The Bad News about Earnings per Member of the Population since 2000, and Hope for the Future*

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Earnings—adjusted for inflation—are the resources derived from work effort. An informative measure of economic performance is real earnings per member of the population. From 1980 to 2000, real earnings rose substantially, except for temporary interruptions for two recessions. After 2000, growth was much slower. A number of underlying determinants accounted for the dramatic slowdown. Productivity growth declined, especially after 2004. The fraction of total income growth making its way into earnings fell and the fraction received by owners of capital rose. The fraction of the population 16 and older who were in the labor force—working or looking for work—declined starting in 2007, with the onset of retirement for baby-boomers. Performance measured by real earnings per member of the population was quite a bit inferior to performance measured by real output per person, or by other measures that leave out the special factors that held back real earnings.

There are good reasons to believe that some of the headwinds depressing earnings growth may have been temporary over the period from 2000 through 2015. I conclude with a discussion of a plausible optimistic projection of the components of earnings growth over the years through 2030. Under this projection, total annual growth of real earnings per member of the population is 1.6 percent, only slightly below the average growth from 1980 through 2000.

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1 Real Earnings per Member of the Population

This section presents the chain of relationships from the nation's real output—the total quantity of goods and services the U.S. economy produces—to real earnings per person. The relationships are definitional. They reflect the way government agencies compile the data. I arrange the definitions in a way that is intended to be informative about the determinants of the variations in growth of real earnings. But it is important to keep in mind that the relationships are *not causal*. For example, it would be an overstatement to say that some of the decline in real earnings was caused by a decline in the income share of labor. Rather, one can say is that forces that resulted in declines in the labor share caused real earnings to grow more slowly than real output. This paper does not try to give a comprehensive account of those underlying causal forces, some of which, such as the decline in labor-force participation, have eluded any consensus among experts, to date.

The first relationship is

Total real earnings = [labor share] × [real output]

The labor share is one of the components of the ultimate decomposition. I further break down

Real output = [productivity per unit of labor input] × [volume of labor input]

Productivity = [real output] ÷ [volume of labor input]

Volume of labor input=[Hours per worker] × [quality of hours] × [workers per member of the labor force] × [members of the labor force per person aged 16 or over, 16-60] × [people over 16 as a fraction of the total population]

The result is a seven-way breakdown of real earnings per member of the population among the following:

1. **Labor share**

2. **Labor productivity**

3. **Hours per worker**

4. **Quality per hour**

5. **Employment rate: 1– unemployment**

6. **Ratio of labor force to population aged 16 and over**

7. **Ratio of population 16 and over to the population of all ages**

I emphasize that the measure considered here is real earnings per member of the population, **not per worker**. This measure encompasses changes in the labor force and unemployment, as well as in the earnings of workers. The measure focuses on total resources created by workers per member of the population, before deduction of taxes, exclusive of additions from government transfers (public benefits), and inclusive of fringe benefits provided by employers.

2 Data

The data come primarily from the U.S. National Income and Product Accounts, together with population data from the Bureau of Labor Statistics. A convenient source is John Fernald's frequently updated spreadsheet on the San Francisco Federal Reserve's website. A spreadsheet with the calculations for this paper is available on my website.

3 Results

Table 1 summarizes the results of the calculations in terms of average growth rates for the period through 2000 and the subsequent period ending in 2015. For both periods, productivity growth is the most important component of overall earnings growth. It accounts for most of the growth in the earlier period and way more than all of the growth in the recent period. Productivity growth was close to the same in both periods. The reasons that earning growth was so poor on average since 2000 are entirely bad outcomes for other components—labor share, fraction of the population of working age, and hours per worker.

The role of the declining share of output, and thus of real income, in the overall decline in earnings growth is striking. The value of the income generated from the production of output has three major components—labor earnings (well over half), the return to plant and equipment (an important part of the remainder), and the return to intangibles (the rest). Research is approaching a consensus that the share of the return to plant and equipment

Component	1980-2000	2000-2015
Labor share	-0.04	-0.71
Labor productivity	1.77	1.71
Hours per worker	0.06	-0.47
Quality per hour	0.17	-0.09
Employment rate: 1- unemployment rate	0.32	0.21
Ratio of labor force to working-age population	0.25	-0.45
Working-age fraction of the population of all ages	0.11	0.24
Sum = earnings per member of population	2.65	0.44

Table 1: Averages over Time for Components of Earnings Growth and Total Growth per Member of the Population

has probably not grown enough to explain the decline in the labor share. Rather, growth in the intangible share accounts for the shift away from labor.

