

Vital Lessons from the WWII Economic Mobilization

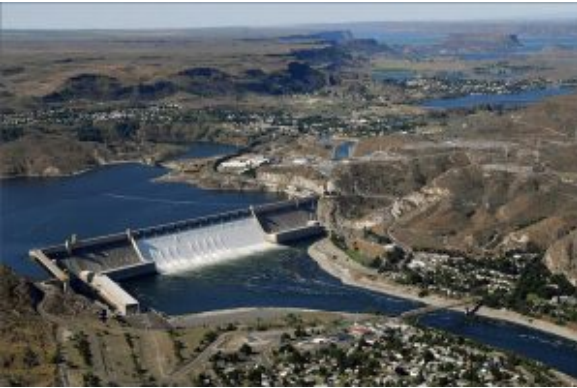
Sept. 11, 2018—In this final section of Stuart Rosenblatt's Lessons from the WWII Economic Mobilization, he presents three key conclusions from his indepth study of the 1939-1944 period. First, he discusses the components of the dramatic rise in Total Factor Productivity. Second, he recapitulates the means of financing the mobilization. Third, he draws some specific lessons which can be applied to our foundering economy today. The other parts of the series can be found at americansystemnow.com.

By Stuart Rosenblatt

Increasing Productivity

Perhaps the most important marker for the overwhelming success of the economic outpouring was the measurement of dramatically increased productivity. Unlike the current economic downslide, where productivity is stumbling around at .5% or less per year, during WWII productivity was in the 3-5% per year range. Author Robert Gordon in his landmark work, *The Rise and Fall of American Growth*, has much to say, some of it very original, on this crucial topic.

Gordon notes that there was a significant increase in productivity during the 1933-38 New Deal, as previous and new breakthroughs in technology were put to work in the economy. The two crucial elements were the new applications of the internal combustion engine, where the United States led the world, and of electricity, which played a decisive role in increasing energy throughput the economy. These applications are discussed in his book, as well as a [review](#) by this author.



The Grand Coulee Dam, one of the major power projects of the New Deal.

The 1933-38 New Deal was central to the success of the war-time mobilization. The massive construction of new infrastructure laid the basis for the increased output in the wartime period in many areas. Without the water and power projects it completed, there never would have been the mass airplane or ship construction, for example.

It was no accident that the main Manhattan Project facilities were located in regions served by the key water and power program of the New Deal, namely the [Tennessee Valley Authority](#) and the Columbia River Dam projects. New Deal construction programs helped in other ways as well. The Colorado River aqueduct program opened up Los Angeles to the defense effort; the Bonneville and Grand Coulee Dams supplied the airplane and shipbuilding efforts in the Northwest with power and water; the Public Works Administration and the Reconstruction Finance Corporation built the bridges, roads, and dams in the Midwest that led to those areas becoming the Arsenal of Democracy.

Gordon characterizes the period from the prewar mobilization (1939-1941) to the full war-time economy (1942-1945), as a "Great Leap." By 1944, war-time spending amounted to 80% of the entire economy of 1939. **Real GDP in 1944 was double that of 1939.** (Gordon, p. 536)

The first approximation of The Great Leap showed up in output

per person, which is equal to output per hour times hours per person. This was made possible by the dramatic increase in the input of capital newly developed and applied. The vast expansion of the nation's capital stock was largely paid for by the government directly, and the RFC and its seven major subsidiaries. New factories were built by the government and sold or leased to the private sector. The private sector also built facilities themselves. The massive infrastructure projects built by the government and the RFC during the 1930s continued during the war. Two charts from Gordon's book tell the story of the massive increase in productivity in the 1930s and WWII.

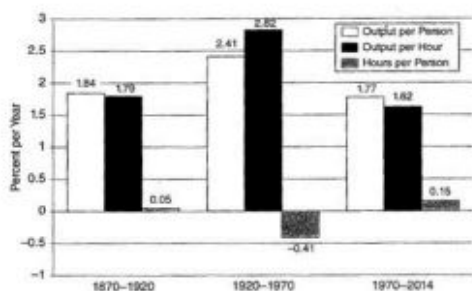


Figure 1-1. Annualized Growth Rate of Output per Person, Output per Hour, and Hours per Person, 1870-2014
Source: See Data Appendix.

