

Rockoff, Hugh

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From ploughshares to swords: The American economy in World War II

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Hugh Rockoff
Rutgers University and the NBER

Department of Economics
Rutgers University
New Brunswick NJ
08550
908-932-7857
Hrockoff@rci.rutgers.edu

Abstract

This paper examines the U.S. economy in World War II. It argues that the mobilization must be viewed as a rapidly evolving historical process rather than, as is often the case, a single undifferentiated event. For example, the employment of unemployed resources, a factor often cited to explain the success of the mobilization, was important during the national defense period, but was a relatively unimportant during the period of active U.S. involvement. On the financial side, money creation was more important during the first year of active involvement than in subsequent years. The most significant legacy of the war, viewed in relation to the prosperous era that followed, may have been the change in the macroeconomic regime. The paper also discusses the limitations of the basic time series.

Introduction

Between 1939 when World War II began and 1944 when U.S. output reached its wartime peak, the U.S. economy grew at a remarkable rate. Contemporaries described it as a "production miracle." In many ways it was the obverse of the Great Depression. Between 1929 and 1933 real GDP collapsed, shaking the faith of Americans in their economic system; between 1939 and 1944 real GDP rose by an even larger percentage restoring the faith of Americans in their economic system -- provided its given a strong dose of centralized control. The Great Depression was without doubt the most important macroeconomic event of the twentieth century; the mobilization of the American economy in World War II is a close second. Yet the economic history of the Great Depression has been studied in great depth, while World War II remains comparatively unknown.

This paper is concerned mainly with three questions about the war economy. First, where did the United States find the resources it needed? Second, how was this effort financed? Third, what were the long-run economic consequences? The paper argues that the answers traditionally given to these questions need to be modified. To take the first question for example, there is a tendency when explaining the growth of real output to focus on a single factor, usually the high level of unemployment prevailing before the war, or the entry of more women into the labour force. As we will see, however, no single factor can explain the expansion of real output during the War.

Modifications of the traditional picture are needed in part because we tend to think of the war as a single, undifferentiated event rather than as an unfolding historical process. The emphasis on the role of unemployment, to return to the first question, flows from our tendency to forget the substantial changes that took place in the economy between the outbreak of the war in Europe and Pearl Harbor. In December 1941, when all out mobilization began, unemployment had already fallen to about 6 percent of the labour force -- other ways had to be found to increase production.

In the section on finance I argue that our tendency to think of the war as a unit has led us to neglect the role of monetary expansion. And in the section on long-run consequences I argue that attempts to link postwar prosperity in the United States to changes on the real side -- to the new initiatives in education, to the capital constructed during the war, or to the favorable position in world trade in which the U.S. found itself -- are likely to prove disappointing. Instead, the key factor appears to have been the new macroeconomic regime.

The paper also provides a discussion of the meaning and limitations of the basic time series, to facilitate comparisons between the United States and other countries.

The Production Miracle

In this section I discuss the composition of output in the war economy. There are, of course, numerous measurement problems (which are discussed in subsection B, but the transformation of the

economy was so dramatic that measurement problems cannot obscure the broad outlines of what happened.

Guns and Butter

The division of real GNP (at 1958 prices) into civilian output and military output is shown in figure 1; the data are in table 1.¹ The basic story is clear. Real GNP rose sharply, about 55 percent, between 1939 and the peak in 1944.² The share of military spending in GNP rose from 1.4 percent in 1939 to 45 percent in 1944 (at 1958 prices; the figure was 42 percent at current prices). The United States squeezed the civilian sector in 1942 (severe limits on consumer durable production were the most important) and then put the civilian sector "on hold" for the remainder of the war, turning the increase in GNP over to the military.

As a result real civilian GNP in 1944 was only a bit below the level achieved in 1939. Most of the increase in war production came from the increase in output. Below I will examine how this result was achieved. First, however, I need to consider the conceptual problems that underlie wartime estimates of real GNP and related variables.

Measurement Problems

The difficulties inherent in measuring national income were magnified by the War. They can be considered under three headings: (1) the decision whether or not to include war output in GNP, (2)

errors in the measurement of prices and quantities in the war sector, and (3) errors in the measurement of prices and quantities in the civilian sector.

1. The inclusion of war output in GNP. Recently, Robert Higgs argued that most war output, perhaps all, should be excluded from GNP because war output doesn't contribute directly to the current or future flow of goods and services that create utility. War output should be treated, in his view, as an intermediate product. Thus, his estimate of real GNP declines between 1941 and 1944.³

Earlier, Simon Kuznets, the father of national income accounting in the United States, had considered the same question, reaching a somewhat different conclusion. Kuznets argued that in peacetime only the formation of durable war goods should be included in GNP; the rest should be excluded on grounds similar to those invoked by Higgs.⁴ Kuznets, however, concluded that in a major war there were really two end purposes of economic activity, production of goods for the civilian sector and production of goods for the military sector, and that both should be included in aggregate output.

The point is debatable. Many expenditures ordinarily included in GNP would have to be excluded if the Higgs or Kuznets criterion was applied consistently. Medical care, for example, would have to be excluded because it doesn't contribute directly to current or future flows of goods and services that create utility. Or perhaps, following Kuznets, one would exclude ordinary checkups from GNP (peacetime expenditures), and include radiation therapy

for cancer (wartime -- two end purposes!). Indeed, the frequency with which the discussion of illness is carried out with military metaphors reveals an underlying psychological analogy. Cancer "invades the body," the Nixon Administration launches a "War on Cancer," and Paul Ehrlich discovers a treatment for syphilis, a "magic bullet."⁵ Munitions production, in other words, -- like medical expenditures or like expenditures for police and fire protection -- is important because it protects future flows of consumption.

I do not raise this point to argue that munitions production must always be included. Different measures of aggregate production are useful for different purposes. The Higgs measure is useful for making the point that Americans were better off once the war was over and production could be redirected toward civilian goods.⁶ But for other purposes, such as determining the pace of the mobilization, or comparing the performance of the United States with that of other belligerents, central concerns of the conference, an output measure that includes munitions is the only one that makes sense.

It is also important to keep in mind that there are a variety of aggregate measures; its not necessary to use GNP to answer every question. If one is concerned with how civilians fared during the war, an index of consumption is best; if one is concerned with the speed of mobilization, an index of war output is best.

2. Prices and quantities in the war sector.⁷ The prices for tanks or planes specified in government contracts represented only

a small part of the funds flowing from the government to munitions makers: a wide array of subsidies were used to stimulate production. Thus deflating total spending on war goods by a price index based on contract prices probably overestimates the increase in war output. Kuznets made an attempt to solve this problem in National Product in Wartime. He began by noting that resources provide a common denominator between the civilian and military sectors. Guns and butter both require labour to produce them. It is possible then to produce estimates of war output in terms of prewar resource costs by deflating spending on war goods by an index of resource costs.

But how does one go from resource costs to war output at final product prices? Kuznets then estimated efficiency in the war sector relative to efficiency in the nonwar sector, basing his estimates on scattered bits of qualitative and quantitative data. He concluded that the level of efficiency in the war industries during the war was substantially below that of similar civilian industries (metal fabricators) in 1939 because the civilian industries had matured slowly under peacetime conditions. Despite significant increases in efficiency between 1939 and 1943, the war industries, in Kuznets's view, still suffered from labour and raw material hoarding, and other wasteful practices. By deflating war output at resource cost by his efficiency index, Kuznets produced estimates of war output at final product prices that showed substantially less expansion of war output than the figures published by the Commerce Department.

Subsequently, Milton Friedman and Anna J. Schwartz, developed an alternative approach: they used current nominal income to interpolate the NNP deflator during the War because changes in current income were probably less vulnerable to measurement error. Table 11 shows their estimates, an alternative developed by Geoffrey Mills and myself which tries to improve on the Friedman and Schwartz estimates by using wages paid as an additional interpolator, and several related series.⁸ Evidently, measurement errors in the price indexes make it impossible to make precise statements about the size of the expansion. Nevertheless, even allowing for substantial errors in the deflators leaves us with a remarkable increase in output.

