THE LONG-RANGE ECONOMIC ASSUMPTIONS FOR THE 2019 TRUSTEES REPORT

OFFICE OF THE CHIEF ACTUARY
SOCIAL SECURITY ADMINISTRATION

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PRINCIPAL ECONOMIC ASSUMPTIONS

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OVERVIEW

Each year, the Board of Trustees of the Federal Old-Age and Survivors Insurance (OASI) and Disability Insurance (DI) Trust Funds provides an annual report to the Congress on the financial and actuarial status of the program. For this report, the Office of the Chief Actuary (OCACT), on behalf of the Board of Trustees, projects future cost and income based on three separate sets of long-range (75-year) assumptions for key economic variables. The intermediate (alternative II) set of assumptions represents the Trustees' best estimate for future experience, while the low cost (alternative I) and high cost (alternative III) sets of assumptions represent more and less favorable scenarios, respectively, from the perspective of program cost and income as a percent of taxable payroll. The intermediate assumptions are also used as the point of comparison for sensitivity analysis and the central tendency for the stochastic projections presented in the OASDI Trustees Report. This memorandum presents the ultimate economic assumptions used in the 2019 Annual Report of the Board of Trustees.

The following changes have been made to the ultimate economic assumptions for the 2019 report: (1) a 0.05 percentage point reduction in the average annual percentage change in total economy productivity from 1.68 percent used in the 2018 report to 1.63 percent; (2) a 0.05 percentage point increase in the assumed price differential (GDP deflator less CPI-W) from -0.40 percentage point used in the 2018 report to -0.35 percentage point; (3) an increase in the average real wage differential from 1.20 percent used in the 2018 report to 1.21 percent; and (4) a reduction in the real interest rate from 2.7 percent used in the 2018 report to 2.5 percent. There are no changes in the other ultimate economic assumptions.

The key economic variables include the average annual percentage changes in total-economy productivity, the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W), and the gross domestic product (GDP) deflator, as well as the average real wage differential, the unemployment rate, the annual trust fund real interest rate, and the taxable ratio. Total-economy productivity is the ratio of real GDP to total hours worked. The real wage differential is the rate of change in the average OASDI covered wage less the rate of change in the CPI-W. The OASDI taxable ratio is the share of OASDI covered earnings that is subject to the payroll tax. Table A.1, below, lists the assumed ultimate (i.e., long-range future) values for these key economic variables in the 2019 Trustees Report alternatives I, II, and III.

Table A.1: Long-Range Values for Key Economic Assumptions and Summary Measures for the Long-Range (75-year) Projection Period

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
Ultimate Assumptions	**I**	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Average Percentage Change In:									
Productivity (Total-Economy)	1.93	1.63	1.33	1.98	1.68	1.38	-0.05	-0.05	-0.05
Prices (CPI-W)	3.20	2.60	2.00	3.20	2.60	2.00	0.00	0.00	0.00
Prices (GDP Deflator)	2.95	2.25	1.55	2.90	2.20	1.50	0.05	0.05	0.05
Price Differential (GDP Deflator less CPI-W)	-0.25	-0.35	-0.45	-0.30	-0.40	-0.50	0.05	0.05	0.05
Real Wage Differential (Percent)	1.83	1.21	0.59	1.82	1.20	0.58	0.01	0.01	0.01
Unemployment Rate (Percent)	4.50	5.50	6.50	4.50	5.50	6.50	0.00	0.00	0.00
Annual Trust Fund Real Interest Rate (Percent)	3.00	2.50	2.00	3.20	2.70	2.20	-0.20	-0.20	-0.20
OASDI Taxable Ratio	0.840	0.825	0.810	0.840	0.825	0.810	0.000	0.000	0.000

The remainder of this section provides brief descriptions and summary information for the key economic variables, as well as the assumed values for alternative II.

Productivity − The rate of growth in total-economy productivity is the fundamental component contributing to the real growth rate of average earnings. OCACT uses a weighted average of the productivity growth rates in economic sectors, where the weights are the shares of each sector in total GDP. The economic sectors include the nonfarm business sector, the farm sector, the household sector, the nonprofit institutions sector, and the general government sector. In the long-range period, OCACT assumes that the sector weights are approximately fixed at recent levels. Based on an analysis of the data and future trends, the ultimate assumed growth rates for the sectors are as follows: 2.00 percent for the non-farm business sector, 2.00 percent for the farm sector, 1.63 for the household sector, 0.0 percent for the nonprofit sector, and 0.0 for the government sector. The weighted average of the assumed sector productivity growth rates is equal to the Trustees' assumed ultimate long-range average annual rate of growth in total-economy productivity of 1.63 percent, which is 0.05 percentage point less than the 1.68 percent rate used in the 2018 report.

Price Inflation − The rate of growth in the CPI-W is used to determine the cost of living adjustment (COLA). The average annual growth rate in the adjusted CPI-W was 4.22 percent over the last 5 complete economic cycles, from 1969 to 2007, and2.51 percent over the last two

complete economic cycles from 1990 to 2007.[1] OCACT expects that monetary policy will continue to target relatively low inflation, but will not be able to prevent occasional bursts of inflation caused by demand and supply shocks. Accordingly, the ultimate long-range average annual percentage change in the CPI-W is assumed to be 2.6 percent, which is the same ultimate value used in the 2018 report.

The GDP deflator is another measure of price inflation. It is used in projecting the level of aggregate GDP and wages and, therefore, OASDI tax revenues. The CPI-W and the GDP deflator are assumed to grow at different rates in the future due to two inherent differences. One difference is the way that groups of goods and services are weighted in computing the overall price increases. Unlike the CPI-W, the GDP deflator formula accounts for shifts in the distribution of purchases across broad groups of goods and services, and thus reflects changes in the behavior of consumers in response to changes in relative price of items that are not close substitutes. Because of this difference, the GDP deflator measures lower price inflation compared to the CPI-W. The Bureau of Labor Statistics (BLS) provides data showing that the behavioral response of consumers to relative price changes would have lowered the average annual rate of change in the CPI-U (and therefore CPI-W) between 1990 and 2016 by about 0.3 percentage point. OCACT expects the future average annual rate of change in the GDP deflator to be 0.3 percentage point below the average annual rate of change in the CPI-W due to this difference in computational methods.

The second important difference between the CPI-W and the GDP deflator is coverage. The CPI-W measures the annual growth rate in consumer prices for urban wage earners and clerical workers, while the GDP deflator reflects the annual growth rate in prices covered by all consumption, investment, and government expenditures. OCACT expects that the net effect of this difference in coverage is that the average annual growth rate in the GDP deflator will be about 0.05 percentage point lower than the average annual growth rate in the CPI-W.

Thus, the ultimate assumed long-range average annual growth rate in the GDP deflator is 2.25 percent, or 0.35 percentage point below the 2.6 percent assumed ultimate long-range average annual growth rate in the CPI-W. The price differential of -0.35 percentage point is the sum of -0.3 percentage point for computational difference and -0.05 percentage point for coverage difference. The assumed -0.35 percentage point price differential represents a change from the -0.40 used in the 2018 report. The change is a result of an updated analysis of the coverage component of the price differential, in particular, the data on the implicit price deflators for investment and government goods. This analysis indicates that a -0.05 percentage point difference is more consistent with the long-term corresponding price trends than the -0.10 percentage point difference used in the 2018 report.

Average Real Wage Differential – Annual real wage differentials vary to a small degree over the last 65 years of the 75-year projection horizon (i.e., from 2028 to 2093), averaging 1.21 percent, which is 0.01 percentage point higher than in the 2018 report. The Centers for Medicare and

[1] Consecutive NBER defined peak years are used to define each economic cycle, except that OCACT uses 1979 through 1990 period as an economic cycle. NBER identified January 1980 as a peak month, but 1979 is more representative of a peak on an annual basis. NBER also identified a peak in July of 1981. This brief 18-month economic cycle is merged to the 1981 to 1990 cycle to form the 1979 to 1990 cycle.

Medicaid Services (CMS) projects slightly lower average growth in the share of employee compensation that is provided as employer-sponsored group health insurance (ESI) than in last year's report.

The Trustees assume the ultimate average annual rate of change in the average OASDI covered wage to be approximately the same as for (1) average U.S. wages and (2) average U.S. earnings (which include the self-employed). The average annual real growth rate in average U.S. earnings is assumed to be 1.18 percent over the 65-year period. This reflects average annual changes of 1.63 percent for total-economy productivity, -0.35 percent for the price differential, -0.06 percent for the average earnings ratio, 0.0 percent for the compensation ratio, and -0.05 percent for the average hours worked per week.

Unemployment Rate – The aggregate civilian unemployment rate, adjusted for the 2011 age-sex distribution of the labor force, averaged about 5.2 percent over the last five complete economic cycles from 1969 to 2007, and about 5.6 percent over the last 50 years (from 1968 to 2017). The ultimate long-range civilian age-sex adjusted unemployment rate is assumed to be 5.5 percent, which is the same ultimate age-sex adjusted unemployment rate used in the 2018 report.

Annual Trust Fund Real Interest Rate – The real interest rate (real effective annual yield) on the special public debt obligations issuable to the trust funds for a given year is defined as the nominal effective annual yield adjusted for the increase in the CPI-W for the first year after issue. Future real interest rates on long-term Treasury securities will depend in part on the market view of the stability and solidity of the domestic financial markets and the domestic economy. Real ex-post (actual) interest rates on long-term Treasury securities averaged 3.30 percent over the last five economic cycles (from 1969 to 2007). Real interest rates have been substantially lower recently due to the weak economy in most of the developed world.

The assumed ultimate long-range real interest rate for new issues is 2.5 percent, which is 0.2 percentage point less than in the 2018 report. This ultimate assumption is consistent with a sustainable domestic fiscal policy over the long-range period and a gradual return to the sustainable rate of economic growth throughout the developed world.

OASDI Taxable Ratio – The OASDI taxable ratio is the share of OASDI covered earnings that is subject to the payroll tax. It is a fundamental component to projections of taxable payroll. This ratio declined substantially between 1983 and 2001, and has continued to decline between 2001 and 2015, but much more slowly. The ratio is assumed to stabilize at about 82.5 percent in 2028 and thereafter, which is the same ultimate ratio assumed for the 2018 report.

1. PRODUCTIVITY

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1 Productivity

1.1 Summary

For the 2019 Trustees Report, the assumed ultimate annual rates of increase in total-economy productivity[2] are 1.93 percent, 1.63 percent, and 1.33 percent for alternatives I, II, and III, respectively, as shown in Table 1.1. These rates of increase are 0.05 percentage points lower than those used in the 2018 Trustees Report. The assumed rates of increase for total-economy productivity for the 2019 Trustees Report are consistent with assumed ultimate annual rates of increase in nonfarm business productivity of 2.36 percent, 2.00 percent, and 1.63 percent for alternatives I, II, and III, respectively.

Table 1.1: Assumed Ultimate Annual Rates of Increase in Total-Economy Productivity

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Total-Economy Productivity	1.93	1.63	1.33	1.98	1.68	1.38	-0.05	-0.05	-0.05

Total-economy productivity is defined as the ratio of real gross domestic product (GDP) to total hours worked by all workers in the U.S. economy. The Bureau of Economic Analysis (BEA) estimates historical values for real GDP in its National Income and Product Accounts (NIPA). The Bureau of Labor Statistics (BLS) provides total hours worked based mostly on data from its Current Employment Statistics (CES) Survey.

This section is divided into three subsections. The first reviews any recent BEA and BLS revisions to real GDP and total hours worked. The second decomposes total-economy productivity by major sector and analyzes differences in sector productivity growth over several periods. A final subsection provides alternative long-run assumptions from private forecasters.

1.2 Recent BEA and BLS Data Revisions

BEA made a comprehensive update of the NIPA data on July 27, 2018.[3] This update affected data back to 1929, and changed the base year for price indices from 2009 to 2012. Compared to the values published in October 2017, the nominal GDP estimate was revised up by 0.4 percent for 2016, between 0.5 and 0.6 percent for 2013-2015, and about 0.2 percent for 2009-12. For years 2008 and earlier, nominal GDP was revised down, with the largest reduction being 0.5 percent for 2004. Real GDP levels are not directly comparable to last year's estimates because of the change in the base year, but real GDP growth rates generally changed little, with the most

[2] Total-economy productivity is defined as the ratio of total real gross domestic product (GDP) to total hours worked by all workers (where hours worked are defined and measured by BLS).

[3] https://www.bea.gov/information-updates-national-income-and-product-accounts

significant change being an approximately 0.2 percent per year higher average growth rate from 2004 to 2009.

BLS also revised its estimates of total hours worked for years 1948-2016. Compared to last year's estimates, hours worked are lower by about 0.1 percent for recent years (2008-2016), little changed for years between 1992 and 2007, and higher by between 0.1 and 0.4 percent in most earlier years. The lower average growth rate in total hours worked in the revised estimates, combined with a slightly higher average growth rate in real GDP, implies a higher level of productivity for the period.[4]

1.3 Productivity Growth Rates for Major Sectors and Over Long Time Periods and Economic Cycles[5]

Table 1.2: Historical Average Annual Rates of Increase in Total-Economy Productivity and Its Components (%)

	Total Economy	Nonfarm Business	Farm	Households	Nonprofit Institutions	General Government
1952-2017 (65 years)	1.88	2.05	4.42	4.41	0.53	0.32
1967-2017 (50 years)	1.60	1.86	3.86	4.04	0.39	0.19
1967-1992 (25 years)	1.64	1.82	5.14	4.03	0.57	0.37
1992-2017 (25 years)	1.56	1.90	2.59	4.06	0.20	0.02
2007 (peak) - 2017	1.03	1.26	1.59	3.44	0.40	0.21
Economic Cycles						
Last One - 2001-2007 (6 years)	2.19	2.66	3.52	0.21	0.41	0.29
Last Two - 1990-2007 (17 years)	1.97	2.40	3.82	4.12	-0.02	-0.07
Last Three - 1979-2007 (28 years)	1.75	2.05	4.68	3.77	0.11	0.23
Last Four - 1973-2007 (34 years)	1.63	1.90	4.54	3.65	0.16	0.11
Last Five - 1969-2007 (38 years)	1.73	2.01	4.52	4.00	0.28	0.14

[4] The changes in hours worked are concentrated in two sectors and mainly consist of a small increase in nonfarm business hours and a significant decrease in nonprofit hours.

[5] Peaks in economic cycles roughly follow the NBER cycle dating, except for short recoveries such as 1980-81, which are not counted as separate cycles.

Table 1.3: Ultimate Average Annual Rates of Increase in Total-Economy Productivity and Its Components for the 2019 Trustees Report

	Total Economy	Nonfarm Business	Farm	Households	Nonprofit Institutions	General Government
I	1.93	2.36	2.36	1.93	0.00	0.00
II	1.63	2.00	2.00	1.63	0.00	0.00
III	1.33	1.63	1.63	1.33	0.00	0.00

Table 1.2 lists the average annual rates of increase in productivity for the total economy and its major sectors over several different time periods and economic cycles.[6] The major sectors include nonfarm business, farm, households, nonprofit institutions, and general government. Listed in Table 1.3 are the assumed ultimate average annual rates of increase in productivity for the total economy and its major sectors. For the ultimate assumptions, the Trustees assume that the relative size of employment by sector will stabilize.

The annual growth rate in productivity can vary from its trend growth rate over an economic cycle, assuming employers are slow to adjust labor to changes in output. Going into a recession, the growth rate in productivity may drop below trend, as employers reduce output faster than labor. During an economic recovery, the growth rate in productivity may rise above trend, as employers increase output using their existing stock of labor. Productivity growth rates also exhibit runs of high or low growth not necessarily related to economic cycles. For example, the growth rate in total-economy productivity was 2.80 percent over the 25-year period from 1948 to 1973, 1.29 percent over the 22-year period from 1973 to 1995, 2.49 percent over the 10-year period from 1995 to 2005, and 1.03 percent over the 12-year period from 2005 to 2017. Hence, it seems reasonable to analyze productivity growth rates over several economic cycles and long timespans, such as the latest 50-year period from 1967 to 2017, a 65-year period from 1952 to 2017 or even longer periods.[7]

However, setting the ultimate long-range assumption for the annual rate of increase in productivity to its average value over some long-range historical period has its limitations. First, the NIPA data are less reliable in earlier periods.[8] BEA began measuring income in the

[6] Historical productivity growth rates in this section are based on the published real GDP data from BEA, without adjustments to pre-1978 data used in Sections 2 and 3. While the adjusted data are more consistent with current inflation measurement methods (see Section 2.6 for the description of the adjustments), they are available only for the aggregate GDP and not by sector. Therefore, in this section we use unadjusted data for consistency between the aggregate rate of change and the rates of change in each sector. With the adjustments, the annual growth rates for years before 1978 would be about 0.1 percentage point higher.

[7] Ferguson, Roger W. and William L. Wascher. "Distinguished Lecture on Economics in Government: Lessons from Past Productivity Booms," *Journal of Economic Perspectives*. Volume 18, Number 2 (Spring 2004), pp. 3-28.

[8] NIPA data for the most recent years are also less reliable, since they are subject to revisions.

mid-1930s, and output in the early to mid-1940s.[9] It then "backcasted" both measures to 1929. Based on conversations with BEA analysts, the agency did not introduce the more modern methods of sampling, collecting, and processing of data until 1948, and did not simultaneously collect and balance income and output data until the early 1950s. Consequently, it seems reasonable to limit the use of historical data to the last sixty-five years. Compound annual rates of growth for total-economy labor productivity for approximately the past five decades are shown in Table 1.4.

A second important limitation is that a significant portion of the total historical average annual rate of increase in total-economy productivity occurred because of shifts in workers from relatively low- to high-productivity jobs. For example, over the 50-year period from 1967 to 2017, the ratio of agricultural to total-economy hours worked declined from about 0.047 to 0.017, and the ratio of agricultural to total nominal GDP declined from about 0.023 to 0.007. Furthermore, although farm productivity grew faster than total economy productivity over the last 50 years, the average *level* of productivity for agricultural workers in 2017 was about 63 percent of the average *level* of productivity for all workers.

This shift complicates the consideration of historical experience. The assumed ultimate long-range value for the annual rate of increase in total-economy productivity should be consistent with the average value over a long-range historical period with adjustment for differences between conditions of the past and conditions expected for the future. The average long-range historical value is inflated due to sectoral shifts in employment that are not expected to continue into the future.[10] This problem can be resolved by removing the effects of sectoral shifts in employment from the historical record or, more simply, by setting the ultimate long-range value for the annual rate of increase in total-economy productivity to a weighted average of the expected ultimate long-range values for the annual rate of increase in productivity for each sector.

1.3.1 Sector Productivity Growth Rates

1.3.1.1 Nonfarm Business (NFB)

The average annual growth rate in NFB productivity was 2.66 percent over the last complete economic cycle (i.e., a 6-year period from 2001 to 2007), and 2.40 percent over the last two economic cycles (17-year period from 1990 to 2007). These relatively high growth rates reflect the heavy influence of the 1995-2005 "new economy" period characterized by rapid improvements in computers and their assimilation into the economy.

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[9] BEA, "GDP: One of the Great Inventions of the 20th Century," *Survey of Current Business*, January 2000, p. 7.

[10] For example, the 0.030 decline (i.e., from 0.047 to 0.017) in the ratio of agriculture to total-economy hours worked over the last fifty years cannot be repeated in the future since the level of the ratio in 2017 is only 0.017 and it cannot become negative.

Looking at longer periods, the average annual growth rate in NFB productivity was 2.05 percent over the last three economic cycles (28-year period from 1979 to 2007), 1.90 percent over the last four economic cycles (34-year period from 1973 to 2007), and 2.01 percent over the last five economic cycles (38-year period from 1969 to 2007). These productivity growth rates include the effects of a relatively low growth rate period from 1973 to 1995. The 1973-1995 slowdown has been attributed to a shift in employment from relatively high-productivity manufacturing jobs to low-productivity service jobs, and to the influx of new unskilled baby-boomers into the workforce. Historical compound annual rates of growth in labor productivity for the nonfarm business sector are shown in Table 1.5.

The 2.01 percent average annual growth rate for NFB productivity over the last five economic cycles (1969 to 2007) is a reasonable starting point for estimating the ultimate growth rate. Although productivity growth since the last cycle has been slower (the growth rate in NFB productivity has averaged only 1.26 percent over the 10-year period from 2007 to 2017), the average over the longest available period of good data points to a somewhat higher long-range rate of growth. (The growth rate in NFB productivity over the last 65 years was 2.05 percent and would be somewhat higher if pre-1978 inflation adjustments were consistent with today's methodology.) Therefore, the Trustees assume an ultimate rate of increase in NFB productivity of 2.00 percent. This rate of increase is 0.06 percentage points lower than in the 2018 Trustees Report, consistent with taking into account the relatively slow-growth experience of the most recent period.

1.3.1.2 Farm

The average annual growth rate in farm productivity was about 3.86 percent from 1967 to 2017. A significant portion of the relatively high growth rate in farm productivity was due to a shift in farm operation and ownership from smaller farms run by the self-employed to larger, more efficient and capital-intensive farms run by corporations. For example, based on BLS' Current Population Survey (CPS) data, the ratio of self-employed to all paid workers in the agricultural sector fell from about 0.61 in 1967 to 0.32 in 2017. For the long-range future, this shift is expected to slow and the difference in the productivity growth rates between the farm and nonfarm sectors is expected to decline to zero. Thus, the assumed ultimate rate of increase in farm productivity is 2.00 percent, equal to the assumed ultimate average annual growth rate in NFB productivity.

1.3.1.3 Nonprofit Institutions (NI)

The average annual rate of change in NI productivity was 0.57 percent over the 25-year period from 1967 to 1992, 0.20 percent over the 25-year period from 1992 to 2017, and 0.39 percent over the combined 50-year period from 1967 to 2017. The pattern of growth rates in NI productivity, with periods of positive and negative values, is largely due to shifts in employment within the NI sector.

In the NIPA, NI labor compensation accounts for about 84 percent of NI nominal GDP. NI compensation is summed from five subsectors including education, health, social, religious, and

business services. For each subsector, the level of real output is defined as the product of the level of average compensation per hour in a base year (currently 2012) and the level of hours worked. This means that the *level* of productivity in each subsector is a constant (i.e., the average compensation per hour in a base year), and that the *growth rate* in productivity in each sector is zero. However, this also means that the *level* of productivity for the total NI sector is a weighted average of the *levels* of productivity in the subsectors, and that the *growth rate* in total NI productivity may be positive (or negative), due to shifts in employment from sectors with relatively low (high) average compensation to sectors with relatively high (low) compensation.

In fact, BEA data indicate that the average annual compensation in health services has been higher than the average annual compensation in other service sectors since the mid-1970s, and that the growth in employment in health services over the 25-year period from 1967 to 1992 was higher than the growth in employment in other service sectors. The NIPA include data on compensation and full-time equivalent employment in health care, educational services, and social assistance.[11] These three sectors are mostly composed of NI workers.[12] The data show that the level of average annual compensation for full-time equivalent employment in 2017 was $73,900, $58,100, and $33,900 in health care, educational services, and social assistance, respectively. The data also show that the ratio of full-time equivalent employment in the health sector to the total for all three sectors rose from about 0.46 in 1967 to 0.61 in 1986, declined to 0.57 in 2000, and remained relatively stable thereafter.[13]

Thus, the data indicate that the relative increase in employment in health services significantly contributed to the average annual rate of increase in NI productivity of 0.57 percent over the 25-year period from 1967 to 1992. The data also indicate that the subsequent relative stability in the growth rates in employment across NI subsectors significantly contributed to the decline in the NI productivity growth rate to 0.20 percent over the 25-year period from 1992 to 2017. In the future, it seems reasonable to assume that the more recent historical trend in employment will continue, and that the ultimate long-range growth rates in employment in the NI subsectors will be roughly equal.[14] Thus, the assumed ultimate long-range growth rate in NI productivity is zero.

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[11] BEA, NIPA, Tables 6.2B through 6.2D and Tables 6.5B through 6.5D.

[12] BEA, "Income and Outlays of Households and of Nonprofit Institutions Serving Households," *Survey of Current Business*, April 2003, p. 14 http://www.bea.gov/scb/pdf/2003/04april/0403household.pdf.

[13] NIPA categories of services changed in 1998, so present ratios are not directly comparable with the old ratios. The ratio declined from 0.61 in 1982-1987 to 0.57 in 2000 (the data for 1998-2000 are available both under the old and the new categorization), and remained roughly constant at 0.71 under the new categorization from 2000 to 2011. However, it has since declined to 0.69 for 2013 through 2017.

[14]Given that the overall assumptions reflect a continued growth in the health sector as a percent of GDP, this faster growth is assumed to occur in the for-profit sector of the economy.

1.3.1.4 General Government (GOV)

The average annual rate of increase in GOV productivity was 0.37 percent over the 25-year period from 1967 to 1992 and 0.02 percent over the 25-year period from 1992 to 2017. These relatively small growth rates in GOV productivity are due to shifts in employment within the GOV sector.