The intangible share has two distinct elements. One is intellectual property. Firms invest in technologies and earn returns reflecting the advantages over rivals that the technologies deliver. The value of newly created intellectual property is included in the national income and product accounts in the form of reported flows of investment, which the accounts cumulate to estimate the intellectual property component of the capital stock. The second element of the intangible share is the return to market power that cannot be attributed to new technology. Large businesses are growing relative to their smaller rivals, so product markets are becoming more concentrated. Oligopoly theory generally associates concentration with higher margins of price over marginal cost.

Higher margins result in lower labor shares according to the following logic. By definition,

$$\text{labor share} = \frac{\text{labor earnings}}{\text{labor earnings + owners' earnings}} \qquad (1)$$

Divide and multiply by marginal cost:

$$\text{labor share} = \frac{\text{labor earnings}}{\text{marginal cost}} \times \frac{\text{marginal cost}}{\text{labor earnings + owners' earnings}} \qquad (2)$$

The second factor is the markup ratio of price to marginal cost, so

$$\text{labor share} = \frac{\text{labor earnings}}{\text{marginal cost}} \times \frac{1}{\text{markup ratio}} \tag{3}$$

There are good reasons to think that the share of labor earnings in marginal cost is stable over time, so a rising markup ratio depresses the labor share. Both the growth of intellectual property and of market power result in higher price-cost margins.

Tech companies like Apple and Google sell their products for prices far above marginal cost, so their growh since 2000 would be a contributor to the rise in the overall markup ratio. Pharmaceuticals have also contributed to markup growth. The growing tendency for U.S. firms to outsource production to other countries but to retain research, development, branding, and other costs in the U.S. that are not part of marginal cost has further contributed to the change. The hypothesis of markup growth is fairly new to economics and it remains to undergo serious quantitative verification, however.

The decline in hours per worker is another important difference between the two periods. Hours per worker is measured as total hours of work in a year divided by the average number of people at work over the year. It is the number of hours the typical worker would put in if employed throughout the year. It is close to proportional to the number of hours the typical worker puts in during a week. After 2000, hours per worker fell by almost half a percent per year, after rising slightly each year from 1980 to 2000. A rise in part-time work accounts for part of the decline.

Labor quality reflects changes in productivity of workers based on their education and other measured determinants. Its role in earnings growth was small in both periods. Growth in earnings comes mainly from improved technology in the use of labor rather than from changes in the characteristics of workers.

The employment rate is the complement of unemployment—it is the fraction of the labor force at work. Unemployment makes up the rest of the labor force. Unemployment fell during both periods, on net, but the contribution of lower unemployment to earnings growth was slightly greater before 2000 than after.

The ratio of the labor force to the population 16 and older—the labor-force participation rate—rose modestly from 1980 to 2000, then fell by almost half a percent per year after 2000. Part of the decline reflects changes in the age distribution of the population. The main change was the growth of the population over 60. Relatively few people remain in the labor force after 60. The large baby-boom generation crossed this boundary during this

period—people born in 1948 turned 60 in 2008 and those born in 1955 turned 60 in 2015. But more than half of the decline reflects changes within demographic groups. The reasons for that part of the decline are not well understood.

The ratio of the population 16 and over to the total population contributed slightly to earnings growth per member of the population in the earlier period, and somewhat more in the later period. It is the only category that changed favorably for earnings growth after 2000.

There is more to learn from the annual movements of the components of earnings over time. The following series of figures, all in the same format, show the movements. They each present the log of an index, where the index itself starts at one, so the log starts at zero. The vertical axis is in log units, so the slopes are rates of growth. Each unit of increase of 0.1 is growth of a bit over 10 percent ($100 \times (\exp(0.1)\text{-}1)$ to be exact). The vertical axis runs from –0.2 percent per year to +0.7 percent. Thus all the figures are comparable to one another. The log index for earnings over population is exactly the sum of the log indexes of the components, by construction.