Annualized Growth Rates of Output per Person.

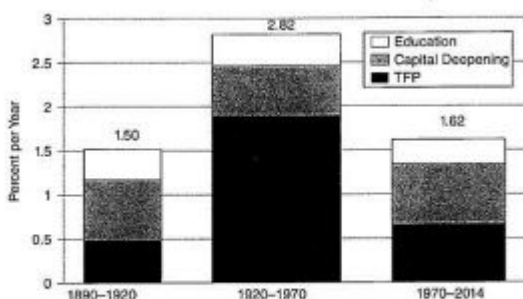


Figure 1-2. Average Annual Growth Rates of Output per Hour and Its Components, Selected Intervals, 1890-2014
Source: See Data Appendix.

Annualized Growth Rates of Output per Hour

Embedded in the increases in output is the concept of Total

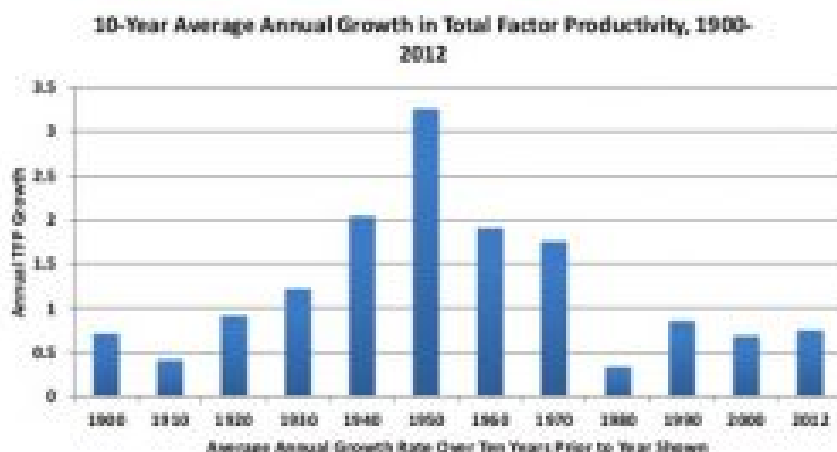
Factor Productivity (TFP), a [concept](#) used by government economists to deal with what they consider the intangibles determining economic growth. TFP is the best measure of the rate of increase in new technologies and their application, determining whether an economy will thrive or not. On the one hand, TFP measures the innovation and application of technological change; it also measures “the residual.” This latter is that factor of productivity increase driven by creative breakthroughs and all forms of their application during the course of production. It includes everything from harnessing hydroelectric power, to transformations in airplane engines, to the rate of exodus of labor from low productivity farm work to employment in a higher productivity industrial plant.

New technologies embody new creative breakthroughs. They are either elaborations of existing technologies, or whole new categories of technology, i.e. the change from plowing a field with a mule, to the use of a tractor. A higher level is the breakthrough into a new scientific discovery. The scientific achievement of understanding the functioning of the atom and harnessing it in the form of nuclear power exemplified such a breakthrough. This was accomplished as a “crash program” within the larger “crash program” of mobilizing to win WWII. This was a model for how future such breakthroughs, be they in space travel or achieving nuclear fusion, may be accomplished.

Gordon produced a new model of TFP growth during the 20th century. He measured all the ingredients that are baked into his product, including a revised measure of capital inputs and also real production output. He concluded that the 1930s witnessed a dramatic increase in TFP, as has been documented by Alexander Field in his 2012 book “A Great Leap Forward: 1930s Depression and U.S. Economic Growth”, but argued that this was far surpassed by the WWII economy. Measuring sheer output (forgetting that much was consumed in the course of combat), TFP was the highest in U.S. history during the

1941-45 period. Even accounting for military utilization, TFP in the domestic and industrial economy was the highest ever during this period, averaging at least 3.5% per year for the war decade.