Rapid technological progress in arms production, changes in the scale of munitions production, and possibly changes in the institutional structure of munitions production, moreover, make comparison of arms prices at distant points in time problematic. In the postwar years munitions prices have risen relative to prices in other sectors. This means that the bulge in wartime production looks larger the later the date we use for measuring relative prices. Measured at 1958 prices (figure 1), the increase was 55 percent, and measured at 1987 prices (the most recent estimates I have looked at), the increase was 69 percent! The solution adopted here is to use, when possible, a base year relatively close to the War, so we that we are seeing the War from the perspective of the generation that experienced it.

3. Prices and quantities in the civilian sector. Price controls and rationing produced the usual problems in the civilian sector. Quality deteriorated -- cheap fillers were added to candy bars, clothing was made from coarser weaves, maintenance expenditures on rental properties were reduced, and so on. So called "Forced uptrading," the elimination of lower priced lines of merchandise, was a major problem. And classic black markets developed: One could buy off-ration meat, gasoline, or tires for the right price if one knew the right people.

The Bureau of labour statistics tried valiantly to cope with these problems. When a lower-priced line disappeared, for example, the Bureau counted part of the difference between the lower-priced and the higher-priced lines as a price increase. But inevitably, adjustments were incomplete. Rationing created a related problem. A consumer who was prevented from buying good X because of some form of rationing was in much the same position as a who had been prevented from buying X by an increase in price. But the price index was not adjusted upward to reflect the scope of rationing and hence deflated spending did not reveal this loss in consumer welfare.

Not all of the measurement problems worked in the direction of overstating the size of the civilian sector. There was a sizable black market, especially in the last years of the war, and production in the black market was not reflected fully in the statistics on aggregate spending.

In short, the penumbra of uncertainty that always surrounds economic measurements expanded during the war. But for what it is worth, my judgment is that the aggregate statistics are nonetheless useful for painting a broad brush picture of the mobilization.

The Composition of Output

Let us take a closer look at what happened in the civilian sector by making use of the traditional decomposition of GNP into consumption, investment, net private exports, and government spending. This is done in figure 2.

Government spending (the top section of each bar) increased rapidly in 1942 and 1943 and peaked in 1944. Most of this increase, as noted above, came out of the increase in total GNP. Private consumption was squeezed a bit in 1942, and then rose a bit in 1943 and 1944. The decline in consumption would be greater (probably) if we adjusted for the problems in the deflator and total spending. But my guess is that the general impression created by the figure would not be changed: the United States put consumption "on hold" during the war while generating the means to defeat the axis by squeezing private investment and expanding total output.

To some extent the long-term effects of the squeeze on private investment were offset by government spending on industrial plant and equipment (aluminum and synthetic rubber factories, for example) that were sold to the private sector after the war. Private net exports were also squeezed, actually turning negative

during the war. (See subsection E. for a discussion of exports that includes Lend-Lease and other government transfers.)

Government purchases of goods and services, the total shown in figure 2 is not precisely the same as military spending, but in fact comes close. Figure 3 shows three measures of war spending, each as percentages of GNP (all figures in current dollars). The lowest line is simply the sum of Army (which included the Air Force) and Navy spending as shown in the Federal Budget.⁹ The middle line is government purchases of goods and services less civilian purchases in 1938 (total government less Army and Navy). The top line is the Commerce Department's estimates of "National Security" expenditures. In the peak year, 1944, Army and Navy spending was 37.25 percent of GNP, Government purchases of goods and services net of nominal spending on civilian purchases in 1938 was 40.33 percent of GNP, and the official Commerce Department estimates of national security spending was 42.18 percent of GNP. Even the Commerce Department estimates can be considered only a first approximation: many government expenditures (investments in new plant and equipment for example) served civilian as well as military purposes; and many civilian expenditures (for example, the costs incurred in moving to war production centers) served military as well as civilian purposes. Nevertheless, the Commerce Department estimate of a maximum "effort" of 42 percent seems reasonable.

The Level of Consumption

Many historians have maintained that real consumption was high during the war -- "Americans never had it so good," and Americans on the home front engaged in a "carnival of consumption."¹⁰ But skepticism is justified, as Higgs has recently stressed, because of the measurement errors in the price indices, and the changes in the composition of civilian consumption induced by wartime constraints. The standard estimates of consumption produced by the Commerce Department go some way toward justifying the "never-had-it-so-good" view. Real per capita consumption rises sharply in 1940 and 1941, drops slightly in 1942, but then rises in 1943 and 1944, so that the level in 1944 is an all-time high. If one divides total consumption by the resident civilian population, rather than total population, the results are even more dramatic: the decline in 1942 disappears, and average consumption in 1943 is already well above past achievements.

A number of years ago I constructed a consumer price index that incorporated adjustments for rationing, the decline in the maintenance of rental property, and similar problems. And Harold Vatter constructed an upper bound estimate of the consumer price index by assuming that the price level reached in 1947 (after controls were removed) had effectively been reached by 1945 although the inflation was hidden by controls.¹¹ Figure 4 shows per capita consumption calculated using these deflators, and perhaps somewhat inappropriately in this case, the alternative NNP deflators discussed above. It now appears that consumption per

capita may have been depressed in the years of total war (1942-1944) compared with the years of neutrality (1939-1941).

Higgs's emphasis on the fall in real per capita consumption from the level reached in 1941 thus partly justifies his challenge to the claim that Americans's "never had it so good." But while Higgs's basis of comparison, 1941 or 1946, makes sense to us now, these are probably not the years that most Americans, or most historians, had in mind when they dwelt on how good Americans had it during the war. The war years look pretty good compared with the Great Depression. Note that in figure 4 none of the estimates of real per capita consumption fall below the level of 1939. Real per capita consumption in 1939, moreover, was the highest of the decade, exceeding real per capita consumption even in the boom year 1929. Legally and militarily 1941 was the last year of peace for the United States, so it is technically correct to compare consumption during the war with the level reached in 1941. But probably comes closer to what people were actually talking about when they said "we never had it so good" if we compare 1941 and the years that followed with the Depression.

It is also likely that when historians write about the prosperity of the war years they are focussing to some extent on the lower part of the distribution of income. Poor people from the South and from pockets of rural poverty in the Midwest, "hoosiers," were drawn to war production centers in the Midwest, the South, and the Pacific coast by high real wages. It is true that these workers often had to endure crowded living conditions and to work long

hours at a pace they were not accustomed to -- high levels of measurable consumption are not the same as high levels of economic welfare -- but these costs must have been offset at least in part by the hope that these condition were temporary, and that at long last they had escaped from a life of grinding rural poverty.

Additional insight can be gained by looking at the major components of consumption. Production of new consumer durables, particularly those containing metal, was curtailed drastically during the war; automobile production, for example, was halted. The impact on consumers, however, was cushioned by running down business inventories and by postponing normal replacements until after the War. Construction of new housing and repair and maintenance expenditures on existing housing declined during the War, but again the effect on consumers was cushioned because to some extent current consumption could be maintained while repair and maintenance could be postponed until after the War. The expansion of the armed forces also reduced pressures on the civilian housing stock: the number of civilians per occupied dwelling declined from 3.63 in 1940 to 3.30 in 1944.¹²

Housing shortages were severe, however, in war production centers such as the aircraft and shipbuilding centers on the Pacific Coast. It would have been difficult in any case for new construction in those areas to keep pace with the influx of workers seeking jobs in defense plants. But uncertainties about the postwar viability of the plants, rent controls, and shortages of construction materials hampered construction.

Civilian food consumption (table 4) held up well. Total civilian consumption of calories fell slightly from the high level recorded for 1941, but the average during the War (when many heavy consumers of calories were in the armed forces) was comparable to the late Depression and early prewar years. Protein consumption, owing to an abundance of meat, fowl, and eggs reached an all time high.

Column 3 of Table 4 shows consumption of vitamin C which rose to a new high, partly as a result of a government supplementation program. Column 4 shows pounds of meat (beef, pork, and lamb) consumed per year. Today, reaching a higher level of meat consumption would be considered a sign of moral and intellectual bankruptcy; but at the time it was considered a sign of prosperity. Column 4, moreover, is a good example of a category which is probably understated because of the black market. Toward the end of the War beef sometimes moved from ranches to black market slaughter houses to restaurants or households, completely bypassing legal channels. It is doubtful that these supplies were counted by the Department of Agriculture. Wartime meat shortages, clearly, were the result of large increases in demand combined with price controls, rather than decreases in supply.