Figure 1 shows the resulting calculation of real earnings per member of the population. This is

$$\log\left(\frac{\text{Total real earnings}}{\text{Total population}}\right)$$

From 1980 to 2000, growth was rapid and uniform, except for declines during the recessions of 1981-1982 and 1990-1991. These declines occurred almost entirely because of the rise in unemployment—there was little decline in earnings per worker, but noticeable declines in earnings per member of the population. The average growth rate over these years was 2.6 percent per year. At this rate, earnings per person in one generation would be 2.4 times that of its predecessor, taking a generation to be 33 years.

The behavior of earnings over population in the period after 2000 could hardly be more different. The recession of 2001 occurred during a period of low growth, so that earnings over population was only slightly higher at the cyclical peak in 2007 compared to 2001. Then the recession of 2007-2009 resulted in a large decline, partly from a big increase in unemployment and corresponding decline in employment, and partly from other sources, to be described shortly. The growth rate of the earnings-population ratio averaged only
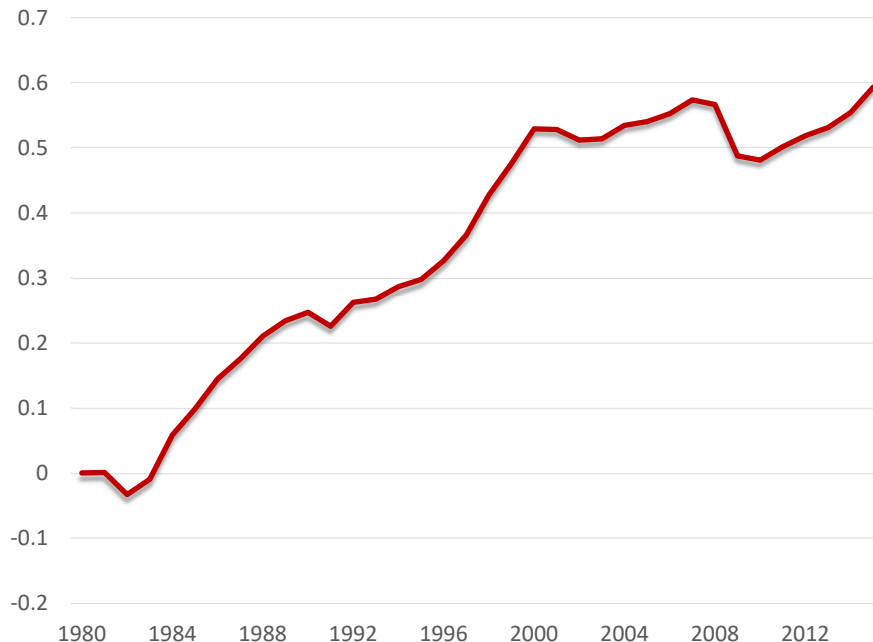
Figure 1: Real Earnings per Member of the Overall Population

0.4 percent per year. Compounded over a generation, this low growth rate implies that a successor generation would earn only 1.2 times as much as their parents.

Figure 2 shows labor productivity in the same format as the previous figure. Business-cycle fluctuations in labor productivity are relatively small. The recessions of 1990-1991 and 2001 are invisible, the severe recession of 1981-1982 had a small and quickly reversed decline, and the recession of 2007-2009 had a larger decline in growth but also quickly reversed. The stretch from 1996 through 2006 had exceptional growth. Though, as shown earlier, productivity growth was equal in 1980 to 2000 and 2000 to 2015, growth in the latter period was rapid at first and extremely poor after 2010, even though the economy enjoyed a full recovery in the sense that unemployment fell below 5 percent at the end.

Fernald, Hall, Stock, and Watson carry out an analysis of the low rate of productivity growth since 2009.[1] The rapid growth of productivity from 1995 to 2006 was likely the result of rapid adoption of information technology—such as the relational database—in many sectors, notably retail trade. Adoption may have slowed down. Other hypotheses about the slowdown, such as a rising burden of regulation, remain plausible but are not supported