GOV labor compensation accounts for about 80 percent of GOV nominal GDP.[15] GOV compensation is the total of compensation from three primary subsectors: federal civilian, federal military, and state and local government. As with the NI subsector, the *level* of productivity in each subsector is a constant (i.e., the average compensation per hour in a base year), and the *growth rate* in productivity in each sector is zero. However, this also means that the *level* of productivity for the total GOV sector is a weighted average of the *levels* of productivity in the subsectors, and that the *growth rate* in total GOV productivity may be positive (negative), due to shifts in employment from sectors with relatively low (high) average compensation to sectors with relatively high (low) compensation.[16]

The relatively small, positive growth rate in GOV productivity over some historical periods is due to shifts in employment between subsectors. In the future, the growth rate in GOV productivity could be negative, reflecting a reversal of historical trends. For the future, however, it seems reasonable to assume that the ultimate long-range growth rates in employment in the GOV subsectors will be about equal and that the assumed ultimate long-range growth rate in GOV productivity will be zero.[17]

1.3.1.5 Households

In the NIPA, nominal GDP in the household sector is the sum of the nominal compensation of private household workers and the nominal imputed output of owner-occupied housing (IOH). In 2017, the nominal compensation of private household workers made up only about 1.4 percent of the total nominal GDP in the household sector. Though this component is relatively small, it is useful to analyze each component of GDP in the household sector.

Compensation of Household Workers - As with NI and GOV compensation sectors, BEA sets the real growth rate in GDP equal to the growth rate in hours worked. Hence, the growth rate in productivity is, by definition, zero.

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[15] BEA, NIPA, Table 3.10.5

[16] BEA, "Government Transactions, Methodology Papers: U.S. National Income and Product Accounts," September 2005, http://www.bea.gov/national/pdf/mp5.pdf.

[17] Beginning with the 2017 report, OCACT estimates that the number of active military will remain constant rather than grow in proportion to civilian employment. This implies a gradual shift in the weights of civilian government and the military, and a resulting small decrease in average productivity of the government sector, but the effect is small.

Imputed Output of Owner-Occupied Housing (IOH) - Renters of apartments and homes pay rent and receive streams of housing services. BEA includes these business transactions in the NIPA. Though the owners of homes pay no rent and have no business transactions, they receive similar streams of housing services. Hence, for consistency, BEA estimates the real and nominal values of housing services received by those who own their own homes (i.e., real and nominal IOH) and includes these amounts in the NIPA.

BEA's inclusion of IOH in GDP creates a problem. Since IOH has no associated measure of labor hours worked, how should it be included when estimating historical and projecting future growth rates in sector and total-economy productivity? There are two possible approaches to handle IOH in projections of total-economy productivity for the long-range.

First, total real GDP could be projected as the sum of projections for real IOH and real GDP less IOH. Real GDP less IOH would be the product of the total-economy-less-IOH productivity and total hours worked. The ultimate average annual growth rate in total-economy-less-IOH productivity could be set to the weighted average of the assumed ultimate average annual growth rates in sector productivity.[18] Real IOH could be projected as a fixed ratio to total real GDP less IOH. [19] Total real GDP could then be constructed as the sum of real IOH and real GDP less IOH.

As a second and equivalent approach, household productivity could be defined as the sum of real IOH and real output of private household workers to the total hours worked of private household workers (as in Table 1.2). Using this definition, the average annual rate of increase in productivity for private household workers over the 50-year period from 1967 to 2017 was about 4.04 percent. In the future, however, the average annual growth rate in productivity for private household workers is expected to be much lower. In fact, it is expected to equal the average annual growth rate of total-economy-less-IOH productivity, as described in the first approach.[20]

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[18] Sector weights would be defined as the ratio of sector to total nominal GDP less IOH.

[19] Over the 30-year period from 1987 through 2016, the ratio of real IOH to real GDP less IOH has been fairly constant and averaged 0.078.

[20] If,

$$Pph = \text{Real IOH} / Hph$$
$$Pxph = \text{Real GDP less IOH} / Hxph$$

Then,

$$\dot{Pph} = \dot{\text{Real IOH}} - \dot{Hph}$$
$$\dot{Pxph} = \dot{\text{Real GDP less IOH}} - \dot{Hxph}$$

Assuming,

$$\dot{\text{Real IOH}} = \dot{\text{Real GDP less IOH}}$$
$$\dot{Hph} = \dot{Hxph}$$

Then,

$$\dot{Pph} = \dot{Pxph}$$

The ultimate average annual growth rate in total-economy productivity could be set to the weighted average of the assumed ultimate average annual growth rates in sector productivity.[21] Finally, total real GDP would be the product of total-economy productivity and hours worked.

1.3.2 Total-Economy Productivity Growth Rate

The assumed ultimate growth rate in total-economy productivity is equal to a weighted average of the growth rates in sector productivity and employment (see Section 1.5 Appendix). This relationship is simplified by assuming that the ultimate long-range growth rate in employment in all sectors of the economy will be about equal, and that the ultimate long-range growth rates in productivity for the nonprofit institution and general government sectors will be zero. Given these assumptions, the ultimate long-range growth rate in total-economy productivity is equal to the weighted average of the ultimate long-range growth rates in productivity in the farm, nonfarm business, and household sectors of the economy.

Sector weights are defined as the ratio of sector to total nominal GDP. This "nominal output" weight for the farm sector declined from about 0.023 in 1967 to 0.007 in 2017, and it averaged about 0.008 over the last complete business cycle from 2001 to 2007. The nominal output weight for the nonfarm business sector was much more stable. It averaged 0.750 over the 25-year period from 1968 through 1992, 0.749 over the 25-year period from 1993 through 2017, and 0.751 over the last complete business cycle. For the future, the ultimate long-range values for the nominal output weights are assumed to remain at 0.75 for the nonfarm business sector and 0.01 for the farm sector.

The nominal weight for the household sector rose from about 0.053 in 1977–79 to the historically high value of 0.076 in 2009. As mentioned, the increase in the weight occurred because the GDP deflator for IOH grew faster than the GDP deflator for all other goods over the period. More recently, the weight has fallen to 0.070 in 2012 and has remained at or close to that value since. In the future, OCACT expects the GDP deflator for IOH will grow at about the same rate as the GDP deflator for all other goods and that therefore the nominal weight for the household sector should stabilize at 0.07, close to its recent historical average.

Sector weights can also be defined as the ratio of sector to total nominal GDP excluding IOH. In this case, the ultimate long-range values for the nominal output weights will be 0.0108 (i.e., 0.01 / (1.0 − 0.07)) for the farm sector, and 0.8065 (i.e., 0.75 / (1.0 − 0.07)) for the nonfarm sector.

Where,

Pph	=	Productivity, private household
Pxph	=	Productivity, total economy less private household
Hph	=	Hours worked, private household
Hxph	=	Hours worked, total economy less private household
$\dot{Y}$	=	Rate of change in Y

[21] In this second approach, sector weights would be defined as the ratio of sector to total nominal GDP.

This analysis indicates that the long-range future growth rate in productivity for the total economy excluding IOH will be about 1.63 percent (i.e., 2.00 * (0.8065 + 0.0108)). It also indicates that the long-range future growth rate in productivity for the total economy including IOH will be about 1.63 percent (i.e., 2.00 * (0.75 + 0.01) + 1.63 * 0.07). Thus, for the 2019 Trustees Report, the assumed annual rates of increase in total-economy productivity are 1.93 percent, 1.63 percent, and 1.33 percent for alternatives I, II, and III, respectively. These rates of increase are 0.05 percentage points lower than those used in the 2018 Trustees Report.

1.4 Future Expectations

Growth in total economy labor productivity has been unusually slow since the last economic cycle peak. From 2007 to 2017, total economy productivity grew 1.03 percent per year on average, while nonfarm business productivity grew 1.26 percent per year on average. This is significantly slower than the historical average growth rate over the 65-year period (1952-2017) of 1.88 percent for total economy productivity and 2.05 percent for the nonfarm business productivity.

The reasons for the recent productivity slowdown are currently being debated by the economic profession. Similarly, there is also a debate as to whether the productivity slowdown of recent years is a temporary phenomenon that will be reversed, or a more fundamental change that is likely to persist.

The position that future productivity growth is likely to be slower than the historical average observed prior to 2007 rests primarily on the argument that the pace of technological innovation has slowed. Its main proponent, Robert J. Gordon, argues that the unusually rapid pace of technological innovation observed in 1920-1970 period resulted from the invention of several general-purpose technologies, such as electricity and the internal combustion engine, that dramatically boosted productivity. He argues that similarly powerful general-purpose technologies have not been invented since the 1970s and are not likely to be invented in the near future. This explains the productivity slowdown in recent decades, and suggests slower productivity growth in the future. [22]

Additionally, Robert J. Gordon, Dale W. Jorgenson, and others argue that some of the past productivity growth was driven by improvements in labor quality owning to the rising educational attainment of the labor force. However, as Jorgenson notes, "average levels of educational attainment remain high for people entering the labor force, but will no longer increase." As a result, rising average educational attainment will gradually disappear as a source of productivity growth.[23]

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[22] See Gordon, Robert J. 2016. *The Rise and Fall of American Growth: The U.S. Standard of Living Since the Civil War*. Princeton: Princeton University Press, and Gordon, Robert J. 2012 "Is U.S. Economic Growth Over? Faltering Innovation Confronts the Six Headwinds*",* NBER working paper 18315, http://www.nber.org/papers/w18315.pdf.

[23] Jorgenson, Dale W., Mun S. Ho, and Jon D. Samuels. "Educational Attainment and the Revival of U.S. Economic Growth." In *Education, Skills, and Technical Change: Implications for Future U.S. GDP Growth*. Chicago: University of Chicago Press, 2017

The opposing view holds that productivity growth will rebound in the future owing to new technologies evolving at a pace at least as fast as in the past. Proponents of this view, primarily Erik Brynjolfsson and his co-authors, point to artificial intelligence and machine learning as the new general-purpose technology that will result in a return to faster productivity growth in the future. They argue that slow productivity growth in the recent past is not a predictor of future productivity growth. In fact, as new technology is being developed, new investments required to fully realize the transformative potential of the new technology are being made, and complementary innovations are being undertaken, one should expect productivity growth to be slow – until the effects of the new technology begin to spread across the economy.[24]

The future rate of technological innovations and their effects on productivity are extremely difficult to forecast. OCACT believes that it is reasonable to assume that the inevitable slowing of the rate of change in educational attainment will slow the rate of productivity growth, even assuming that technological advances will continue at a similar pace as in the past. This supports the assumed lower value for the ultimate assumption for future total economy productivity growth.

1.5 Projections from Other Sources

IHS Markit (formerly Global Insight, Inc.) provides projections through 2048 in its latest long-run trend forecast (see *The 30-Year Focus, Third Quarter*, August 2018). For the 20-year period from 2028 to 2048, IHS Markit projects that the average annual rate of increase in productivity will be about 1.50 percent for the nonfarm business sector. Moody's Analytics' September 2018 forecast extends to 2048. For the 20-year period from 2028 to 2048, Moody's Analytics projects the average annual growth rate in productivity will be about 1.58 percent for the nonfarm business sector.

The Office of Management and Budget (OMB) Mid-Session Review of the Fiscal Year 2019 Budget includes projections through 2028. The OMB annual growth rate for the total-economy productivity was 2.19 percent for 2028. The Congressional Budget Office (CBO) June 2018 report, *The 2018 Long-Term Budget Outlook*, includes projections through 2048. CBO's average annual growth rate for total-economy productivity was 1.54 percent over the entire 30-year period and 1.56 percent over the last 10 years, 2039 through 2048. The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended no changes to the assumed ultimate annual rate of increase in total-economy productivity of 1.68 percent in the 2015 Trustees Report, alternative II.

[24] Brynjolfsson, Erik, Daniel Rock, and Chad Syverson. 2017 "Artificial Intelligence and the Modern Productivity Paradox: A Clash of Expectations and Statistics" NBER working paper No. 24001 http://www.nber.org/papers/w24001

Table 1.4: Total-Economy Productivity: Compound Annual Rates of Growth (%) Base Year = 2009

		From																		
To	Variable	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1961	40.40																			
1962	41.82	3.52																		
1963	43.31	3.53	3.54																	
1964	44.65	3.39	3.32	3.10																
1965	45.98	3.28	3.20	3.04	2.97															
1966	47.35	3.22	3.15	3.02	2.98	2.98														
1967	48.11	2.95	2.84	2.66	2.52	2.29	1.61													
1968	49.58	2.97	2.88	2.74	2.65	2.55	2.33	3.06												
1969	49.92	2.68	2.56	2.40	2.26	2.08	1.78	1.87	0.68											
1970	50.91	2.60	2.49	2.34	2.21	2.06	1.83	1.91	1.33	1.99										
1971	52.83	2.72	2.63	2.52	2.43	2.34	2.22	2.37	2.14	2.87	3.77									
1972	54.12	2.69	2.61	2.51	2.43	2.36	2.25	2.38	2.22	2.73	3.11	2.45								
1973	55.42	2.67	2.59	2.50	2.43	2.36	2.27	2.39	2.25	2.65	2.87	2.42	2.39							
1974	54.92	2.39	2.30	2.18	2.09	1.99	1.87	1.91	1.72	1.93	1.91	1.30	0.73	-0.90						
1975	56.42	2.41	2.33	2.23	2.15	2.07	1.97	2.01	1.86	2.06	2.08	1.66	1.40	0.90	2.74					
1976	57.77	2.41	2.33	2.24	2.17	2.10	2.01	2.05	1.93	2.11	2.13	1.80	1.64	1.39	2.56	2.39				
1977	58.39	2.33	2.25	2.16	2.09	2.01	1.93	1.96	1.83	1.98	1.98	1.68	1.53	1.32	2.07	1.73	1.09			
1978	58.93	2.24	2.17	2.07	2.00	1.93	1.84	1.86	1.74	1.86	1.84	1.57	1.43	1.24	1.78	1.46	1.00	0.91		
1979	59.07	2.13	2.05	1.96	1.88	1.81	1.72	1.73	1.61	1.70	1.67	1.41	1.26	1.07	1.47	1.15	0.75	0.58	0.24	
1980	59.14	2.03	1.94	1.85	1.77	1.69	1.60	1.60	1.48	1.55	1.51	1.26	1.11	0.93	1.24	0.95	0.59	0.42	0.18	0.12
1981	60.37	2.03	1.95	1.86	1.79	1.72	1.63	1.64	1.53	1.60	1.56	1.34	1.22	1.08	1.36	1.13	0.89	0.83	0.81	1.09
1982	60.33	1.93	1.85	1.76	1.69	1.61	1.53	1.52	1.41	1.47	1.42	1.21	1.09	0.95	1.18	0.96	0.73	0.65	0.59	0.71
1983	62.01	1.97	1.89	1.81	1.74	1.68	1.60	1.60	1.50	1.56	1.53	1.34	1.24	1.13	1.36	1.19	1.02	1.01	1.02	1.22
1984	63.34	1.97	1.90	1.83	1.76	1.70	1.63	1.63	1.54	1.60	1.57	1.41	1.32	1.22	1.44	1.29	1.16	1.17	1.21	1.41
1985	64.45	1.97	1.90	1.82	1.76	1.70	1.64	1.64	1.56	1.61	1.58	1.43	1.35	1.27	1.47	1.34	1.22	1.24	1.29	1.46
1986	65.95	1.98	1.92	1.85	1.79	1.73	1.67	1.67	1.60	1.65	1.63	1.49	1.42	1.35	1.54	1.43	1.33	1.36	1.42	1.59
1987	66.26	1.92	1.86	1.79	1.73	1.68	1.61	1.61	1.54	1.59	1.56	1.43	1.36	1.28	1.46	1.35	1.26	1.27	1.31	1.45
1988	67.20	1.90	1.84	1.77	1.72	1.66	1.60	1.60	1.53	1.58	1.55	1.43	1.36	1.29	1.45	1.35	1.27	1.28	1.32	1.44
1989	67.85	1.87	1.81	1.74	1.69	1.64	1.58	1.58	1.51	1.55	1.52	1.40	1.34	1.27	1.42	1.33	1.25	1.26	1.29	1.40
1990	68.88	1.86	1.80	1.73	1.68	1.63	1.57	1.57	1.51	1.55	1.52	1.41	1.35	1.29	1.43	1.34	1.26	1.28	1.31	1.41
1991	69.70	1.83	1.78	1.71	1.66	1.61	1.56	1.56	1.49	1.53	1.51	1.40	1.34	1.28	1.41	1.33	1.26	1.27	1.30	1.39
1992	72.20	1.89	1.84	1.78	1.73	1.69	1.64	1.64	1.58	1.62	1.60	1.50	1.45	1.40	1.53	1.46	1.40	1.43	1.46	1.56
1993	72.54	1.85	1.79	1.73	1.69	1.64	1.59	1.59	1.53	1.57	1.55	1.45	1.40	1.36	1.48	1.41	1.35	1.36	1.39	1.48
1994	73.05	1.81	1.76	1.70	1.65	1.61	1.56	1.56	1.50	1.53	1.52	1.42	1.37	1.32	1.44	1.37	1.31	1.33	1.35	1.43
1995	73.51	1.78	1.72	1.67	1.62	1.58	1.53	1.53	1.47	1.50	1.48	1.39	1.34	1.29	1.40	1.33	1.28	1.29	1.31	1.38
1996	74.94	1.78	1.73	1.68	1.63	1.59	1.54	1.54	1.49	1.52	1.50	1.41	1.37	1.32	1.42	1.36	1.31	1.32	1.34	1.41
1997	76.32	1.78	1.73	1.68	1.64	1.60	1.55	1.55	1.50	1.53	1.51	1.43	1.38	1.34	1.44	1.38	1.34	1.35	1.37	1.43
1998	78.09	1.80	1.75	1.70	1.66	1.62	1.58	1.57	1.53	1.55	1.54	1.46	1.42	1.38	1.48	1.42	1.38	1.39	1.42	1.48
1999	80.41	1.83	1.78	1.73	1.70	1.66	1.62	1.62	1.57	1.60	1.59	1.51	1.48	1.44	1.54	1.49	1.45	1.46	1.49	1.55
2000	82.46	1.85	1.80	1.76	1.72	1.68	1.65	1.65	1.60	1.63	1.62	1.55	1.52	1.48	1.58	1.53	1.49	1.51	1.54	1.60
2001	84.27	1.85	1.81	1.77	1.73	1.70	1.66	1.66	1.62	1.65	1.64	1.57	1.54	1.51	1.60	1.56	1.52	1.54	1.57	1.63
2002	86.86	1.88	1.84	1.80	1.77	1.73	1.70	1.70	1.66	1.69	1.68	1.62	1.59	1.56	1.65	1.61	1.58	1.60	1.63	1.69
2003	89.80	1.92	1.88	1.84	1.81	1.78	1.74	1.75	1.71	1.74	1.73	1.67	1.65	1.62	1.71	1.67	1.65	1.67	1.70	1.76
2004	92.17	1.94	1.90	1.86	1.83	1.80	1.77	1.77	1.74	1.77	1.76	1.70	1.68	1.65	1.74	1.71	1.68	1.70	1.74	1.80
2005	94.04	1.94	1.90	1.86	1.83	1.81	1.78	1.78	1.75	1.77	1.77	1.71	1.69	1.67	1.75	1.72	1.69	1.72	1.75	1.80
2006	94.95	1.92	1.88	1.84	1.81	1.78	1.75	1.76	1.72	1.75	1.75	1.69	1.67	1.65	1.73	1.69	1.67	1.69	1.72	1.77
2007	95.95	1.90	1.86	1.82	1.79	1.77	1.74	1.74	1.71	1.73	1.73	1.67	1.65	1.63	1.71	1.67	1.65	1.67	1.70	1.75
2008	96.97	1.88	1.84	1.81	1.78	1.75	1.72	1.72	1.69	1.72	1.71	1.66	1.63	1.61	1.69	1.65	1.63	1.65	1.67	1.72
2009	100.00	1.91	1.87	1.84	1.81	1.78	1.75	1.76	1.73	1.75	1.75	1.69	1.67	1.65	1.73	1.70	1.68	1.70	1.72	1.77
2010	102.59	1.92	1.89	1.85	1.83	1.80	1.77	1.78	1.75	1.77	1.77	1.72	1.70	1.68	1.75	1.72	1.70	1.72	1.75	1.80
2011	102.64	1.88	1.85	1.81	1.79	1.76	1.73	1.74	1.71	1.73	1.72	1.67	1.65	1.64	1.70	1.68	1.66	1.67	1.70	1.74
2012	103.13	1.85	1.82	1.79	1.76	1.73	1.71	1.71	1.68	1.70	1.70	1.65	1.63	1.61	1.67	1.64	1.62	1.64	1.66	1.70
2013	103.75	1.83	1.80	1.76	1.74	1.71	1.68	1.68	1.65	1.68	1.67	1.62	1.60	1.58	1.64	1.62	1.60	1.61	1.63	1.67
2014	104.34	1.81	1.77	1.74	1.71	1.69	1.66	1.66	1.63	1.65	1.64	1.60	1.58	1.56	1.62	1.59	1.57	1.58	1.60	1.64
2015	105.13	1.79	1.75	1.72	1.69	1.67	1.64	1.64	1.61	1.63	1.62	1.58	1.56	1.54	1.60	1.57	1.55	1.56	1.58	1.61
2016	105.39	1.76	1.73	1.69	1.67	1.64	1.61	1.61	1.58	1.60	1.59	1.55	1.53	1.51	1.56	1.54	1.51	1.53	1.54	1.58
2017	106.30	1.74	1.71	1.68	1.65	1.62	1.60	1.60	1.57	1.59	1.58	1.53	1.51	1.49	1.55	1.52	1.50	1.51	1.52	1.56

Table 1.4 (continued). Total-Economy Productivity: Compound Annual Rates of Growth (%) Base Year = 2009

		From																			
To	Variable	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
1979	59.07																				
1980	59.14	0.12																			
1981	60.37	1.09	2.08																		
1982	60.33	0.71	1.00	-0.07																	
1983	62.01	1.22	1.59	1.35	2.78																
1984	63.34	1.41	1.73	1.61	2.47	2.15															
1985	64.45	1.46	1.74	1.65	2.23	1.95	1.76														
1986	65.95	1.59	1.83	1.79	2.25	2.08	2.04	2.33													
1987	66.26	1.45	1.64	1.56	1.89	1.67	1.51	1.39	0.47												
1988	67.20	1.44	1.61	1.54	1.81	1.62	1.49	1.40	0.94	1.42											
1989	67.85	1.40	1.54	1.47	1.69	1.51	1.39	1.29	0.95	1.19	0.97										
1990	68.88	1.41	1.54	1.48	1.67	1.51	1.41	1.34	1.09	1.30	1.24	1.51									
1991	69.70	1.39	1.50	1.45	1.62	1.47	1.38	1.31	1.11	1.27	1.23	1.35	1.19								
1992	72.20	1.56	1.68	1.64	1.81	1.71	1.65	1.64	1.52	1.73	1.81	2.09	2.38	3.59							
1993	72.54	1.48	1.58	1.54	1.69	1.58	1.52	1.49	1.37	1.52	1.54	1.68	1.74	2.01	0.46						
1994	73.05	1.43	1.52	1.48	1.61	1.50	1.44	1.40	1.28	1.40	1.40	1.49	1.48	1.57	0.58	0.70					
1995	73.51	1.38	1.46	1.42	1.53	1.43	1.36	1.32	1.21	1.31	1.29	1.34	1.31	1.34	0.60	0.67	0.64				
1996	74.94	1.41	1.49	1.45	1.56	1.47	1.41	1.38	1.29	1.38	1.37	1.43	1.41	1.46	0.93	1.09	1.29	1.94			
1997	76.32	1.43	1.51	1.48	1.58	1.49	1.44	1.42	1.34	1.42	1.42	1.48	1.48	1.52	1.12	1.28	1.47	1.89	1.85		
1998	78.09	1.48	1.56	1.53	1.63	1.55	1.51	1.49	1.42	1.50	1.51	1.57	1.58	1.64	1.31	1.49	1.68	2.03	2.08	2.32	
1999	80.41	1.55	1.63	1.61	1.70	1.64	1.60	1.59	1.54	1.63	1.65	1.71	1.73	1.80	1.55	1.73	1.94	2.27	2.38	2.65	
2000	82.46	1.60	1.68	1.65	1.75	1.69	1.66	1.66	1.61	1.70	1.72	1.79	1.82	1.89	1.67	1.85	2.04	2.32	2.42	2.61	
2001	84.27	1.63	1.70	1.68	1.77	1.72	1.69	1.69	1.65	1.73	1.76	1.82	1.85	1.92	1.73	1.89	2.06	2.30	2.38	2.51	
2002	86.86	1.69	1.76	1.75	1.84	1.79	1.77	1.77	1.74	1.82	1.85	1.92	1.95	2.02	1.86	2.02	2.19	2.41	2.49	2.62	
2003	89.80	1.76	1.83	1.82	1.91	1.87	1.85	1.86	1.83	1.92	1.95	2.02	2.06	2.13	2.00	2.16	2.32	2.53	2.62	2.75	
2004	92.17	1.80	1.87	1.86	1.95	1.91	1.89	1.90	1.88	1.96	1.99	2.06	2.10	2.17	2.06	2.20	2.35	2.55	2.62	2.73	
2005	94.04	1.80	1.87	1.86	1.95	1.91	1.90	1.91	1.88	1.96	2.00	2.06	2.10	2.16	2.05	2.19	2.32	2.49	2.55	2.64	
2006	94.95	1.77	1.84	1.83	1.91	1.87	1.86	1.86	1.84	1.91	1.94	2.00	2.03	2.08	1.98	2.09	2.21	2.35	2.39	2.46	
2007	95.95	1.75	1.81	1.80	1.87	1.84	1.82	1.82	1.80	1.87	1.89	1.94	1.97	2.02	1.91	2.02	2.12	2.24	2.27	2.31	
2008	96.97	1.72	1.78	1.77	1.84	1.80	1.79	1.79	1.77	1.83	1.85	1.90	1.92	1.96	1.86	1.95	2.04	2.15	2.17	2.20	
2009	100.00	1.77	1.83	1.82	1.89	1.86	1.84	1.85	1.83	1.89	1.91	1.96	1.98	2.03	1.93	2.03	2.12	2.22	2.24	2.28	
2010	102.59	1.80	1.85	1.85	1.91	1.88	1.87	1.88	1.86	1.92	1.94	1.99	2.01	2.06	1.97	2.06	2.15	2.25	2.27	2.30	
2011	102.64	1.74	1.79	1.78	1.85	1.82	1.80	1.81	1.78	1.84	1.86	1.90	1.92	1.95	1.87	1.95	2.02	2.11	2.12	2.14	
2012	103.13	1.70	1.75	1.74	1.80	1.77	1.76	1.76	1.73	1.79	1.80	1.84	1.85	1.88	1.80	1.87	1.93	2.01	2.02	2.03	
2013	103.75	1.67	1.72	1.71	1.76	1.73	1.72	1.71	1.69	1.74	1.75	1.79	1.80	1.82	1.74	1.81	1.86	1.93	1.93	1.94	
2014	104.34	1.64	1.68	1.67	1.73	1.69	1.68	1.67	1.65	1.70	1.71	1.74	1.75	1.77	1.69	1.75	1.80	1.86	1.86	1.86	
2015	105.13	1.61	1.66	1.64	1.70	1.66	1.65	1.64	1.62	1.66	1.67	1.70	1.71	1.73	1.65	1.70	1.75	1.80	1.80	1.79	
2016	105.39	1.58	1.62	1.60	1.65	1.62	1.60	1.60	1.57	1.61	1.62	1.64	1.65	1.67	1.59	1.64	1.68	1.73	1.72	1.71	
2017	106.30	1.56	1.60	1.58	1.63	1.60	1.58	1.58	1.55	1.59	1.59	1.62	1.62	1.64	1.56	1.60	1.64	1.69	1.68	1.67	