How Did Innovation in the Past Compare with the Past 40 Years?



A graphic of total factor productivity in the 20th Century, showing the effects of the FDR banking policy.

Gordon correctly analyzes this breakthrough as an upshift in the real, physical economy from the 1933 New Deal to the War Mobilization. Among other factors, he points to the role of infrastructure building in the 1930s, and the continuous increase in capital equipment investment in the pre-war years. He says that “the ratio of equipment investment to the value of equipment capital was 13.6% in 1928, but rose above that to 14.4% in 1936, 16.1% in 1937, and 17.1% in 1941... Moreover the new capital investment of the late 1930s reflected continuing innovation. Railroad locomotives, tracks, tractors, and industrial equipment manufactured in the late 1930s were all of substantially higher quality than their counterparts of the 1920s.” (*Rise and Fall*, p. 548)

Gordon underscores the dramatic impact of the war economy,

“All the indexes of output, hours of work, and productivity soared during 1942-45. This is not surprising, for the entire economy converted to a maximum production regime in which every machine and structure was used twenty-four hours per day if enough workers could be found to staff three shifts.”
(*Rise and Fall*, 548-9)

The breakthroughs in shipbuilding technology and airplane construction were emblematic of the overall transformation, Gordon says. Liberty Ship construction time was reduced from eight months to several weeks, while Willow Run was producing fourteen B-24 bombers per day at a gargantuan plant designed to build only one a day!

As to the civilian economy, he shows that, despite rationing, the overall level of consumption and standard of living increased rapidly during the war years. Real consumption from 1941 to 1944 remained roughly the same, but **consumption during that time period was 28% higher than in the period 1930-39!** Gordon attributes this to the Great Leap in productivity in both sectors of the economy starting in the late 1930s.

Gordon underscores the role of the government as the driving force for investment and innovation, which it accomplished by both supplanting and complementing the private sector as the driver of new industrial investment from 1940-45. He singles out the construction of the two oil pipelines, “Big Inch” and “Little Big Inch” as examples.

Another crucial example that Gordon cites is the enormous investment made by the “government” (acting through the Defense Plant Corporation [DPC] subsidiary of the Reconstruction Finance Corporation [RFC]) in machine tool production. The number of machine tools doubled in the United States from 1940-45. He also restates the tremendous impact of productivity levels achieved in the myriad of defense industries which employed new technologies.

Embedded in the increase of TFP was the widespread expansion and utilization of electric power and the internal combustion engine. These were united in the assembly line factories put into place in many of the new industries. Motor vehicle horsepower tripled between 1929 and 1950, and total electricity production rose by over 300%.

Table 16-2. Horsepower of Prime Movers and Kilowatt Hours of Net Production of Electric Energy, 1929=100, Selected Years 1899-1950

	1899	1909	1919	1929	1940	1950
(1) Variable Depreciation Private Equipment Capital in 1950 Dollars	34	57	82	100	120	164
Horsepower						
(2) Automotive	0	1	16	100	176	309
(3) Factories	49	84	101	100	110	170
(4) Farms	13	34	76	100	156	231
(5) Electric Central Stations	5	13	33	100	134	220
(6) Average of Auto, Factories, Farms	20	40	64	100	147	237
(7) Ratio of Horsepower to Equipment Capital	61	70	79	100	123	145
	1902	1912	1920	1929	1941	1950
(8) Variable Depreciation Private Equipment	39	63	84	100	123	164
Kilowatt Hours						
(9) Industrial Establishments	14	54	70	100	177	242
(10) Electric Utilities	3	13	43	100	178	357
(11) Total	5	21	48	100	178	333
(12) Ratio to Equipment Capital	13	34	58	100	145	203

Sources: HUS Colonial Times to 1957, Series S2, S6, S11, S13, S18, and S33.
Variable Depreciation Private Equipment Capital from the data underlying Figure 16-4.