Edible fat consumption was down somewhat during the War, particularly butter consumption -- the United States did not have, literally, guns and butter. The reasons are not clear, although it is probable that the long-term decline in butter consumption played a role. Ice cream consumption, which had been rising for a long

time, continued to rise -- the United States did have, literally, guns and ice cream. The decline in edible fat consumption was a major concern, and the meat rationing system was designed to provide each family with an adequate fat ration. The concern about fat aside, food production held up well.

Clothing, on the other hand, suffered from quality deterioration. Only shoes were rationed, however, because of the shortage of high quality leather and rubber. And, although shoe inventories were run down, overall sales of shoes stabilized during 1942-1944 at five percent above their 1941 level.¹³

Other areas of consumption also suffered somewhat owing to wartime strains. The build up of the Army and Navy medical services undoubtedly hurt civilian medical care, and the rapid pace of internal migration exposed large numbers of people to new disease environments. Vatter summarized as follows. "Except for malaria, typhoid, and smallpox, the incidence of most diseases among the civilian population increased as compared with 1940."¹⁴ Long hours in hastily constructed industrial plants increased the rate of industrial accidents. Shipbuilding, a dangerous business in the best of times, was especially dangerous when undertaken by inexperienced workers in yards crowded with supplies.

Overall, Vatter's judicious conclusion concerning consumption levels appears correct. "Although there were specific pockets of civilian deprivation and harsh regional differences, particularly with respect to durable commodities, the overall flow of per capita

consumer goods and services was maintained at a surprisingly high level."¹⁵

The Foreign Sector

In the Spring of 1940 Britain began placing large scale orders with American factories. Initially, Britain paid for weapons by running down her dollar balances by \$235 million, by selling \$335 million worth of U.S. securities requisitioned from British holders, and by transferring over 2 billion in gold. The policy of was known, correctly, as "Cash and Carry."¹⁶

In March 1941, however, the United States began paying for the weapons under "Lend-Lease." This euphemistic name was intended to suggest that weapons would only be lent or leased temporarily to our future allies -- the weapons would be returned after the War was over! Various forms of compensation, such as the right to British military bases, were exchanged for lend-lease weapons. But the main purpose of the title and the compensation provisions was to defuse potential criticism from the still potent, although diminished, anti-war forces in Congress.

Lend-lease lasted from March 1941 until June 1945. Altogether some \$50 billion was spent under the Act. Figure 5 shows the effects of lend-lease. Both the relatively small increase in exports relative to GNP in 1940-1941 under cash and carry, and the unprecedented increase in 1942-1945 under lend-lease are evident.¹⁷ Thus, even though the increase in exports in 1940 and 1941

threatened to exhaust Britain's ability to pay, these amounts were small compared with what followed.

It is sometimes claimed that lend-lease "boosted" the economy. The intended picture is Keynesian. The government, in this view, increased spending on arms for its future allies, and this produced a multiple increase in real GNP. Lend-lease weapons, on this view, more than paid for themselves. True, unemployment was still high in March 1941 when lend-lease was inaugurated; but the economy was then expanding smartly under monetary and fiscal stimuli already in place. During the winter of 1942 the U.S. reached full employment. In 1942, 1943, and 1944, when huge lend-lease transfers had to be made, they had to be made the old fashioned way -- at the expense of other goods.

The Production Possibilities Curve

The production possibilities curve provides a way of describing the increase in war production that clarifies the economic and technological possibilities open to the United States at each point in time. In figure 6 real civilian output is plotted on the horizontal axis and real military spending (both at 1958 prices) on the vertical axis.

The resulting picture shows that the war years can be divided into four phases.

1. Between 1939 and 1941 the United States made gains in both civilian production and war production by reemploying unemployed resources: by moving toward the production possibilities curve.

2. Between 1941 and 1942, however, some civilian output had to be sacrificed to achieve more war production: the movement was back along the production possibilities curve.

3. The curve then shifted upward, so that in 1944 the economy was producing considerably more munitions without further reductions in the size of the civilian sector. The exact position of the curve in 1943-45 is unknown because of the measurement problems described above. It seems likely that if the price deflators and spending measures were adjusted for measurement problems, the high points on the graph (1943-45) would migrate toward the southwest. But in any case, it is clear that the shift in the curve permitted the United States to produce a vast supply of munitions in 1943-45 with a surprisingly small reduction in civilian output.

4. With peace came a second movement along a production possibilities curve, this time away from guns and toward butter, leaving the economy in 1946 producing war goods at a rate only slightly below that of 1941, but with a much higher level of real civilian output.

The Factors of Production

In this section I use John Kendrick's estimates of inputs and total factor productivity to explain the shifts in and movements along the production possibilities curve.¹⁸ The major aim, of course, is to explain the upward shift in the production possibilities curve.

The Labour Force

Before turning to the workforce, let us look briefly at the vital statistics. The domestic crude death rate (table 5, column 4) remained around the level reached in the late 1930s, providing additional evidence that civilian sector remained on hold -- civilians experienced neither extreme stress in health and nutrition levels, nor rapid improvement. The crude birthrate, column (6), increased slightly during the War and then dramatically in 1946.

The 1946 increase in the crude birthrate was the result, partly, of the reuniting of couples separated during the War. But there was more to the "baby boom," which lasted well into the 1950s, than romantic reunions. The baby boom was a response to the rise in real per capita income, and perhaps even more important, to the rise in economic security that came with the return of full employment.

The crude death rate, when the deaths of military personnel stationed overseas are included, column (3), rose substantially in 1944 and 1945 with the intensification of the fighting. Nevertheless, neither the supply of labour to the homefront, nor the supply of labour to the fighting fronts, was seriously compromised by the losses sustained in 1944 and 1945. The United States could have fought much longer and harder had it proved necessary.

Column (5) shows the crude death rate for military personnel stationed overseas. If it appears somewhat low, as it undoubtedly

does to someone more familiar with the losses sustained by the other belligerents, it is because of the large number of support personnel in the U.S. military. The death rates for men headed for the killing lines, for riflemen and bomber crews, however, were extremely high. Indeed, losses in rifle companies in the European theater were so high that American commanders had to contend with a severe shortage of riflemen despite their superiority in men and material in almost every other category.

To achieve the "production miracle" the United States, first of all, increased the supply of labour. A division of the increase in Kendrick's estimate of total labour inputs into the amounts contributed by the increase in the number of workers, the increase in the number of hours worked, and the residual, which I have labelled "reallocation," is shown in figure 7. The increase in the number of workers was the most important factor and will be considered in more detail below. Average hours worked per week increased, but only about 7 percent between 1940 and 1944, from 43.9 hours to 47.0 hours, and the work week remained below the level of 1929, 48.7 hours.¹⁹ Hours increased greatly, however, in the factories producing munitions. The term "reallocation" was given to the residual because the main component of the residual is the affect of moving a worker from a-low-paying-low-productivity job, for example in southern agriculture to a high-paying-high-productivity job, for example building tanks in Detroit.

All three factors were making substantial contributions to the increase in labour inputs at the peak in 1944. After the War annual

hours per worker fell back to its prewar level, and by 1948 had fallen noticeably below the level of 1938. But the increase in total employment and the gains from the reallocation of labour persisted, providing part of the explanation for the permanent upward shift in the production possibilities curve. The southern agricultural worker who moved to Detroit to build tanks, stayed to build automobiles.

In figure 8 the increase in the size of the paid labour force, the major factor in figure 7, is divided into three components: the amount contributed by the reduction in unemployment (of both men and women), the amount contributed by the increase in the number of women participating, and by the increase in the number of men participating. The labour force increased by 17.6 million workers between 1940 and 1944. The reduction in the number of unemployed workers contributed about 42 percent of the increase, increased participation by women contributed about 28 percent, and increased participation by men, about 30 percent.