		From																			
To	Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1997	76.32																				
1998	78.09	2.32																			
1999	80.41	2.65	2.98																		
2000	82.46	2.61	2.76	2.55																	
2001	84.27	2.51	2.57	2.37	2.19																
2002	86.86	2.62	2.70	2.60	2.63	3.07															
2003	89.80	2.75	2.83	2.80	2.88	3.23	3.39														
2004	92.17	2.73	2.80	2.77	2.82	3.03	3.01	2.64													
2005	94.04	2.64	2.69	2.64	2.66	2.78	2.68	2.33	2.02												
2006	94.95	2.46	2.47	2.40	2.38	2.41	2.25	1.88	1.49	0.97											
2007	95.95	2.31	2.31	2.23	2.19	2.19	2.01	1.67	1.35	1.01	1.05										
2008	96.97	2.20	2.19	2.10	2.05	2.03	1.85	1.55	1.28	1.03	1.06	1.07									
2009	100.00	2.28	2.27	2.20	2.17	2.16	2.03	1.81	1.64	1.55	1.74	2.09	3.12								
2010	102.59	2.30	2.30	2.24	2.21	2.21	2.10	1.92	1.80	1.76	1.96	2.26	2.86	2.59							
2011	102.64	2.14	2.12	2.05	2.01	1.99	1.87	1.68	1.55	1.47	1.57	1.70	1.91	1.31	0.04						
2012	103.13	2.03	2.01	1.93	1.88	1.85	1.73	1.55	1.41	1.33	1.39	1.46	1.55	1.03	0.26	0.48					
2013	103.75	1.94	1.91	1.84	1.78	1.75	1.63	1.46	1.32	1.24	1.28	1.31	1.36	0.93	0.38	0.54	0.60				
2014	104.34	1.86	1.83	1.75	1.69	1.66	1.54	1.37	1.25	1.16	1.19	1.20	1.23	0.85	0.42	0.55	0.58	0.56			
2015	105.13	1.79	1.76	1.69	1.63	1.59	1.48	1.32	1.20	1.12	1.14	1.15	1.16	0.84	0.49	0.60	0.64	0.66	0.76		
2016	105.39	1.71	1.68	1.60	1.55	1.50	1.39	1.24	1.12	1.04	1.05	1.05	1.05	0.75	0.45	0.53	0.54	0.52	0.50	0.25	
2017	106.30	1.67	1.64	1.56	1.50	1.46	1.36	1.21	1.10	1.03	1.03	1.03	1.03	0.77	0.51	0.59	0.61	0.61	0.62	0.55	0.86

Table 1.5: Nonfarm Business Productivity: Compound Annual Rates of Growth (%) Base Year = 2009

		From																		
To	Variable	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1961	34.15																			
1962	35.71	4.56																		
1963	36.93	3.98	3.41																	
1964	38.00	3.62	3.16	2.90																
1965	39.21	3.51	3.17	3.05	3.19															
1966	40.63	3.54	3.28	3.24	3.41	3.62														
1967	41.40	3.26	3.00	2.90	2.90	2.75	1.89													
1968	42.85	3.29	3.08	3.02	3.05	3.00	2.69	3.50												
1969	42.93	2.90	2.67	2.54	2.47	2.29	1.85	1.83	0.19											
1970	43.57	2.74	2.52	2.39	2.31	2.13	1.76	1.72	0.84	1.48										
1971	45.28	2.86	2.67	2.58	2.53	2.43	2.19	2.26	1.85	2.69	3.92									
1972	46.81	2.91	2.74	2.67	2.64	2.56	2.39	2.49	2.24	2.93	3.66	3.40								
1973	48.26	2.92	2.78	2.71	2.69	2.63	2.49	2.59	2.41	2.97	3.47	3.24	3.09							
1974	47.47	2.56	2.40	2.31	2.25	2.14	1.96	1.97	1.72	2.03	2.17	1.59	0.69	-1.65						
1975	48.77	2.58	2.43	2.34	2.29	2.20	2.05	2.07	1.87	2.15	2.28	1.88	1.37	0.52	2.75					
1976	50.47	2.64	2.50	2.43	2.39	2.32	2.19	2.23	2.07	2.34	2.48	2.20	1.90	1.50	3.12	3.49				
1977	51.34	2.58	2.45	2.38	2.34	2.27	2.15	2.18	2.03	2.26	2.37	2.12	1.86	1.56	2.65	2.61	1.72			
1978	52.05	2.51	2.38	2.31	2.27	2.20	2.09	2.10	1.96	2.16	2.25	2.01	1.78	1.52	2.33	2.19	1.55	1.38		
1979	51.97	2.36	2.23	2.16	2.11	2.03	1.91	1.91	1.77	1.93	1.98	1.74	1.50	1.24	1.83	1.60	0.98	0.61	-0.16	
1980	51.94	2.23	2.10	2.03	1.97	1.89	1.77	1.76	1.62	1.75	1.77	1.54	1.31	1.06	1.51	1.27	0.72	0.39	-0.10	-0.05
1981	52.75	2.20	2.07	2.00	1.95	1.87	1.76	1.75	1.61	1.73	1.75	1.54	1.34	1.12	1.52	1.32	0.89	0.68	0.45	0.75
1982	52.28	2.05	1.92	1.85	1.79	1.71	1.59	1.57	1.43	1.53	1.53	1.32	1.11	0.89	1.22	1.00	0.59	0.36	0.11	0.20
1983	54.45	2.14	2.03	1.96	1.91	1.84	1.74	1.73	1.61	1.71	1.73	1.55	1.38	1.21	1.54	1.39	1.09	0.98	0.90	1.17
1984	55.67	2.15	2.04	1.97	1.93	1.86	1.77	1.76	1.65	1.75	1.77	1.60	1.45	1.31	1.61	1.48	1.23	1.16	1.13	1.39
1985	56.63	2.13	2.03	1.96	1.92	1.85	1.76	1.76	1.65	1.75	1.76	1.61	1.48	1.34	1.62	1.51	1.29	1.23	1.21	1.44
1986	58.32	2.16	2.07	2.01	1.97	1.91	1.82	1.82	1.73	1.82	1.84	1.70	1.58	1.47	1.73	1.64	1.46	1.43	1.43	1.66
1987	58.66	2.10	2.01	1.95	1.91	1.85	1.76	1.76	1.67	1.75	1.77	1.63	1.52	1.40	1.64	1.55	1.38	1.34	1.34	1.53
1988	59.63	2.09	1.99	1.93	1.89	1.84	1.76	1.75	1.67	1.74	1.76	1.63	1.52	1.42	1.64	1.56	1.40	1.37	1.37	1.54
1989	60.17	2.04	1.95	1.90	1.86	1.80	1.72	1.71	1.63	1.70	1.71	1.59	1.49	1.39	1.59	1.51	1.36	1.33	1.33	1.48
1990	61.18	2.03	1.94	1.89	1.85	1.79	1.72	1.71	1.63	1.70	1.71	1.60	1.50	1.40	1.60	1.52	1.38	1.36	1.36	1.49
1991	62.18	2.02	1.93	1.88	1.84	1.79	1.72	1.71	1.63	1.70	1.71	1.60	1.51	1.42	1.60	1.53	1.40	1.38	1.38	1.51
1992	64.96	2.10	2.01	1.97	1.93	1.89	1.82	1.82	1.75	1.82	1.83	1.73	1.65	1.58	1.76	1.70	1.59	1.58	1.59	1.73
1993	65.03	2.03	1.95	1.90	1.87	1.82	1.76	1.75	1.68	1.75	1.76	1.66	1.58	1.50	1.67	1.61	1.50	1.49	1.50	1.61
1994	65.49	1.99	1.91	1.87	1.83	1.78	1.72	1.71	1.64	1.70	1.71	1.62	1.54	1.46	1.62	1.56	1.46	1.44	1.45	1.55
1995	66.21	1.97	1.89	1.84	1.81	1.76	1.70	1.69	1.62	1.68	1.69	1.60	1.52	1.45	1.60	1.54	1.44	1.42	1.43	1.53
1996	67.61	1.97	1.90	1.85	1.82	1.77	1.71	1.71	1.64	1.70	1.70	1.62	1.54	1.48	1.62	1.57	1.47	1.46	1.46	1.56
1997	68.92	1.97	1.90	1.85	1.82	1.78	1.72	1.71	1.65	1.70	1.71	1.63	1.56	1.50	1.63	1.58	1.49	1.48	1.49	1.58
1998	71.02	2.00	1.93	1.89	1.86	1.82	1.76	1.76	1.70	1.75	1.76	1.68	1.62	1.56	1.69	1.65	1.56	1.56	1.57	1.66
1999	73.73	2.05	1.98	1.94	1.91	1.87	1.82	1.82	1.77	1.82	1.83	1.76	1.70	1.64	1.78	1.74	1.66	1.66	1.67	1.76
2000	76.20	2.08	2.01	1.98	1.95	1.92	1.87	1.87	1.82	1.87	1.88	1.81	1.75	1.71	1.84	1.80	1.73	1.73	1.75	1.84
2001	78.28	2.10	2.03	2.00	1.97	1.94	1.89	1.89	1.84	1.89	1.91	1.84	1.79	1.74	1.87	1.84	1.77	1.77	1.79	1.88
2002	81.65	2.15	2.09	2.06	2.03	2.00	1.96	1.96	1.91	1.97	1.98	1.92	1.87	1.83	1.96	1.93	1.87	1.87	1.89	1.98
2003	84.76	2.19	2.13	2.10	2.08	2.05	2.01	2.01	1.97	2.02	2.04	1.98	1.93	1.89	2.02	1.99	1.94	1.95	1.97	2.06
2004	87.19	2.20	2.15	2.12	2.10	2.07	2.03	2.03	1.99	2.04	2.06	2.01	1.96	1.93	2.05	2.02	1.97	1.98	2.00	2.09
2005	89.11	2.20	2.15	2.12	2.10	2.07	2.03	2.04	2.00	2.05	2.07	2.01	1.97	1.93	2.05	2.03	1.98	1.99	2.01	2.10
2006	90.09	2.18	2.13	2.10	2.08	2.05	2.01	2.01	1.97	2.02	2.04	1.99	1.94	1.91	2.02	2.00	1.95	1.96	1.98	2.06
2007	91.66	2.17	2.12	2.09	2.07	2.04	2.00	2.01	1.97	2.02	2.03	1.98	1.94	1.90	2.01	1.99	1.94	1.95	1.97	2.05
2008	92.64	2.15	2.09	2.06	2.05	2.02	1.98	1.98	1.95	1.99	2.01	1.95	1.91	1.88	1.99	1.96	1.92	1.92	1.94	2.01
2009	95.94	2.18	2.12	2.10	2.08	2.05	2.02	2.02	1.99	2.03	2.04	2.00	1.96	1.93	2.03	2.01	1.97	1.97	1.99	2.06
2010	99.16	2.20	2.15	2.12	2.11	2.08	2.05	2.05	2.02	2.06	2.08	2.03	1.99	1.97	2.07	2.05	2.01	2.01	2.03	2.11
2011	99.13	2.15	2.11	2.08	2.06	2.04	2.00	2.00	1.97	2.01	2.03	1.98	1.94	1.91	2.01	1.99	1.95	1.95	1.97	2.04
2012	100.00	2.13	2.08	2.05	2.04	2.01	1.98	1.98	1.94	1.99	2.00	1.95	1.92	1.89	1.98	1.96	1.92	1.92	1.94	2.00
2013	100.51	2.10	2.05	2.02	2.00	1.98	1.95	1.95	1.91	1.95	1.96	1.92	1.88	1.85	1.94	1.92	1.88	1.88	1.90	1.96
2014	101.32	2.07	2.03	2.00	1.98	1.96	1.92	1.92	1.89	1.93	1.94	1.89	1.86	1.83	1.91	1.89	1.85	1.85	1.87	1.93
2015	102.63	2.06	2.01	1.99	1.97	1.94	1.91	1.91	1.88	1.91	1.92	1.88	1.84	1.81	1.90	1.88	1.84	1.84	1.85	1.91
2016	102.77	2.02	1.98	1.95	1.93	1.91	1.87	1.87	1.84	1.87	1.88	1.84	1.80	1.77	1.86	1.83	1.79	1.80	1.81	1.86
2017	103.93	2.01	1.96	1.93	1.92	1.89	1.86	1.86	1.82	1.86	1.87	1.82	1.79	1.76	1.84	1.82	1.78	1.78	1.79	1.84

Table 1.5 (continued). Nonfarm Business Productivity: Compound Annual Rates of Growth (%) Base Year = 2009

		From																		
To	Variable	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1979	51.97																			
1980	51.94	-0.05																		
1981	52.75	0.75	1.56																	
1982	52.28	0.20	0.33	-0.89																
1983	54.45	1.17	1.58	1.59	4.14															
1984	55.67	1.39	1.75	1.81	3.19	2.25														
1985	56.63	1.44	1.74	1.79	2.70	1.99	1.72													
1986	58.32	1.66	1.95	2.03	2.77	2.32	2.35	2.99												
1987	58.66	1.53	1.75	1.79	2.33	1.88	1.76	1.78	0.58											
1988	59.63	1.54	1.74	1.77	2.21	1.83	1.73	1.73	1.11	1.64										
1989	60.17	1.48	1.65	1.66	2.03	1.68	1.56	1.52	1.04	1.27	0.90									
1990	61.18	1.49	1.65	1.66	1.98	1.68	1.58	1.56	1.20	1.41	1.29	1.68								
1991	62.18	1.51	1.65	1.66	1.95	1.67	1.59	1.57	1.29	1.47	1.41	1.66	1.65							
1992	64.96	1.73	1.88	1.91	2.19	1.98	1.95	1.98	1.81	2.06	2.16	2.59	3.04	4.46						
1993	65.03	1.61	1.74	1.76	2.00	1.79	1.74	1.74	1.57	1.73	1.75	1.96	2.06	2.27	0.12					
1994	65.49	1.55	1.67	1.68	1.89	1.69	1.64	1.63	1.46	1.59	1.58	1.71	1.72	1.74	0.41	0.70				
1995	66.21	1.53	1.63	1.64	1.83	1.64	1.59	1.57	1.42	1.52	1.51	1.61	1.59	1.58	0.64	0.90	1.10			
1996	67.61	1.56	1.66	1.67	1.85	1.68	1.63	1.62	1.49	1.59	1.58	1.68	1.68	1.69	1.01	1.30	1.60	2.11		
1997	68.92	1.58	1.68	1.68	1.86	1.70	1.65	1.65	1.53	1.62	1.62	1.71	1.72	1.73	1.19	1.46	1.71	2.02	1.93	
1998	71.02	1.66	1.75	1.76	1.93	1.79	1.75	1.76	1.66	1.75	1.76	1.86	1.88	1.92	1.50	1.78	2.05	2.37	2.50	3.06
1999	73.73	1.76	1.86	1.88	2.04	1.91	1.89	1.90	1.82	1.92	1.95	2.05	2.10	2.15	1.83	2.11	2.40	2.73	2.93	3.44
2000	76.20	1.84	1.93	1.95	2.11	2.00	1.98	2.00	1.93	2.03	2.06	2.17	2.22	2.28	2.01	2.29	2.56	2.85	3.03	3.40
2001	78.28	1.88	1.97	1.99	2.15	2.04	2.03	2.04	1.98	2.08	2.12	2.22	2.27	2.33	2.10	2.35	2.58	2.83	2.98	3.24
2002	81.65	1.98	2.08	2.10	2.25	2.16	2.15	2.18	2.13	2.23	2.27	2.38	2.44	2.51	2.31	2.56	2.80	3.04	3.20	3.45
2003	84.76	2.06	2.15	2.18	2.33	2.24	2.24	2.27	2.22	2.33	2.37	2.48	2.54	2.61	2.45	2.68	2.91	3.14	3.28	3.51
2004	87.19	2.09	2.18	2.21	2.35	2.27	2.27	2.30	2.26	2.36	2.40	2.50	2.56	2.63	2.48	2.70	2.90	3.11	3.23	3.42
2005	89.11	2.10	2.18	2.21	2.35	2.26	2.26	2.29	2.26	2.35	2.39	2.48	2.54	2.60	2.46	2.66	2.84	3.01	3.12	3.26
2006	90.09	2.06	2.14	2.16	2.29	2.21	2.21	2.24	2.20	2.28	2.32	2.40	2.45	2.50	2.36	2.54	2.69	2.84	2.91	3.02
2007	91.66	2.05	2.13	2.15	2.27	2.19	2.19	2.21	2.18	2.26	2.29	2.37	2.41	2.45	2.32	2.48	2.62	2.75	2.81	2.89
2008	92.64	2.01	2.09	2.11	2.22	2.15	2.14	2.16	2.13	2.20	2.23	2.30	2.33	2.37	2.24	2.39	2.51	2.62	2.66	2.73
2009	95.94	2.06	2.14	2.16	2.27	2.20	2.20	2.22	2.19	2.26	2.29	2.36	2.40	2.44	2.32	2.46	2.58	2.68	2.73	2.80
2010	99.16	2.11	2.18	2.20	2.31	2.25	2.24	2.27	2.24	2.31	2.34	2.41	2.44	2.49	2.38	2.51	2.63	2.73	2.77	2.84
2011	99.13	2.04	2.11	2.13	2.23	2.16	2.16	2.18	2.14	2.21	2.23	2.30	2.33	2.36	2.25	2.37	2.47	2.55	2.58	2.63
2012	100.00	2.00	2.07	2.08	2.19	2.12	2.11	2.13	2.10	2.16	2.18	2.23	2.26	2.29	2.18	2.29	2.38	2.46	2.48	2.51
2013	100.51	1.96	2.02	2.03	2.13	2.06	2.06	2.07	2.04	2.09	2.11	2.16	2.18	2.21	2.10	2.20	2.28	2.35	2.36	2.39
2014	101.32	1.93	1.98	2.00	2.09	2.02	2.02	2.03	1.99	2.04	2.06	2.11	2.12	2.15	2.04	2.13	2.21	2.26	2.27	2.29
2015	102.63	1.91	1.96	1.98	2.06	2.00	1.99	2.00	1.97	2.02	2.03	2.08	2.09	2.11	2.01	2.10	2.16	2.22	2.22	2.24
2016	102.77	1.86	1.91	1.92	2.01	1.94	1.93	1.94	1.91	1.95	1.96	2.00	2.02	2.03	1.93	2.01	2.07	2.12	2.12	2.13
2017	103.93	1.84	1.89	1.90	1.98	1.92	1.91	1.92	1.88	1.92	1.93	1.97	1.98	2.00	1.90	1.97	2.03	2.07	2.07	2.08

		From																			
To	Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1997	68.92																				
1998	71.02	3.06																			
1999	73.73	3.44	3.81																		
2000	76.20	3.40	3.58	3.34																	
2001	78.28	3.24	3.30	3.04	2.74																
2002	81.65	3.45	3.55	3.46	3.52	4.30															
2003	84.76	3.51	3.60	3.54	3.61	4.05	3.80														
2004	87.19	3.42	3.48	3.41	3.43	3.66	3.34	2.87													
2005	89.11	3.26	3.29	3.21	3.18	3.29	2.96	2.53	2.20												
2006	90.09	3.02	3.02	2.90	2.83	2.85	2.49	2.06	1.65	1.10											
2007	91.66	2.89	2.87	2.76	2.67	2.66	2.34	1.98	1.68	1.42	1.74										
2008	92.64	2.73	2.69	2.57	2.47	2.43	2.13	1.79	1.53	1.30	1.41	1.07									
2009	95.94	2.80	2.77	2.67	2.59	2.57	2.33	2.09	1.93	1.86	2.12	2.31	3.56								
2010	99.16	2.84	2.82	2.73	2.67	2.66	2.46	2.27	2.17	2.16	2.43	2.66	3.46	3.36							
2011	99.13	2.63	2.60	2.50	2.42	2.39	2.18	1.98	1.85	1.79	1.93	1.98	2.28	1.65	-0.03						
2012	100.00	2.51	2.47	2.37	2.29	2.25	2.05	1.85	1.73	1.66	1.75	1.76	1.93	1.39	0.42	0.87					
2013	100.51	2.39	2.34	2.24	2.15	2.10	1.91	1.72	1.59	1.52	1.58	1.55	1.64	1.17	0.45	0.69	0.50				
2014	101.32	2.29	2.25	2.14	2.06	2.00	1.81	1.64	1.51	1.44	1.48	1.44	1.50	1.10	0.54	0.73	0.66	0.81			
2015	102.63	2.24	2.19	2.09	2.01	1.95	1.77	1.61	1.49	1.42	1.46	1.42	1.47	1.13	0.69	0.87	0.87	1.05	1.29		
2016	102.77	2.13	2.07	1.97	1.89	1.83	1.66	1.49	1.38	1.31	1.33	1.28	1.31	0.99	0.60	0.72	0.69	0.75	0.71	0.14	
2017	103.93	2.08	2.02	1.93	1.84	1.79	1.62	1.47	1.36	1.29	1.31	1.26	1.29	1.01	0.67	0.79	0.77	0.84	0.85	0.63	1.13

1.6 Appendix

Nordhaus demonstrates how the growth rates in productivity in *n* sectors of the economy can be aggregated to the growth rate in total-economy productivity.[25] Monaco adopts the formulation to aggregate the growth rates in productivity in the nonfarm business, farm, and "all other" sectors.[26] Equation A1 is a similar adaptation to five sectors: nonfarm business (n), farm (f), households (h), nonprofit institutions (i), and general government (g).

$$(A1) \quad \dot{P}_t = \dot{P}_n wt_n^Q + \dot{P}_f wt_f^Q + \dot{P}_h wt_h^Q + \dot{P}_i wt_i^Q + \dot{P}_g wt_g^Q + \dot{H}_n (wt_n^Q - wt_n^H) + \dot{H}_f (wt_f^Q - wt_f^H) + \dot{H}_h (wt_h^Q - wt_h^H) + \dot{H}_i (wt_i^Q - wt_i^H) + \dot{H}_g (wt_g^Q - wt_g^H)$$

Where,

$\dot{X}$	=	rate of change in x
P	=	productivity
H	=	hours worked
wt^Q_f	=	nominal output weight for farm sector defined as the ratio of nominal GDP in the farm sector to nominal GDP for the total economy
wt^H_f	=	hours worked weight for farm sector defined as the ratio of hours worked in the farm sector to hours worked in the total economy
t	=	total economy

In the long-range, it is reasonable to assume that the growth rate in hours worked in all sectors will be equal. Thus, Equation A1 can be simplified to A2.

$$(A2) \quad \dot{P}_t = \dot{P}_n wt_n^Q + \dot{P}_f wt_f^Q + \dot{P}_h wt_h^Q + \dot{P}_i wt_i^Q + \dot{P}_g wt_g^Q$$

Furthermore, if the ultimate long-range growth rates in productivity in the household, nonprofits, and general government sectors are zero, Equation A2 can be further simplified to A3.

$$(A3) \quad \dot{P}_t = \dot{P}_n wt_n^Q + \dot{P}_f wt_f^Q$$

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[25] Nordhaus, William D., "Productivity Growth and the New Economy." Brookings Papers on Economic Activity, (Volume 2, 2002). pp.211-265

[26] Monaco, Ralph, "Issues in Projecting Productivity in the Very Long Term." Sept. 28, 2005. Treasury Office of Economic Policy. Unpublished.

2. PRICE INFLATION

THE 2019 TRUSTEES REPORT
OFFICE OF THE CHIEF ACTUARY, SOCIAL SECURITY ADMINISTRATION

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2.1 Summary

For the 2019 Trustees Report, the assumed ultimate annual rates of increase in the CPI-W are 3.20 percent, 2.60 percent, and 2.00 percent for alternatives I, II, and III, respectively, as shown in Table 2.1. The Trustees also assume the ultimate annual rates of increase in the gross domestic product implicit price deflator (PGDP) to be 2.95 percent, 2.25 percent, and 1.55 percent for alternatives I, II, and III, respectively. Thus, the ultimate price differential, defined as the PGDP less CPI-W average annual rates of increase, is assumed to be -0.25, -0.35, -0.45 percentage point for alternatives I, II, and III, respectively.[27] The assumed ultimate annual rates of increase for CPI-W are unchanged from those assumed for the 2018 Report. The assumed differences between the ultimate annual rates of increase for the PGDP and CPI-W are 0.05 percentage point higher than those assumed for the 2018 Report.