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[1]Fernald, John, Robert Hall, James Stock, and Mark Watson, "The Disappointing Recovery of U.S. Output since 2009," *Brookings Papers on Economic Activity*, 2017, (1), Forthcoming.
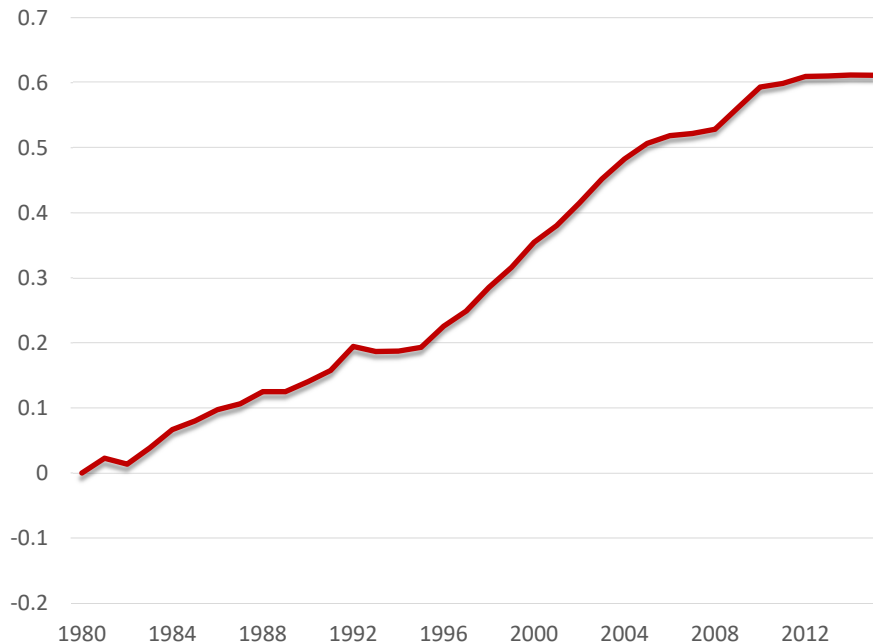
Figure 2: Productivity

by the limited data available. Productivity growth has varied considerably in the past, as
Figure 2 shows: Growth was low from 1980 through 1995.

Figure 3 shows the labor share, another major source of disappointment for earnings in
the period after 2000. The share was essentially constant from 1980 to 2001, and then began
a steady decline. The decline coincides with the expansion of major tech companies. Google
began selling search advertising in 2000. Apple launched the iPhone in 2007. It is unlikely
that the tech sector by itself is big enough to account for the magnitude of the decline in
the labor share, however.

