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SYMPOSIUM

The economic consequences of U.S. mobilization for the Second World War: Reflections on the symposium

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The central arguments of my book are first, that contrary to conventional wisdom, productivity in U.S. manufacturing declined during the Second World War, and second, that little of the learning associated with producing military durables had lasting supply-side benefits. The main reason productivity declined was that the war forced sudden, radical, and ultimately temporary changes in the product mix. The main reason the benefits of learning failed to endure is that most were product-specific, and soon after or in some cases even before VJ day, the United States stopped making most of the goods whose production had given rise to the learning.

These arguments are based on a blend of statistical and narrative evidence. Most who have read the book, and many who haven't, find them persuasive. Within this group are participants in this symposium, as well as readers and reviewers on Amazon and elsewhere. But not everyone is on board. Bob Gordon, for example, remains a skeptic. I take this opportunity to consider why some might continue to have reservations and why I believe the arguments stand. I discuss as well some of the avenues for future research suggested by contributors to this symposium.

The most important calculations I make are of labor and total factor productivity (TFP) in U.S. manufacturing in 1941 and 1948. Over the interval, I find that labor productivity grew hardly at all and TFP declined at −1.40 percent per year. This supports my conclusion that the experience of war mobilization played at best a minor role in establishing the supply foundations for the golden age of U.S. economic growth (1948–1973), most of which were already in place in 1941.

Estimating output and productivity trends involves inherent challenges that are particularly severe during wartime, when the output mix can change drastically. 1941 to 1948 is a comparison of one peacetime year to another and is less subject to these concerns than are estimates of year-to-year changes between 1941 and 1945.

To claim that 1941 and 1948 are, from an economic standpoint, both peacetime years may seem surprising. One of the several misconceptions I dispel in the book is the view that the U.S. economy was close to fully mobilized at the time of Pearl Harbor. It was not. Despite British (and before its collapse) French aircraft orders

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and funding of plant construction, despite the passage of the Selective Service Act in September 1940 and Lend-Lease in March 1941, barely five percent of total U.S. real defense spending between 1940 and the end of the war had taken place by December 1941. Of the over 300,000 aircraft produced in the United States between these years, only 1 in 12 (and by no means the largest and most expensive) had been completed at the time of Pearl Harbor. Similarly, military headcount rose from 330,000 in 1939 to 1.6 million in 1941, but most of the increase to a peak of over 12 million in 1945 lay ahead. In December 1941, there was still little or no consumer or producer rationing, aside from machine tools, and almost all of the apparatus of wartime control was still to come. As two Commerce Department economists wrote during the war, "before Pearl Harbor the rearmament effort was still small enough to leave the civilian economy essentially undisturbed" (Gilbert and Jaszi 1943: 10).

For output, I deflate value added in durable and nondurable manufacturing by the personal consumption deflators for these two components during the relevant years, and then sum. I calculate the growth of labor input by summing the growth rate of manufacturing full time equivalents (FTEs) and the growth rate of weekly hours. I make no effort to adjust for labor quality in either an upward or downward direction. It has often been argued, as alluded to by Peter Meyer in his comments, that the wartime expansion of the civilian labor force to include more women, teenagers, and older workers diluted its levels of skill and experience. Women, however, were prized for their dexterity in electronics and small parts assembly, and their smaller size was valued for such tasks as pulling cable through fuselages in airplane assembly. And because of the radical shift in output mix, product-specific skills derived from prior manufacturing experience lost value and weakened a productivity differential that men might have brought to wartime manufacturing.

With respect to capital input measures, Meyer calls attention to the distinction between the value of a capital good and the value of its service flow, a distinction that becomes particularly important if, as I do, one rejects the assumption of geometric depreciation favored by Jorgenson and others (Jorgenson and Griliches 1967). This rejection means that, as the Bureau of Labor Statistics (BLS) recognizes, for physical capital goods, there will be a difference between age-wealth and age-efficiency profiles, and a related distinction between wealth stocks and productive stocks (U.S. Department of Labor 2020). Data limitations force me, along with everyone else, to begin with wealth stocks and assume implicitly that service flows change proportionately with them. However, I suggest that my capital input measures likely understate the true growth of capital services, because the capital stock was getting younger, because it contained an increasing share of shorter-lived equipment, and because much of this equipment became prematurely obsolete because it was specialized to the manufacture of goods whose life cycles were cut short by the end of the conflict.