The numerical preciseness of the estimates hides gray areas. On the one hand, many of the workers who were counted as not participating in the labour force in 1940 were discouraged workers who could, with some justice, have been counted as unemployed. On the other hand, a substantial part of the labour force designated as unemployed in 1940 actually had jobs in emergency relief agencies such as the Civilian Conservation Corps and the Works Progress Administration -- agencies that were shut down as wartime jobs were created. These workers were being reallocated to more

productive jobs rather than moving from unemployment to employment.²⁰ Something similar could be said of many of the women who entered the labour force, they began producing for the market rather than for the home, a reallocation that adds to GNP partly because home production is not adequately valued in GNP. Many of the workers reemployed in 1940 and 1941, moreover, were set to work producing civilian goods and then reallocated to war goods: starting in a later base year would change the picture.

When all is said and done, however, it is clear that the War produced a remarkable increase in total employment. The reasons are not completely clear. The most likely candidate explanations would appear to be the increase in real wages, the expectation that high real wages would be temporary because the Depression would return after the War (make hay while the sun shines), and patriotism. In some cases compulsion may have been a factor, working in a war plant could (sometimes) persuade a draft board to grant an exemption, but compulsion was probably not a major factor in the increase in the supply of labour.

Who were the women who entered the labour force? A breakdown by marital status (available only for selected years) is shown in figure 9. There the increase in the number of women in the labour force is divided into four categories: married women with husband present (which includes husbands absent in the military), married women without husband present, single women, and widowed and divorced women.²¹ Married women with husband present accounted for over 40 percent of the increase. Many of these women had husbands

in the military. The image of American women building the weapons of war while their husbands served in the armed forces has a foundation in fact, although as figure 9 shows, there were substantial increases in all four categories.

The shifts labour force participation by women between 1944 and 1948 are surprising. The number of women with husbands present in the paid labour force increased by another 1.3 million between 1944, the peak of the mobilization, and 1948. Decreases were recorded, but these were confined to single women and to married women with the husband not present. A full analysis is beyond the scope of the paper. Undoubtedly, part of the story is a change in attitudes. Women who worked during the war developed a taste for work, and some employers realized that they were good workers. But another part of the story must be improved economic conditions combined with the long-term trend toward increased labour force participation of women. Increased family incomes, on the other hand, permitted young single women and married women with husbands not present to return to school.²²

Together, the additional sources of labour made it possible for the United States to substantially increase the amount of labour devoted to producing munitions without significantly reducing the amount of labour in other sectors. Between 1939 and 1943 workers in durable manufacturing increased by a factor of 2.4, from 4.7 million to 11 million. At the same time employment in most other sectors held roughly constant. Perhaps the major exceptions were agricultural and household workers.²³

An alternative view of how the increase in the labour force was allocated, that may be useful when comparing the United States with other belligerents, is provided in Figure 10. It is based (very roughly) on the British sector-of-origin breakdown of the labour force: Group I consists of workers in durable manufacturing; Group II consists of workers in agriculture, mining, government, transportation, and public utilities; and Group III consists of workers in non-durable manufacturing, construction, finance, and services. The idea is that the goal of the mobilization was to reallocate as many workers "as possible" from groups II and III to group I.

My attempt to match the British sectors-of-origin breakdown is only approximate because I have allocated all durable manufacturing workers to category I, and I have allocated all non-durable manufacturing workers to category III. A closer look at industry by industry data would produce some adjustments in the boundaries among the categories. By way of comparison, consider Harrison's estimates.²⁴ In 1940 he estimates 8.4 percent of the U.S. labour force was in Group I industries; using durable manufacturing as a proxy gives 9.5 percent.²⁵ In 1943 Harrison estimates 19.0 percent of the U.S. labour force was in Group I industries; using durable manufacturing as a proxy gives 17.2 percent. The durable goods proxy therefore seems close enough for present purposes.

This breakdown provides still another illustration of the decision by the United States to put the civilian sector, particularly consumption, on hold. Category I employment rose,

while category II remained about constant. Category III fell, but only slightly, and only in the peak years 1943 and 1944.

The Stock of Capital

Existing factories were converted to war production and new factories, especially designed to mass produce arms, were constructed. Ford halted automobile production, and began turning out tanks; Ford also built a huge plant at Willow Run for mass producing B17 bombers. The decision to invest heavily at the start in new plants was controversial: it slowed down the conversion, perhaps so that firms could maintain profitable lines of production for the civilian market. But the decision paid in the long-run by assuring that the United States could outproduce Germany and Japan.

A good deal of the plant and equipment built during the War was converted to the production of civilian goods afterwards. Much of this capital, which had been financed by the Defence Plant Corporation and other federal agencies, was sold to private firms at bargain prices after the War, and so was undercounted in the official estimates of the capital stock. In a famous article published in 1969, Robert J. Gordon put a price tag on the understatement: "45 Billion [1958 dollars] of U.S. Private Investment Has Been Mislaid." The \$45 Billion was mislaid, of course, by economists not by businessmen.²⁶

Although the wartime expansion of industrial capital was striking to contemporaries, it is easy to exaggerate its importance

during the War and, especially, for the postwar years. Between 1939 and 1946 the increase in the net private capital stock, including Gordon's estimate of the missing capital, was only 14 percent. It is not surprising, therefore, that in the total factor productivity framework the increase in the capital stock accounts for only a small part of the increase in output.

Total Factor Productivity

The estimates of labour and capital discussed above can now be used to divide the increase in output into the amounts contributed by the increase in labour, the increase in capital, and the increase in total productivity. Kendrick's estimates are used throughout except that I have adjusted his estimates of the capital input upward to reflect Gordon's findings.²⁷ The division is presented in figure 11. Each bar in figure 11 shows the percentage increase in real NNP in that year over 1940 divided into the amounts contributed by increases in labour (subdivided into lower unemployment, more workers, longer hours, and labour reallocation), capital, and total factor productivity.

Increased inputs, especially labour, provided the bulk of the increase in output. Comparing 1944 with 1940, we find that increased supplies of labour contributed 73 percent of the increase in output, increased supplies of capital contributed about 3 percent, and increased total factor productivity contributed about 24 percent.²⁸

The most important lesson to be drawn from the figure is that no single factor accounts for the rise in output. Americans who were unemployed went back to work, many who were not part of the paid labour force decided to go to work, they worked longer hours, and they moved from the South and other low-wage areas to industrial production centers. Capital was converted to war production, and new plant and equipment was built, and considerable gains were made in total factor productivity. Success, in other words, was the result of an across-the-board effort to mobilize resources.

Financing the War

The effort described above was produced by a great flood of money that poured out of Washington and affected, ultimately, every town and hamlet in the country. In this section I will focus first on how the government raised the financial resources it needed, and then on the inflationary consequences of its financial policies.

Taxes, Bonds, and Money

It is a commonplace that there are three ways of financing government spending: taxes, borrowing, and printing money. This is, to be sure, a simplification that ignores other sources of finance that may be important during wartime, including the liquidation of existing assets, the commandeering of resources both domestically and from conquered nations, voluntary contributions both

domestically and from abroad, and even financial transactions such as the refinancing of government debt.

In the United States during World War II the most important form of commandeering was the drafting of men into the armed services. The difference between the pay draftees would have required to serve voluntarily and what they were actually paid was a tax that went unreported in the standard financial accounts. Similarly, the difference between what true volunteers could have earned in the civilian sector and what they earned in government service could be considered a gift to the government.²⁹ Despite these and similar qualifications, the traditional tripartite division is useful for understanding how the War was financed.

In a world in which money consisted solely of paper issued by the government the calculation of the tripartite division would be straightforward. Taxes would be measured by tax receipts, borrowing by the interest bearing debt issued, and money creation by the amount of paper money issued. The existence of the banking system, however, creates an additional complication. When the government prints paper money or creates deposits for itself on the books of the central bank, the banking system receives additional reserves that it uses to expand its asset holdings while creating additional deposit money. Or as it is sometimes put, the government shares the seignorage with the banking system. Thus, part of the interest-bearing debt issued by the government, the part held by banks or by individuals who have financed their acquisition of debt with bank loans, must be considered as financed indirectly by money creation.

