U.S. Productivity Growth: The Slowdown Has Returned After a Temporary Revival

Robert J. Gordon[1]
Northwestern University and NBER

Abstract

There was never any slowdown in productivity growth in U.S. manufacturing during the postwar period, and indeed there was an unprecedented explosion of manufacturing productivity growth between 1996 and 2004. But the share of the manufacturing sector in the total economy has declined from 30 to 10 per cent since the 1950s. The record for the other 90 per cent, consisting of all the economy outside of manufacturing, is far less encouraging; in non-manufacturing labour productivity growth fell from 2.95 per cent per year in 1948-72 to 1.29 per cent per year in 1972-96. After a brief revival to 2.63 per cent in the brief eight-year period 1996-2004, the growth rate slumped again to 1.47 in the past eight years. This examination of the data provides evidence that the revival of productivity growth associated with the dot.com revolution is over, that multifactor productivity growth in the total economy has returned to the rate achieved in the post-1972 slowdown years.

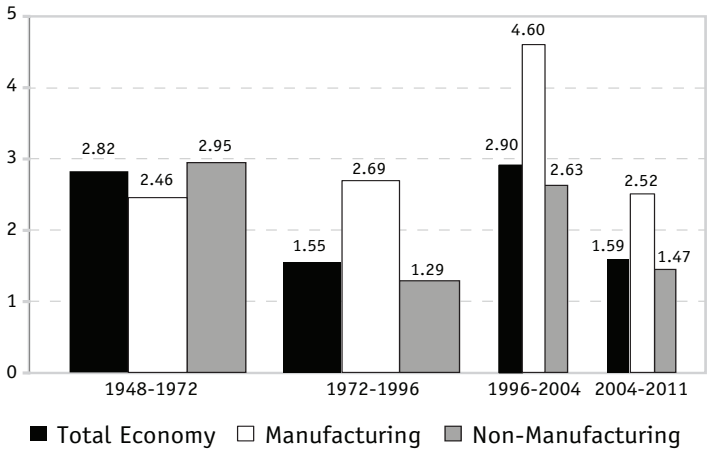
Résumé

Il n'y a jamais eu de ralentissement de la croissance de la productivité dans le secteur de la fabrication aux États-Unis pendant l'après-guerre et il y a effectivement eu une explosion de croissance sans précédent dans les industries manufacturières entre 1996 et 2004. Cependant, la part qu'occupe le secteur de la fabrication dans l'économie totale est passée de 30 à 10 % depuis les années 1950. Les statistiques pour l'autre tranche de 90 %, constituée de tous les secteurs de l'économie autres que la fabrication, sont beaucoup moins encourageantes : dans ces secteurs, la croissance de la productivité du travail a diminué pour passer de 2,95 % par année entre 1948 et 1972 à 1,29 % par année entre 1972 et 1996. Après un bref regain de vie qui l'a de nouveau porté brièvement à 2,63 % entre 1996 et 2004, le taux de croissance a rechuté pour se fixer à 1,47 % au cours des huit dernières années. Cet examen des données prouve que le regain de vie de la croissance de la productivité associé à la révolution du dot.com est terminé, et que la croissance de la productivité multifactorielle dans l'économie totale est revenue au taux où elle se trouvait après le ralentissement de 1972.

THIS COMMENT PROVIDES my perspective on the future of productivity growth in the United States. I concur with the view expressed in Baily, Manyika, and Gupta (2013) that American manufacturing has a bright future of productivity growth, even though its employment prospects are uncertain. But, as I have written elsewhere, "manufacturing is performing a

1 Robert J. Gordon is Stanley G. Harris Professor in the Social Sciences in the Department of Economics at Northwestern University. Email: rjg@northwestern.edu.

Chart 1
Output per Hour in the United States, Total Economy and Selected Sectors, 1948-2011
(average annual rate of change, per cent)



Source: BLS and BEA

magnificent ballet on a shrinking stage." As we will see, manufacturing represents a steadily declining share of nominal GDP and employment, even though rapid reductions in the relative price of manufactured goods (made possible in large part by rapid productivity gains) have maintained remarkable stability in manufacturing's share of real GDP.