I start with chain-type quantity indexes of the net private fixed capital stock in U.S. manufacturing. To take account of government-owned capital in U.S. manufacturing, I use Gordon's (1969, table 4) numbers on government investment in such capital, subtracting retirements, all in 1958 dollars. I then convert the time series for current-cost net stock of privately owned manufacturing capital into 1958 values for each year between 1941 and 1948 by multiplying each annual value by the

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ratio of the implicit GDP deflator for nonresidential fixed investment in 1958 to its value in the year in question. This values everything in 1958 prices and enables calculation of the ratio of government owned to privately owned manufacturing capital in each year during the war. Finally, I go back to the chained index series for private sector manufacturing capital and augment it by multiplying by 1 plus that ratio for each year. This increases manufacturing capital by about 8 percent in 1941, 27 percent in 1942, 41 percent in 1943, 50 percent in 1944, and 32 percent in 1948 and yields an estimate of 1941–1948 growth rate of manufacturing capital input of 6.75 percent per year, continuously compounded. Combining this series with growth rates of output and labor input in the fundamental growth accounting equation, and weighting capital growth by .3 and labor input growth by .7, yields manufacturing TFP growth of −1.40 percent per year between 1941 and 1948, as compared with 3.05 percent per year between 1929 and 1941. These findings buttress my conclusion that most of the supply-side foundations for the golden age were already in place in 1941 (for details and sources on these calculations, see Field 2022 : ch. 2).

There are understandable concerns about intra-war calculations. Between 1941 and 1945, prices and quantities of both inputs and outputs were heavily controlled. An even more serious issue is a new product problem on steroids. Although much of what the military bought consisted of commodities also sold to households, in 1944 roughly 40 percent of manufacturing went into munitions, which were not sold to households and did not face a true market test. One might question whether using personal consumption deflators is appropriate in this instance, at least for the munitions output. The difficulty is that alternatives may be worse.

The government began to develop a deflator for national defense expenditures in the late 1970s, which was then extended backward to include the World War II period. It shows prices declining. There is much data showing that, for particular durables, unit costs declined with cumulative output. But it does not necessarily follow that munitions prices were flat or declining. Many believed this during the war, but the issue was then highly contested, and important dissenters included a trio of NBER researchers: Solomon Fabricant (1952), Simon Kuznets (1944), and Geoffrey Moore (1944).

Consider a stylized version of the war economy whose only output was a sequence of heavy bombers. Imagine B-24 production coming to a halt, followed by a short interval during which special purpose machine tools are switched out, a new set installed, after which B-29 production begins, with much higher unit costs, which then decline. If one takes a glimpse at almost any part of this timeline (the exception is the period of changeover), one will observe declining unit costs, implying that productivity is increasing. But that doesn't necessarily mean that heavy bomber productivity will be higher at the end of the cycle.

The critical problem is how the output series for the two bomber models are linked, in other words, how the output of B-29s is to be expressed in B-24 equivalents (or vice versa). This requires a determination of how much of the higher price of B-29s (they in fact averaged about three times the price of B-24s during their respective production runs) can be attributed to quality improvements and how much to pure inflation. The more attributed to quality improvement, the lower will

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be the rise in a heavy bomber price index, and the higher will be the growth rate of heavy bomber output, and, perforce, productivity. Compared to the B-24, the B-29 had longer range (so it could take the war to Japan and return), larger payload capacity, a pressurized cabin, and an advanced computer-based fire control system. If a B-29 was truly the equivalent on average of three B-24s, then perhaps there was no inflation in heavy bomber prices.

But how is that to be determined? The BLS faces similar challenges in adjusting the CPI (a price, not a goods index) for new models and new products introduced during the intervals between base year changes. Most of the focus has been on automobiles and computers (Armknecht et al. 1996). In the former, manufacturers are asked for information on how much the new features added to production costs; if the new model prices rose more, the difference is attributed to inflation. For computers, hedonic regressions are used to estimate the value of quality improvements, and computer price increases are marked down accordingly. Neither method would work for the heavy bombers, since they were sold directly to the government and did not face a true market test. Did the Department of Commerce employees have some super-duper method for effecting this decomposition during the war? Sadly, no. We learn from Gilbert and Jaszi (1943 : 10) that due to the inadequacies of data, they simply assumed that munitions prices were flat.