Table 2.1: Assumed Ultimate Annual Rates of Increase in Price Level Measures

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
CPI-W	3.20	2.60	2.00	3.20	2.60	2.00	0.00	0.00	0.00
PGDP	2.95	2.25	1.55	2.90	2.20	1.50	0.05	0.05	0.05
Price Differential (PGDP less CPI-W)	-0.25	-0.35	-0.45	-0.30	-0.40	-0.50	0.05	0.05	0.05

2.2 Recent Revisions to BLS and BEA Data

2.2.1 Recent and Expected Future Changes to Methods BLS Uses to Compute the CPI

The Bureau of Labor Statistics (BLS) collects and publishes data on the CPI. BLS updated the consumption expenditure weights in the CPI-W and in the CPI for all Urban Consumers (CPI-U) from the 2011-2012 to 2013-2014 period, effective January 2016.[28] Since 2000, BLS has been updating the weights every two years, and plans to continue on that schedule, instead of the

[27] The projected price differential is important because it affects the real rate of increase in the average OASDI covered wage (see Section 3.3.2.4) and, therefore, the long-range actuarial balance.

[28] For BLS's CPI methodology, see http://www.bls.gov/opub/hom/pdf/homch17.pdf. The new weights are in http://www.bls.gov/cpi/usri_2015.txt, and the weights they replaced are in http://www.bls.gov/cpi/usri11-12_2015.pdf. In January 2018, BLS again updated the weights going forward but annual 2018 data was not available when this analysis was completed.

pre-2000 historical average of about once per decade. BLS believes that more frequent updates of the consumption-expenditure weights will have little or no effect on the average future growth rate in the CPI over long periods.[29] Recent data support this view for relatively short periods. When BLS switched from using 1999-2000 to 2001-2002 weights beginning in January 2004, it published monthly values for the CPI-W (and CPI-U) for January through June 2004 based on the 1999-2000 expenditure weights.[30] The values in June 2004 for the CPI-W (and CPI-U) based on the old and new weights were identical. However, the data may also vary over short periods. When BLS switched from using 2001-2002 to 2003-2004 weights beginning in January 2006, it published monthly values for the CPI-W (and CPI-U) for January through June 2006 based on the 2001-2002 expenditure weights.[31] The data indicate that the growth rate in the CPI-W (and CPI-U) over this period was about 0.2 percentage point lower using the newer weights. [32]

2.2.2 OCACT Adjustments to the Published CPI-W

Over the years, BLS has introduced numerous improvements to the CPI-W. For example, beginning in January 1995 and July 1996, BLS introduced changes to correct methodological errors introduced into the index in January 1978 and January 1987. In addition, beginning in January 1999, BLS introduced a new geometric mean formula that assumes some lower-level substitution among items purchased by consumers within broad categories of goods and services due to changes in relative prices.

Because the BLS has no plans to revise the historical CPI, these improvements present a comparability problem. The goal is to project future growth rates in the CPI, based, in part, on an analysis of historical growth rates. Any projected growth rate in the CPI will be affected by the BLS method improvements mentioned above. Thus, OCACT adjusted the historical CPI to reflect the estimated effects of these method changes, effectively reducing the measured growth rate in the CPI-W over the historical period. This adjustment is the same as in last year's Trustees Report. Table 2.4 lists the adjusted CPI-W. (See Section 2.6 Appendix for details on OCACT's adjustments to the actual published CPI-W annual growth rates.)

2.2.3 BEA Comprehensive Revisions

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[29] *Future Schedule for Expenditure Weight Updates in the Consumer Price Index*, BLS, http://stats.bls.gov/cpi/cpiupdt.htm.

[30] *News Release for Consumer Price Index, January through June 2004*, BLS, Table 1(OW) and Table 2(OW), http://stats.bls.gov/schedule/archives/cpi_nr.htm.

[31] *News Release for Consumer Price Index, January through June 2006*, BLS, Table 1(OW) and Table 2(OW), http://stats.bls.gov/schedule/archives/cpi_nr.htm.

[32] This was partly due to the fact that, compared to the old 2001-2002 weight, the new 2003-2004 weight for gasoline fell by about 0.2 percentage point while the price of gasoline rose by about 25.0 percent from January to June 2006.

On July 27, 2018, BEA released a comprehensive revision to the NIPA data, including GDP, PGDP, and their components potentially for the entire history.[33] In a comprehensive revision, which is typically performed every five years, BEA integrates updated statistics from its quinquennial benchmark input-output accounts, and takes an opportunity to introduce improvements to methods and data, such as statistical changes to introduce new and improved methodologies, changes in definitions to more accurately portray the evolving U.S. economy, and changes in presentations to reflect the definitional and statistical changes.

The 2018 comprehensive revision also included a change in the base year used to compute the real (inflation-adjusted) measures. The new base year is 2012, while prior to the revision the base year was 2009. The change in the base year slightly alters the entire history of the growth rates of all price measures, including PGDP and its components, as well as the history of growth rates of real (inflation-adjusted) measures.

With the comprehensive revision and the change in the base year, the growth rate of PGDP has changed in most years, starting in 1947. The changes are small—less than 0.2 percentage point in any given year. The change in the average price growth over the entire 1947–2017 period, however, is much smaller, with the average increase in PGDP over this period being 3.20 percent per year both before and after the comprehensive revision.

2.2.4 OCACT Adjustments to the Published PGDP

BEA's estimate of the PGDP is based, in part, on the CPI. BLS has introduced numerous improvements to the CPI that have lowered its post-1995 growth rate. BEA "backcasted" these improvements in the NIPA, lowering the growth rate in the PGDP (and raising the real growth rate in GDP). However, because BEA only backcasted these effects to 1978, OCACT has lowered the pre-1978 growth rate in the PGDP for consistency (see Section 2.7 Appendix for further details on the adjustments to the actual published annual growth rates in PGDP and annual real growth rates in GDP). The adjusted PGDP is shown in Table 2.5.

[33] BEA's data release with the new GDP data reflecting the comprehensive revisions can be found at http://www.bea.gov/system/files/2018-08/gdp2q18_adv_4.pdf. The description of changes introduced by the comprehensive revision can be found at https://apps.bea.gov/scb/2018/09-september/0918-nipa-update.htm.

2.3 Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W)

2.3.1 Historical Growth in the Adjusted CPI-W[34]

Over the last forty years (1977 to 2017), the adjusted CPI-W grew at an average annual rate of 3.25 percent, or about 0.65 percentage point higher than the assumed ultimate rate of increase of 2.6 percent in the 2018 Trustees Report alternative II. Over the last five complete economic cycles (1969 to 2007), the adjusted CPI-W grew at an average annual rate of 4.22 percent. The growth rates by cycle were 4.44, 7.59, 5.0, 2.45, and 2.64 percent for the 1966-73, 1973-79, 1979-90, 1990-2001, and 2001-07 periods, respectively. The relatively higher inflation rates experienced from the mid-1960s to the mid-1980s can be reasonably attributed to high capacity utilization associated with the Vietnam War, the two oil price shocks in the early and late 1970s, and the fiscal and monetary policy responses to those events.

The high inflation rate in the late-1970s led the Federal Reserve to place a greater emphasis on price stability as part of their mandate to pursue maximum employment and stable prices. In the early 1980s, the Federal Reserve raised the federal funds rate to reduce the double digit inflation rates that occurred in 1979 and 1980. In the mid-1990s the Federal Reserve made a judgment that inflation at the rate of 2 percent (as measured by the annual change in the price index for personal consumption expenditures, or PCE) is most consistent over the longer run with the Federal Reserve's statutory mandate. The Federal Reserve publicly announced their 2 percent goal in 2012, and in their May 2018 meeting clarified that the goal was meant to be symmetric and that "a temporary period of inflation modestly above 2 percent would be consistent with the Committee's symmetric inflation objective."

After 1981, various other factors also contributed to the slowdown in the inflation rate. Oil prices were mostly stable between 1980 and 2001, and the dependence of the US economy on oil has decreased since the 1970s. The economic output of developing nations with relatively low labor costs (for example, China and India) increased substantially, as did the share of US imports from those countries. The dollar appreciated relative to the trade-weighted average of other currencies between 1980 and 1985 and again between 1995 and 2002, further contributing to decreases in prices of imported goods. Between 2002 and 2008, some of those factors reversed: the price of oil and other commodities increased sharply and the dollar depreciated sharply, but there was relatively little corresponding increase in the inflation rate. Since 2008, the inflation rate has been even lower, due to a recession, a decrease in the price of oil and other commodities, and appreciation of the dollar.[35]

[34] See section 2.2.4 for a description of the adjusted CPI-W.

[35] CPI-W grew at a 2.2 percent annual rate over the 7-year period 1995-2002, 3.1 percent over the 6-year period 2002-08, and 1.7 percent over the 8-year period 2008-15. The dollar has appreciated significantly relative to the euro and the British pound since 2008, and has been stable relative to the yen and the yuan.

Since the end of the last complete economic cycle (i.e., from 2007 to 2017), the CPI-W grew at an average annual rate of about 1.7 percent. This period has been characterized by unusually weak aggregate demand for goods and services. Trustees do not expect this weak demand to continue into the long-range future.

Table 2.2: Historical Growth in the Adjusted CPI-W, the GDP Deflator, and the Price Differential

Period	CPI-W Average Annual Rate of Growth (percent)	GDP Deflator Average Annual Rate of Growth	Price Differential = GDP Deflator less CPI-W
Historical:			
1967-2017 (50 years)	3.69	3.53	-0.16
1967-1992 (25 years)	5.27	5.18	-0.09
1992-2017 (25 years)	2.14	1.91	-0.24
Since Most Recent Economic Cycle Peak			
2007(peak)-2017 (10 years)	1.67	1.56	-0.12
By Complete Economic Cycle (Peak-to-Peak)			
Individual Cycle			
1969-1973	4.44	4.93	0.49
1973-1979	7.59	7.45	-0.14
1979-1990	5.00	4.61	-0.39
1990-2001	2.45	2.08	-0.37
2001-2007	2.64	2.49	-0.15
Last Five Cycles			
1969-2007	4.22	4.01	-0.21
Last Four Cycles			
1973-2007	4.20	3.90	-0.30
Last Three Cycles			
1979-2007	3.48	3.15	-0.33
Last Two Cycles			
1990-2007	2.51	2.22	-0.29

2.3.2 Future Growth in the CPI-W

If only past inflation rates were used to determine the assumed ultimate rate for the future, then only the period (e.g., the most recent 40 or 20 years) and method (e.g., a simple, weighted or geometric average) would need to be chosen. The best historical period would be the one that is most representative of the conditions that are expected to prevail over the upcoming 75-year projection period. The 50-year historical record is filled with inflation-related events, some of which occurred in unique circumstances and have limited relevance for projecting the future.

These include the Vietnam War, oil price shocks, and periods of price controls. Furthermore, after a historically unusual departure in the 1970s, monetary policy has returned to a strong emphasis on price stability.

While these specific historical events will not recur in the future (at least not exactly as they have in the past), other inflation-related events may take their place. It is reasonable to expect some additional upward pressure on the future growth rate in the CPI due to changes in international trade. The ratio of net exports (i.e., exports less imports) to GDP averaged about -3.3 percent over the 10-year period from 2008 through 2017. Part of this imbalance is due to imports of relatively low-priced consumer goods from emerging markets, such as China. However, as these developing economies mature, their average wage and consumption levels are expected to rise relative to their output, and their currencies and price levels are expected to rise relative to those of the U.S. This may put further upward pressure on the prices of basic commodities and, therefore, the CPI. These trends are also expected to ultimately return the ratio of net exports to GDP to zero in the future.

The 3.48 percent average annual growth rate for the adjusted CPI-W for the last three economic cycles from 1979 to 2007 is higher than the most reasonable assumption for the ultimate CPI-W annual rate of increase. OCACT believes that the 2.51 percent average annual growth rate for the adjusted CPI-W over the last two complete economic cycles (as measured over an 17-year period from 1990 to 2007), a period that reflects the current domestic monetary policy environment expected to exist in the future, is closer to an expected future trend. However, OCACT believes that unexpected inflationary events are likely to contribute to a somewhat higher average rate for the future. Thus, the assumed ultimate rate of increase in the CPI-W is 2.60 percent for alternative II, and 3.20 and 2.00 percent for alternatives I and III, respectively.

2.4 Gross Domestic Product Implicit Price Deflator (PGDP)

2.4.1 Historical Behavior of the Adjusted PGDP

Table 2.3 shows historical data on the average annual percentage change for PGDP and its key components. The PGDP can be viewed as a weighted average of its key components, which include the implicit price deflator for personal consumption expenditures (PGDP_C), the implicit price deflator for gross private domestic investment (PGDP_I), the implicit price deflator for government consumption expenditures and gross investment (PGDP_G). While the implicit price deflators for imports and exports also contribute to PGDP over the historical period, the effect of net exports on the deflator is assumed to be zero on average over the 75-year projection period. The weights are the ratios of the components' nominal expenditures to total nominal GDP. The weights have been relatively stable in the historical period. In 2017, the weights for personal consumption, investment, and government expenditures were about 0.68, 0.17, and 0.17, respectively. These weights summed to more than one because net exports were negative. Adjusting for the assumed effect of net exports on the PGDP, the weights for personal consumption, investment, and government expenditures are assumed to be 0.62, 0.18, and 0.20, respectively. These values are consistent with the average values observed in the historical period.

Table 2.3: Average Annual Percentage Change in the GDP Deflator, and the Implicit Price Deflators for Consumption Expenditures(PGDP_C), Investment Expenditures (PGDP_I) and Government Expenditures(PGDP_G)

Period	GDP Deflator	PGDP_C	PGDP_I	PGDP_G
Historical:				
1967-2017 (50 years)	3.53	3.56	2.83	4.27
1967-1992 (25 years)	5.18	5.31	4.72	5.87
1992-2017 (25 years)	1.91	1.84	0.97	2.68
Since Most Recent Economic Cycle Peak				
2007-2017	1.56	1.50	0.55	1.88
By Complete Economic Cycle (Peak-to-Peak)				
Individual Cycle				
1969-1973	4.93	4.43	4.72	7.57
1973-1979	7.45	7.75	8.64	7.55
1979-1990	4.62	4.95	3.42	4.88
1990-2001	2.08	2.11	0.68	2.79
2001-2007	2.59	2.31	2.18	4.04
Last Five Cycles				
1969-2007	4.01	4.08	3.36	4.83
Last Four Cycles				
1973-2007	3.90	4.04	3.20	4.52
Last Three Cycles				
1979-2007	3.15	3.26	2.07	3.88
Last Two Cycles				
1990-2007	2.22	2.18	1.21	3.23

PGDP tends to have a lower annual percentage change than the CPI-W, as shown in Table 2.2, primarily due to two factors. First, the computational weighting method for the PGDP allows for substitution between items over time, which contributes to a slower annual rate of change when compared to the CPI-W. Second, the PGDP covers investment and government expenditures in addition to consumer expenditures. The second factor generally contributes to slower growth in GDP due to the PGDP_I, with the exception of the 1969-1973 period and the 2001-2007 period where the average annual growth in PGDP_G was elevated due to the Vietnam war and the Afghanistan and Iraq wars, respectively. While there are other differences between the two measures, such differences are relatively less important in explaining the differences in the annual percentage change.

The long-run historical growth rate in PGDP is mostly explained by the separate historical growth rates in PGDP_C, PGDP_I, and PGDP_G. The historical and expected future growth rates for each component deflator are examined below.

2.4.1.1 Adjusted Deflator for Personal Consumption Expenditures (PGDP_C)

While both the PGDP_C and the CPI-W focus on changes in the prices of consumer goods, the PGDP_C differs from the CPI-W in terms of the formula used for the computation and the scope of items covered. The PGDP_C formula allows for substitution between items, which tends to result in a lower annual rate of change when compared to the CPI-W. The difference in the scope of items covered tends to contribute less to systematic differences over time than the difference in the formula. Thus, all else equal, the average annual change in the PGDP_C contributes to the annual percentage change in the PGDP being lower than the annual percentage change in the CPI-W.

When examining the historical data on the PGDP_C and the CPI-W, the more recent complete economic cycles provide a good basis for assessing the future relationship between the two price measures because the BLS provides the information necessary to produce a good approximation of the current CPI-W computation method from 1978 to the present. Over the 28-year period from 1979 to 2007, the average annual growth rate for the adjusted PGDP_C was 3.26 percent, rounding to 0.23 percentage point below the CPI-W growth rate of 3.48. Over the 17-year period from 1990 to 2007, the average annual growth rate for the adjusted PGDP_C was 2.18 percent, or 0.33 percentage point below the CPI-W growth rate of 2.51. Over the most recently completed cycle from 2001 to 2007, the average annual growth rate for the adjusted PGDP_C was 2.31 percent, or about 0.33 percentage point below the CPI-W growth rate of 2.64.

From 2007 to 2017, the annual percentage change in PGDP_C was 1.50 percent, or about 0.18 percentage point below the CPI-W growth rate of 1.68 percent. The smaller difference might be due to lower overall inflation during this period, which may result in less room for the substitution between items to contribute to a lower the annual rate of change in the PGDP_C. Indeed, as the CPI-W rebounded to an annual percentage change of 2.15 percent in 2017, the annual percentage change in PGDP_C was 1.76 percent, or 0.39 percentage point less than the CPI-W.

The historical difference in past complete economic cycles between the PGDP_C and the CPI-W of between 0.23 and 0.33 percentage point is very similar to the difference between the CPI-U and the chained-CPI-U (C-CPI-U), as shown in Table 2.4. Like the PGDP_C, the C-CPI-U allows for substitution between items over time and tends to grow at a slower rate than the CPI-U. BLS has published initial, interim, and final monthly values for the C-CPI-U for each year beginning in January 2000. Final values are now available for 2016. The average annual growth rate in the C-CPI-U from the first quarter of 2000 to the fourth quarter of 2016 was 1.86 percent. Over the same period, the average annual growth rates in the PGDP_C, CPI-U, and CPI-W were approximately 1.81, 2.12, and 2.07 percent, respectively. The data suggest that over this period, the contribution of the difference in computational methods was about 0.26 percentage point (i.e., 2.12 − 1.86), and that the PGDP_C price differential was -0.26 percentage point

(i.e., 1.81 − 2.07).[36] OCACT believes that the difference of -0.26 is somewhat low due to the unusually low inflation rate over the 2008-2016 period that may have limited the substitution between items over that time.

Table 2.4: CPI-U vs. C-CPI-U growth rates

	CPI-U growth rate less C-CPI-U growth rate (December-to-December, percentage points)	
Year	All Items Less Food and Energy	All Items
2000	0.7	0.8
2001	0.6	0.3
2002	0.3	0.4
2003	0.4	0.2
2004	-0.1	0.1
2005	0.3	0.5
2006	0.4	0.3
2007	0.5	0.4
2008	0.0	-0.1
2009	0.3	0.3
2010	0.2	0.2
2011	0.0	0.0
2012	0.3	0.3
2013	0.2	0.2
2014	0.4	0.2
2015	0.4	0.3
2016	0.3	0.3
Average 2000-2016	0.31	0.27

Over the long-range period, it is reasonable to assume that the average annual growth rates in the CPI-W and CPI-U will be roughly equal. It also seems reasonable to assume that the difference in the long-range average annual growth rates (PGDP_C less CPI-W) will be -0.30 percentage point, and that this difference will be only due to the expected 0.30 percentage point effect from the different computational weighting methods. Stated differently, the expected growth-rate differential for the personal consumption deflator (PGDP_C less CPI-W) due to factors other than the computational weighting methods is assumed to be zero. Thus, the assumed ultimate annual growth rate for PGDP_C is 2.3 percent, equal to the assumed ultimate annual growth rate

[36] The data also suggest that from the first quarter of 2000 to the fourth quarter of 2016, the average annual growth rate in the C-CPI-U (1.86 percent) was a reasonable approximation of the average annual growth rate in the PGDP_C (1.81 percent), and that the average annual growth rates in the CPI-U (2.12 percent) and CPI-W (2.07 percent) were approximately equal over the period, compared to the 0.09 average annual percentage point differential (CPI-U minus CPI-W) over the 1979-2017 period.

for CPI-W (i.e., 2.6 percent) less the 0.30 percentage point effect of the different computational weighting methods.

2.4.1.2 Deflator for Investment Expenditures (PGDP_I)

The PGDP_I can be viewed as a weighted average of deflators for its principal components: investment in equipment (PGDP_INE), investment in intellectual property (PGDP_INIP), residential investment (PGDP_IR), and investment in nonresidential structures (PGDP_INS).[37] The equipment and intellectual property components in their current form were first used in the 2013 revisions to NIPA. The 2018 comprehensive revisions to NIPA further refined the definition, which resulted in revisions to historical data for investment in software and computer equipment.

Deflator for Equipment (PGDP_INE) – Over the 38-year period from 1979 to 2017, the average annual growth rate was about -0.16 percent for the PGDP_INE, compared to 2.79 percent for the PGDP_C. The PGDP_INE growth rate has been depressed by the rise in nominal investment expenditures for computers and the sharp decline in their quality-adjusted prices. Over this period, the deflator for computers fell at an average annual rate of about 11.63 percent, and the ratio of nominal investment expenditures for computers to all investment expenditures for equipment rose from about 5 percent in 1979 to about 13 percent in the late 1990s, followed by a decline to about 9 percent in 2017.

It seems reasonable to assume that quality-adjusted computer prices will continue to decline in the future, but at a somewhat slower rate. The average annual rate of decline was about 12.9 percent over the 1982 to 1994 period, 22.2 percent over the 1994 to 1999 period, and 7.0 percent over the 1999 to 2017 period. The large rate of decline in the late 1990s was probably due to a combination of technological advances and production volume increases that are unlikely to be sustained over a longer period. It seems more reasonable to assume that the future rate of price decline will be similar to that over the last 18 years; thus, the assumed rate of decline in quality-adjusted computer prices is 6 percent per year. Furthermore, it is expected that the ratio of nominal investment expenditures for computers to all investment expenditures for equipment will stabilize at the approximate average value of the ratio over the last decade (i.e., 10 percent).

Over the period from 1979 to 2017, the deflator for equipment other than computers grew on average at a 1.23 percent annual rate, or 1.56 percentage points less than the 2.79 percent annual growth rate for the PGDP_C. Similarly, over the last three complete economic cycles (1979-2007), the deflator for other equipment grew slower by 1.48 percentage points per year than PGDP_C. OCACT believes that the growth rate in the price deflator for other equipment will continue to be depressed relative to the PGDP_C, since the prices for at least some items in other equipment (e.g., printers, calculators, etc.) will be driven down by the same types of future technological advancements expected for computers. Thus, it is reasonable to expect that, in the future, the average annual growth rate in other equipment will be about 1 percent, or 1.3

[37] This decomposition excludes the change in business inventories, which has averaged roughly 1.7 percent of total investment expenditures over the 38-year period from 1979 to 2017.

percentage points less than the 2.3 percent assumed ultimate average annual growth rate in the PGDP_C.

Using these average annual growth rates and weights, OCACT believes that it is reasonable to set the assumed ultimate average annual rate of growth in PGDP_INE in the future to about 0.3 percent (i.e., -6.0 * 0.10 + 1 * 0.90).

Deflator for Intellectual Property (PGDP_INIP) – Over the 38-year period from 1979 to 2017, the average annual growth rate was about 1.33 percent for the PGDP_INIP, compared to 2.79 percent for the PGDP_C. The PGDP_INIP growth rate has been depressed by the rise in nominal investment expenditures for software and a slow but steady decline in its quality-adjusted prices. Over this period, the deflator for software fell at an average annual rate of about 1.67 percent, and the ratio of nominal investment expenditures for software to all investment expenditures for intellectual property rose from about 17 percent to about 36 percent by 2000, and has slowly increased to about 41 percent since.

Software prices have been declining slowly, but steadily. They declined over four of the last five economic cycles (the only exception being the 1973-79 cycle), and their rate of decline ranged from 0.13 percent in the 1966-1973 cycle to 2.46 percent in 1989-2000, according to the revised data released with the 2018 comprehensive revision of NIPA. Since the end of the last cycle (a 10-year period from 2007 to 2017), software prices declined at an average annual rate of 1.48 percent. It seems reasonable to expect some future price decline, but at a somewhat slower rate than the average over the last 38 years. OCACT expects that software prices will decline at a rate of 1 percent per year. OCACT also expects that the ratio of nominal investment expenditures for software to all investment expenditures for intellectual property will stabilize at about 45 percent.

Over the period from 1979 to 2017, the deflator for intellectual property other than software grew on average at a 2.64 percent annual rate, or 0.15 percentage point less than the 2.79 percent annual growth rate for the PGDP_C. Over the last three complete economic cycles (1979-2007), the deflator for other intellectual property grew at an annual rate of 3.04 percent, slower by 0.22 percentage point per year than the 3.26 percent growth rate in PGDP_C. OCACT believes that it is reasonable to expect that, in the future, the average annual growth rate in the price deflator for other intellectual property will continue to be somewhat lower than the PGDP_C. The assumed growth rate in the deflator for other intellectual property is 2.1 percent, or 0.2 percentage point less than the 2.3 percent assumed ultimate average annual growth rate in the PGDP_C.

