judging how either nominal hourly wages or nominal hourly nonlabour costs varied in either sector, absolutely or relatively to the other sector. Therefore, I assume these

terms to be constant, and drop them from the equation. What remains is:

$$f_c = f_{nc} \cdot (q_{nc}/q_c) \qquad [2a]$$

That is, the current factor cost of material consumption is determined as the current factor cost of nonconsumption multiplied by the relative labour productivities of the two sectors (taking as given relative factor prices and other factor productivities).

This expression is quantified in Tables B-1 and B-2.

Table B-1. *Labour productivity in material consumption, 1940-4*

	1940	1941	1942	1943	1944
NET OUTPUT, bn 1937 roubles:					
Material consumption[a]	97.8	66.1	38.1	44.2	61.2
agriculture[b]	69.9	42.3	25.3	30.4	45.0
consumer industries[c]	27.9	23.8	12.8	13.8	16.2
light industry[d]	16.6	14.6	8.0	9.0	10.6
food industry[d]	9.1	7.3	3.8	3.7	4.3
other industry[e]	2.2	1.9	1.0	1.1	1.3
EMPLOYMENT, thousands:					
Material consumption[a]	42 952	37 125	19 383	19 031	23 031
agriculture[f]	38 151	33 029	17 298	17 015	20 742
consumer industries[g]	4 801	4 096	2 087	2 016	2 289
1940 YEARS WORKED, thousands:					
Material consumption[a]	42 952	-	20 672	20 564	25 809
agriculture[h]	38 151	-	18 126	18 104	22 816
consumer industries[i]	4 801	4 547	2 546	2 460	2 793
NET OUTPUT PER 1940 YEAR, 1937 roubles:					
Material consumption[j]	2 278	-	1 844	2 150	2 390
agriculture[j]	1 831	-	1 397	1 681	1 974
consumer industries[j]	5 810	5 224	5 026	5 600	5 789
NET OUTPUT PER 1940 YEAR, 1940 = 100:					
Material consumption[j]	100.0	-	81.0	94.4	105.0
agriculture[j]	100.0	-	76.3	91.8	107.8
consumer industries[j]	100.0	89.9	86.5	98.4	99.7

Notes:

a Agriculture *plus* consumer industries.

b Table 1.

c Light *plus* food *plus* other industry.

d Soviet official indices of gross value of output in rouble prices of `1926/27' cited in Mark Harrison, `Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Table 3, *times*

1940 employment shares given in ibid., Table 5, used to derive percentages of Soviet 1940 net output of industry as a whole, given in ibid., Table 6.

e Other industry comprises nonferrous metallurgy, printing, and pottery and glassware. Its 1940 share in net output of industry as a whole is given by residual employment not elsewhere specified in Harrison, `Total output', Table 5. Its net output is assumed to vary after 1940 with that of civilian industry as a whole (ibid., 18). The resulting series is divided between material consumption and nonconsumption according to the percentage shares of nondefence production of industry as a whole allocated to each sector.

f Table 7.

g Net output of consumer industries (above) divided by net output per worker in civilian industries as a whole, estimated in Harrison, `Total output', Appendix E, Table E-3.

h Employment *times* an index of days worked per worker, obtained as follows.

According to `Uchastie kolkhoznikov v obshchestvennom khozyaistve kolkhozov za gody Otechestvennoi voiny', *Istoricheskii arkhiv*, no. 6 (1962), 21-68:52, the workpoints (*trudodni*) accumulated by the average able bodied kolkhoz worker in the rear regions varied as follows in each year:

	1940	*1941*	*1942*	*1943*	*1944*
Workpoints per collective farmer	250	243	282	266	275

I take this as an indication of the changing number of hours worked per year by agricultural workers generally. I may be wrong to do so. Perhaps deteriorating conditions of production made it significantly more time consuming after 1940 for the average collective farmer to register a workpoint.

According to Alec Nove, `The Soviet peasantry in World War II', in Susan J. Linz, ed., *The impact of World War II on the Soviet Union* (Totowa, N.J., 1985), 80, even in peacetime each *trudoden'* represented `roughly 1.5 actual days' worked. This must be an overestimate. Moreover, even if it were significantly scaled down, it would leave little room for a wartime increase in the ratio of days worked to *trudodni* registered.

I feel sure, however, that the 1941 figure cannot be generalised to the country as a whole. The sudden loss of territory was concentrated in the second half

of the year, when major agricultural tasks (e.g. harvesting) were concentrated. Therefore, the collective farmers of the frontline regions were probably able to accumulate workpoints during the year at a significantly slower rate than their colleagues of the rear regions, before being overtaken by the invading forces. If the 1941 figure for average workpoints were accepted as being represented for the country as a whole, then net output per day worked in agriculture would appear lower in 1941 than in 1942 or 1943 - another meaningless result. Therefore I make no estimate for agriculture in 1941 in the table.

i Employment *times* an index of hours worked per worker in industry as a whole, from Harrison, 'Total output', Appendix D, Table D-3.

j Net output divided by 1940 years worked.

Table B-2. *Approximate imputed prices and factor costs in material consumption and 'nonconsumption', 1942-4*
(1940 = 100)

	1942	1943	1944
'NONCONSUMPTION':[a]			
Net output,			
bn 1937 roubles[b]	72.0	83.8	97.0
current roubles[c]	84.3	73.8	88.7
Net output deflator (f_{nc})[d]	89.3	88.1	91.5
1940 years worked[e]	58.5	60.2	74.3
Net output, 1937 roubles,			
per 1940 year worked (q_{nc})[f]	123.2	139.1	130.6
MATERIAL CONSUMPTION:[g]			
Net output, 1937 roubles,			
per 1940 year worked (q_c)[h]	81.0	94.4	105.0
Net output deflator			
($f_c = f_{nc} \cdot [q_{nc}/q_c]$)[i]	135.7	129.7	113.7

Notes:

a NNP *less* material consumption, *also excluding* military services.

b NNP (Table 1) *less* material consumption (Table B-1), all at 1937 prices.

c Nonconsumption at 1937 prices, revalued by appropriate deflators (Table 4).

d Nonconsumption at 1937 prices *divided by* nonconsumption at current prices.

e The employed population (Table 7) *less* employment in material consumption (Table B-1), *times* an index of hours worked per worker in industry as a whole, from Mark Harrison, 'Total output and the productivity of labour in Soviet industry, 1940-1945', Warwick Economic Research Papers, no. 319 (University of Warwick, 1989), Appendix D, Table D-3.

f Net output *divided by* 1940 years worked.

g Agriculture *plus* the food and light industries *plus* a share of industry not elsewhere specified (Table B-1, note [e]).

h Table B-1.

i The nonconsumption net output deflator *times* net output per 1940 year worked in nonconsumption, *divided by* net output per 1940 year worked in material consumption.