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Gordon contradicts Field's analysis that electricity production reached its apogee in the 1930s. Rather, it accelerated through the war years and beyond. There were both new inventions, and drastically upgraded technologies like larger electric-generating boilers, which produced more power at a lower cost. The advent of new boiler technologies also allowed higher temperatures and pressures, further increasing productivity. Most of the breakthroughs were byproducts of the war mobilization, and the vast majority of new investments were funded by various arms of the government.

Most estimates of TFP are concerned only with private sector investment in new technologies and related equipment, and omit the government's input. Hence, conventional estimates of TFP expansion during the war are hopelessly in error. While appreciating the excellent analyses of Alexander Field and others, who argued that TFP growth was greater in the 1930s than during the war, Gordon disproves Field's conclusions.

With the government driving the investment, TFP grew faster during WWII than in any previous decade.

This was the great secret of the success of the WWII mobilization, viz. that investment in new technologies, in science driver efforts across the board, and application on a mass scale of innovations like the assembly line, generated a "Great Leap" unmatched before or since, in the U.S. productive economy.

Financing of the War Effort

World War II was mainly financed by the U.S. government. For five to six years "free market economics" was relegated to its appropriate place in the storage cabinet. This was both a "directed" economy and one focused by and large on physical wealth production. Since obviously much of the output was "consumed" on the battlefields, the potential increase in overall potential population density relative to new technologies, went largely unrealized.

Total federal spending increased dramatically as the war progressed. Gross Domestic Product in 1940 was approximately \$101 billion, and federal spending, mostly to ramp up war production, was \$9.4 billion. In 1942, federal spending was \$30 billion, in 1943 \$63 billion, and \$72 billion for both 1944 and 1945. Defense spending, as a portion of federal spending, increased from \$6 billion in 1941 to \$44 billion in 1943, and \$63 billion in 1944 and \$65 billion in 1945.

GDP rose simultaneously until by 1944 it was nearly \$175 billion, a 75% increase! **For the four years 1941-1944, GDP rose at a rate of over 12% per year!** At the same time, unemployment fell from 8% in 1940 to less than 1% in 1945. (*American Economy in WWII*).

Even though there were over 11 million soldiers under arms and deployed around the world, (15 million soldiers overall during

the war), in 1944 there was a concomitant increase in the manufacturing work force. While roughly 10 million people were engaged in manufacturing in 1939, that figure had jumped to 17 million by 1943. Industrial output had doubled in the same time period. All the while, unemployment fell to near 0%. (Freeman, RFC, p. 59, EIR)

How did the government pay for this surge?

Taxes: The first method was a broad extension of taxes. The first general income tax in American history was enacted even before the outset of hostilities in 1940, and extended in the Revenue Act of 1942. For the first time, people had taxes withheld from their paychecks. The numbers of Americans included in the tax plan rose from 4 million in 1939 to 43 million in 1945.

In 1941 taxes yielded \$8.7 billion, but in 1945 it was \$45 billion. Tax rates varied, but unlike today, tax rates were ramped up on the "upper 10%". The corporate tax rate was increased from 31 to 40 %, and the excess profits tax jumped up from 35-60% to a flat 90%.



A meeting of one of Kaiser's workforces. Full employment at decent wages built the tax base.

All told, taxes generated approximately \$137 billion out of

the total \$304 billion cost of the war. To make up the difference, the government created war bonds, and sold them to the American people. Ultimately 85 million citizens purchased the 2.9% ten year bonds, yielding \$185 billion. Banks and other commercial investors bought over \$24 billion as well.

Clearly, the overall expansion of the workforce and economy created a growing tax base. Wages were increasing, and productivity was growing at over 3% per year. Thus the debt created by the war could be serviced and paid, while the physical economy remained on a rising trajectory. This is precisely the opposite of today's collapsing tax base and falling incomes, which make funding anything increasingly difficult.