Because the performance of the manufacturing sector is increasingly divorced from the rest of the economy, it is possible to share the authors' optimism about manufacturing while creating a very dismal forecast for the economy as a whole, particularly for future growth of the disposable income of the bottom 99 per cent of the American income distribution (Gordon, 2012). This comment presents several unique charts of historical data that emphasize the growing divergence between productivity growth in manufacturing and in the rest of the economy.

Chart 1 displays annual average growth rates of labour productivity from standard BLS data for the total economy and separately for the manufacturing and non-manufacturing sectors. The growth rates are calculated over four intervals designed to highlight the alternation of growth rates, high-low-high-low. These growth rate cycles are particularly evident when the postwar 1948-2011 period is divided at 1972, 1996, and 2004. Note that the width of the bars on the charts are proportional to the number of years in each interval.[2]

For the total economy, labour productivity displays the well-known rapid growth of 2.82 per cent per year for 1948-72, slow growth of 1.55 per cent for 1972-96, then a shorter eight-year interval of rapid growth for 1996-2004, and finally a second slowdown that has been little noticed heretofore, a growth rate of 1.59 per cent for 2004-12, virtually identical to what we have come to call the "dismal years" after 1972. But productivity growth in manufacturing shows a much happier picture of growth in these four intervals respectively of 2.46 per cent, 2.69 per cent, 4.60 per cent, and 2.52 per cent respectively. In manufacturing, there has been no slowdown at all, with the 2004-12 period matching the growth rate of 2.46 per cent achieved in the "golden years" of 1948-72 and the dot.com years of 1996-2004 exceeding any precedent in U.S. history.

Arithmetic dictates that the non-manufacturing sector mimicks the alternation of fast-slow-fast-slow evident in the total economy. The growth rates for the four intervals in non-manufacturing alternate between fast (2.95 per cent in 1948-72), then slow (1.29 per cent in 1972-96), then fast again (2.63 per cent in 1996-2004), and then a return to slow (1.47 per cent in 2004-

2 The BLS publishes data only for the private business sector (with and without the farm sector). All aggregate data in this comment refer to the total economy. Coverage is extended from the private business sector to the total economy by using BEA data on output and hours for the non-private sector, i.e., government, households, and institutions. The BLS does not publish productivity measures for non-manufacturing; these are backed out from the underlying data by using BEA shares of nominal value added in each sector.

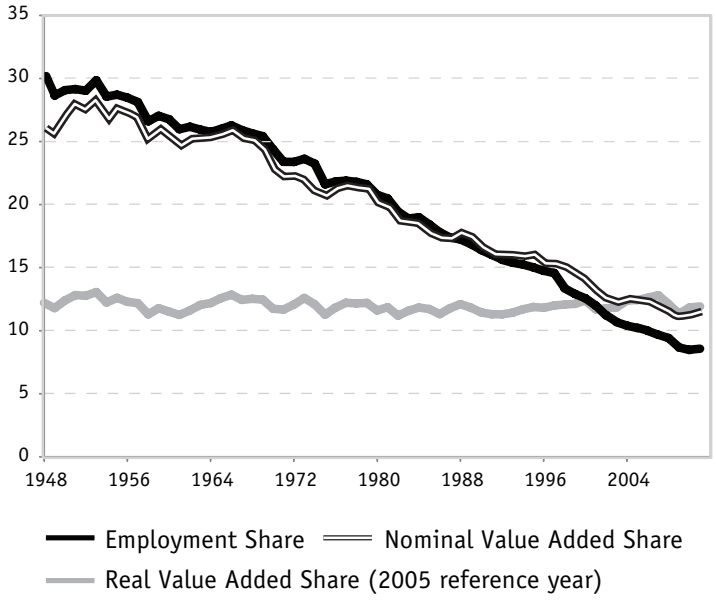
2011). The emerging data for 2012 confirm that productivity growth has returned to a slow path. Total economy labour productivity growth averaged only 0.3 per cent per year in the 12 quarters ending in 2012:Q4.