Using these average annual growth rates and weights, OCACT believes that it is reasonable to set the assumed ultimate average annual rate of growth in PGDP_INIP in the future to about 0.71 percent (i.e., -1 * 0.45 + 2.1 * 0.55).

Deflator for Residential Investment (PGDP_IR) – Residential investment is almost entirely composed of investment in fixed structures, which, in turn, is composed of single-family, multifamily, and other structures (e.g., manufactured homes, dormitories, etc.). Over the 21-year period from 1979 to 2000, the average annual growth rate was about 3.75 percent for the PGDP_IR, compared to 3.60 percent for the PGDP_C. Thus, the average annual growth rate for

the PGDP_IR was about 0.15 percentage point (3.75 − 3.60) higher than the average annual growth rate in the PGDP_C over the period. However, over the next 7-year period, this differential increased substantially. From 2000 to 2007, the average annual growth rate was about 4.74 percent for the PGDP_IR and 2.25 percent for the PGDP_C. Thus, the average annual growth rate for the PGDP_IR was about 2.49 percentage points (4.74 – 2.25) higher than the average annual growth rate in the PGDP_C over the period.

OCACT believes that the 2.49 percent growth rate differential between the PGDP_IR and the PGDP_C over the last business cycle was a temporary market phenomenon characterized by overheated demand for housing, house "flipping," subprime mortgage lending, and unusually high profits and gains in stock prices for the builders of new homes. Since 2007, there has been a market correction: the housing bubble has collapsed, new and existing home sales have dropped nationally, prices of new homes in most markets have declined, and the profits and stock prices of new homebuilders have plummeted. Although the housing market has been recovering lately, home prices in 2017 are only slightly above the 2006 level, and the number of sales is well below the mid-2000s level. For the 2007 to 2017 period, the average annual growth in PGDP_IR and PGDP_C was 1.76 and 1.50 percent, respectively, indicating a 0.26 percent (1.76 − 1.50) differential between the two deflators. Over the 17-year period from 2000 to 2017, the average annual growth rate for the PGDP_IR was about 2.98 percent, or 1.13 percentage points higher than the 1.85 percent annual growth rate for the PGDP_C.

OCACT believes it is reasonable to disregard the post-2000 period and set the assumed ultimate average annual rate of increase in the PGDP_IR to 2.5 percent, or about 0.2 percentage point higher than the 2.3 percent assumed ultimate average annual rate of increase in the PGDP_C. [38]

Deflator for Investment in Nonresidential Structures (PGDP_INS) – Investment in nonresidential structures includes investment in structures used for drilling for petroleum and natural gas. Over the 21-year period from 1979 to 2000, the average annual growth rate for PGDP_INS was 3.62 percent, or slightly less than the 3.75 percent growth rate in PGDP_IR. However, over the 7-year period from 2000 to 2007, the average annual growth rates for PGDP_INS and PGDP_IR were 7.17 and 4.74 percent, respectively. The relatively faster average annual growth rate for PGDP_INS occurred because the average annual growth rate in the deflator for investment in petroleum and natural gas was about 20.9 percent. Excluding the effects of petroleum and natural gas, the average annual growth rate for PGDP_INS was about 6.4 percent, closer to the 4.7 percent average annual growth rate in PGDP_IR over the period.

OCACT believes the relatively rapid growth rate in the deflator for investment in petroleum and natural gas is a temporary market phenomenon associated with a run-up in oil prices. The price of a barrel of oil rose from about $26 in 2001 to $72 in 2007, or at an average annual rate of about 19.0 percent. As the market price for oil rose, previously expensive technologies became economically profitable.

[38] In the future, the PGDP_IR may grow faster than the PGDP_C due to more rapid increases in the prices of scarce land and basic building commodities such as copper, lumber, and cement.

OCACT believes that in the future the average annual growth rate in the price of a barrel of oil will not be significantly greater than the growth rate in the PGDP_C and that the average annual growth rates in the PGDP_INS and PGDP_IR will be approximately equal. Thus, the assumed ultimate average annual rate of increase in PGDP_INS is 2.5 percent, or 0.2 percentage point higher than the 2.3 percent assumed ultimate average annual growth rate in the PGDP_C, and equal to the assumed ultimate average annual rate of increase in the PGDP_IR.

The ratio of investment expenditures in equipment to total investment expenditures has averaged about 36 percent over the past 60 years. In the past 20 years, from 1997 to 2017, the average has decreased to 35 percent. OCACT assumes that the share of investment expenditures in equipment to total investment expenditures will continue to hold at this level, i.e. 35 percent, in the future. Investment in intellectual property has been an increasing share of total investment. Much of the increase, however, has been due to the sharp rise in investment in software from the 1970s to the early 2000s. Since the share of software in the investment in intellectual property has stabilized recently, OCACT believes it is reasonable to assume that the ratio of investment in intellectual property to total investment will be similar to its recent levels, or about 25 percent. OCACT also assumes that the investment expenditure weights for nonresidential investment for structures and residential investment will account for approximately equal shares of the rest of the investment expenditures, or 20 percent each.

Thus, the assumed ultimate average annual rate of increase for PGDP_I is 1.28 percent (i.e., 0.30 * 0.35 + 0.71 * 0.25 + 2.5 * (0.20 + 0.20)).

2.4.1.3 Deflator for Government Expenditures (PGDP_G)

The PGDP_G can be viewed as a weighted average of deflators for government consumption expenditures (PGDP_GC) and government investment (PGDP_GI).

Deflator for Government Consumption Expenditures (PGDP_GC) – Government consumption expenditures can be separated into employee compensation and other (residual) government consumption expenditures. In the NIPA, the deflator for government consumption expenditures on employee compensation is defined as an index proportional to average employee compensation. From 1979 to 2001, a 22-year period covering two complete economic cycles, the average annual growth rate in the deflator for employee compensation and the adjusted CPI-W were about 5.34 and 3.72 percent, respectively. This indicates that over the period, the real annual growth rate in average employee compensation was 1.62 percentage points (i.e., 5.34 – 3.72), slightly higher than the 1.27 percent assumed ultimate real annual growth rate in average compensation in the 2018 Trustees Report.[39]

From 2001 to 2007, a 6-year period covering the latest complete economic cycle, the average annual growth rate in the deflator for employee compensation and the adjusted CPI-W were about 4.61 and 2.64 percent, respectively. This indicates that over the period, the real annual growth rate in average employee compensation was 1.97 percentage points (i.e., 4.61 − 2.64),

[39] For the 2018 Trustees Report alternative II, the Trustees assumed that the ultimate average annual rates of increase in the average compensation for all employees and in the CPI were 3.87 and 2.6 percent, respectively.

about 0.7 percentage point higher than the 1.27 percent ultimate real annual growth rate in average compensation assumed in the 2018 Trustees Report.

OCACT believes that the relatively high growth rate in the deflator for employee compensation over the 2001 to 2007 period is a temporary phenomenon mostly associated with military pay incentives related to the conflicts in Iraq and Afghanistan. Over this period, the average annual growth rates in the average compensation of state and local, federal civilian, and federal military employees were 4.10, 5.62, and 9.52 percent, respectively. By contrast, between 2007 and 2017, the average annual growth rates in the average compensation of state and local, federal civilian, and federal military employees were 2.62, 2.62, and 1.54 percent, respectively, and the average annual growth rate in the deflator for employee compensation was 2.57 percent, or just 0.90 percentage points higher than the 1.67 percent growth rate in CPI-W over the same period. It is reasonable to assume that in the future the average annual growth rate in the average compensation for all government employees will be 3.87 percent, the same rate assumed for the economy-wide average compensation. Therefore, OCACT believes that the average annual growth rate in the deflator for government consumption expenditures on employee compensation will be 3.87 percent.[40]

It is also reasonable and consistent to assume that the average annual growth rate in the deflator for other government consumption will be equal to the assumed ultimate average annual growth rate in the PGDP_C, or 2.3 percent.

Using rough averages over the 1979 to 2017 period, OCACT assumes that future government consumption expenditures for employee compensation will be about 70 percent of total government consumption expenditures. Thus, the assumed ultimate average annual growth rate for PGDP_GC is 3.40 percent (i.e., 3.87 * 0.70 + 2.3 * 0.30).

Deflator for Government Investment (PGDP_GI) – Government investment can be separated into 1) structures, 2) equipment, and 3) intellectual property. It is reasonable to assume that the future average annual growth rate in the deflator for each of these categories of government investment will be equal to the expected future average annual growth rate in the corresponding categories of private investment. Thus, OCACT also assumes the future average annual growth rates in the deflator for government investment will be 2.5 percent for investment in structures, 0.30 percent for investment in equipment, and 0.71 percent for investment in intellectual property.

Using rough averages over the 1979 to 2017 period, OCACT assumes the future ratio of government investment components to total government investment will be about 0.45 for structures, about 0.25 for equipment, and about 0.30 for intellectual property. Thus, the assumed ultimate average annual growth rate for PGDP_GI is 1.41 percent (i.e., 2.5 * 0.45 + 0.3 * 0.25 + 0.71 * 0.30).

[40] For the 2019 report, OCACT assumes the size of the active military remains constant throughout the projection period, rather than increasing proportionally with the civilian employment. This implies a gradual shift in weights between civilian government employment and the military and, since the average military compensation is higher, a slightly slower average growth in government compensation. However, the effect is small.

Finally, the historical proportions of government consumption and investment expenditures over the 40-year period from 1977 to 2017 averaged about 78 and 22 percent of total government expenditures, respectively. Since the mid-1990s, however, the proportion of government consumption in total government expenditures consistently has been higher, at or above 79 percent. OCACT assumes that the future proportions of government consumption and investment expenditures will be 79 and 21 percent of total government expenditures, respectively. Hence, the assumed ultimate average annual rate of increase in the PGDP_G is 2.98 percent (i.e., 3.4 * 0.79 + 1.4 * 0.21).

2.4.1.4 Ultimate Assumption for the GDP Deflator

The assumed annual growth rates for the components of the GDP deflator, and corresponding weights, result in an assumed average annual growth rate of 2.25 percent for the intermediate assumption. The 2.25 percent is equal to the sum of the PGDP_C component of 2.3 percent times its weight of 0.62, the PGDP_I component of 1.28 percent times its weight of 0.18, and the PGDP_G component of 2.98 percent and its weight of 0.20. For alternatives I and III the assumptions are 2.95 and 1.55, respectively.

For the alternative II, the assumed GDP deflator is 0.05 percentage point higher than the average annual increase of 2.2 percent used in the 2018 report. The change is a result of an updated analysis of the data on the PGDP_I and PGDP_G which indicates that a -0.05 percentage point difference is more consistent with the long-term corresponding trends than the -0.10 percentage point difference assumed in the 2018 report.

2.5 Price Differential

The price differential is defined as the annual growth rate in the PGDP less the annual growth rate in the CPI-W. For the 2019 Trustees Report, the assumed ultimate price differential is -0.25, -0.35, and -0.45 percentage point for alternative I, II, and III, respectively.

For alternative II, the ultimate price differential of -0.35 percentage point is the sum of -0.30 percentage point due to the difference in computational methods and -0.05 percentage point due to coverage differences between the PGDP and CPI-W. These values are 0.05 percentage point higher than those used in the 2018 report. The change is a result of an updated analysis of the data on the implicit price deflator for investment expenditures which indicates that a -0.05 percentage point difference is more consistent with the long-term corresponding price trends than the -0.10 percentage point difference used in the 2018 report.

2.6 Projections from Other Sources

IHS Markit (formerly Global Insight, Inc.) provides projections through 2048 in its latest long-run trend forecast (see *The 30-Year Focus, Third Quarter*, August 2018). Over the 20-year period from 2028 to 2048, IHS Markit projects an average annual rate of increase of 2.19 percent for the CPI and 2.36 percent for the PGDP, with a resulting price differential of 0.17 percentage point (2.36 − 2.19). The Moody's Analytics' September 2018 forecast extends to 2048. Over the

20-year period from 2028 to 2048, Moody's Analytics projects an average annual growth rate of 2.23 percent for the CPI-W and 1.92 percent for the PGDP, for a price differential of -0.31 percentage point (1.92 – 2.23).

The Office of Management and Budget (OMB) Mid-Session Review of the Fiscal Year 2019 Budget includes projections through 2028. OMB's annual growth rates for the PGDP and CPI-W (and CPI-U) for 2028 were 2.01 and 2.27 percent, respectively. Thus, OMB projects a price differential of -0.26 percentage point (i.e., 2.01 – 2.27). The Congressional Budget Office (CBO) June 2018 report, *The 2018 Long-Term Budget Outlook*, includes projections through 2048. CBO's annual growth rates for the PGDP and CPI-W (and CPI-U) for 2028-48 were 2.0 and 2.4 percent, respectively. Thus, CBO projects an average annual price differential of -0.4 percentage point (i.e., 2.0 − 2.4) for the period. The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended assuming an ultimate (i.e., long-range average) annual rate of increase in the CPI-W of 2.5 percent for alternative II, and a price differential of -0.4 percentage point.

Table 2.5: Adjusted CPI W: Compound Annual Rates of Growth (%) Base Year = 1982-1984

To	Variable	From 1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1961	35.39																			
1962	35.67	0.80																		
1963	36.07	0.96	1.12																	
1964	36.46	1.00	1.11	1.10																
1965	36.98	1.10	1.21	1.25	1.40															
1966	37.95	1.41	1.56	1.71	2.02	2.64														
1967	39.04	1.65	1.82	2.00	2.30	2.75	2.87													
1968	40.40	1.91	2.10	2.29	2.59	2.99	3.17	3.48												
1969	42.11	2.20	2.40	2.61	2.92	3.30	3.53	3.86	4.24											
1970	44.05	2.46	2.67	2.90	3.20	3.56	3.80	4.11	4.42	4.61										
1971	45.85	2.62	2.83	3.04	3.33	3.65	3.85	4.10	4.31	4.34	4.08									
1972	47.28	2.67	2.86	3.05	3.30	3.58	3.73	3.91	4.01	3.94	3.60	3.13								
1973	50.11	2.94	3.14	3.34	3.59	3.87	4.05	4.25	4.40	4.44	4.39	4.54	5.98							
1974	55.06	3.46	3.68	3.92	4.21	4.52	4.76	5.03	5.30	5.51	5.73	6.29	7.91	9.87						
1975	59.41	3.77	4.00	4.25	4.54	4.86	5.10	5.39	5.66	5.90	6.16	6.69	7.91	8.88	7.90					
1976	62.68	3.88	4.11	4.34	4.62	4.91	5.15	5.40	5.64	5.85	6.05	6.45	7.30	7.75	6.70	5.51				
1977	66.52	4.02	4.24	4.47	4.73	5.02	5.23	5.47	5.70	5.88	6.06	6.40	7.07	7.34	6.51	5.82	6.13			
1978	70.93	4.18	4.39	4.61	4.87	5.14	5.35	5.58	5.79	5.96	6.14	6.43	6.99	7.20	6.54	6.09	6.38	6.63		
1979	77.72	4.47	4.69	4.91	5.17	5.45	5.67	5.91	6.13	6.32	6.51	6.82	7.36	7.59	7.14	6.95	7.43	8.09	9.57	
1980	86.28	4.80	5.03	5.26	5.53	5.81	6.04	6.29	6.53	6.74	6.95	7.28	7.81	8.07	7.77	7.75	8.32	9.06	10.29	11.02
1981	94.51	5.03	5.26	5.50	5.76	6.04	6.27	6.52	6.76	6.97	7.19	7.50	8.00	8.25	8.03	8.05	8.56	9.18	10.04	10.28
1982	100.08	5.08	5.29	5.52	5.77	6.03	6.25	6.48	6.69	6.89	7.08	7.35	7.79	7.99	7.76	7.74	8.11	8.51	8.99	8.80
1983	104.19	5.03	5.24	5.45	5.68	5.92	6.12	6.33	6.52	6.68	6.85	7.08	7.45	7.59	7.34	7.27	7.53	7.76	7.99	7.60
1984	108.49	4.99	5.19	5.38	5.60	5.83	6.01	6.20	6.37	6.51	6.65	6.85	7.17	7.27	7.02	6.92	7.10	7.24	7.34	6.90
1985	112.06	4.92	5.10	5.29	5.49	5.70	5.86	6.03	6.19	6.31	6.42	6.59	6.86	6.94	6.67	6.55	6.67	6.74	6.75	6.29
1986	113.85	4.79	4.95	5.12	5.31	5.50	5.65	5.79	5.93	6.03	6.11	6.25	6.48	6.52	6.24	6.09	6.15	6.15	6.09	5.61
1987	117.56	4.73	4.89	5.05	5.22	5.40	5.53	5.67	5.78	5.87	5.94	6.06	6.26	6.28	6.01	5.85	5.88	5.86	5.77	5.31
1988	121.72	4.68	4.83	4.99	5.15	5.32	5.44	5.56	5.67	5.75	5.81	5.91	6.09	6.10	5.83	5.67	5.69	5.65	5.55	5.11
1989	126.93	4.67	4.81	4.96	5.12	5.27	5.39	5.51	5.60	5.67	5.73	5.82	5.98	5.98	5.73	5.57	5.58	5.53	5.43	5.03
1990	132.96	4.67	4.81	4.95	5.10	5.25	5.36	5.47	5.56	5.63	5.68	5.76	5.91	5.91	5.66	5.52	5.52	5.47	5.38	5.00
1991	137.66	4.63	4.77	4.90	5.04	5.19	5.29	5.39	5.48	5.53	5.58	5.65	5.79	5.77	5.54	5.39	5.39	5.33	5.23	4.88
1992	140.94	4.56	4.69	4.81	4.95	5.08	5.18	5.27	5.34	5.39	5.43	5.49	5.61	5.59	5.36	5.21	5.19	5.13	5.03	4.69
1993	144.25	4.49	4.61	4.73	4.86	4.98	5.07	5.16	5.22	5.26	5.29	5.35	5.45	5.43	5.20	5.05	5.03	4.96	4.85	4.52
1994	147.12	4.41	4.53	4.64	4.76	4.88	4.96	5.04	5.10	5.13	5.15	5.20	5.29	5.26	5.04	4.89	4.85	4.78	4.67	4.35
1995	150.74	4.35	4.46	4.57	4.68	4.80	4.87	4.94	5.00	5.03	5.04	5.08	5.17	5.13	4.91	4.77	4.73	4.65	4.53	4.23
1996	154.63	4.30	4.41	4.51	4.62	4.72	4.79	4.86	4.91	4.94	4.95	4.98	5.06	5.02	4.81	4.66	4.62	4.54	4.42	4.13
1997	157.94	4.24	4.34	4.44	4.54	4.64	4.71	4.77	4.81	4.83	4.84	4.87	4.94	4.90	4.69	4.54	4.50	4.42	4.30	4.02
1998	159.79	4.16	4.25	4.34	4.44	4.53	4.59	4.65	4.69	4.71	4.71	4.73	4.79	4.75	4.54	4.40	4.35	4.26	4.14	3.87
1999	163.09	4.10	4.19	4.28	4.37	4.46	4.52	4.57	4.60	4.62	4.62	4.64	4.69	4.64	4.44	4.30	4.25	4.16	4.04	3.78
2000	168.84	4.09	4.18	4.26	4.35	4.43	4.49	4.54	4.57	4.58	4.58	4.60	4.65	4.60	4.40	4.27	4.22	4.13	4.02	3.76
2001	173.38	4.05	4.14	4.22	4.30	4.39	4.44	4.48	4.51	4.52	4.52	4.53	4.58	4.53	4.34	4.21	4.15	4.07	3.96	3.71
2002	175.83	3.99	4.07	4.15	4.23	4.30	4.35	4.39	4.42	4.43	4.42	4.43	4.48	4.42	4.23	4.10	4.05	3.96	3.86	3.61
2003	179.78	3.95	4.02	4.10	4.18	4.25	4.29	4.33	4.36	4.36	4.35	4.36	4.40	4.35	4.17	4.03	3.98	3.90	3.79	3.56
2004	184.48	3.91	3.99	4.06	4.14	4.21	4.25	4.29	4.31	4.31	4.30	4.31	4.35	4.29	4.11	3.98	3.93	3.85	3.74	3.52
2005	190.98	3.91	3.98	4.05	4.12	4.19	4.23	4.27	4.29	4.29	4.28	4.29	4.32	4.27	4.09	3.97	3.92	3.84	3.74	3.52
2006	197.05	3.89	3.96	4.03	4.10	4.17	4.20	4.24	4.26	4.26	4.25	4.25	4.29	4.24	4.07	3.94	3.89	3.82	3.72	3.51
2007	202.76	3.87	3.94	4.00	4.07	4.13	4.17	4.20	4.22	4.22	4.21	4.22	4.25	4.20	4.03	3.91	3.86	3.78	3.69	3.48
2008	210.98	3.87	3.94	4.00	4.07	4.13	4.17	4.20	4.22	4.22	4.21	4.21	4.24	4.19	4.03	3.92	3.87	3.79	3.70	3.50
2009	209.64	3.78	3.84	3.90	3.96	4.02	4.05	4.08	4.10	4.09	4.08	4.08	4.11	4.06	3.89	3.78	3.73	3.65	3.56	3.36
2010	214.00	3.74	3.80	3.86	3.92	3.98	4.01	4.04	4.05	4.04	4.03	4.03	4.05	4.00	3.84	3.73	3.68	3.60	3.51	3.32
2011	221.53	3.74	3.80	3.85	3.91	3.97	4.00	4.02	4.04	4.03	4.02	4.02	4.04	3.99	3.83	3.72	3.67	3.60	3.51	3.33
2012	226.22	3.70	3.76	3.82	3.88	3.93	3.96	3.98	3.99	3.99	3.97	3.97	3.99	3.94	3.79	3.68	3.63	3.56	3.47	3.29
2013	229.29	3.66	3.72	3.77	3.82	3.87	3.90	3.92	3.93	3.93	3.91	3.91	3.93	3.88	3.73	3.62	3.57	3.50	3.41	3.23
2014	232.77	3.62	3.67	3.72	3.78	3.83	3.85	3.87	3.88	3.87	3.86	3.85	3.87	3.82	3.67	3.56	3.51	3.44	3.36	3.18
2015	231.81	3.54	3.59	3.64	3.69	3.74	3.76	3.78	3.79	3.78	3.76	3.75	3.77	3.71	3.57	3.46	3.41	3.34	3.25	3.08
2016	234.08	3.49	3.55	3.59	3.64	3.68	3.71	3.72	3.73	3.72	3.70	3.69	3.70	3.65	3.51	3.40	3.35	3.28	3.19	3.02
2017	239.05	3.47	3.52	3.56	3.61	3.65	3.67	3.69	3.70	3.68	3.66	3.66	3.67	3.61	3.47	3.37	3.32	3.25	3.16	3.00

Table 2.5 (continued): Adjusted CPI W: Compound Annual Rates of Growth (%) Base Year = 1982-1984