Investment: The other means of financing came from the unique but critical role of the Reconstruction Finance Corporation (RFC). This report has already developed the singular role of the RFC, stressing its functioning on the model of a Hamiltonian National Bank. However, it was funded by the Treasury, through appropriations of Congress, as opposed to the Hamiltonian model of trading Treasury or other debt for equity in the bank. As for disbursement, it was a gigantic bank, which utilized many traditional banking principles.

On June 25, 1940 Congress amended the original RFC legislation to enable the Corporation "to aid the Government of the United States in its national-defense program." RFC was allowed to create new corporations and purchase the capital stock of those corporations to address a broad range of necessities, including but not limited to: dealing in strategic materials, acquiring real estate and plant facilities for the manufacture of strategic and critical materials, arms, ammunition, implements of war, and equipment needed for their manufacture; leasing of plant facilities and selling them; engaging in manufacturing; acquiring and disposing of railroad equipment, commercial aircraft, parts, and supplies necessary to airplanes; training aviators; and taking any

other action deemed necessary by the President and the Federal Loan Administrator (Jesse Jones) to carry out the defense program. ([RFC Final Report](#) , p. 123)

To accomplish this, the RFC created seven corporations and acquired one other for that purpose. These included: Metals Reserve Company; Rubber Reserve Company; Defense Plant Corporation; Defense Supplies Corporation; War Damage Corporation; U.S. Commercial Company; Rubber Development Corporation; and Petroleum Reserve Corporation.

The RFC financed all its subsidiary companies in the same manner: It purchased capital stock of the company, and loaned money to the company to run its operations. The RFC borrowed from the Treasury, generally at a low rate, and bought capital stock in the company as well as loaning money to the subsidiary. Surprisingly, much of the money was repaid, and generally that which was not was cancelled by the government. **Approximately two-thirds of the outlays were recovered**, which, given the immense sums involved, and the experimental nature of many of the projects, was no small accomplishment.

The RFC coordinated its operations directly with government agencies involved in the war effort. Let us outline some examples.

The **Metals Reserve Corporation (MRC)** was organized under the authority of the June 25, 1940 Act with a capital stock of \$5 million, and the RFC subscribed to the entirety. Further, the RFC loaned the Metals Reserve Corporation \$2.4 billion during the war, which it used to stockpile key metals and minerals, and pay subsidies to producers of those materials. MRC was deployed by a number of Government agencies, including the War Production Board, Office of Price Administration, the War and Navy Departments, etc. It ultimately disbursed \$2.75 billion in acquiring critical metals and minerals from the U.S. and around the world.

The MRC was able to sell much of its inventory to the various departments of the government and private businesses. It repaid all but \$665 million to the RFC. The notes that were ultimately unpayable to the RFC and Treasury were cancelled after the war.

The **Rubber Reserve Company (RRC)** was also organized in June 1940, with a capital stock of \$5 million, which was subscribed to by the RFC. During its existence, Rubber Reserve borrowed \$1.7 billion. Its purpose was to acquire and produce rubber to aid in the defense mobilization. It received policy directives from many Government agencies including: Departments of State, Commerce, Treasury, and Agriculture; Board of Economic Warfare; War Production Board, and the Departments of the Navy and Army.



A synthetic rubber plant
built during World War II

It became the sole importer of natural rubber, then the collection of scrap rubber, and finally the producer of synthetic rubber. It built 51 plants to produce synthetic rubber. The total cost was \$700 million, and construction was financed and supervised by the Defense Plant Corporation, (DPC) another RFC subsidiary.

The synthetic rubber plants were leased by the DPC to private companies for \$1 per year. The Rubber Reserve Company operated the plants jointly with the companies, under various arrangements. The rubber produced was sold to industrial

users.

The RRC received \$1.4 billion for its rubber and related products and filed to repay only \$300 million to the RFC, notes which were later cancelled after the war.

The **Defense Plant Corporation (DPC)** was organized in a similar way as the previous companies, and its \$5 million capital stock was also subscribed to by the RFC. But it was extremely large, and borrowed \$8 billion from the RFC to carry out its construction projects, as has been previously reported.