Figure 4 shows the index of hours of work per employed person. The length of the
work-week is moderately pro-cyclical. In particular, hours rose to its high point during
the strong expansion of the 1990s. But after 2000, hours of the employed began to fall,
reaching a low point at the trough of the deep recession in 2009. Hours increased during
the recovery from 2010 onward, but remained low. As noted earlier, the decline in hours
coincided with an increase in part-time work, less than 35 hours per week. Some of this was
involuntary—there was an increase among workers on shorter schedules reporting a desire for
longer hours, which persisted through the time when unemployment had returned to levels
below 5 percent, indicating a generally tight labor market. The reasons for the decline in
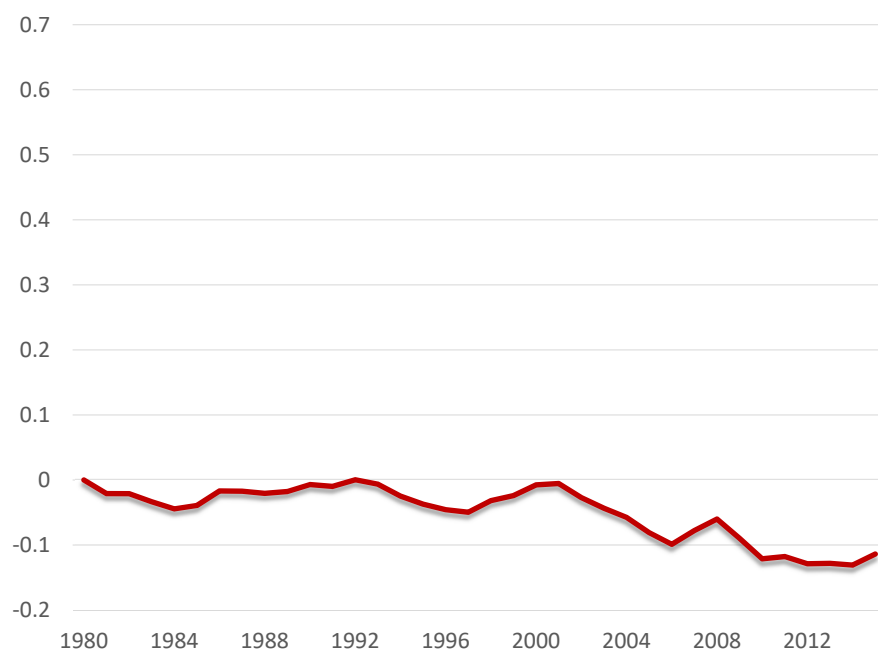hours per employed person are not well understood.
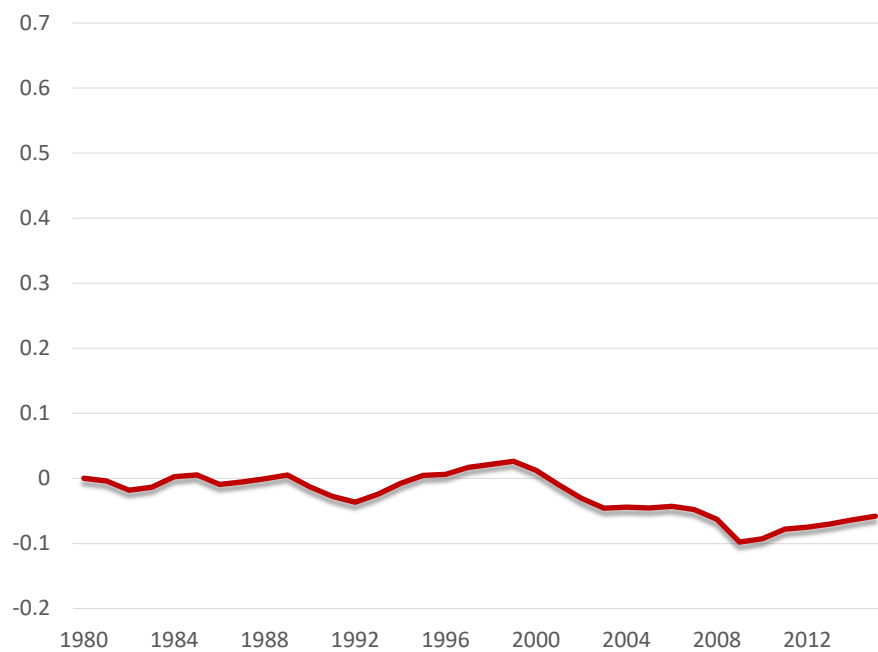
Figure 3: Labor Share of Income
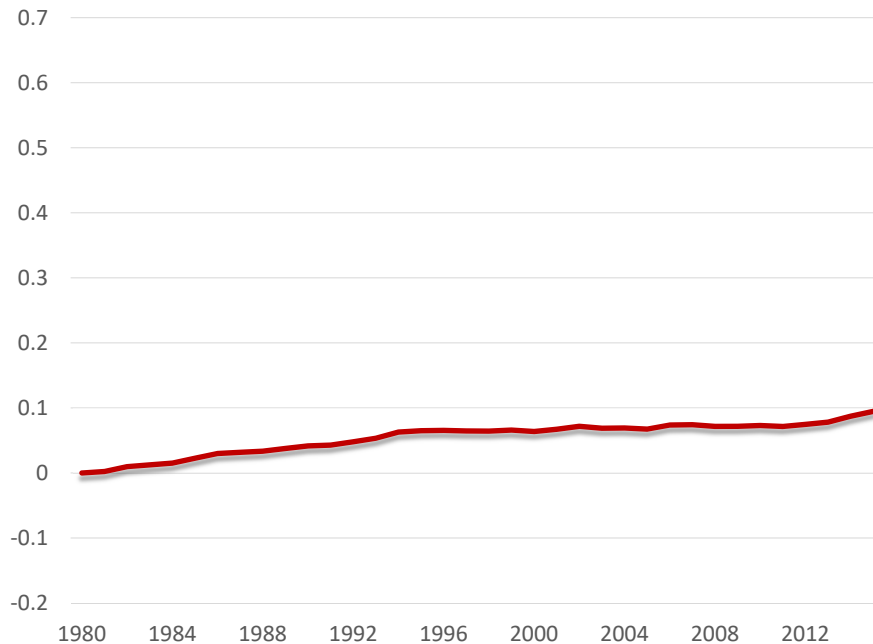

Figure 4: Hours per Employed Person

Figure 5: Labor Quality

Figure 5 shows the index of labor quality. It grew fairly rapidly until 1994, leveled off until recently, then grew again.