The optimistic view on wartime productivity trends was and continues to be fueled by the learning by doing data. But in a situation in which the output mix is radically changing, unit costs may be falling for all currently observed products and yet we may still conclude that productivity was declining across the entire interval.

Another measure of output one might consider is the widely referenced Federal Reserve Board index of industrial production (Board of Governors of the Federal Reserve System 2024). But if one digs down, one finds that by 1944, more than half of that index was based on manhour input data marked up by assumptions, mostly optimistic and impressionistic, about productivity growth (Kuznets 1944 : 25; U.S. War Production Board 1945 : 2). Using this series is obviously questionable if one is trying to estimate productivity trends independently.

The year-to-year changes calculated during the war itself (Field 2022 : 206) are subject to greater uncertainty than the 1941 to 1948 growth rates. They do, however, map well onto conclusions drawn from analysis of narrative material and other data. In 1942 the United States transitioned from an economy marked by surplus to one plagued by shortages, producer hoarding, and production intermittency. These features of the wartime economy create a strong presumption that manufacturing productivity fell during the conflict. There is considerable evidence that improving efficiency ranked far down the list of priorities during the war.

Much research can be done to explore the external validity of this analysis. One avenue is to consider in greater detail the experience of other countries, as suggested by Jari Eloranta. Vincent Geloso is of a similar view and adduces supportive data from Canada. One can also compare the U.S. experience over the entire twentieth century, during which there were five major defense buildups: WWI, WWII, Korea, Vietnam, and the Reagan expansion. A 1946 BLS article concluded that labor productivity in U.S. manufacturing was lower in 1919 than it had been in 1914 (U.S. Department of Labor 1946). Combining data from the

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Korean, Vietnam, and Reagan episodes, Ramey and Shapiro (1998) concluded that the effects of defense spending shocks in the postwar period on manufacturing productivity were negative in the first years after the shock. This leads naturally to this question: Why should the productivity effects of mobilization for World War II have been different?

My implied counterfactual is that in the absence of war U.S. manufacturing would have continued the strong trajectory of TFP advance evidenced during the 1930s (Field 2011). David Mitch considers the possibility of a more immediate mobilization in 1942 and 1943. But it is hard to see how it could have been any more immediate than it was. Although 1944 was a lot bloodier for U.S. forces than the two preceding years, economic mobilization peaked in November 1943, well before D-Day. Indeed, absent what had been accomplished in 1942 and 1943, the cross-channel invasion could not have taken place when it did.

Both Geloso and Meyer observe that during wartime, the connection between GDP growth and welfare improvement is weakened. Agreed. But even if consumers would not voluntarily have chosen the product mix, we can still ask whether there were efficiency gains in manufacturing during the war and whether, if they occurred, such gains had a significant postwar impact.

Mitch suggests that "the heart of the book is about mobilization itself and the challenges encountered in mobilization as much if not more so than in downstream consequences for the economy." I can understand why he reaches this conclusion. But the motivating question for this study remains the impact of war mobilization on the postwar supply side ("downstream consequences"). A demonstration of declining industrial productivity during the war strengthens my argument that, from the standpoint of long run growth, the war was a detour. But I don't actually need that result to reach this conclusion. Even if one believes that during the war the chemical and metal fabrication subsectors as a whole became more (not less) efficient at turning inputs into outputs, the argument that most of this learning was product-specific, that we quickly stopped making the products that gave rise to the learning, and that therefore the war experience had relatively little postwar supply-side benefits will still hold.

Mitch also suggests that the war had a ratchet effect in permanently increasing the level of U.S. military spending as the country assumed the role of a superpower. This is, however, more a political than an economic consequence. The acceptance of military Keynesianism can be viewed as a consequence on the demand side, but, again, my emphasis is on the supply side.

While accepting most of my argument and highlighting some of the many areas in which the work could be extended, Hugh Rockoff suggests that the experience of mobilization increased the confidence of the United States in its ability to tackle big problems. As Rockoff acknowledges, it's hard to know how to evaluate this claim. There is a case to be made that, among government leaders, excessive confidence generated by overwhelming victory in World War II may have precipitated disasters such as the Bay of Pigs invasion and ultimately Vietnam. Perhaps, however, World War II does give us hope, bolstered by the rapid development and diffusion of COVID vaccines, that the United States can be a leader in addressing pressing problems such as climate change.

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