It built more than 2,550 facilities for the construction and equipping of manufacturing operations. It did not have to go through Congress for approval, and it built all types of manufacturing enterprises. Over 50% of its outlays went to aviation. DPC spent over \$4 billion on war planes. Metals production and processing plants accounted for \$2.2 billion, and \$1 billion of that went to enlarge steel capacity.

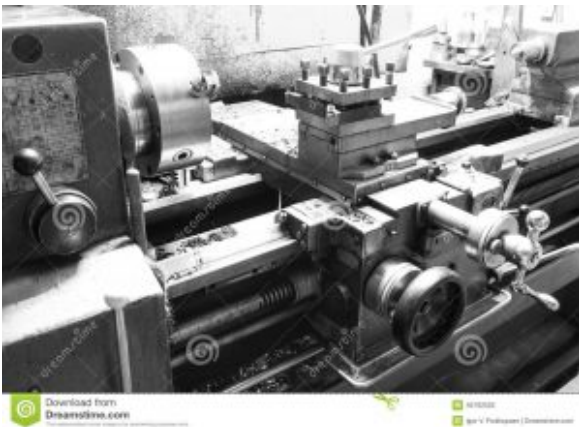
It also played a major role in ordnance, shipbuilding, and chemicals.

One of its most crucial areas of investment was the manufacture of [machine tools](#). DPC was in the middle of converting existing industry to war production, and deploying the brand new machine tools into newly finished buildings before the workforce even showed up.

The DPC was contracted to build factories by most Government agencies, viz. Department of Agriculture, Commodity Credit Corporation, Office of Strategic Services, Office of War Information, War Department, Treasury Department, etc. Many of its industrial projects were executed under "takeout" agreements with the sponsoring agencies. DPC would eventually be paid for its outlays, with approximately half being remunerated as the project progressed. The remainder would be received at a later date, when the sponsoring agency received funds from the Congress. DPC retained ownership of the

facility until the transaction was completed. DPC ultimately received \$1.3 billion on these arrangements, with a significant amount outstanding at the end of the war.

Much of the DPC investment was financed by leases of varying time frames and also rentals. Lease agreements with fixed rentals were preferred, but the magnitude of the investments and the instability of the war effort made collection very challenging.



A caliper lathe machine tool from the WWII era.

As to the crucial machine tool sector, the DPC created purchase agreements for the tool makers in order to underwrite their costs. It then orchestrated the sale of machines directly to producers and also agreed to take delivery of unsold machines at a discount.

Of \$2 billion in machine tool orders, DPC only had to take possession of \$27 million of machines due to non-payment. However, because of the overall nature of the investments, DPC was left holding the bag on significant outstanding debt.

This was due in large measure to the absolute stupidity of the post-war Truman administration, which refused to convert the war economy to a robust peace time industrial expansion, and ended up selling off or destroying many of the machines created for military purposes. Hence, much of the DPC

inventory was written off. The machine tool investment notwithstanding, DPC had additional investments of \$7 billion. Approximately \$2.5 billion was recovered through various lease and purchase arrangements, and the remainder was declared unrecovered and canceled after the war.

The **Defense Supplies Corporation (DSC)** was the other large progeny of the RFC. It was created in 1940 and capitalized by the RFC at \$5 million. It borrowed \$6.4 billion from the RFC. It stockpiled, bought, and deployed strategic, non-metallic commodities. It also paid significant subsidies to producers and transporters of strategic materials and also helped stabilize prices, including for consumers.

Like the other government companies, it was deployed by a myriad of Government agencies, including the War Production Board, Office of Price Administration, Board of Economic Warfare, Departments of the Army and Navy and other departments. Overseeing its price subsidies were the Office of Price Administration, Office of Economic Stabilization, Department of Agriculture and others.