		From																			
To	Variable	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
1979	77.72																				
1980	86.28	11.02																			
1981	94.51	10.28	9.54																		
1982	100.08	8.80	7.70	5.89																	
1983	104.19	7.60	6.49	4.99	4.10																
1984	108.49	6.90	5.89	4.70	4.11	4.13															
1985	112.06	6.29	5.37	4.35	3.84	3.71	3.29														
1986	113.85	5.61	4.73	3.79	3.28	3.00	2.44	1.60													
1987	117.56	5.31	4.52	3.70	3.27	3.07	2.71	2.43	3.26												
1988	121.72	5.11	4.40	3.68	3.32	3.16	2.92	2.79	3.40	3.53											
1989	126.93	5.03	4.38	3.75	3.45	3.35	3.19	3.16	3.69	3.91	4.28										
1990	132.96	5.00	4.42	3.86	3.61	3.54	3.45	3.48	3.95	4.19	4.51	4.75									
1991	137.66	4.88	4.34	3.83	3.61	3.54	3.46	3.49	3.87	4.02	4.19	4.14	3.54								
1992	140.94	4.69	4.17	3.70	3.48	3.41	3.33	3.33	3.62	3.69	3.73	3.55	2.96	2.38							
1993	144.25	4.52	4.03	3.59	3.38	3.31	3.22	3.21	3.44	3.47	3.46	3.25	2.75	2.37	2.35						
1994	147.12	4.35	3.89	3.46	3.26	3.19	3.09	3.07	3.26	3.26	3.21	3.00	2.56	2.24	2.17	1.99					
1995	150.74	4.23	3.79	3.39	3.20	3.13	3.04	3.01	3.17	3.16	3.10	2.91	2.54	2.29	2.27	2.22	2.46				
1996	154.63	4.13	3.71	3.34	3.16	3.08	3.00	2.97	3.11	3.09	3.04	2.86	2.55	2.35	2.35	2.34	2.52	2.58			
1997	157.94	4.02	3.62	3.26	3.09	3.02	2.93	2.90	3.02	3.00	2.94	2.77	2.49	2.32	2.30	2.29	2.39	2.36	2.14		
1998	159.79	3.87	3.48	3.14	2.97	2.89	2.80	2.77	2.86	2.83	2.76	2.59	2.32	2.15	2.11	2.07	2.09	1.96	1.65	1.17	
1999	163.09	3.78	3.41	3.08	2.91	2.84	2.76	2.72	2.80	2.77	2.70	2.54	2.30	2.14	2.11	2.07	2.08	1.99	1.79	1.62	
2000	168.84	3.76	3.41	3.10	2.95	2.88	2.80	2.77	2.85	2.82	2.76	2.63	2.42	2.29	2.28	2.27	2.32	2.29	2.22	2.25	
2001	173.38	3.71	3.38	3.08	2.93	2.87	2.80	2.77	2.84	2.81	2.76	2.63	2.44	2.33	2.33	2.33	2.37	2.36	2.32	2.36	
2002	175.83	3.61	3.29	3.00	2.86	2.79	2.72	2.69	2.75	2.72	2.66	2.54	2.36	2.25	2.24	2.22	2.25	2.22	2.16	2.17	
2003	179.78	3.56	3.24	2.97	2.83	2.77	2.69	2.66	2.72	2.69	2.63	2.52	2.35	2.25	2.24	2.23	2.25	2.23	2.18	2.18	
2004	184.48	3.52	3.22	2.95	2.82	2.76	2.69	2.66	2.72	2.69	2.63	2.52	2.37	2.28	2.27	2.26	2.29	2.27	2.23	2.24	
2005	190.98	3.52	3.23	2.97	2.85	2.79	2.73	2.70	2.76	2.73	2.69	2.59	2.44	2.37	2.37	2.37	2.40	2.39	2.37	2.40	
2006	197.05	3.51	3.23	2.98	2.86	2.81	2.75	2.72	2.78	2.76	2.71	2.62	2.49	2.42	2.42	2.43	2.46	2.47	2.45	2.49	
2007	202.76	3.48	3.22	2.98	2.86	2.81	2.76	2.73	2.79	2.76	2.72	2.64	2.51	2.45	2.45	2.46	2.50	2.50	2.49	2.53	
2008	210.98	3.50	3.24	3.02	2.91	2.86	2.81	2.79	2.84	2.82	2.79	2.71	2.60	2.54	2.55	2.57	2.61	2.62	2.62	2.67	
2009	209.64	3.36	3.11	2.89	2.78	2.73	2.67	2.64	2.69	2.66	2.62	2.54	2.43	2.36	2.36	2.36	2.39	2.38	2.37	2.39	
2010	214.00	3.32	3.07	2.86	2.75	2.70	2.65	2.62	2.66	2.64	2.60	2.52	2.41	2.35	2.35	2.35	2.37	2.36	2.35	2.36	
2011	221.53	3.33	3.09	2.88	2.78	2.73	2.68	2.66	2.70	2.68	2.64	2.56	2.46	2.41	2.41	2.41	2.44	2.44	2.43	2.45	
2012	226.22	3.29	3.06	2.86	2.76	2.71	2.66	2.64	2.68	2.65	2.62	2.54	2.45	2.39	2.39	2.40	2.42	2.42	2.41	2.42	
2013	229.29	3.23	3.01	2.81	2.71	2.66	2.61	2.59	2.63	2.60	2.57	2.49	2.40	2.35	2.34	2.34	2.36	2.36	2.34	2.36	
2014	232.77	3.18	2.96	2.77	2.67	2.63	2.58	2.55	2.59	2.56	2.53	2.46	2.36	2.31	2.31	2.30	2.32	2.31	2.30	2.31	
2015	231.81	3.08	2.86	2.67	2.58	2.53	2.48	2.45	2.48	2.45	2.41	2.34	2.25	2.20	2.19	2.18	2.19	2.18	2.15	2.15	
2016	234.08	3.02	2.81	2.62	2.53	2.48	2.43	2.40	2.43	2.40	2.36	2.29	2.20	2.15	2.14	2.13	2.13	2.12	2.09	2.09	
2017	239.05	3.00	2.79	2.61	2.52	2.47	2.42	2.40	2.42	2.39	2.35	2.29	2.20	2.15	2.14	2.13	2.13	2.12	2.10	2.09	

		From																			
To	Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1997	157.94																				
1998	159.79	1.17																			
1999	163.09	1.62	2.07																		
2000	168.84	2.25	2.79	3.52																	
2001	173.38	2.36	2.76	3.10	2.69																
2002	175.83	2.17	2.42	2.54	2.05	1.42															
2003	179.78	2.18	2.39	2.47	2.12	1.83	2.25														
2004	184.48	2.24	2.42	2.50	2.24	2.09	2.43	2.61													
2005	190.98	2.40	2.58	2.67	2.50	2.45	2.79	3.07	3.52												
2006	197.05	2.49	2.65	2.74	2.61	2.59	2.89	3.10	3.35	3.17											
2007	202.76	2.53	2.68	2.76	2.65	2.64	2.89	3.05	3.20	3.04	2.90										
2008	210.98	2.67	2.82	2.90	2.82	2.84	3.08	3.25	3.41	3.37	3.47	4.06									
2009	209.64	2.39	2.50	2.54	2.43	2.40	2.54	2.59	2.59	2.36	2.09	1.68	-0.63								
2010	214.00	2.36	2.46	2.50	2.40	2.37	2.49	2.52	2.50	2.30	2.08	1.81	0.71	2.08							
2011	221.53	2.45	2.55	2.58	2.50	2.48	2.60	2.64	2.65	2.50	2.37	2.24	1.64	2.80	3.52						
2012	226.22	2.42	2.51	2.55	2.47	2.45	2.55	2.59	2.58	2.45	2.33	2.21	1.76	2.57	2.82	2.12					
2013	229.29	2.36	2.44	2.46	2.38	2.36	2.44	2.46	2.45	2.31	2.19	2.07	1.68	2.27	2.33	1.74	1.36				
2014	232.77	2.31	2.38	2.40	2.32	2.29	2.37	2.38	2.35	2.22	2.10	1.99	1.65	2.12	2.12	1.66	1.44	1.52			
2015	231.81	2.15	2.21	2.22	2.14	2.10	2.15	2.14	2.10	1.96	1.82	1.69	1.35	1.69	1.61	1.14	0.82	0.55	-0.41		
2016	234.08	2.09	2.14	2.15	2.06	2.02	2.06	2.05	2.00	1.87	1.74	1.61	1.31	1.59	1.51	1.11	0.86	0.69	0.28	0.98	
2017	239.05	2.09	2.14	2.15	2.07	2.03	2.07	2.06	2.01	1.89	1.77	1.66	1.40	1.65	1.59	1.28	1.11	1.05	0.89	1.55	2.13

Table 2.6:Adjusted GDP Deflator: Compound Annual Rates of Growth (%) Base Year = 2012

		From																		
To	Variable	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1961	17.11																			
1962	17.30	1.11																		
1963	17.48	1.08	1.04																	
1964	17.72	1.19	1.23	1.42																
1965	18.03	1.32	1.39	1.57	1.72															
1966	18.52	1.60	1.72	1.94	2.21	2.70														
1967	19.03	1.79	1.93	2.16	2.40	2.74	2.79													
1968	19.82	2.13	2.30	2.55	2.84	3.21	3.47	4.15												
1969	20.78	2.46	2.65	2.92	3.23	3.61	3.91	4.48	4.80											
1970	21.85	2.76	2.96	3.24	3.55	3.92	4.22	4.71	4.98	5.17										
1971	22.94	2.98	3.18	3.46	3.75	4.09	4.37	4.77	4.98	5.07	4.97									
1972	23.90	3.09	3.29	3.54	3.81	4.11	4.35	4.66	4.79	4.78	4.59	4.21								
1973	25.19	3.28	3.47	3.72	3.98	4.27	4.49	4.78	4.90	4.93	4.85	4.79	5.37							
1974	27.42	3.69	3.91	4.18	4.46	4.77	5.03	5.35	5.55	5.70	5.84	6.13	7.10	8.86						
1975	29.94	4.08	4.31	4.59	4.88	5.20	5.48	5.82	6.06	6.28	6.50	6.89	7.79	9.02	9.18					
1976	31.55	4.17	4.39	4.65	4.92	5.22	5.47	5.78	5.98	6.15	6.32	6.59	7.19	7.80	7.28	5.40				
1977	33.48	4.29	4.50	4.75	5.01	5.29	5.53	5.81	5.99	6.15	6.29	6.51	6.97	7.38	6.88	5.75	6.10			
1978	35.80	4.44	4.65	4.90	5.15	5.42	5.65	5.91	6.09	6.23	6.37	6.57	6.96	7.29	6.89	6.14	6.51	6.93		
1979	38.77	4.65	4.86	5.10	5.36	5.62	5.85	6.11	6.29	6.44	6.58	6.78	7.15	7.45	7.17	6.68	7.10	7.61	8.29	
1980	42.28	4.88	5.09	5.33	5.58	5.85	6.07	6.33	6.51	6.67	6.82	7.03	7.39	7.68	7.48	7.15	7.59	8.09	8.67	9.06
1981	46.27	5.10	5.31	5.56	5.81	6.07	6.30	6.55	6.74	6.90	7.06	7.27	7.62	7.90	7.76	7.53	7.96	8.43	8.93	9.25
1982	49.13	5.15	5.36	5.59	5.83	6.07	6.29	6.53	6.70	6.84	6.99	7.17	7.47	7.71	7.56	7.33	7.66	7.97	8.24	8.22
1983	51.05	5.10	5.29	5.51	5.73	5.95	6.15	6.36	6.51	6.63	6.75	6.90	7.14	7.32	7.15	6.90	7.12	7.29	7.36	7.12
1984	52.89	5.03	5.21	5.41	5.62	5.83	6.00	6.20	6.33	6.43	6.52	6.64	6.84	6.98	6.79	6.53	6.67	6.75	6.72	6.41
1985	54.57	4.95	5.12	5.31	5.50	5.69	5.85	6.03	6.14	6.22	6.29	6.39	6.56	6.66	6.46	6.19	6.28	6.30	6.21	5.86
1986	55.67	4.83	4.99	5.17	5.34	5.52	5.66	5.81	5.90	5.97	6.02	6.09	6.23	6.29	6.08	5.80	5.84	5.81	5.68	5.31
1987	57.04	4.74	4.89	5.05	5.21	5.37	5.50	5.64	5.72	5.77	5.81	5.86	5.97	6.01	5.80	5.52	5.53	5.47	5.31	4.95
1988	59.06	4.70	4.84	4.99	5.14	5.29	5.41	5.54	5.61	5.65	5.68	5.72	5.82	5.85	5.63	5.37	5.36	5.30	5.13	4.79
1989	61.37	4.67	4.80	4.95	5.09	5.24	5.35	5.47	5.53	5.56	5.59	5.62	5.70	5.72	5.52	5.26	5.25	5.18	5.02	4.70
1990	63.68	4.64	4.76	4.91	5.04	5.18	5.28	5.39	5.45	5.48	5.49	5.52	5.59	5.61	5.41	5.16	5.14	5.07	4.92	4.61
1991	65.82	4.59	4.72	4.85	4.98	5.11	5.20	5.31	5.36	5.38	5.39	5.41	5.48	5.48	5.29	5.05	5.02	4.95	4.80	4.51
1992	67.32	4.52	4.63	4.76	4.88	5.00	5.09	5.18	5.23	5.24	5.25	5.26	5.31	5.31	5.12	4.88	4.85	4.77	4.61	4.34
1993	68.92	4.45	4.56	4.68	4.79	4.91	4.99	5.07	5.11	5.12	5.12	5.13	5.17	5.16	4.97	4.74	4.70	4.62	4.46	4.20
1994	70.39	4.38	4.48	4.60	4.70	4.81	4.88	4.96	4.99	5.00	4.99	5.00	5.03	5.02	4.83	4.60	4.56	4.47	4.32	4.06
1995	71.86	4.31	4.41	4.52	4.62	4.72	4.79	4.86	4.89	4.89	4.88	4.87	4.90	4.88	4.70	4.48	4.43	4.34	4.18	3.93
1996	73.18	4.24	4.33	4.43	4.53	4.62	4.69	4.75	4.77	4.77	4.76	4.75	4.77	4.75	4.56	4.35	4.30	4.20	4.05	3.81
1997	74.45	4.17	4.26	4.35	4.44	4.53	4.59	4.65	4.67	4.66	4.64	4.63	4.65	4.62	4.44	4.23	4.17	4.08	3.93	3.69
1998	75.27	4.09	4.17	4.26	4.34	4.43	4.48	4.53	4.55	4.54	4.52	4.50	4.51	4.48	4.30	4.09	4.03	3.93	3.79	3.55
1999	76.35	4.01	4.09	4.18	4.26	4.34	4.39	4.44	4.45	4.43	4.41	4.39	4.40	4.36	4.18	3.98	3.92	3.82	3.67	3.45
2000	78.07	3.97	4.05	4.13	4.20	4.28	4.32	4.37	4.38	4.36	4.34	4.31	4.32	4.28	4.11	3.91	3.85	3.75	3.61	3.39
2001	79.82	3.93	4.00	4.08	4.15	4.22	4.26	4.31	4.31	4.30	4.27	4.24	4.25	4.21	4.04	3.84	3.78	3.69	3.55	3.34
2002	81.04	3.87	3.94	4.01	4.08	4.15	4.19	4.23	4.23	4.21	4.18	4.16	4.15	4.11	3.95	3.76	3.69	3.60	3.46	3.26
2003	82.57	3.82	3.89	3.96	4.02	4.09	4.12	4.16	4.16	4.14	4.11	4.08	4.08	4.04	3.87	3.69	3.63	3.53	3.40	3.20
2004	84.78	3.79	3.86	3.93	3.99	4.05	4.08	4.12	4.12	4.10	4.07	4.04	4.04	3.99	3.83	3.65	3.59	3.50	3.37	3.18
2005	87.41	3.78	3.84	3.91	3.97	4.03	4.06	4.09	4.09	4.07	4.04	4.01	4.01	3.97	3.81	3.64	3.58	3.49	3.36	3.18
2006	90.07	3.76	3.82	3.89	3.95	4.00	4.03	4.07	4.06	4.04	4.01	3.99	3.98	3.94	3.79	3.62	3.56	3.47	3.35	3.17
2007	92.50	3.74	3.80	3.86	3.92	3.97	4.00	4.03	4.03	4.01	3.98	3.95	3.94	3.90	3.75	3.59	3.53	3.45	3.33	3.15
2008	94.26	3.70	3.75	3.82	3.87	3.92	3.95	3.98	3.97	3.95	3.92	3.89	3.89	3.84	3.70	3.54	3.48	3.40	3.28	3.11
2009	95.00	3.64	3.69	3.75	3.80	3.85	3.88	3.90	3.90	3.87	3.84	3.81	3.80	3.76	3.61	3.45	3.40	3.31	3.20	3.03
2010	96.11	3.59	3.64	3.69	3.74	3.79	3.81	3.84	3.83	3.81	3.77	3.74	3.73	3.69	3.55	3.39	3.33	3.25	3.13	2.97
2011	98.11	3.55	3.61	3.66	3.71	3.75	3.77	3.80	3.79	3.77	3.73	3.70	3.69	3.64	3.51	3.35	3.29	3.21	3.10	2.94
2012	100.00	3.52	3.57	3.62	3.67	3.71	3.73	3.76	3.75	3.72	3.69	3.66	3.64	3.60	3.46	3.31	3.26	3.18	3.07	2.91
2013	101.77	3.49	3.54	3.59	3.63	3.67	3.69	3.71	3.70	3.68	3.64	3.61	3.60	3.55	3.42	3.27	3.22	3.14	3.03	2.88
2014	103.69	3.46	3.50	3.55	3.60	3.63	3.65	3.67	3.66	3.64	3.60	3.57	3.56	3.51	3.38	3.24	3.18	3.10	3.00	2.85
2015	104.76	3.41	3.46	3.50	3.55	3.58	3.60	3.62	3.61	3.58	3.54	3.51	3.50	3.45	3.32	3.18	3.12	3.05	2.94	2.80
2016	105.90	3.37	3.41	3.46	3.50	3.53	3.55	3.56	3.55	3.53	3.49	3.46	3.44	3.40	3.27	3.13	3.07	3.00	2.90	2.75
2017	107.93	3.34	3.38	3.43	3.47	3.50	3.52	3.53	3.52	3.49	3.46	3.42	3.41	3.36	3.24	3.10	3.05	2.97	2.87	2.73

Table 2.6 (continued). Adjusted GDP Deflator: Compound Annual Rates of Growth (%) Base Year = 2012

To	Variable	From																			
1979	38.77	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
1980	42.28																				
1981	46.27	9.44																			
1982	49.13	7.80	6.18																		
1983	51.05	6.49	5.04	3.91																	
1984	52.89	5.76	4.56	3.76	3.61																
1985	54.57	5.24	4.21	3.56	3.39	3.16															
1986	55.67	4.69	3.77	3.17	2.93	2.59	2.02														
1987	57.04	4.37	3.55	3.03	2.81	2.55	2.24	2.46													
1988	59.06	4.27	3.55	3.11	2.96	2.79	2.67	2.99	3.53												
1989	61.37	4.23	3.59	3.23	3.12	3.02	2.98	3.30	3.73	3.92											
1990	63.68	4.18	3.61	3.29	3.21	3.14	3.14	3.41	3.74	3.84	3.76										
1991	65.82	4.11	3.59	3.30	3.23	3.17	3.17	3.40	3.64	3.68	3.56	3.37									
1992	67.32	3.95	3.47	3.20	3.12	3.06	3.05	3.22	3.37	3.33	3.13	2.82	2.28								
1993	68.92	3.83	3.38	3.12	3.05	2.98	2.96	3.10	3.20	3.14	2.94	2.67	2.33	2.37							
1994	70.39	3.71	3.28	3.04	2.96	2.90	2.87	2.97	3.05	2.97	2.78	2.54	2.26	2.25	2.13						
1995	71.86	3.60	3.20	2.97	2.89	2.83	2.79	2.88	2.93	2.84	2.67	2.45	2.22	2.20	2.12	2.10					
1996	73.18	3.49	3.10	2.89	2.81	2.74	2.70	2.77	2.81	2.72	2.55	2.35	2.14	2.11	2.02	1.96	1.83				
1997	74.45	3.38	3.02	2.81	2.73	2.66	2.62	2.68	2.70	2.61	2.44	2.26	2.07	2.03	1.95	1.89	1.78	1.73			
1998	75.27	3.26	2.90	2.70	2.62	2.55	2.50	2.54	2.55	2.46	2.29	2.11	1.93	1.88	1.78	1.69	1.55	1.42	1.10		
1999	76.35	3.16	2.82	2.63	2.55	2.48	2.43	2.46	2.46	2.36	2.21	2.04	1.87	1.81	1.72	1.64	1.52	1.42	1.27	1.43	
2000	78.07	3.11	2.79	2.61	2.53	2.46	2.42	2.44	2.44	2.35	2.21	2.06	1.91	1.87	1.80	1.74	1.67	1.63	1.60	1.84	
2001	79.82	3.07	2.76	2.59	2.51	2.45	2.41	2.43	2.43	2.34	2.21	2.08	1.95	1.91	1.85	1.81	1.77	1.75	1.76	1.98	
2002	81.04	3.00	2.70	2.53	2.46	2.40	2.35	2.37	2.37	2.29	2.16	2.03	1.91	1.87	1.82	1.78	1.73	1.72	1.71	1.86	
2003	82.57	2.95	2.67	2.50	2.43	2.37	2.33	2.35	2.34	2.26	2.14	2.02	1.91	1.87	1.82	1.79	1.75	1.74	1.74	1.87	
2004	84.78	2.94	2.67	2.51	2.44	2.39	2.35	2.36	2.36	2.29	2.18	2.07	1.97	1.94	1.90	1.88	1.85	1.86	1.87	2.00	
2005	87.41	2.95	2.69	2.54	2.47	2.42	2.38	2.40	2.40	2.33	2.23	2.13	2.05	2.03	2.00	1.99	1.98	1.99	2.03	2.16	
2006	90.07	2.95	2.70	2.56	2.50	2.45	2.42	2.43	2.43	2.37	2.28	2.19	2.11	2.10	2.08	2.08	2.07	2.10	2.14	2.27	
2007	92.50	2.94	2.70	2.56	2.51	2.46	2.43	2.45	2.45	2.39	2.31	2.22	2.15	2.14	2.12	2.12	2.13	2.15	2.19	2.32	
2008	94.26	2.91	2.67	2.54	2.48	2.44	2.41	2.42	2.42	2.37	2.28	2.20	2.14	2.13	2.11	2.11	2.11	2.13	2.17	2.28	
2009	95.00	2.83	2.60	2.47	2.42	2.37	2.34	2.35	2.35	2.29	2.21	2.13	2.06	2.05	2.03	2.02	2.01	2.03	2.05	2.14	
2010	96.11	2.78	2.55	2.43	2.37	2.32	2.29	2.30	2.29	2.24	2.16	2.08	2.01	2.00	1.98	1.97	1.96	1.97	1.98	2.06	
2011	98.11	2.75	2.54	2.41	2.36	2.31	2.28	2.29	2.29	2.23	2.16	2.08	2.02	2.00	1.98	1.97	1.96	1.97	1.99	2.06	
2012	100.00	2.73	2.52	2.40	2.35	2.30	2.27	2.28	2.27	2.22	2.15	2.07	2.01	2.00	1.98	1.97	1.96	1.97	1.99	2.05	
2013	101.77	2.70	2.49	2.38	2.33	2.28	2.25	2.26	2.25	2.20	2.13	2.06	2.00	1.99	1.97	1.96	1.95	1.96	1.97	2.03	
2014	103.69	2.67	2.48	2.36	2.31	2.27	2.24	2.25	2.24	2.19	2.12	2.05	2.00	1.98	1.96	1.96	1.95	1.95	1.97	2.02	
2015	104.76	2.63	2.43	2.32	2.27	2.23	2.20	2.20	2.19	2.15	2.08	2.01	1.96	1.94	1.92	1.91	1.90	1.91	1.92	1.96	
2016	105.90	2.58	2.39	2.28	2.24	2.19	2.16	2.17	2.16	2.11	2.04	1.98	1.92	1.91	1.89	1.87	1.86	1.87	1.87	1.92	
2017	107.93	2.57	2.38	2.27	2.23	2.18	2.15	2.16	2.15	2.10	2.04	1.97	1.92	1.91	1.89	1.88	1.87	1.87	1.87	1.92	

To	Variable	From																			
1997	74.45	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1998	75.27	1.10																			
1999	76.35	1.27	1.43																		
2000	78.07	1.60	1.84	2.26																	
2001	79.82	1.76	1.98	2.25	2.25																
2002	81.04	1.71	1.86	2.01	1.88	1.52															
2003	82.57	1.74	1.87	1.98	1.88	1.70	1.89														
2004	84.78	1.87	2.00	2.12	2.08	2.03	2.28	2.68													
2005	87.41	2.03	2.16	2.28	2.29	2.30	2.55	2.89	3.10												
2006	90.07	2.14	2.27	2.39	2.41	2.45	2.68	2.94	3.08	3.05											
2007	92.50	2.19	2.32	2.43	2.45	2.49	2.68	2.88	2.95	2.87	2.69										
2008	94.26	2.17	2.28	2.37	2.38	2.40	2.55	2.69	2.69	2.55	2.30	1.91									
2009	95.00	2.05	2.14	2.21	2.20	2.20	2.30	2.37	2.30	2.10	1.79	1.34	0.78								
2010	96.11	1.98	2.06	2.11	2.10	2.08	2.15	2.19	2.11	1.92	1.63	1.28	0.97	1.17							
2011	98.11	1.99	2.06	2.11	2.10	2.08	2.15	2.18	2.11	1.94	1.72	1.48	1.34	1.63	2.08						
2012	100.00	1.99	2.05	2.10	2.08	2.07	2.12	2.15	2.09	1.94	1.76	1.57	1.49	1.72	2.00	1.92					
2013	101.77	1.97	2.03	2.07	2.06	2.05	2.09	2.11	2.05	1.92	1.76	1.61	1.54	1.74	1.93	1.85	1.77				
2014	103.69	1.97	2.02	2.06	2.05	2.03	2.07	2.09	2.03	1.92	1.77	1.64	1.60	1.77	1.92	1.86	1.83	1.88			
2015	104.76	1.92	1.96	2.00	1.98	1.96	1.99	2.00	1.94	1.83	1.69	1.57	1.52	1.64	1.74	1.65	1.56	1.46	1.03		
2016	105.90	1.87	1.92	1.94	1.92	1.90	1.93	1.93	1.87	1.76	1.63	1.51	1.47	1.56	1.63	1.54	1.44	1.33	1.06	1.09	
2017	107.93	1.87	1.92	1.94	1.92	1.90	1.93	1.93	1.87	1.77	1.66	1.56	1.52	1.61	1.67	1.60	1.54	1.48	1.35	1.50	1.92

2.7 Appendix

OCACT adjustments to the published CPI-W annual growth rates. Between 1978 and 2017, OCACT set the annual growth rate in the adjusted CPI-W to the growth rate in the published CPI-W plus an annual growth rate differential, defined as the growth rate in the CPI-U "Research Series" (CPI-U-RS) less the growth rate in the published CPI-U. BLS constructs the CPI-U-RS by recalculating the CPI-U back to 1978 using present methodology (see http://stats.bls.gov/cpi/cpiurs.htm). An exception to this specification was made because BLS introduced an improvement for "rental equivalence" in 1983 for the CPI-U, but not until 1985 for the CPI-W. Thus, for 1983 and 1984, the annual percent change in the adjusted CPI-W is defined as the percent change in the CPI-U-RS less 0.1 percentage point. This adjustment reflects the belief that, had the introductions been simultaneous in 1983, the observed differences in growth between the two inflation measures would have been equal to their published compound average annual difference (0.1 percentage point) over the post-1985 period.

Between 1967 and 1977, the annual growth rate in the adjusted CPI-W was set to the growth rate in the published CPI-W less 0.2 percentage point plus an annual growth rate differential, defined as the growth rate in the CPI-U-X1 (a BLS "experimental series" that incorporates the improvement for rental equivalence into the historical CPI-U) less the growth rate in the actual published CPI-U. The 0.2 percentage point adjustment reflects a BLS estimate of the effect of introducing an improved geometric weighting formula into the CPI-W beginning in January 1999. Finally, for 1966 and earlier, the annual growth rate in the adjusted CPI-W was set to the growth rate in the published CPI-W less the 0.2 percentage point adjustment for the improved geometric formula.