This initial examination of the data confirms the conclusion of Baily *et al.* (2013) – the United States has many problems, but productivity growth in the manufacturing sector is not one of them. The problem is that manufacturing is shrinking as a share of the total economy and as a result, its outstanding performance has an ever-smaller weight in the determination of productivity growth for the total economy. Chart 2 shows that between 1953 and 2011 the share of overall employment in the manufacturing sector dropped from 30 per cent to 8 per cent. Almost as dramatic was the decline in manufacturing's share of nominal GDP from 28 per cent to 12 per cent. Only the real GDP share remained relatively stable, starting and ending the postwar years at roughly 12 per cent. But the elementary theory of chain-weighted index numbers requires that the share of manufacturing in the national total be based on its share in nominal GDP, not real GDP.

At the total economy level, the U.S. productivity performance cannot be saved by manufacturing alone because the share of that sector is shrinking. In my view, productivity growth is faltering in the total economy because of a reality that is becoming ever more evident as the years march on. The second Industrial Revolution of the late 19th century, with all its inventions and spin-offs, was fundamentally more important than the third Industrial Revolution associated with the computer and its spin-offs.

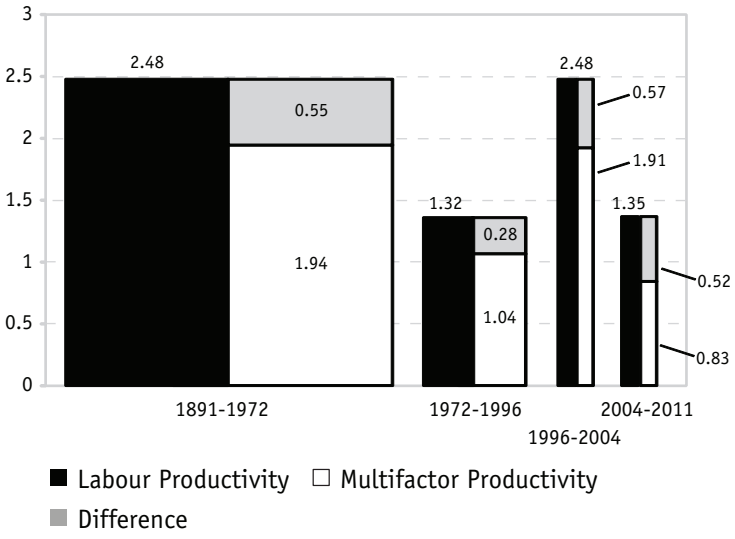
Chart 3 is a novel way to appreciate the role of the two industrial revolutions. Shown are the growth rate of labour productivity, multifactor productivity (MFP) and the difference between them, with the same postwar years separating

Chart 2
Importance of Manufacturing in the U.S. Total Economy, 1948-2011
(per cent)



Source: BLS and BEA.

Chart 3
Output per Hour and Multifactor Productivity in the United States, Total Economy, 1891-2011
(average annual rate of change, per cent)



Source: BLS, BEA, and Kendrick (1961).

the intervals but now with the first period extending back to 1891 rather than 1948.[3] By making the width of the bars proportional to the length of each interval, Chart 3 provides a convincing story of diminishing returns that was interrupted only briefly during 1996-2004.

The U.S. economy achieved a growth rate of labour productivity of 2.48 per cent per year for 81 years, followed by 24 years of 1.32 per cent, then a temporary recovery back to 2.48 per cent per cent, and a final slowdown to 1.35 per cent. The similarity of the growth rates in 1891-1972 with 1996-2004, and of 1972-96 with 1996-2011 is quite remarkable. The MFP series shown here includes the effects of shorter-lived capital ("capital quality") and higher educational attainment ("labour quality") as part of MFP rather than as separate contributions, a choice made due to data limitations rather than any disagreement with the Jorgenson-like MFP concept adopted by the BLS in its published MFP measures for the postwar years.