Recovering outlays in the subsidy program proved extremely difficult for obvious reasons, but the DSC was able to get large repayments from the stockpiling/selling operation. DSC repaid \$4.8 billion to the RFC as a result of its trading operations, but still owed the RFC \$1.6 billion on other loans and capital stock. Those notes would also be canceled.

The RFC loaned at least \$23 billion through its subsidiaries, and \$9.3 billion of that was written off after the cessation of the war. This means that over \$14 billion was repaid. The two main categories of cancellation were the DSC's outlays for subsidies, and the DPC, which wrote off about \$5-6 billion.

Takeaways for Today

Some of the striking takeaway lessons from the WWII economic

mobilization are as follows:

First, the industrial expansion could not have succeeded without the previous six-year infrastructure program of the New Deal. The New Deal built the fabric of roads, bridges, tunnels, water projects, power stations, and other crucial programs that provided what is called a new platform. It was upon this platform, which itself kept expanding during the war, that the mobilization was erected.

Second, the success of industrial development depends upon the level and pace of technological advance. At the outset of the war, the United States was already the world leader in internal combustion engine technology. War-time conversion to equipment and munitions production was a herculean undertaking, but the preconditions were already in place. And the skilled and semi-skilled work force was also already trained, and these people contributed mightily to the war production effort.

Third, government leadership and direction for promoting scientific breakthroughs is a sine qua non. The totality of the combined infrastructure and manufacturing economy developed during the war represented what is possible any time the United States returns to a [Hamiltonian policy](#) of directed credit for industrial expansion. The economic mobilization that ensured victory in WWII was not a “free market” experiment. Quite the contrary, it was a “dirigist” “command economy”, where all major decisions on economic allocations were determined by the exigencies of winning WWII.



FDR and RFC
Chairman Jesse
Jones, key
collaborators for
the mobilization

This led to an integrated industrial effort whose underlying organizing principle was the application of the most advanced production techniques available, the development of new technologies, and the invention of whole new areas of scientific breakthrough. This latter was typified by the success of the Manhattan Project. The results of this “crash program” approach to winning the war through “production logistics in- depth” were impressive.

Fourth, full employment need not lead to inflation, and is compatible with rising living standards. As production was ramped up, GDP nearly doubled and unemployment fell dramatically. The U.S. military sent 15 million men overseas, heavily equipped, while the nation supported a labor force at literal full employment. The common misconception is that the pre-war unemployed workforce was absorbed by the military, but in fact, both the military and the labor force grew enormously. The manufacturing work force rose from 10 million people in 1939 to 17 million in 1944, and the civilian workforce stabilized at approximately 55 million throughout the war years.

Not only did employment rise, but **wages and living standards rose as well**, and due to various rationing and price control mechanisms, even inflation was kept in check. The usual projections of the Philips Curve (Employment and wages are inversely correlated) went out the window. Manufacturing workers saw their real income (purchasing power) increase 25% between 1940 and 1945. Income per capita in Washington and Oregon rose 40-45% from 1940 to 1948, and income in California rose 22%. (*American Economy during WWII*, Tassava, pp. 9-11) These substantial gains contributed to the dramatic rise in productivity.

Fifth, a successful program requires a credit institution not bound by short-term, miserly thinking, but directed toward in-depth physical economic growth. An absolutely indispensable vehicle which drove the effort was the role of the Reconstruction Finance Corporation and its subsidiary corporations. RFC was deployed by President Roosevelt as a *de facto* national bank. It proved decisive in many areas of the economic drive, especially machine tools, war plane production, the development of synthetic rubber, and other commodities. From a purely financial standpoint, the RFC never set out to "make a profit", yet by spurring economic expansion, in most of its investments it did precisely that.

Despite Truman's sabotage of a reconversion program that would have put the productive power of the war machine to work rebuilding the United States and the world after the war, the United States lived off the productive breakthroughs of that period until the Kennedy space program gave the economy another boost. While there are obvious shortcomings of a production and consumption effort devoted largely to winning a war, nevertheless, the WWII economic mobilization is a profound model for guiding our foundering nation out of the morass it has brought upon itself.