Figure 6 shows the employment index, which is the log of one minus the unemployment rate in decimal form, stated as an index with log zero in 1980. The employment rate has no long-run trend, and tends to return to its base value fairly quickly after recessions and booms. The fall of the employment index between 2007 and 2010 was the largest in any of the recessions in the data. The trough value of the employment rate was almost the same in 2010 as in 1982—the labor market was quite a bit tighter in 2007 than in 1980. Although the recovery of the economy after 2010 was much slower by the standard of output, the recovery of the employment rate was actually slightly faster after 2010. The recent recovery also had slow growth of employment, because the labor force shrank relative to the adult population.

Figure 7 show the labor-force participation rate. It rose through 2000. More than all of the increase occurred among women. Participation is slightly procyclical—slight declines are visible in the recessions of 1990-1991, 2001, and 2007-2009. In the last recession, most of the decline appears to be the result of noncyclical forces, including the demographic shift mentioned earlier. From 2010 through 2015, as unemployment returned to normal, participation continued to decline.
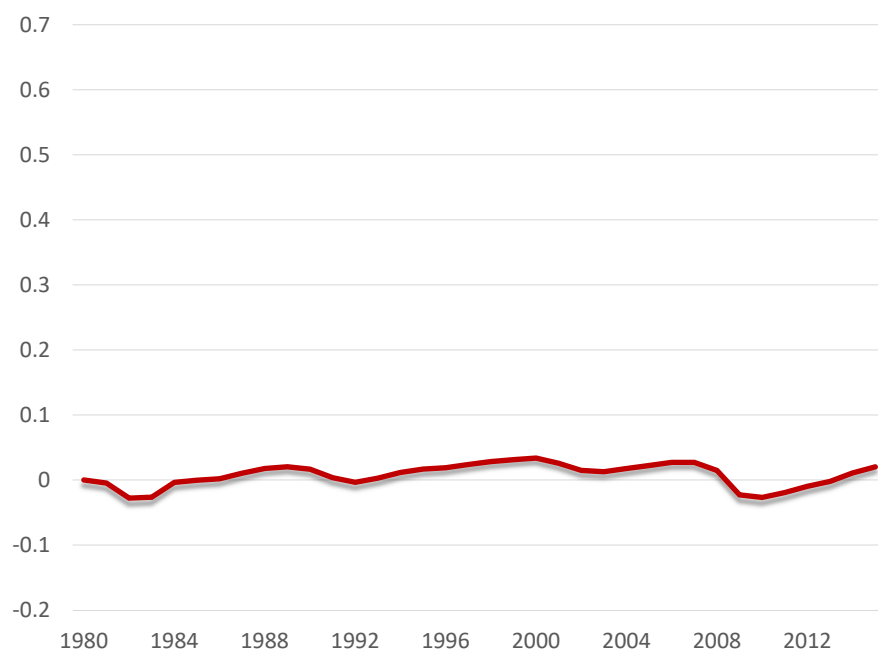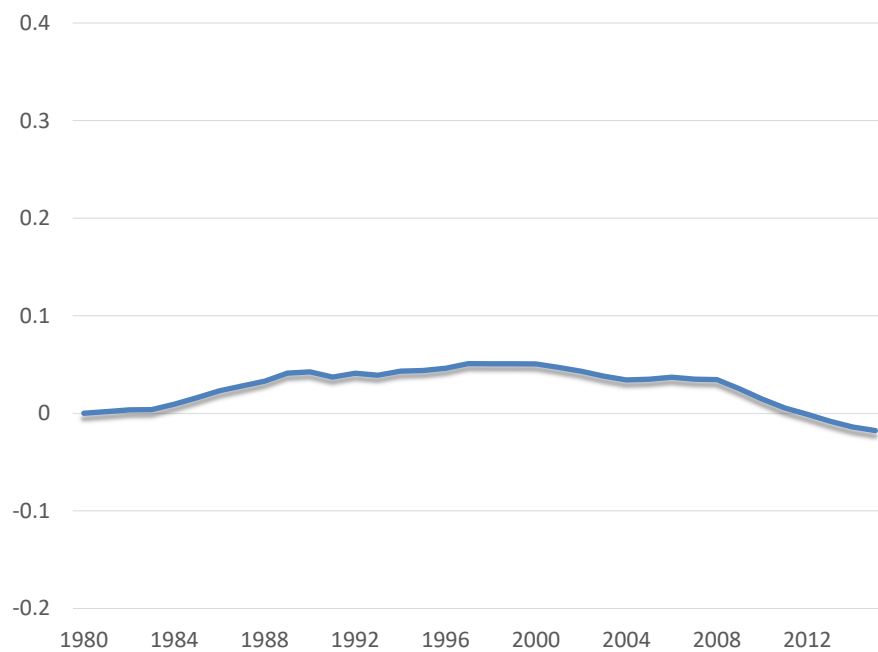
Figure 6: Employment rate: 1-unemployment