A remarkable aspect of Table 3 is the lack of importance of capital deepening (the difference between the growth rates of labour productivity and MFP) in explaining the ups and downs of U.S. economic growth over the past 120 years. As a result, the MFP growth rates exhibit the same ups and downs of the labour productivity growth measures. In the four intervals average annual MFP growth was 1.94 per cent for 1891-1972, 1.04 per cent in 1972-96, back up to 1.91 per cent in 1996-2004, and a mere 0.83 per cent for 2004-11.

Part of the reason for slowing productivity growth is the declining importance of inventions. I have often posed the following set of choices. Option A is to keep everything invented up until ten years ago, including laptops, Google, Amazon, and Wikipedia, while also keeping running water and indoor toilets. Option B is to keep everything invented up until yesterday, including Facebook, iphones, and ipads, but give up running water and indoor toilets; one must go outside to take care of one's needs; one must carry all the water for cooking, cleaning, and bathing in buckets and pails. Often audiences laugh when confronted with the choice between A and B, because the answer seems so obvious.

But running water and indoor toilets were not the only inventions between 1870 and 1970 that made it possible for U.S. labour productivity to grow at the 2.48 per cent rate displayed in Chart 3. The list is endless – electric light, elevators that made possible the vertical city, electric machine tools and hand tools, central heating, air conditioning, the internal combustion engine that replaced the horse, commercial aviation, phonographs, motion pictures, radio, TV, and many others including fundamental medical inventions ranging from aspirin to penicillin. By comparison the computer revolution kick-started productivity growth between 1996 and 2004 for only eight years, compared to the 81 years propelled by the second Industrial Revolution of the late nineteenth century.

While the diminishing importance of inventions may be controversial and difficult to quantify, the dire situation of education in the United States is easier to measure and interpret. The United States reached an educational plateau

3 Labour productivity growth estimates differ slightly between charts because they were constructed using a different mix of BLS and BEA sources, as needed for the bar charts to refer to the total economy. In Chart 1, the manufacturing sector data are as published by the BLS. For the total economy, the BLS data on the private business sector are supplemented by BEA data on output and hours in the non-private sector (government, households, institutions). The non-manufacturing growth rates are "backed out" from the total and manufacturing data by using BEA nominal shares of manufacturing and non-manufacturing in the total economy. For Charts 3 and 4, we use a different set of sources: output comes from Kendrick (1961) for 1891-1929 and from the BEA for 1929-2011 or 2012; hours come from Kendrick for 1891-1948 and from an unpublished BLS series on total economy hours for 1948-2011 or 2012. The capital stock estimates used to calculate to contribution of capital deepening to labour productivity growth come from Kendrick for 1891 to 1929 and from the BEA Fixed Assets Tables for 1929-2011.

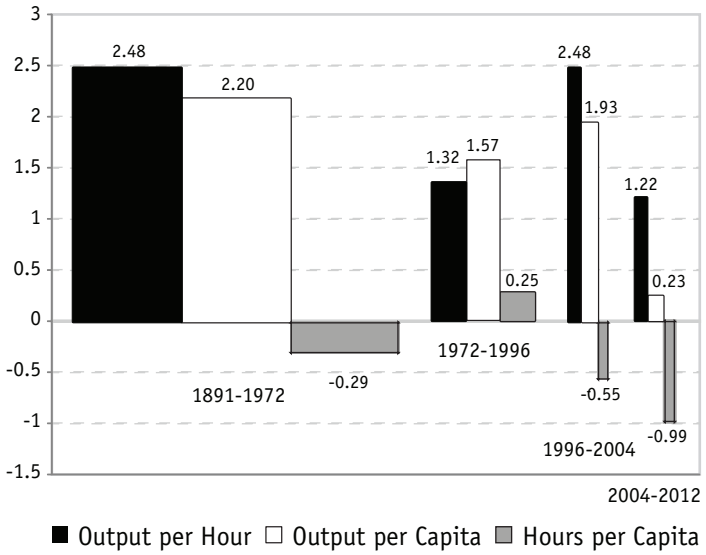
more than 20 years ago. It is the only developed nation in which the 55-64 age group is as well-educated as the 25-34 age group. The United States has steadily slipped down the league table of post-secondary education completion and currently registers 15 percentage points lower than Canada. College cost inflation is even worse than inflation in the price of medical care, and college debt has now reached $1 trillion. The U.S. high school dropout rate scrapes the bottom of the OECD league tables. Dale Jorgenson has suggested that the transition from rising educational attainment to the current plateau will subtract 0.3 per cent per year from future growth.