OCACT adjustments to the published PGDP and real GDP (and therefore productivity) annual growth rates. As mentioned above, starting in January 1999, BLS introduced a new geometric weighting formula to the CPI, estimating that it would lower the future annual growth rate in the CPI by about 0.2 percentage point. BEA estimates that this change would have had a 50.0 percent "feed-through" effect on the aggregate annual PGDP growth rate in the past. Thus, due to BLS' introduction of an improved geometric weighting formula to the CPI, BEA lowered the annual growth rate in the aggregate PGDP by about 0.1 percentage point (0.2 * 50.0%). In addition, since the BLS improvement to the CPI does not alter the historical path of nominal GDP, BEA raised the annual real growth rate in the GDP by about 0.1 percentage point. However, BEA made these adjustments only back to 1978. Thus, to improve consistency, OCACT added the effect of this BLS improvement to the earlier data. That is, for 1978 and each earlier year, OCACT lowered the annual growth rate in the CPI by 0.2 percentage point, lowered the annual growth rate in the aggregate PGDP index by 0.1 percentage point, and raised the annual real growth rate in GDP, and therefore productivity, by 0.1 percentage point. Furthermore, a change in the CPI growth rate affects the PGDP through about 85.0% of the prices used to determine one of the components of the PGDP, that is, the GDP deflator for consumption (PGDP_C). Hence, the annual growth rate for the PGDP_C in 1978 and earlier was lowered by about 0.17 percent (0.2 * 0.85).

3. AVERAGE REAL WAGE DIFFERENTIAL

THE 2019 TRUSTEES REPORT
OFFICE OF THE CHIEF ACTUARY, SOCIAL SECURITY ADMINISTRATION

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3 Average Real Wage Differential

3.1 Summary

For the 2019 Trustees Report, over the 65-year period from 2028 to 2093, the average annual growth rate in the OASDI covered wage is assumed to be 5.03 percent, 3.81 percent, and 2.59 percent for alternatives I, II, and III, respectively (Table 3.1). [41,42] Also for the 2019 Trustees Report, the assumed ultimate annual rates of increase in the CPI-W are 3.20 percent, 2.60 percent, and 2.00 percent for alternatives I, II, and III, respectively (Table 2.1). Thus, for the 2019 Trustees Report, the average real wage differential, over the 65-year period from 2028 to 2093, is assumed to be 1.83 percent (5.03 less 3.20), 1.21 percent (3.81 less 2.60), and 0.59 percent (2.59 less 2.00) for alternatives I, II, and III, respectively.[43] These average real wage differentials for alternatives I, II, and III are 0.01 percentage point higher than in the 2018 Trustees Report.

Table 3.1: Assumed Average Real Wage Differential

Average Annual Percent Change (2028 to 2093)	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Average Nominal Wage	5.03	3.81	2.59	5.02	3.80	2.58	0.01	0.01	0.01
Less: CPI-W	3.20	2.60	2.00	3.20	2.60	2.00	0.00	0.00	0.00
Equals: Average Real Wage Differential	1.83	1.21	0.59	1.82	1.20	0.58	0.01	0.01	0.01

3.2 Definition of Average Real Wage Differential

The average OASDI covered wage is defined as the ratio of total OASDI covered wages in a year to the number of workers with any covered wages during the year. The annual real wage

[41] The 65-year period begins with the last year of the 10-year (2018 to 2028) "short-range" projection period and ends with the last year of the 75-year (2018 to 2093) "long-range" projection period.

[42] Starting with the 2010 Trustees Report, the annual growth rate in the average OASDI covered wage has been assumed to vary over the last 65 years of the projection, as the ratio of wages to compensation would decline at a varying rate over the period, reflecting the assumed path of the national health expenditures and the assumed effect of the Affordable Care Act on employer contributions to employee group health insurance.

[43] The real wage differential is defined as the annual percentage change in the average OASDI covered wage minus the annual percentage change in the CPI.

differential is defined as the annual percentage change in the average OASDI covered wage minus the annual percentage change in the CPI. The average real wage differential over the 65-year period from 2028 to 2093 is the average of annual real wage differentials over the period.

Both the income to the Social Security program and the benefits paid are related to total covered earnings (i.e., the combination of covered wages and covered net earnings from self-employment). For this reason, the growth in average earnings, not average wages, is the subject of the balance of this section. The future real growth rates in average U.S. earnings, average U.S. wages, and the average OASDI covered wage, are expected to be approximately equal.

For the 2019 Trustees Report, the average annual rate of increase in average real U.S. earnings, over the 65-year period from 2028 to 2093, is assumed to be 1.77 percent, 1.18 percent, and 0.60 percent for alternatives I, II, and III, respectively. These values are 0.01 percentage point higher than in the 2018 Trustees Report.

3.3 Average Real Economy-Wide Earnings Growth

Average real earnings in the total U.S. economy are defined as the ratio of total nominal earnings (wage and salary disbursements and net proprietors' income) to total adjusted average weekly civilian employment (see Section 3.5 Appendix A) and U.S. Armed Forces, divided by the adjusted CPI-W. BEA estimates historical values for nominal earnings as part of its broader responsibility of maintaining the NIPA for the U.S. economy. BLS estimates the CPI-W from its sample of prices and the civilian employment from its monthly CPS data. Because CPS data for the U.S. represent average weekly employment, the growth in average earnings for the total U.S. economy represents the growth in average weekly earnings for those employed.

Average real weekly earnings in the total U.S. economy increased at an average annual rate of 0.99 percent over the last 40 years (1977-2017), 1.22 percent over the last 30 years (1987-2017), 1.15 percent over the last 20 years (1997-2017), and 0.76 percent over the last 10 years (2007-2017). The average real earnings of OASDI covered workers (which differs from average real weekly earnings in the total economy partly because of changes in the types of workers covered by the OASDI program) increased at an average annual rate of 0.97 percent over the last 40 years, 0.96 percent over the last 30 years, 0.93 percent over the last 20 years, and 0.49 percent over the last 10 years (see Table 3.2 below). Note that these periods do not cover complete economic cycles and thus may not be the best indicators of true trend growth rates.

The types of workers covered by the OASDI program have changed in the past as a result of changes in the law and shifts in employment. Even without further changes in the law, the proportion of federal civilian government employees covered under the OASDI program will continue to increase toward 100 percent. All federal civilian government employees hired after 1983 are covered under OASDI, while some of those hired earlier are not. Virtually all federal civilian government employees will be covered around 2030. As a result, the composition of OASDI covered employment, which has varied since 1940, will stabilize around 2030. This

suggests that it is reasonable to evaluate the 1.18 percent assumed average real rate of increase for average covered earnings for alternative II in relation to the historical real growth rate in average earnings for all workers in the total economy. Therefore, the balance of this section focuses on the past trends for average earnings in the U.S. economy.

Considering complete economic cycles, the average annual real growth rate in earnings for all workers in the total U.S. economy was 1.93 percent from 1969 to 1973 (4 years), -0.45 percent from 1973 to 1979 (6 years), 0.47 percent from 1979 to 1990 (11 years), 2.12 percent from 1990 to 2001 (11 years), and 0.53 percent from 2001 to 2007 (6 years).[44] The 1.18 percent assumed average future annual real growth rate in average economy-wide earnings is close to the 1.13 percent historical average annual real growth rate over the last three complete cycles (28-year period from 1979 to 2007).

Table 3.2: Average Annual Real Percentage Change in Average Earnings: Comparison of the U.S. Economy to OASDI Covered

Period	Average Real Earnings for U.S. Economy	Total Links	Ratio of Employed Labor Force to Covered Workers	Ratio of Covered Earnings to U.S. Earnings	Average Real Earnings for OASDI Covered
Historical:	(1)	(2)	(3)	(4)	(5)
By Decade:					
1967-1977	1.02	-0.14	-0.05	-0.09	0.88
1977-1987	0.31	0.71	0.30	0.41	1.02
1987-1997	1.35	-0.34	-0.16	-0.18	1.01
1997-2007	1.55	-0.18	-0.11	-0.07	1.37
2007-2017	0.76	-0.26	-0.02	-0.24	0.49
1967-2017	1.00	-0.04	-0.01	-0.03	0.95
1977-2017	0.99	-0.02	0.00	-0.02	0.97
1987-2017	1.22	-0.26	-0.10	-0.16	0.96
1997-2017	1.15	-0.22	-0.06	-0.16	0.93
2007-2017	0.76	-0.26	-0.02	-0.24	0.49
By Complete Economic Cycle (Peak-to-Peak):					
Individual Cycle					
1969-1973	1.93	-0.32	-0.23	-0.10	1.60
1973-1979	-0.45	1.01	0.47	0.53	0.56
1979-1990	0.47	0.11	0.09	0.02	0.58
1990-2001	2.12	-0.49	-0.23	-0.26	1.62
2001-2007	0.53	0.26	0.08	0.18	0.79
Last Two Cycles					
1990-2007	1.56	-0.23	-0.12	-0.11	1.33
Last Three Cycles					
1979-2007	1.13	-0.09	-0.04	-0.06	1.03
Last Four Cycles					
1973-2007	0.85	0.10	0.05	0.05	0.95
Last Five Cycles					
1969-2007	0.96	0.06	0.02	0.03	1.02

[44] Peaks in economic cycles roughly follow the NBER cycle dating, except for short recoveries such as 1980-81, which are not counted as separate cycles.

The real growth rate in average earnings of all workers in the economy was depressed for the 1973-1979 and 1979-1990 cycles in a way not expected to be repeated in the future. During this period, the baby boom generation reached working age and the proportion of women in the labor force increased dramatically. As a result, the economy accommodated an extraordinary number of relatively low-paid (inexperienced and young) workers, thus depressing real growth in overall average earnings. However, the inclusion of baby boomers in the labor force ended in the mid-1980s, and the increasing percentage of women under age 60 in the labor force stabilized more recently.

The rapid increase in average earnings during the complete economic cycle from 1990 to 2001 may reflect maturation of the baby boomers and women in the labor force. The large number of baby boomers and women in the labor force have been reaching prime working ages and thus boosted growth since 1990. This kind of swing in demographic trends is not projected to occur in the future, so consideration of the longer period of the last three complete economic cycles seems appropriate. This approach allows us to average out the effects of past demographic trends, which initially depressed and later boosted average earnings growth.

Additional circumstances contributing to the potential future growth of average earnings are discussed in the next two sections on productivity growth and earnings links to productivity.

3.3.1 Productivity

Total-economy productivity growth ultimately affects the growth of real earnings. Total-economy productivity is defined as the ratio of real GDP to total hours worked in the U.S. economy. For the 2019 Trustees Report, the assumed ultimate annual rates of increase in total-economy productivity are 1.93 percent, 1.63 percent, and 1.33 percent for alternatives I, II, and III, respectively. These ultimate rates of increase for total-economy productivity are consistent with ultimate annual rates of increase in nonfarm business productivity of 2.36 percent, 2.00 percent, and 1.63 percent for alternatives I, II, and III, respectively (see Section 1).

3.3.2 Other Components: Links between Real Earnings and Productivity

Not all of the historical gains in productivity have resulted in proportional increases in average real earnings. For example, over the last four economic cycles (1973-2007), average real earnings increased at an average annual rate of only 0.85 percent per year, while productivity for the total U.S. economy increased at 1.64 percent per year. The approximate difference of -0.78 percent per year (1.0085 / 1.0164; values are rounded) was due to changes in the links, that is, factors that connect productivity to average real earnings in a multiplicative fashion. Table 3.3 summarizes the U.S. experience over the last five economic cycles for each of those factors.[45]

[45] This section calculates values for productivity, hours per week, price differential, and average real earnings using adjusted data for the CPI, PGDP, real GDP, and employment (weeks worked). Hence, Table 3.3 contains adjusted productivity values, which may not equal the unadjusted productivity values in Table 1.4 in Section 1. Adjustments to the CPI, PGDP and real GDP are described in Section 2.6 Appendix. Adjustments to

Those factors include the ratio of compensation to nominal GDP, the ratio of earnings to compensation, the ratio of total hours worked to total average weekly employment, and the ratio of the gross domestic product implicit price deflator (PGDP) to the CPI_W. Each of those links is discussed separately below.

Table 3.3: Average Annual Real Percentage Change in Average Earnings: Total U.S. Economy and Its Components

Period	Productivity	Total Links	Compensation to GDP	Earnings to Compensation	Hours per Week	Price Differential	Residual	Average Real Earnings
Historical:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
By Decade:								
1967-1977	2.06	-1.02	-0.18	-0.40	-0.75	0.32	0.00	1.02
1977-1987	1.28	-0.96	-0.15	-0.28	-0.17	-0.37	0.00	0.31
1987-1997	1.42	-0.07	-0.04	-0.03	0.29	-0.29	0.00	1.35
1997-2007	2.31	-0.75	-0.05	-0.12	-0.25	-0.33	0.00	1.55
2007-2017	1.03	-0.27	-0.05	0.04	-0.16	-0.10	0.00	0.76
1967-2017	1.62	-0.61	-0.10	-0.16	-0.21	-0.15	0.00	1.00
1977-2017	1.51	-0.51	-0.07	-0.10	-0.07	-0.27	0.00	0.99
1987-2017	1.59	-0.36	-0.05	-0.04	-0.04	-0.24	0.00	1.22
1997-2017	1.67	-0.51	-0.05	-0.04	-0.21	-0.22	0.00	1.15
2007-2017	1.03	-0.27	-0.05	0.04	-0.16	-0.10	0.00	0.76
By Complete Economic Cycle (Peak-to-Peak):								
Individual Cycle								
1969-1973	2.75	-0.80	-0.04	-0.34	-0.88	0.46	0.00	1.93
1973-1979	1.15	-1.59	-0.48	-0.43	-0.55	-0.13	0.00	-0.45
1979-1990	1.41	-0.92	-0.16	-0.29	-0.11	-0.37	0.00	0.47
1990-2001	1.85	0.27	0.43	0.05	0.16	-0.36	0.00	2.12
2001-2007	2.19	-1.63	-0.93	-0.18	-0.37	-0.15	0.00	0.53
Last Two Cycles								
1990-2007	1.97	-0.40	-0.05	-0.03	-0.03	-0.29	0.00	1.56
Last Three Cycles								
1979-2007	1.75	-0.61	-0.10	-0.13	-0.06	-0.32	0.00	1.13
Last Four Cycles								
1973-2007	1.64	-0.78	-0.16	-0.19	-0.15	-0.28	0.00	0.85
Last Five Cycles								
1969-2007	1.76	-0.78	-0.15	-0.20	-0.23	-0.21	0.00	0.96
Future Average Annual Rates of Increase for the 2019 Trustees Report (2028-2093)								
I	1.93	-0.17	0.00	0.02	0.05	-0.24	0.00	1.77
II	1.63	-0.45	0.00	-0.07	-0.05	-0.34	0.00	1.18
III	1.33	-0.74	0.00	-0.15	-0.15	-0.44	0.00	0.60

employment are described in Section 3.5 Appendix A.

3.3.2.1 Ratio of Compensation to Nominal GDP

The first link is the ratio of total compensation to nominal GDP, or the total compensation ratio (CR). The CR is the ratio of the sum of employee compensation and self-employed (proprietors') income to nominal GDP. For the 2019 Trustees Report, the assumed ultimate annual rate of change in the CR is 0.0 percent for alternatives I, II, and III. The CR is closely related to the labor share of total output. Most economists believe that the shares of total output going to the various factors of production tend towards stable proportions in the long run. Therefore, it is assumed that the CR will be constant over the last 65 years of the long-range period.

3.3.2.2 Ratio of Earnings to Compensation

The second link is the ratio of total worker earnings to compensation. Worker earnings differ from compensation because part of compensation comes in the form of employer contributions to employee pension plans, insurance premiums, and government social insurance programs. Using NIPA definitions, total worker earnings are the sum of total wage and salary disbursements and total proprietors' income. Total compensation is the sum of employee compensation and total proprietors' income. Total employee compensation is the sum of total wage and salary disbursements, employer contributions for employee pension and insurance funds, and employer contributions to government social insurance programs. Employer contributions to government social insurance programs include payments for public insurance and publicly mandated insurance such as for unemployment, workers' compensation, Medicare, and Social Security.

The average annual rate of change for the ratio was -0.20 percent from 1969 to 2007, a 38-year period that covers the last five peak-to-peak economic cycles. The historical decline in the ratio has been due primarily to relatively faster growth in employer contributions to employee pensions and health insurance.

Most employer contributions to pensions are for employees in the private sector and are composed of contributions to defined-benefit (DB) and defined-contribution (DC) plans. After declining in the 1980s and 1990s, when the work force was relatively young, asset returns relatively high, and the proportion of employees covered by DB plans was beginning to decline, employer contributions to pension plans rose sharply between 1997 and 2010 as the workforce aged, the stock market experienced two major crashes, and interest rates reached unusually low levels. Counteracting these trends is the continuing decline in DB coverage. Contributions have declined somewhat since 2010 as the stock market rebounded and may decline further in the near future if interest rates rise from current low levels. OCACT also expects a relative increase in employer contributions to employee pension funds due to increased life expectancy, and a relative decrease due to a continued shift from DB to DC plans.

Contributions to employer-sponsored group health insurance (ESI) in the future are expected to be significantly affected by the Affordable Care Act enacted in 2010. This expectation led to a significant change in the assumed future path of the ratio of earnings to compensation between

the 2009 and subsequent Trustees Reports.[46] For the 2019 Trustees Report, the annual rates of change in the ratio of wages to employee compensation are assumed to be consistent with the most recent projections of ESI from the Center for Medicare and Medicaid Services (CMS). In September 2018, CMS revised its projections of ESI for the period 2019-93. The average growth rate of ESI in the revised CMS projections is slightly lower than in their 2017 projections. The assumed path for the annual rates of change in the ratio of wages to employee compensation over the last 65 years of the projection horizon (2028 to 2093) is consistent with the annual rates of change from the revised CMS projections and the National Health Expenditure projections for 2017-26 released in February 2018.[47] This will result in an average annual rate of growth in the ratio of wages to employee compensation of about -0.06 percent for alternative II over the last 65 years of the 75-year projection period. This is a slightly slower decline than the -0.08 percent in the 2018 report.

Hence, for the 2019 Trustees Report, the average annual rate of change in the ratio of wages to employee compensation over the last 65 years of the projection horizon (2028 to 2093) is assumed to be 0.04, -0.06, and -0.16 percentage point for alternatives I, II, and III, respectively. Consistent with this, the assumed average annual rate of change in the ratio of earnings to total compensation over the last 65 years of the projection horizon (2028 to 2093) is 0.03, -0.06, and -0.15 percentage point for alternatives I, II, and III, respectively.

3.3.2.3 Average Hours Worked

The third link is average hours worked per week (AHW), defined as the ratio of total hours worked to total employment in the U.S. economy. Its compounded annual rate of change is shown in Table 3.4. Total hours worked in the U.S. economy is a special request series provided by BLS, based mostly on the Current Employment Statistics (CES), which surveys establishments. Total employment, computed on an average weekly basis, is the sum of civilian employment and the U.S. Armed Forces. BLS publishes total civilian employment from the Current Population Survey (CPS), which surveys households. The Census Bureau provides estimates for the U.S. Armed Forces. For the 2019 Trustees Report, the assumed ultimate annual rate of change in average hours worked is +0.05 percent, -0.05 percent and -0.15 percent in alternatives I, II, and III, respectively. These rates of change are the same as those used in the 2018 Trustees Report.

The average annual rate of change in AHW was -0.23 percent over the last five economic cycles, a 38-year period from 1969 to 2007. Looking at individual cycles, the average annual rate of change in AHW was -0.88 percent, -0.55 percent, -0.11 percent, 0.16 percent, and -0.37 percent, over the 1969-1973, 1973-1979, 1979-1990, 1990-2001, and 2001-2007 periods, respectively.

[46] For details, see Section 3.6 Appendix B.

[47] https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/proj2017.pdf

The historical pattern of AHW, as defined in this section, is also affected by the difference between CES and CPS employment measures. While CES estimates the number of jobs in the economy, CPS estimates the number of employed persons. Furthermore, CPS estimates are controlled to population annually between censuses. This causes the ratio of the two measures to change over time. Since 2015, BLS has made both the total hours worked and the employment estimate on which it is based available as a special request file.[48] The ratio between the employment measure implicit in the BLS measure of total hours worked and the total employment measure used in this section (i.e., CPS-based civilian employment plus the Census estimate of armed forces) has fluctuated between about 1.03 and 1.07. Notably, it was rising steadily in the last decade of the 20th century and declining in the first decade of the 21st century. The average annual rate of change in the average weekly hours implicit in the BLS calculation of total hours worked was –0.57 percent, –0.49 percent, –0.11 percent, –0.04 percent, and –0.12 percent, over the 1969-1973, 1973-1979, 1979-1990, 1990-2001, and 2001-2007 periods, respectively. The average annual rate of change over the last five economic cycles (1969 to 2007) was –0.20 percent, which is very close to the average rate of change calculated using the CPS-based employment measure.[49]

The average annual rate of change in AHW was -0.37 percent over the last complete economic cycle, a 6-year period from 2001 to 2007, suggesting a return to the steep declines seen over the period from 1969 to 1979. However, the magnitude of this drop may be due to differences in employment estimates described above, as the average annual rate of change implicit in the BLS estimates of total hours worked is –0.12 percent. Regardless, the return to declines in the rate of change in AHW since 2001 was substantial. Accordingly, the Trustees lowered the assumed ultimate annual rate of change in AHW to -0.05 percent starting with the 2012 report, or approximately equal to the average annual rate of change of -0.06 percent over the last three economic cycles, a 28-year period from 1979 to 2007.[50]

There are factors that may affect the future AHW in offsetting ways. On one hand, the assumed steady increases in productivity will allow workers to gradually increase leisure time while still maintaining increases in weekly and annual earnings. On the other hand, it is reasonable to assume that the assumed future increases in life expectancy will raise labor force participation rates for older workers and it may also raise AHW, holding other factors constant. The average projected changes in the education and age-sex distributions of the workforce are not expected to significantly affect the average annual rate of change in the AHW in the future. Thus, for the 2019 Trustees Report the assumed ultimate annual rate of change in AHW is -0.05 percent for alternative II.

3.3.2.4 Price Differential (Expressed as Ratio of PGDP to CPI-W)

[48] http://www.bls.gov/lpc/special_requests/us_total_hrs_emp.xlsx.

[49] One could further decouple the "average hours worked" link into two links, roughly corresponding to average hours per job and average jobs per worker. However, despite fluctuations over economic cycles and between censuses, the latter link seems to be very stable over longer time periods, so that such an additional step seems unnecessary for the purpose of deriving assumptions about the future.

[50] The corresponding value implicit in the BLS estimate of total hours worked is -0.08 percent.

The final link is the ratio of the PGDP to the CPI-W. Including this ratio is necessary because nominal earnings depend on nominal GDP (i.e., the product of real GDP and the PGDP), but are converted to real earnings using the CPI-W. For the 2019 Trustees Report, the assumed ultimate price differential (expressed as the PGDP less CPI-W average annual rates of increase) is -0.25, -0.35, and -0.45 percentage point for alternative I, II, and III, respectively. For alternative II, the -0.35 percentage point price differential is the sum of a -0.30 percentage point computational difference and a -0.05 percentage point coverage difference (see Section 2.3). These assumed values for the coverage component and the total are 0.05 percentage point higher those assumed in the 2018 Trustees Report.

3.3.2.5 Total Links

The average annual change in the total links was -0.61 percent over the last three economic cycles and -0.78 percent over the last four cycles. For the 2019 Trustees Report, the assumed average annual changes in the total links are approximately -0.16 percentage point, -0.45 percentage point, and -0.74 percentage point for alternatives I, II, and III, respectively.

3.4 Projections from Other Sources

IHS Markit (formerly Global Insight, Inc.) provides projections through 2048 in its latest long-run trend forecast (see *The 30-Year Focus, Third Quarter*, August 2018). IHS Markit projects that the average annual real growth rate for average U.S. earnings be 1.87 percent over the 20-year period from 2028 to 2048. Moody's Analytics' September 2018 forecast extends to 2048. Over the 20-year period from 2028 to 2048, Moody's Analytics projects that the annual real growth rate for average U.S. earnings will average 1.34 percent.

The Office of Management and Budget (OMB) Mid-Session Review of the Fiscal Year 2019 Budget includes projections through 2028. OMB projects that the annual growth real rate for average U.S. earnings will be about 2.33 percent for 2028. The Congressional Budget Office (CBO) June 2018 report, *The 2018 Long-Term Budget Outlook*, includes projections through 2048. CBO projects that the annual real growth rate for average U.S. wages will average about 1.1 percent over the period 2028 to 2048. The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended no changes to the assumed ultimate (i.e., long-range average) annual real rate of increase in the average wage of 1.17 percent in the 2015 Trustees Report, alternative II. The Technical Panel on Assumptions and Methods also endorsed OCACT's approach to estimating the effect of health insurance cost on wages.