Figure 7: Participation Rate: Ratio of Labor Force To Population Aged 16 and Older
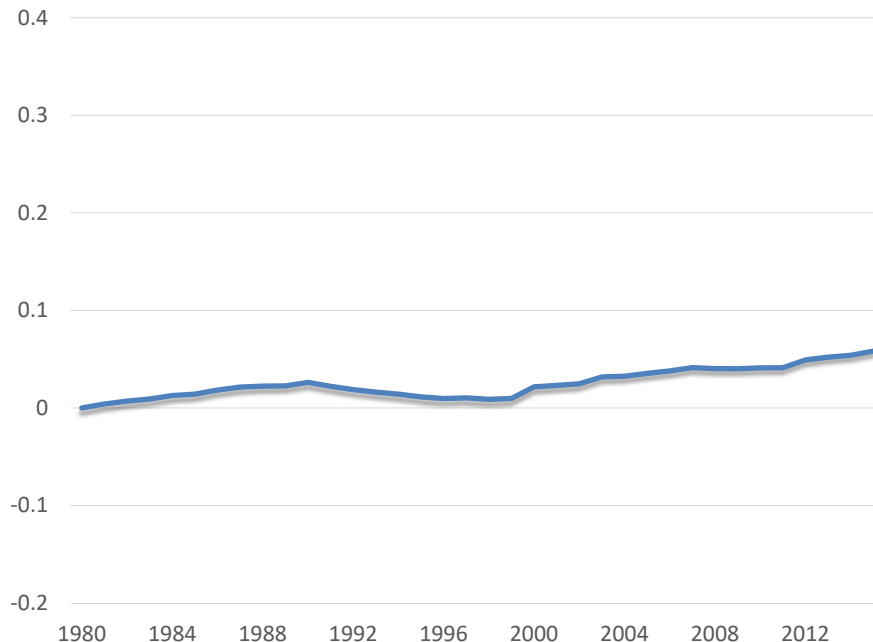
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Figure 8: Fraction of Population Aged 16 and Older

Finally, Figure 8 shows the fraction of the population aged 16 and older. It grew steadily after 2000, on account of the growth of older Americans relative to those under 16 years old.

Figure 9 adds together all of the log-factors apart from productivity. This graph shows the net effect of all the determinants except the dominant one in the long run, productivity. In the period before 2000, only the effect of the recessions of 1981-1982 and 1990-1991 are visible. These effects are mainly the loss of earnings on account of bulges in unemployment. Earnings per member of the population grew smoothly except for the recessions that occurred every 9 or 10 years. After 2000, the recessions of 2001 and especially 2007-2009 had obvious effects through unemployment, but also large adverse effects from unusual noncyclical factors— declining participation, labor share, and hours per worker.