The American economy is in deep trouble not only because of the inevitable slowing of productivity growth that is already evident in the data displayed in Chart 3. Growth in our standard of living is conventionally measured by output per capita, whereas labour productivity is output per hour worked. The standard of living can grow faster than labour productivity when there is an increase in hours per capita, and this happened between 1965 and 1990 as females entered the labour force.

The relationship between growth in labour productivity and in the standard living is shown in Chart 4, where again the width of the bars reflect the length of the periods shown. In the golden age of 1891-1972, the standard of living almost kept up with productivity, falling short by 0.29 percentage points annual decline in hours per capita as working conditions improved and the average work week declined from roughly 60 to 40 hours. Then in 1972-96 the standard of living grew 0.25 percentage per year faster than labour productivity, as the entry of females into the labour force boosted hours per capita.

But after 1996 the bottom fell out of hours per capita, with a negative growth rate of 0.55 per cent per year during 1996-2004 and a catastrophic fall of 0.99 per cent per year between 2004 and 2011.

Chart 4
Output per Hour, Output per Capita, and Hours per Capita in the United States, 1891-2012
(average annual rate of change, per cent)

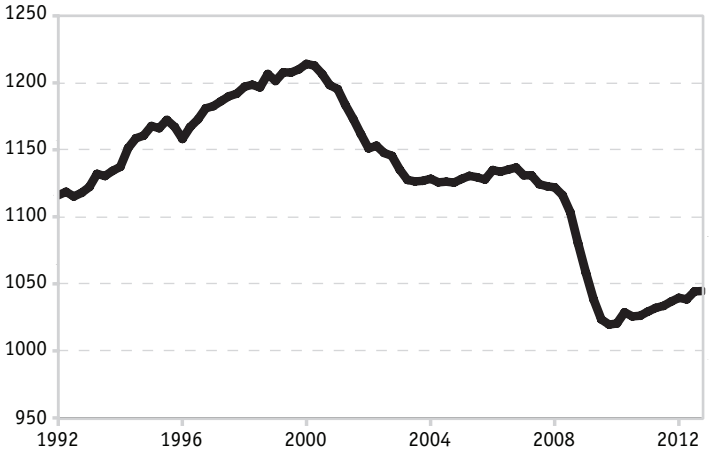


Source: BLS, BEA, and Kendrick (1961).

As a result, per capita income grew much more slowly than labour productivity in 1996-2004 and hardly grew at all between 2004 and 2011. Why did hours per capita fall so fast? Since the earliest cohort of the baby boomers was born in 1947, even those early retirees at age 62 would not have influenced the statistics until 2009, and yet the decline in hours began before that.