If one assumes that all government debt acquired by commercial banks was financed by money creation and that none of the debt held by the public was so financed then we get the following results. On average during the years of large wartime deficits (1942-1945) taxes accounted for 47 percent of total spending, money creation 26 percent, and borrowing from the public 27 percent.³⁰ The monetary share can be further divided into spending financed directly by government created money (6 percent) and spending financed indirectly by money created by the banking system (20 percent).

Each bar in Figure 12 shows the year to year change in government spending and how it was financed. Taxes could finance only about one quarter of the increase in spending between 1941 and 1942: it takes time to legislate, levy, and collect new taxes. The tax fraction increased rapidly to over 50 percent between 1942 and 1943. And between 1943 and 1944 the increase in taxes was sufficient to permit a reduction in the reliance on printing press. But the further increase in spending between 1944 and 1945, partly the result of the unexpectedly strong resistance put up by the Germans and Japanese, required increased reliance on money creation, so that with respect to reliance on the printing press 1944-45 appears to be something of a reprise of 1941-1942.

Orthodox thinking at the time held that wars should be financed by taxes, or as it was usually put on a "pay-as-you-go" basis.³¹ This view was shared across the political spectrum. Printing money was frowned upon because it was thought to be inflationary. Debt finance was frowned upon because it was thought

to burden future generations, which included, most importantly, the young men and women who were now fighting the War, and would later be called upon to repay the debt. But the reality of war finance, as we have seen, was somewhat different. The basic problem was that even in wartime, and even when there was a strong philosophical consensus in favor of tax finance, it was hard to raise taxes. First, there were real technical problems in raising taxes quickly. Second, politicians were not hobbled by the need for philosophical consistency. When faced with a vote on a tax increase, a politician could easily forget the burden on future generations and remember the disincentive effects of higher taxes.

Money and Inflation

Between June 1939 and June 1945 the stock of money (M2) increased by a factor of more than 2.5, from \$48.4 billion to \$125.3 billion. Most of the increase can be accounted for by changes in the monetary base by a factor of 2.40, from \$17.3 billion to \$41.6 billion.

The increase in the monetary base for the war period as a whole can be explained in turn by the decision to finance part of the War by printing money. But during the national defense period the dominant force behind the increase in highpowered money was the increase in the stock of monetary gold which increased from \$13 billion to \$22.7 billion between 1938 and 1941 before levelling off for the remainder of the War. Cash and carry and the arrival of private capital seeking a safe haven explain the rapid increase in

the stock of monetary gold before Pearl Harbor. Both factors were brought to a halt by American entry into the War. Indeed, because of the halt in the expansion of the stock of monetary gold, the increase in highpowered money was actually less in 1942 than it had been in the years immediately preceding.

The increase in the stock of money in turn produced intense inflationary pressures. To some extent these pressures were contained by price controls and rationing, particularly during 1943-1945.³² When controls were released in 1946 there was a considerable jump in prices. Part of this jump, however, was a mirage. During the War the official price indexes understated the true inflation because they did not fully adjust for quality deterioration, black markets, rationing constraints, and so on. Immediately after the War the indexes overstated inflation because they did not adjust for the return to normal quality levels, the disappearance of black markets, and the elimination of rationing. This is why the indexes that make an allowance for these factors, columns (3) and (4) in Table 11, show a smaller increase between 1945 and 1946 than the other indexes.

Full equilibrium was not reached in 1946. Between 1938 and 1947 (the first full postwar year for which we can rule out any distortion in the price indices produced by controls) most of the price indices in table 11 show an increase of around 50 percent. Over the same period M2 grew about 117 percent and real NNP about 43 percent. The increase in money per unit of output, 74 percent, therefore considerably outdistanced the increase in prices. The

resulting monetary "overhang" probably reflected an understandable decision to delay the final dispersal of wartime accumulations: the overhang was gradually run down during the early postwar years.

The Long-Run Consequences of the War

Measuring the costs (and benefits) of World War II is, as John Maurice Clark wrote with respect to World War I, "either a relatively simple matter of tabulation and fiscal allocation; or else it is an economic problem of insoluble difficulty."³³ Like Clark, all I can offer are a few calculations that may shed some additional light on a complex issue. Subsection A, based on the work of Kendrick and Denison looks at the direct impact of the War on the stocks of human and physical capital. Subsection B estimates the cost of the War by comparing the actual path of consumption in the War and postwar years with a counterfactual path based on the assumption that the War was avoided. Subsection C looks at the relationship between the War and the change in macroeconomic regimes, what I believe was the most enduring legacy of the War.

Adding Up the Costs of the War

Human capital losses were undoubtedly the most important direct losses; damage to the physical capital stock was relatively small -- the most important losses being ocean shipping. The most straightforward way of calculating the loss of human capital is to compute the present discounted value of the future earnings of the

men and women killed in the War and the loss in earnings of those who were partially or totally disabled.

To get a crude measure I assumed that the typical soldier or sailor entered the military at age 18 in 1941, and that barring injury or death, this individual would have earned the average real earnings in the economy in each year of his or her working life, and then would have retired at age 65. I then adjusted those earnings for the expected death rate for civilians, and discounted the result at an interest rate of 5 percent. Multiplying the expected lifetime real earnings by the number of people killed (364,111) yielded a total cost for men and women killed of 12.9 billion in 1940 dollars. The total number of men and women suffering non-mortal wounds was 281,881. I assumed that the earnings capacity of each wounded man or woman was reduced, on average, 25 percent, yielding a total of 2.5 billion in 1940 dollars in diminished work capacity resulting from wounds. The total loss from war-related deaths and injuries thus came to about 15.4 billion.

A number of technical questions could be raised about this calculation, as well as the philosophical question of whether it makes sense to put a dollar value on a human life. For one thing, the calculation assumes that veterans earned the average income of all employees. In fact, veterans typically earned more on the job and suffered less unemployment than nonveterans, partly because women and African-Americans were under represented in the veteran population.³⁴ The ability of the United States to replenish losses

of labour through immigration (including highly skilled labour -- this was the era of the "brain drain") raises a further problem. U.S. losses were spread throughout the world economy in the postwar period to the extent that the places that would have been filled by men killed or injured were filled instead by additional immigrants. The distribution of income within the United States was undoubtedly different from what it would have been had there been no War. The extent to which total output of the economy was altered, however, is debatable.³⁵

Leaving these doubts and qualifications to one side, however, the estimate of 15.4 billion appears reasonable. It amounted to about one quarter of consumption in 1940; and to about 10 percent of the Goldin-Lewis type estimate of total losses.

To the extent that American economists think about the long-term effects of the War on the labour force, it is probably more in terms of the increase in human capital than the loss of life. The increase in the educational attainments during War were relatively small, but they are, nonetheless, surprising given the war effort, and they ushered in a period of rapid improvement. Perhaps, the best way of seeing this is by considering Edward F. Denison's index of the amount of education, measured by its ability to produce output. Denison constructed his index by weighting years of schooling by the relative earnings of each level of schooling. This index rose from 100 in 1941 to 103.3 in 1947, to 107.1 in 1953, and to 111.2 in 1959. In 1948, according to Denison, 8.8 percent of the male labour force had 4 or fewer years of schooling; by 1959, this

group had fallen to 5.8 percent.³⁶ Even more dramatic were the changes at the other end of the education distribution. In 1948, 12.3 percent of the male labour force had 1 or more years of college; by 1959, this group had risen to 18.3 percent. By 1976, the last year in Denison's table, the percentage of males with one or more years of college had risen to 32.5 percent.

The education revolution cannot be attributed primarily to the War. The growing faith in education, and particularly higher education, as a way of bringing everyone into the mainstream of American life had produced important developments, such as the high school movement and the land grant college acts, long before the World War II. But the "G.I. Bill of Rights" (officially, the Servicemen's Readjustment Act of 1944) undoubtedly accelerated the expansion of higher education. The bill provided help to veterans in a number of ways: medical care, low interest home mortgages, vocational rehabilitation, job placement, unemployment benefits, and stipends that covered tuition and living expenses for veterans attending trade schools or colleges. The educational benefits were viewed as a double-edged sword. They would help veterans upgrade their skills, while keeping down the number of job seekers in what was expected to be a weak postwar job market. Overall some 10 million veterans received educational benefits between 1944 and 1956, when the program ended.