4 The Future

Table 2 speculates about the future of the seven components of earnings growth and their sum for the period ending in 2030. For each component, I have chosen a value around the 67th percentile of its probability distribution, as I see it, so it is twice as likely to understate growth than to overstate it. Thus the scenario in the table is optimistic but plausible.
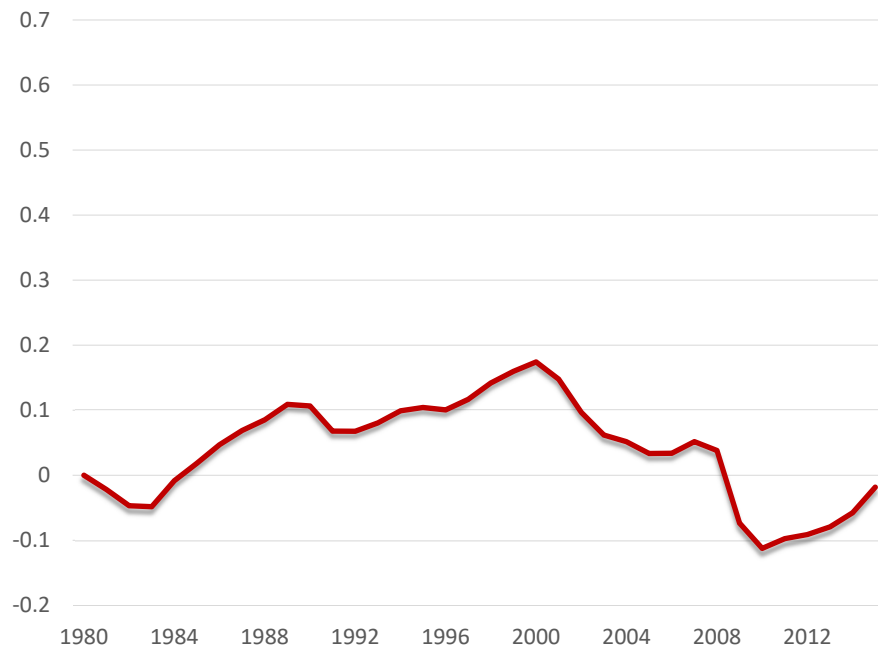
Figure 9: Sum of Contributions of Factors other than Productivity

| | Annual growth rate, percent | |
	Projected, 2018-2030	Actual, 1980-2015
Component		
Labor share	0.00	-0.33
Labor productivity	1.40	1.75
Hours per worker	0.00	-0.17
Quality per hour	0.10	0.06
Employment rate: 1- unemployment rate	0.00	0.27
Ratio of labor force to working-age population	-0.15	-0.05
Working-age fraction of the population of all ages	0.20	0.17
Sum = earnings per member of population	1.55	1.70

Table 2: Speculative Projections for Future Growth of the Components of Earnings

The rationalizations for the figures in Table 2, by component, are: (1) The labor share has been constant for the past few years, as shown in Figure 3, so I take its future growth rate to be zero, an improvement over its average behavior since 2000. (2) With respect to labor productivity growth, I foresee the end of the extremely low rates of the past few years, including 2016 and the first quarter of 2017, but not a resumption of the growth from 1980 through 2015 of over 1.7 percent per year. Productivity grows at 1.4 percent per year. (3) For hours per worker, I note that hours, a highly cyclical variable, is approaching its earlier peak prior to the most recent recession, which means that its trend over the past decade is zero, so I take its projected value as zero. (4) Labor quality has been growing at 0.1 percent per year, and I project continuation at that rate. (5) The employment/labor force ratio returns to normal after booms and busts, which implies that its longer-run growth rate is zero. (6) Labor-force participation has fallen substantially since 2000, but has recently stabilized. It will continue to decline for demographic reasons in the future at a rate of around 0.15 percent per year, so I take its growth contribution to be –0.15. (7) The population 16 and over has been a growing fraction of the total population and it seems plausible to project a continuation, as the fraction of the population made up by children declines, thanks to low birthrates and lower mortality among people over 60. I take the annual growth rate of the population fraction to be 0.20, its recent trend value.

The bottom line of this exercise is a future growth rate of real earnings per member of the population of 1.55 percent per year, a considerable improvement over the rate achieved from 2000 to 2015 of 0.44 percent per year. It appears fully feasible that the U.S. economy can bounce back from the temporary adversities of the period since 2000.

5   Concluding Remarks

The U.S. economy generated abysmal returns from the effort of its workers in the period since 2000, following excellent performance in the prior 20 years. One major reason was the shift in the distribution of total income away from earnings toward physical and intellectual capital and toward the profit from higher price/cost margins. Some economists believe that more vigorous policies to prevent concentration of markets might have avoided part of this shift. The other reason is declining work per member of the working-age population, in hours per worker among the employed and in declining propensity to look for and hold jobs (declining labor-force participation). Policy in this area needs to recognize that the time freed up

by declining total volume of work per member of the working-age population implies that people have more time to enjoy themselves. Policy should focus on removing distortions from high tax rates and other impediments to work, such as unnecessary occupational licensing requirements.