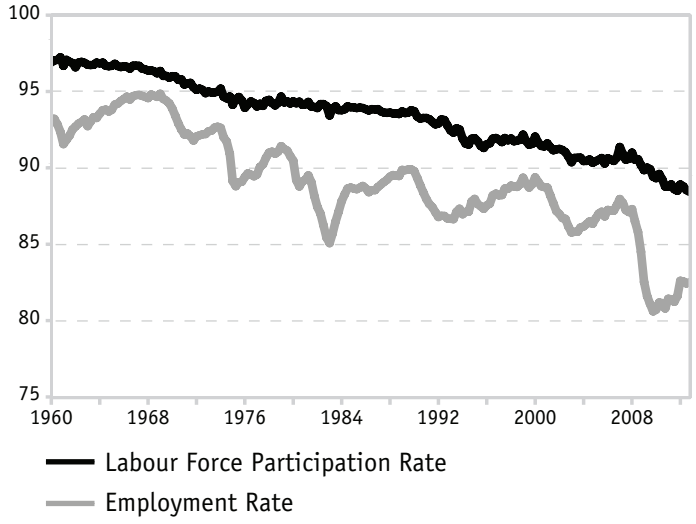
The data on hours per capita are plotted in Chart 5 and show a two-stage reduction in 2000-03 and then again after 2007. This chart supports the view of several analysts that the 2001-07 economic expansion was ephemeral, financed by an explosion of consumer and mortgage debt that disguised a fundamental underlying deterioration of the labour market. The further decline in hours per capita since 2007 may be due to the recession and sluggish recovery but cannot be swept aside in the absence of any evidence that the pace of the recovery is picking up steam.

Chart 5
Hours per Capita in the United States, 1992:Q1-2012:Q4
(Hours/Person)



Source: BLS.

Chart 6
Employment Rate and Labour Force Participation Rate in the United States, Males Ages 25-54, 1960:Q1-2012:Q4
(per cent)



Source: BLS.

Underlying the discouraging data on hours per capita is the phenomenon of labour force drop-out experienced by prime-age males (25-54). Chart 6 shows that the labour force participation rate of prime-age males declined between 1960 and 2012 from 96.9 per cent to 88.5 per cent. The employment-population ratio (or employment rate) declined even more, from 93.2 per cent to 82.6 per cent. This collapse in the employment-population ratio helps explain much of the reduction of hours per capita displayed in Chart 5, and most of the rest can be explained by the increase of involuntary part-time employment in the recent recession and sluggish recovery.

The headwinds buffeting the U.S. economy are formidable. The education headwind reduces future productivity growth. Other headwinds decrease growth in the standard of living relative to productivity growth, starting with the demographic headwind discussed above. Inequality is currently reducing the per capita income growth of the bottom 99 per cent of the income distribution a full 0.55 percentage points below the growth of the economy-wide averages shown in our charts. A further subtraction from future growth must be made when we compare growth of disposable income for the bottom 99 per cent compared to total income, because any significant attempt to stop the growth in the federal government's ratio of debt to GDP must involve slowing the growth of transfer payments and/or increasing the growth rate of tax payments, both of which reduce growth in disposable income compared to total income.

While I share the optimism of Baily *et al.* (2013) about the future of manufacturing productivity, I cannot find any escape from the inexorable arithmetic of the "exercise in subtraction" that I have discussed. The best current estimates of growth of per capita GDP for the UK in the four centuries between 1300 and 1700 register a mere 0.2 per cent annual rate, implying an interminable 350 years for the standard living to double, compared to the mere 35 years to which Americans became accustomed between 1891 and 2007. Once we subtract from

the historical record the demographic, education, inequality, and debt headwinds, together with the likelihood that future inventions will not be as important as those of the second Industrial Revolution, we face a significant possibility that the disposable income growth for the bottom 99 per cent of the income distribution could be as low as 0.5 per cent per year, or perhaps even 0.2 per cent.

References

Baily, Martin N., James Manyika, and Shalabh Gupta (2013) "U.S. Productivity Growth: An Optimistic Perspective," *International Productivity Monitor*, No. 25, Spring, pp. 3-12.

Gordon, Robert J. (2012) "Is U.S. Economic Growth Over? Faltering Innovation and the Six Headwinds," NBER Working Paper 18315, August.

Kendrick, John W. (1961) *Productivity Trends in the United States* (Princeton, N.J.: Princeton University Press for NBER).