While the G.I. Bill did contribute to the postwar boom in higher education, this can at most explain only a small share of the postwar prosperity in the United States.

A similar conclusion could be drawn concerning other changes on the real side of the economy. While wartime construction of plant and equipment did partially offset the decline in private investment spending during the War, it is likely that had a similar boom taken place in peacetime the increase in the capital stock would have been much larger.

It is true, as often pointed out, that the United States gained a temporarily favorable position in world trade compared with some of its chief industrial rivals as a result of the War. But the United States was not export oriented. In 1929 exports were 4.4 percent of GNP; in 1949 they were 4.6 percent. It is doubtful that war related improvements in the terms of trade affecting such a small part of the economy could be the key to prosperity.

The most likely explanation for the postwar prosperity, in my view, was the change in the macroeconomic regime that prevented a recurrence of the sort of financial crisis that had undermined prosperity in 1930-1933.

An Alternative Approach

Some years ago Claudia Goldin and Frank Lewis measured the economic cost of the American Civil War by discounting the differences between the actual flow of goods and services to consumers and a counterfactual flow based on the assumption that the War was avoided, a technique, that as far as I know, they originated.³⁷ The idea is that the loss of life, the destruction of physical capital, the disruption of trade relations, and so on

that occur during a war are important only to the extent that they reduce the flow of consumer goods in the long run below what it otherwise would have been.

In the illustrative estimate that is shown in table 12 I made the following five assumptions.

1. An aggressive monetary and fiscal policy would have produced a vigorous economic expansion between 1941 and 1946, even if the War had not occurred. It is possible to argue, of course, that in the absence of the War, the Depression would have dragged on indefinitely. In that scenario attributing any cost to the War via foregone consumption becomes problematic.

2. In 1946, if there had been no War, real GNP would have been equal to the level that obtained in 1943. In other words, I assume that the counterfactual real GNP in 1946 resulting from a vigorous peacetime boom would have been higher than actual real GNP in 1946.

3. The gap between the counterfactual GNP and the actual GNP would have gradually narrowed and almost disappeared by 1960. In other words, I assume that 1960 was an equilibrium year in the sense that the economy had returned to "desired" levels of capital and labour. As N.F.R. Crafts pointed out in his insightful comments, this is a strong and controversial assumption. Some modern growth theories imply that consumption would have remained permanently higher, but the issue has not been resolved.³⁸ What this controversy shows, however, is that the whole subject of measuring war costs needs to be re-evaluated in the light of modern growth theory.

4. In the absence of the War the ratio of consumption to GDP would have been .60 from 1941 to 1950; after 1950 I use the actual ratio of consumption to GDP. (The ratio was .59 in 1941, the last prewar year, and .61 in 1960, the fourth postwar cyclical peak.)

5. I discount differences between the counterfactual consumption path and the actual path with an interest rate of 5.0 percent, about twice the rate on corporate and government bonds during and after the War, and hopefully representative of the average rate of interest.

The result of this computation, the sum of the last column in table 12 is a cost of the War amounting to about \$148 billion at 1940 prices, about 2.27 years of consumption in 1941. This is actually a slightly higher cost than Goldin and Lewis estimate for the North in the Civil War (1.8 years), reflecting the greater intensity of mobilization during World War II.

The Postwar Macroeconomic Regime

The War played a major role in converting American macroeconomists to Keynesian economics. When the War began it was widely believed that the 1930s had shown that monetary policy was ineffective. The Federal Reserve had done its best, but -- "You can't push on a string." While a few diehards rejected this view, it was not until Milton Friedman and Anna J. Schwartz published A Monetary History of the United States that the profession as a whole began to rethink the view that monetary policy was ineffective. Meanwhile, Keynes's General Theory had convinced a

brilliant generation of young American economists that increased government spending could restore and maintain full employment. The case for Keynesian policies, however, remained a theoretical one in the late 1930s: Deficit spending under the New Deal had not cured the Depression.

The War provided the missing evidence. As Herbert Stein shows, by the end of the War a large segment of the economics profession and the general public had been convinced that full employment should be a major policy objective of the federal government, and that this objective could be achieved by fiscal policy.³⁹ The War, of course, had also produced an extraordinary increase in the stock of money, but monetary policy had been discredited by the Depression. Alvin Hansen's stagnation thesis, moreover, had argued that wartime levels of federal spending were not a temporary aberration: If private investment was permanently depressed then high and growing levels of government spending would be needed to fill the gap.

The wartime experience, however, was not sufficient to satisfy all economists that fiscal policy should be used to maintain full employment because wartime deficits were created simultaneously with less attractive policies: During the War inflation had been checked to an extent by wage and price controls, and rationing. Direct controls were not part of the Keynesian promise, and in the early postwar years many American economists were concerned that Keynesian economics might, nevertheless, require a permanent set of direct controls. As Paul Samuelson put it in the first edition

(1948) of his classic textbook, "The war years have shown fiscal policy to be a very powerful weapon. Indeed, some would argue that it is like the atomic bomb, too powerful a weapon to let men and government play with; that it would be better if fiscal policy were never used."⁴⁰

But the early postwar experience seemed to suggest that direct controls could be avoided. An initial surge in inflation was followed for several years by fairly stable prices and relatively full employment. Alvin Hansen made this point explicitly in his influential A Guide to Keynes.

Keynesian critics, however, have exaggerated the dangers of inflation and wage control in a full-employment society. The price inflation of 1946 - 1947 in the United States was a product of the war, not a test of peacetime full employment. Indeed from January 1948 to December, 1948, the United States enjoyed full employment without inflation despite the absence of price and wage controls.⁴¹

The evidence, in retrospect, was slim. But together, the war years and the early postwar years seemed to show that full employment could be maintained without inflation or direct controls. For the next three decades fiscal policy was used, although not consistently, to maintain full employment. The major enemies of economic growth in the United States, disastrous slumps and long periods of lagging demand, were avoided.

For economists who analyze macroeconomic fluctuations from a monetary standpoint the ascendancy of Keynesian economics may seem to make the postwar prosperity more rather than less mysterious. But there is a connection between the ascendancy of Keynesian

economics and postwar monetary policy. Although Keynesian economics, as it was then understood in the United States, downplayed the role of monetary policy it did not eliminate it altogether. Monetary policy was assigned the marginal task of fighting recessions by keeping interest rates low. Keynesian economics, in other words, although it did not think monetary policy important, did insure that monetary policy would be used to fight recessions aggressively. Again the result was to build in a bias toward inflation, while making sure that neither a disastrous slump nor a long period of lagging demand sapped the natural vitality of the economy.

In addition to the revolution in economic thought, three institutional changes reduced the probability of a paralyzing financial crisis. (1) Deposit insurance, introduced in 1934, reduced the likelihood that individual failures would spiral into full-blown panics. (2) The accumulation of federal debt by banks during the War greatly strengthened their balance sheets, bringing them a long way toward the once utopian dream of 100% reserves. (3) The accumulation of a good share of the world's stock of monetary gold during the War, particularly during the years of neutrality, and the monetary arrangements established under the Bretton Woods agreement that made the dollar the most important international reserve currency, effectively freed the Federal Reserve from the real and psychological constraints of the gold standard.

Together these changes made the combination of banking panic and federal reserve passivity that had produced the Great

Depression a thing of the past. Macroeconomic stability, in turn, had further affects on the economy. Investment spending, for example, must have been encouraged by the new regime. But space does not permit us to explore this effect. The new active approach to monetary and fiscal policy contained within it an unhealthy bias toward inflation, but that is another story.

Conclusion

While the dramatic collapse between 1929 and 1933 has been studied and re-studied, the equally dramatic expansion between 1939 and 1943 has been neglected. This is unfortunate because the War contributed nearly as much to reshaping the political economy of the United States as did the Great Depression. As a result, while economic historians can usually divide the Great Depression into a long list of phases, they usually tend to think of the War as an undifferentiated lump. At times this leads to a misunderstanding of the wartime experience.

The neglect of the surge in the economy in 1940 and 1941 leads to an exaggeration of the amount of unemployed resources available when conversion moved into high gear in 1942. Instead, the U.S. relied on variety of means to increase production: the labour force participation of men and women increased, labour was drained from low-wage occupations, hours of work were increased, private domestic investment was reduced, and so on. The focus on the War as an undifferentiated whole has also led economic historians to downplay the role of the printing press in war finance. Beginning

with the Civil War, the printing press has been a stopgap method for financing wars that was phased out as tax increases become productive, and so it was in World War II.

It is natural for economic historians to focus on the material legacies of the War -- on losses of physical and human capital, on changes in the terms of trade, and so on. A close look, however, shows that the most long lasting legacies may have been intellectual and institutional: a new macroeconomic regime that reshaped monetary and fiscal policy and profoundly influenced employment and inflation for decades afterwards.

Figure 1

GUNS AND BUTTER IN WORLD WAR II

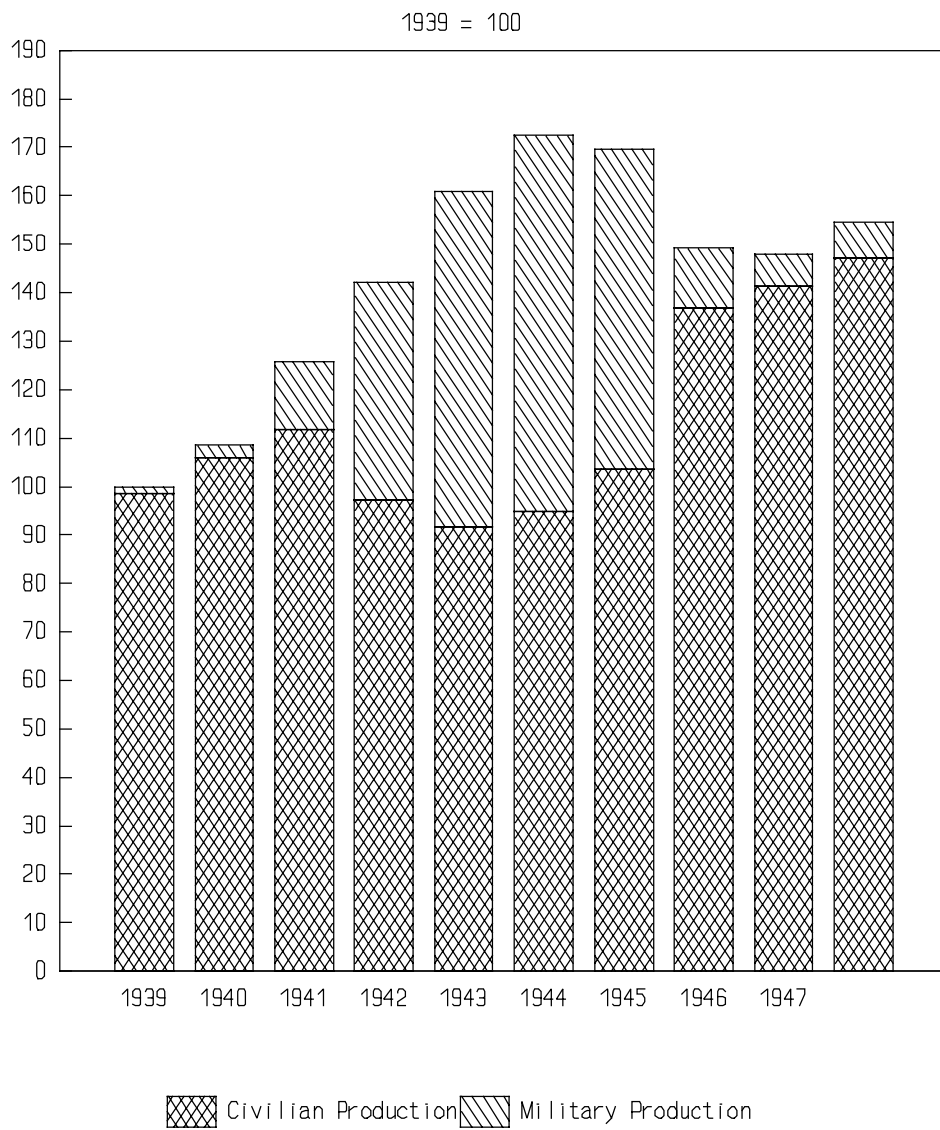


Figure 2

GNP by Type of Expenditure

Billions of 1958 Dollars, 1938-48

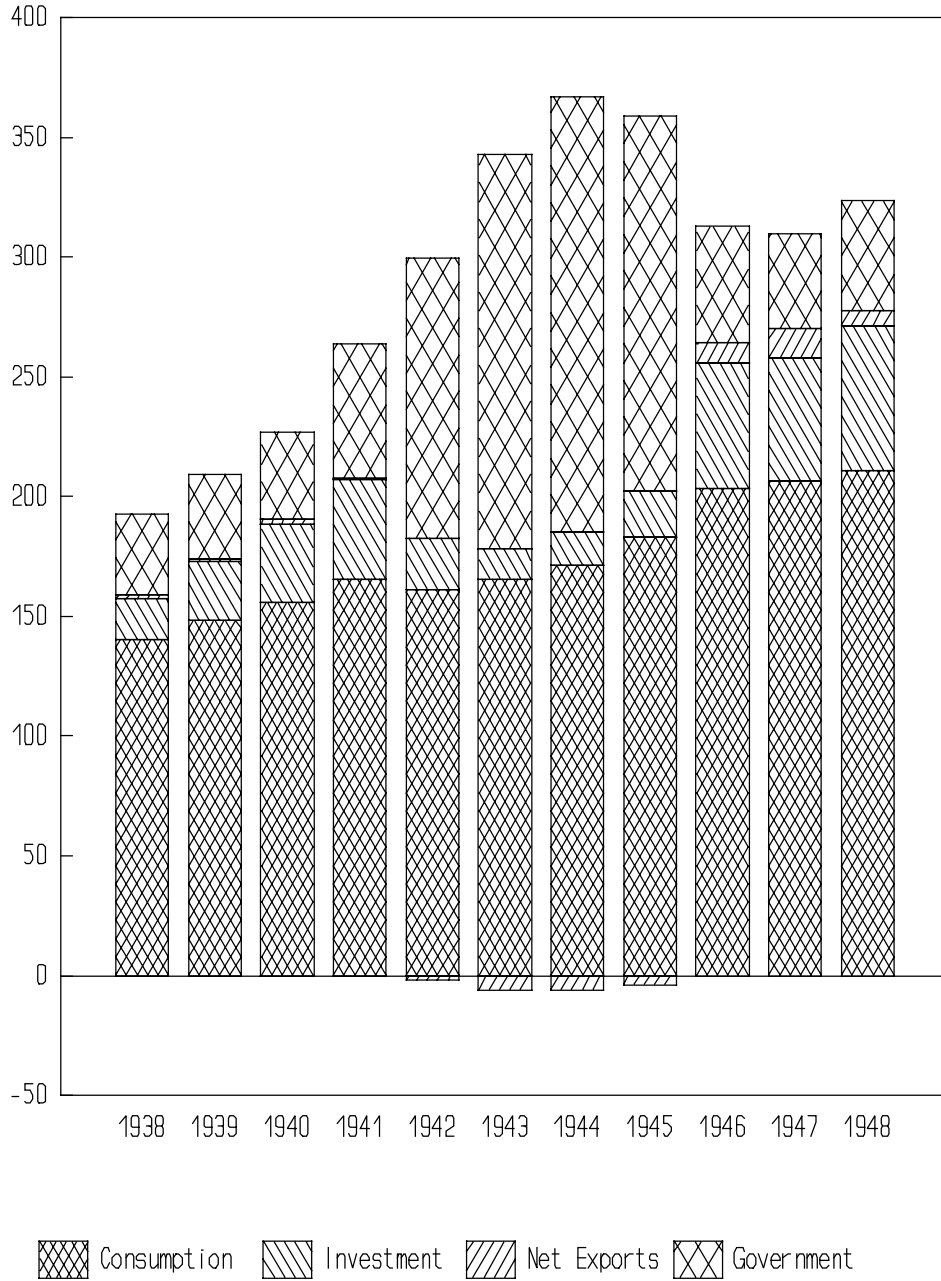


Figure 3

Alternative Measures of War Spending

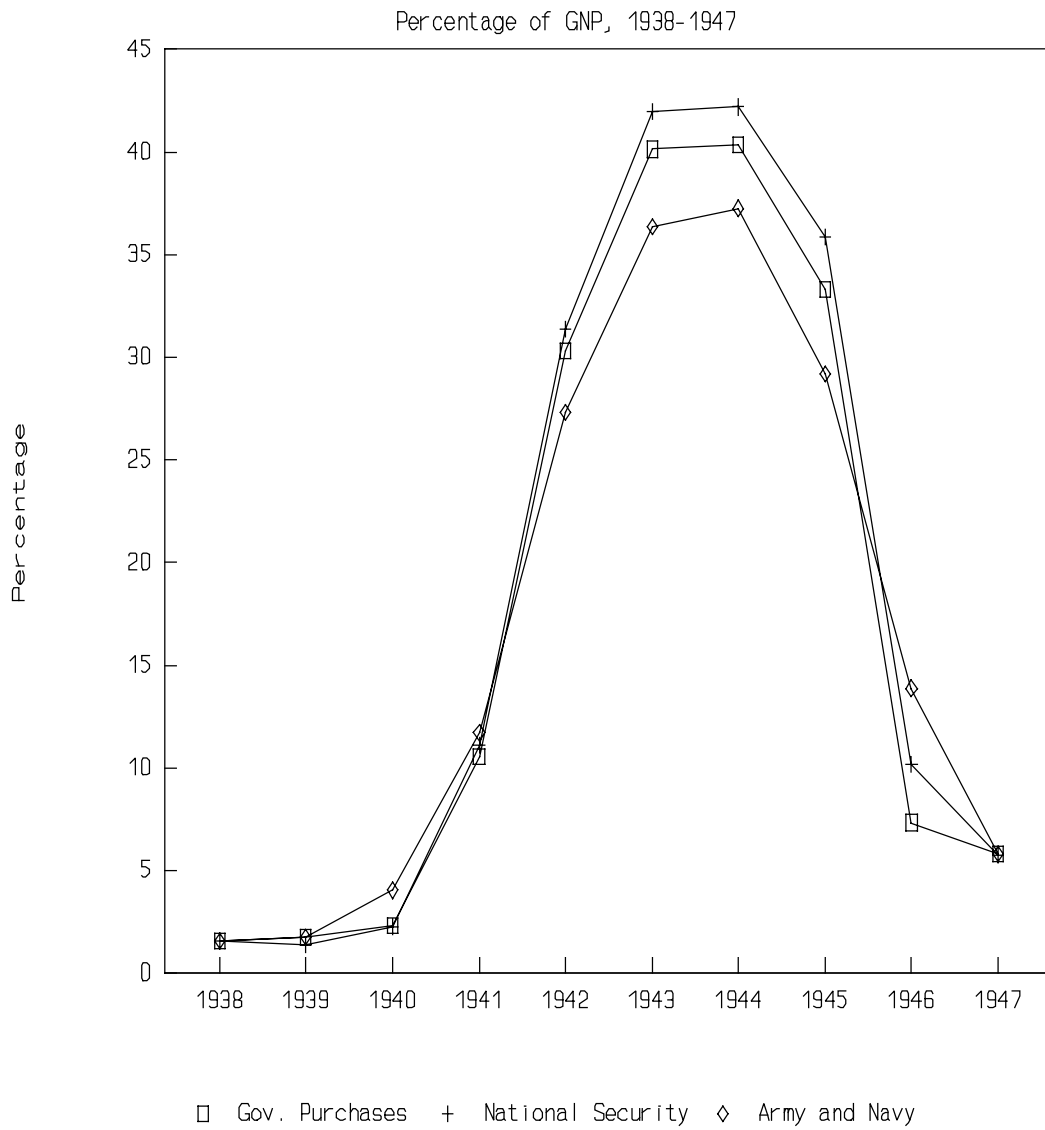
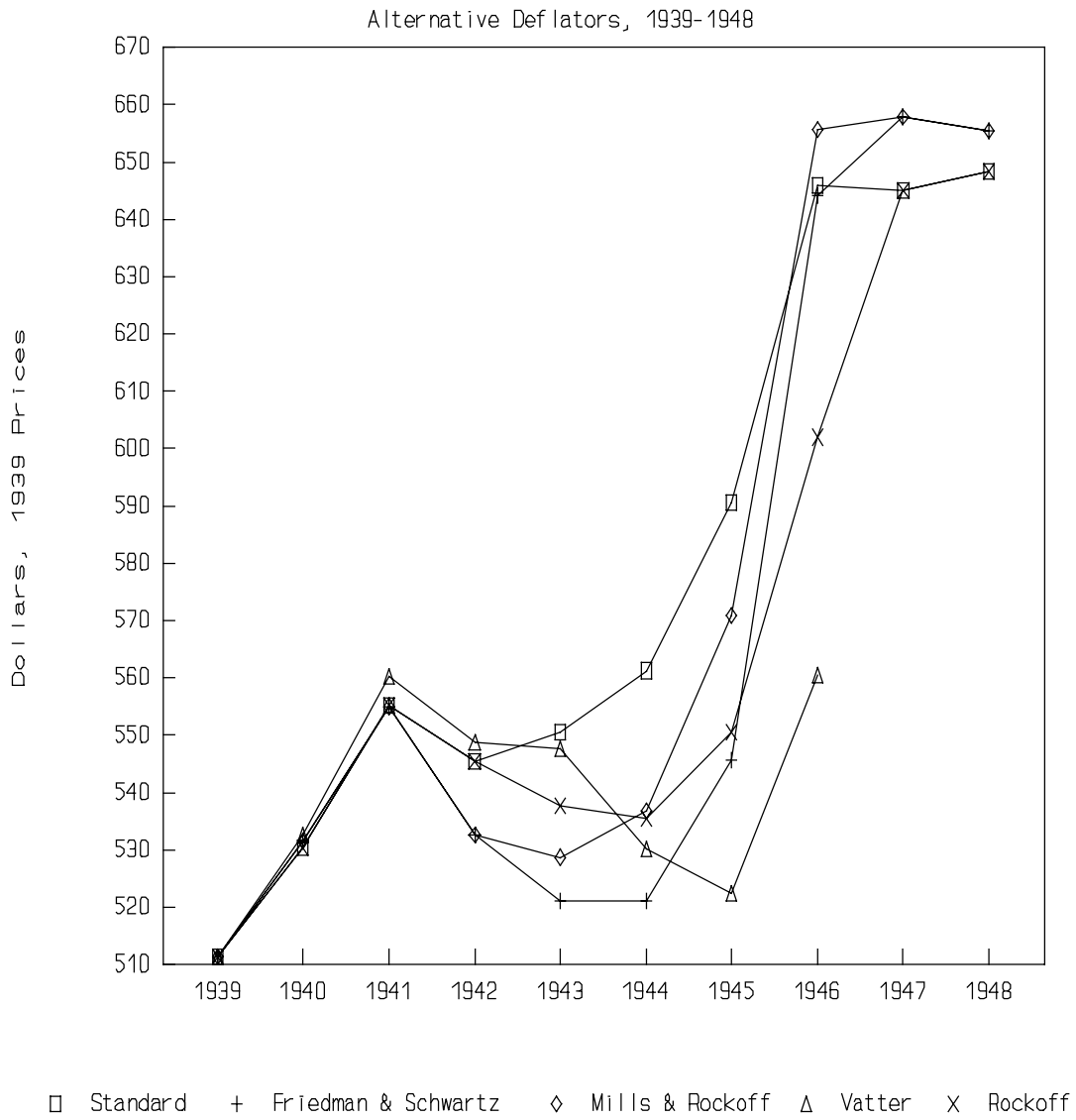


Figure 4

Estimates of Per Capita Consumption



Exports and Imports, 1938-1948