Table 3.4: Average Hours Worked per Week, Total U.S.: Compound Annual Rates of change (%)

		From																		
To	Variable	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
1961	37.56																			
1962	37.83	0.73																		
1963	37.60	0.06	-0.60																	
1964	37.75	0.17	-0.11	0.38																
1965	38.00	0.29	0.15	0.53	0.67															
1966	38.19	0.33	0.23	0.51	0.58	0.49														
1967	37.71	0.07	-0.07	0.07	-0.04	-0.39	-1.26													
1968	37.59	0.01	-0.10	0.00	-0.10	-0.36	-0.78	-0.29												
1969	37.59	0.01	-0.09	-0.01	-0.09	-0.27	-0.53	-0.16	-0.02											
1970	36.71	-0.25	-0.38	-0.34	-0.47	-0.69	-0.98	-0.89	-1.19	-2.34										
1971	36.40	-0.31	-0.43	-0.41	-0.52	-0.72	-0.95	-0.88	-1.07	-1.59	-0.84									
1972	36.33	-0.30	-0.40	-0.38	-0.48	-0.64	-0.83	-0.74	-0.85	-1.13	-0.52	-0.20								
1973	36.28	-0.29	-0.38	-0.36	-0.44	-0.58	-0.73	-0.64	-0.71	-0.88	-0.39	-0.16	-0.13							
1974	35.73	-0.38	-0.47	-0.46	-0.55	-0.68	-0.83	-0.76	-0.84	-1.01	-0.67	-0.61	-0.82	-1.51						
1975	35.11	-0.48	-0.57	-0.57	-0.66	-0.79	-0.93	-0.89	-0.97	-1.13	-0.89	-0.90	-1.13	-1.63	-1.75					
1976	34.98	-0.47	-0.56	-0.55	-0.63	-0.75	-0.87	-0.83	-0.90	-1.02	-0.80	-0.79	-0.94	-1.20	-1.05	-0.35				
1977	34.95	-0.45	-0.53	-0.52	-0.59	-0.69	-0.80	-0.75	-0.81	-0.90	-0.70	-0.67	-0.77	-0.93	-0.73	-0.22	-0.09			
1978	35.06	-0.40	-0.47	-0.47	-0.53	-0.62	-0.71	-0.66	-0.70	-0.77	-0.57	-0.53	-0.59	-0.68	-0.48	-0.05	0.10	0.29		
1979	35.09	-0.38	-0.44	-0.43	-0.49	-0.57	-0.65	-0.60	-0.62	-0.68	-0.50	-0.46	-0.49	-0.55	-0.36	-0.01	0.10	0.20	0.10	
1980	34.79	-0.40	-0.46	-0.46	-0.51	-0.59	-0.66	-0.62	-0.64	-0.70	-0.54	-0.50	-0.54	-0.60	-0.45	-0.18	-0.14	-0.16	-0.39	-0.87
1981	34.53	-0.42	-0.48	-0.47	-0.52	-0.60	-0.67	-0.63	-0.65	-0.70	-0.55	-0.52	-0.56	-0.61	-0.49	-0.27	-0.26	-0.30	-0.50	-0.80
1982	34.18	-0.45	-0.51	-0.50	-0.55	-0.62	-0.69	-0.65	-0.68	-0.73	-0.59	-0.57	-0.61	-0.66	-0.55	-0.38	-0.39	-0.45	-0.63	-0.88
1983	34.30	-0.41	-0.46	-0.46	-0.50	-0.57	-0.63	-0.59	-0.61	-0.65	-0.52	-0.49	-0.52	-0.56	-0.45	-0.29	-0.28	-0.31	-0.43	-0.57
1984	34.58	-0.36	-0.41	-0.40	-0.44	-0.50	-0.55	-0.51	-0.52	-0.55	-0.43	-0.39	-0.41	-0.44	-0.33	-0.17	-0.15	-0.15	-0.23	-0.29
1985	34.67	-0.33	-0.38	-0.37	-0.40	-0.46	-0.51	-0.46	-0.48	-0.50	-0.38	-0.35	-0.36	-0.38	-0.27	-0.12	-0.10	-0.10	-0.16	-0.20
1986	34.26	-0.37	-0.41	-0.40	-0.44	-0.49	-0.54	-0.50	-0.52	-0.54	-0.43	-0.40	-0.42	-0.44	-0.35	-0.22	-0.21	-0.22	-0.29	-0.34
1987	34.38	-0.34	-0.38	-0.37	-0.41	-0.45	-0.50	-0.46	-0.47	-0.49	-0.38	-0.36	-0.37	-0.38	-0.30	-0.17	-0.16	-0.17	-0.22	-0.26
1988	34.54	-0.31	-0.35	-0.34	-0.37	-0.41	-0.46	-0.42	-0.42	-0.44	-0.34	-0.31	-0.32	-0.33	-0.24	-0.13	-0.11	-0.11	-0.15	-0.18
1989	34.75	-0.28	-0.31	-0.30	-0.33	-0.37	-0.41	-0.37	-0.37	-0.39	-0.29	-0.26	-0.26	-0.27	-0.19	-0.07	-0.05	-0.05	-0.08	-0.10
1990	34.68	-0.27	-0.31	-0.30	-0.33	-0.36	-0.40	-0.36	-0.37	-0.38	-0.28	-0.25	-0.26	-0.26	-0.19	-0.08	-0.06	-0.06	-0.09	-0.11
1991	34.51	-0.28	-0.32	-0.31	-0.33	-0.37	-0.40	-0.37	-0.37	-0.39	-0.29	-0.27	-0.27	-0.28	-0.20	-0.11	-0.09	-0.09	-0.12	-0.14
1992	34.27	-0.30	-0.33	-0.32	-0.35	-0.38	-0.42	-0.38	-0.39	-0.40	-0.31	-0.29	-0.29	-0.30	-0.23	-0.14	-0.13	-0.13	-0.16	-0.18
1993	34.54	-0.26	-0.29	-0.28	-0.31	-0.34	-0.37	-0.34	-0.34	-0.35	-0.26	-0.24	-0.24	-0.25	-0.18	-0.09	-0.08	-0.07	-0.10	-0.11
1994	35.03	-0.21	-0.24	-0.23	-0.25	-0.28	-0.31	-0.27	-0.27	-0.28	-0.19	-0.17	-0.16	-0.17	-0.10	-0.01	0.01	0.01	0.00	-0.01
1995	35.21	-0.19	-0.22	-0.21	-0.22	-0.25	-0.28	-0.24	-0.24	-0.25	-0.17	-0.14	-0.14	-0.14	-0.07	0.01	0.03	0.04	0.03	0.02
1996	35.31	-0.18	-0.20	-0.19	-0.21	-0.24	-0.26	-0.23	-0.22	-0.23	-0.15	-0.12	-0.12	-0.12	-0.05	0.03	0.05	0.05	0.04	0.04
1997	35.39	-0.16	-0.19	-0.18	-0.19	-0.22	-0.24	-0.21	-0.21	-0.21	-0.13	-0.11	-0.10	-0.10	-0.04	0.04	0.06	0.06	0.05	0.05
1998	35.59	-0.15	-0.17	-0.16	-0.17	-0.20	-0.22	-0.19	-0.18	-0.19	-0.11	-0.08	-0.08	-0.08	-0.02	0.06	0.08	0.09	0.08	0.07
1999	35.63	-0.14	-0.16	-0.15	-0.16	-0.19	-0.21	-0.18	-0.17	-0.18	-0.10	-0.08	-0.07	-0.07	-0.01	0.06	0.08	0.09	0.08	0.08
2000	35.69	-0.13	-0.15	-0.14	-0.16	-0.18	-0.20	-0.17	-0.16	-0.17	-0.09	-0.07	-0.06	-0.06	0.00	0.07	0.08	0.09	0.08	0.08
2001	35.28	-0.16	-0.18	-0.17	-0.18	-0.21	-0.23	-0.20	-0.19	-0.20	-0.13	-0.10	-0.10	-0.10	-0.05	0.02	0.03	0.04	0.03	0.02
2002	34.95	-0.18	-0.20	-0.19	-0.20	-0.23	-0.25	-0.22	-0.21	-0.22	-0.15	-0.13	-0.13	-0.13	-0.08	-0.02	0.00	0.00	-0.01	-0.02
2003	34.62	-0.19	-0.22	-0.21	-0.22	-0.25	-0.26	-0.24	-0.24	-0.24	-0.18	-0.16	-0.16	-0.16	-0.11	-0.05	-0.04	-0.04	-0.05	-0.06
2004	34.58	-0.19	-0.21	-0.20	-0.22	-0.24	-0.26	-0.23	-0.23	-0.24	-0.18	-0.16	-0.15	-0.15	-0.11	-0.05	-0.04	-0.04	-0.05	-0.06
2005	34.52	-0.19	-0.21	-0.20	-0.22	-0.24	-0.26	-0.23	-0.23	-0.24	-0.18	-0.16	-0.15	-0.16	-0.11	-0.06	-0.05	-0.04	-0.06	-0.06
2006	34.53	-0.19	-0.21	-0.20	-0.21	-0.23	-0.25	-0.23	-0.22	-0.23	-0.17	-0.15	-0.15	-0.15	-0.11	-0.05	-0.04	-0.04	-0.05	-0.06
2007	34.50	-0.18	-0.20	-0.20	-0.21	-0.23	-0.25	-0.22	-0.22	-0.23	-0.17	-0.15	-0.15	-0.15	-0.11	-0.05	-0.04	-0.04	-0.06	-0.06
2008	34.13	-0.20	-0.22	-0.21	-0.23	-0.25	-0.27	-0.24	-0.24	-0.25	-0.19	-0.17	-0.17	-0.17	-0.13	-0.09	-0.08	-0.08	-0.09	-0.10
2009	33.43	-0.24	-0.26	-0.26	-0.27	-0.29	-0.31	-0.29	-0.29	-0.29	-0.24	-0.22	-0.22	-0.23	-0.19	-0.14	-0.14	-0.14	-0.15	-0.16
2010	33.54	-0.23	-0.25	-0.24	-0.26	-0.28	-0.29	-0.27	-0.27	-0.28	-0.22	-0.21	-0.21	-0.21	-0.18	-0.13	-0.12	-0.12	-0.14	-0.15
2011	33.72	-0.22	-0.23	-0.23	-0.24	-0.26	-0.28	-0.25	-0.25	-0.26	-0.21	-0.19	-0.19	-0.19	-0.16	-0.11	-0.11	-0.11	-0.12	-0.12
2012	33.73	-0.21	-0.23	-0.22	-0.23	-0.25	-0.27	-0.25	-0.25	-0.25	-0.20	-0.19	-0.19	-0.19	-0.15	-0.11	-0.10	-0.10	-0.11	-0.12
2013	33.82	-0.20	-0.22	-0.21	-0.22	-0.24	-0.26	-0.24	-0.23	-0.24	-0.19	-0.17	-0.17	-0.18	-0.14	-0.10	-0.09	-0.09	-0.10	-0.11
2014	33.90	-0.19	-0.21	-0.20	-0.21	-0.23	-0.25	-0.23	-0.22	-0.23	-0.18	-0.17	-0.16	-0.17	-0.13	-0.09	-0.08	-0.08	-0.09	-0.10
2015	34.11	-0.18	-0.19	-0.19	-0.20	-0.22	-0.23	-0.21	-0.21	-0.21	-0.16	-0.15	-0.15	-0.15	-0.11	-0.07	-0.06	-0.06	-0.07	-0.08
2016	34.03	-0.18	-0.20	-0.19	-0.20	-0.22	-0.23	-0.21	-0.21	-0.21	-0.16	-0.15	-0.15	-0.15	-0.12	-0.08	-0.07	-0.07	-0.08	-0.08
2017	33.95	-0.18	-0.20	-0.19	-0.20	-0.22	-0.23	-0.21	-0.21	-0.21	-0.17	-0.15	-0.15	-0.15	-0.12	-0.08	-0.07	-0.07	-0.08	-0.09

Table 3.4 (continued). Average Hours Worked per Week, Total U.S.: Compound Annual Rates of change (%)

		From																			
To	Variable	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	
1979	35.09																				
1980	34.79	-0.87																			
1981	34.53	-0.80	-0.72																		
1982	34.18	-0.88	-0.88	-1.03																	
1983	34.30	-0.57	-0.46	-0.33	0.37																
1984	34.58	-0.29	-0.15	0.04	0.58	0.80															
1985	34.67	-0.20	-0.07	0.10	0.48	0.53	0.27														
1986	34.26	-0.34	-0.25	-0.16	0.06	-0.04	-0.46	-1.19													
1987	34.38	-0.26	-0.17	-0.08	0.12	0.05	-0.19	-0.43	0.35												
1988	34.54	-0.18	-0.09	0.00	0.17	0.13	-0.03	-0.13	0.41	0.46											
1989	34.75	-0.10	-0.01	0.08	0.24	0.21	0.10	0.05	0.47	0.54	0.61										
1990	34.68	-0.11	-0.03	0.05	0.18	0.16	0.05	0.01	0.31	0.30	0.21	-0.18									
1991	34.51	-0.14	-0.07	-0.01	0.11	0.08	-0.03	-0.08	0.15	0.10	-0.02	-0.34	-0.50								
1992	34.27	-0.18	-0.13	-0.07	0.03	-0.01	-0.11	-0.17	0.00	-0.06	-0.20	-0.46	-0.60	-0.71							
1993	34.54	-0.11	-0.06	0.00	0.10	0.07	-0.01	-0.05	0.12	0.08	0.00	-0.15	-0.14	0.04	0.80						
1994	35.03	-0.01	0.05	0.11	0.21	0.19	0.13	0.12	0.28	0.27	0.24	0.17	0.25	0.50	1.11	1.43					
1995	35.21	0.02	0.08	0.14	0.23	0.22	0.16	0.15	0.30	0.30	0.28	0.22	0.30	0.50	0.91	0.97	0.50				
1996	35.31	0.04	0.09	0.15	0.23	0.22	0.18	0.17	0.30	0.30	0.28	0.23	0.30	0.46	0.75	0.74	0.40	0.29			
1997	35.39	0.05	0.10	0.15	0.23	0.22	0.18	0.17	0.30	0.29	0.27	0.23	0.29	0.42	0.65	0.61	0.34	0.26	0.23		
1998	35.59	0.07	0.13	0.18	0.25	0.25	0.21	0.20	0.32	0.32	0.30	0.27	0.32	0.44	0.63	0.60	0.40	0.36	0.39	0.56	
1999	35.63	0.08	0.13	0.17	0.24	0.24	0.20	0.19	0.30	0.30	0.28	0.25	0.30	0.40	0.56	0.52	0.34	0.30	0.30	0.33	
2000	35.69	0.08	0.13	0.17	0.24	0.23	0.20	0.19	0.29	0.29	0.28	0.25	0.29	0.38	0.51	0.47	0.31	0.27	0.27	0.28	
2001	35.28	0.02	0.07	0.11	0.17	0.16	0.12	0.11	0.20	0.19	0.16	0.13	0.16	0.22	0.33	0.27	0.10	0.04	-0.02	-0.08	
2002	34.95	-0.02	0.02	0.06	0.11	0.10	0.06	0.05	0.12	0.11	0.08	0.04	0.06	0.11	0.20	0.13	-0.03	-0.11	-0.17	-0.25	
2003	34.62	-0.06	-0.02	0.01	0.06	0.05	0.01	-0.01	0.06	0.04	0.02	-0.03	-0.01	0.03	0.09	0.02	-0.13	-0.21	-0.28	-0.37	
2004	34.58	-0.06	-0.02	0.01	0.05	0.04	0.00	-0.01	0.05	0.03	0.01	-0.03	-0.02	0.02	0.08	0.01	-0.13	-0.20	-0.26	-0.33	
2005	34.52	-0.06	-0.03	0.00	0.04	0.03	-0.01	-0.02	0.04	0.02	0.00	-0.04	-0.03	0.00	0.06	0.00	-0.13	-0.20	-0.25	-0.31	
2006	34.53	-0.06	-0.03	0.00	0.04	0.03	-0.01	-0.02	0.04	0.02	0.00	-0.04	-0.03	0.00	0.06	0.00	-0.12	-0.18	-0.22	-0.27	
2007	34.50	-0.06	-0.03	0.00	0.04	0.02	-0.01	-0.02	0.03	0.02	-0.01	-0.04	-0.03	0.00	0.05	-0.01	-0.12	-0.17	-0.21	-0.25	
2008	34.13	-0.10	-0.07	-0.04	-0.01	-0.02	-0.05	-0.07	-0.02	-0.03	-0.06	-0.09	-0.09	-0.06	-0.02	-0.08	-0.19	-0.24	-0.28	-0.33	
2009	33.43	-0.16	-0.14	-0.12	-0.08	-0.10	-0.14	-0.15	-0.11	-0.13	-0.16	-0.19	-0.19	-0.18	-0.15	-0.20	-0.31	-0.37	-0.42	-0.48	
2010	33.54	-0.15	-0.12	-0.10	-0.07	-0.08	-0.12	-0.13	-0.09	-0.11	-0.13	-0.17	-0.17	-0.15	-0.12	-0.17	-0.27	-0.32	-0.37	-0.41	
2011	33.72	-0.12	-0.10	-0.08	-0.05	-0.06	-0.09	-0.11	-0.06	-0.08	-0.10	-0.14	-0.13	-0.12	-0.08	-0.13	-0.22	-0.27	-0.31	-0.35	
2012	33.73	-0.12	-0.10	-0.08	-0.04	-0.06	-0.09	-0.10	-0.06	-0.08	-0.10	-0.13	-0.13	-0.11	-0.08	-0.12	-0.21	-0.25	-0.29	-0.32	
2013	33.82	-0.11	-0.09	-0.07	-0.03	-0.05	-0.08	-0.09	-0.05	-0.06	-0.08	-0.11	-0.11	-0.09	-0.06	-0.11	-0.19	-0.22	-0.25	-0.28	
2014	33.90	-0.10	-0.08	-0.06	-0.03	-0.04	-0.07	-0.08	-0.04	-0.05	-0.07	-0.10	-0.09	-0.08	-0.05	-0.09	-0.16	-0.20	-0.23	-0.25	
2015	34.11	-0.08	-0.06	-0.04	-0.01	-0.02	-0.04	-0.05	-0.01	-0.03	-0.05	-0.07	-0.07	-0.05	-0.02	-0.06	-0.13	-0.16	-0.18	-0.20	
2016	34.03	-0.08	-0.06	-0.04	-0.01	-0.02	-0.05	-0.06	-0.02	-0.04	-0.05	-0.08	-0.07	-0.06	-0.03	-0.06	-0.13	-0.16	-0.18	-0.21	
2017	33.95	-0.09	-0.07	-0.05	-0.02	-0.03	-0.06	-0.07	-0.03	-0.04	-0.06	-0.08	-0.08	-0.06	-0.04	-0.07	-0.14	-0.16	-0.19	-0.21	

		From																				
To	Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
1997	35.39																					
1998	35.59	0.56																				
1999	35.63	0.33	0.11																			
2000	35.69	0.28	0.15	0.18																		
2001	35.28	-0.08	-0.29	-0.49	-1.15																	
2002	34.95	-0.25	-0.45	-0.64	-1.05	-0.95																
2003	34.62	-0.37	-0.55	-0.72	-1.02	-0.95	-0.95															
2004	34.58	-0.33	-0.48	-0.60	-0.79	-0.67	-0.53	-0.10														
2005	34.52	-0.31	-0.44	-0.53	-0.67	-0.55	-0.41	-0.14	-0.18													
2006	34.53	-0.27	-0.38	-0.45	-0.55	-0.43	-0.30	-0.08	-0.07	0.04												
2007	34.50	-0.25	-0.34	-0.40	-0.48	-0.37	-0.26	-0.08	-0.08	-0.03	-0.09											
2008	34.13	-0.33	-0.42	-0.48	-0.56	-0.47	-0.39	-0.28	-0.32	-0.37	-0.58	-1.06										
2009	33.43	-0.48	-0.57	-0.64	-0.73	-0.67	-0.63	-0.58	-0.68	-0.80	-1.08	-1.57	-2.08									
2010	33.54	-0.41	-0.49	-0.55	-0.62	-0.56	-0.51	-0.45	-0.51	-0.57	-0.72	-0.93	-0.87	0.36								
2011	33.72	-0.35	-0.41	-0.46	-0.52	-0.45	-0.40	-0.33	-0.36	-0.39	-0.47	-0.57	-0.41	0.44	0.52							
2012	33.73	-0.32	-0.38	-0.42	-0.47	-0.41	-0.35	-0.29	-0.31	-0.33	-0.39	-0.45	-0.30	0.30	0.27	0.02						
2013	33.82	-0.28	-0.34	-0.37	-0.41	-0.35	-0.30	-0.23	-0.25	-0.26	-0.30	-0.33	-0.19	0.29	0.27	0.15	0.27					
2014	33.90	-0.25	-0.30	-0.33	-0.37	-0.31	-0.25	-0.19	-0.20	-0.20	-0.23	-0.25	-0.11	0.28	0.26	0.18	0.26	0.24				
2015	34.11	-0.20	-0.25	-0.27	-0.30	-0.24	-0.19	-0.12	-0.12	-0.12	-0.14	-0.14	-0.01	0.34	0.34	0.29	0.38	0.43	0.62			
2016	34.03	-0.21	-0.25	-0.27	-0.30	-0.24	-0.19	-0.13	-0.13	-0.13	-0.15	-0.15	-0.04	0.26	0.24	0.18	0.22	0.21	0.19	-0.25		
2017	33.95	-0.21	-0.25	-0.27	-0.29	-0.24	-0.19	-0.14	-0.14	-0.14	-0.15	-0.16	-0.06	0.20	0.17	0.11	0.13	0.10	0.05	-0.23	-0.22	

3.5 Appendix A

BLS has introduced numerous changes to the Current Population Survey (CPS) concepts over the historical period, such that values for employment are not historically comparable (for more detail on noncomparability of CPS concepts, see http://www.bls.gov/cps/eetech_methods.pdf). To make the total employment series more comparable, OCACT adjusted the published values for the following:

1990 Census – BLS introduced 1990 Census-based population controls in January 1994, increasing employment levels for 1990 from the originally-published estimates by about 880,000 (0.7%). BLS later revised the 1990 to 1993 estimates, but not those for earlier years. Consequently, OCACT adjusted the CPS data for 1981 to 1989 using a linear interpolation of the 0.7% increase.

2000 Census – BLS introduced population controls based on Census 2000 results in January 2003. The revised employment series for 2000 was 1.27% (or 1.724 million persons) higher than the previously published series. BLS revised the CPS data only back to January 2000. OCACT adjusted the CPS data back to 1991 by linearly interpolating the 1.27% adjustment.

1994 CPS Methodology Change − In 1994, BLS introduced methodology changes and a complete redesign of its CPS. Because the survey redesign and methodology changes raised the aggregate employment for 1994, the series was not comparable with earlier years. Thus, OCACT applied a multiplicative-adjustment factor estimated by Polivka and Miller (1995)[51] to the series for years prior to 1994. The aggregate employment series was adjusted for 1993 and earlier years by a factor of 1.0053.

Population Controls since the 2000 Census − In January 2003, the U.S. Census Bureau introduced its updated population controls in the CPS estimates. The difference between the updated and originally published employment values for December 2002 is an increase of 576,000 persons. Data from December 2002 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2004, the U.S. Census Bureau reflected revised net international migration estimates in its updated population controls. The difference between the updated and originally published employment values for December 2003 is a decrease of 409,000 persons. Data from December 2003 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2005, the U.S. Census Bureau introduced updated population controls, which reflected updated vital statistics information, as well as revised estimates of net international

[51] Anne E. Polivka and Stephen M. Miller, "The CPS after the Redesign: Refocusing the Economic Lens," *Labor Statistics Measurement Issues; Studies in Income and Wealth Volume 60*, Edited by John Haltiwanger, Marilyn E. Manser and Robert Topel, National Bureau of Economic Research, 1998, Table 6. Also available at http://www.bls.gov/ore/pdf/ec950090.pdf. Polivka and Miller's adjustment factors are for employment-population ratios, not employment levels. Because the CPS methodology change affected the employment levels, but not the civilian noninstitutional population, we can use their multiplicative employment-population ratio factors to adjust the employment levels.

migration. The difference between the updated and originally published employment values for December 2004 is a decrease of 45,000 persons. Data from December 2004 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2006, the U.S. Census Bureau introduced updated population controls, which reflected updated vital statistics information, as well as revised estimates of net international migration. The difference between the updated and originally published employment values for December 2005 is a decrease of 123,000 persons. Data from December 2005 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2007, the U.S. Census Bureau introduced updated population controls, which reflected revised estimates of net international migration and updated vital statistics information. The difference between the updated and originally published employment values for December 2006 is an increase of 153,000 persons. Data from December 2006 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2008, the U.S. Census Bureau introduced updated population controls, which reflected updated vital statistics information, as well as revised estimates of net international migration and the institutional population. The difference between the updated and originally published employment values for December 2007 is a decrease of 598,000 persons. Data from December 2007 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2009, the U.S. Census Bureau introduced updated population controls, reflecting revised net international migration and vital statistics information. The difference between the updated and originally published employment values for December 2008 is a decrease of 407,000 persons. Data from December 2008 and earlier are not updated by BLS. OCACT adjusted the employment series back to 2000.

In January 2010, the U.S. Census Bureau introduced updated population controls, reflecting updated vital statistics information, revised estimates of net international migration, as well as methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2009 is a decrease of 243,000 persons. BLS does not update data from December 2009 and earlier. OCACT adjusted the employment series back to 2000.

In January 2011, the U.S. Census Bureau introduced updated population controls, reflecting revised net international migration, vital statistics information, and some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2010 is a decrease of 472,000 persons. BLS does not update data from December 2010 and earlier. OCACT adjusted the employment series back to 2000.

In January 2012, the U.S. Census Bureau incorporated the Census 2010 population base, as well as adjustments for net international migration, updated vital statistics information, and

methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2011 is an increase of 216,000 persons. BLS does not update data from December 2011 and earlier. OCACT adjusted the employment series back to 2000.

In January 2013, the U.S. Census Bureau introduced updated population controls, reflecting net international migration adjustments, updated vital statistics information, and some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2012 is an increase of 127,000 persons. BLS does not update data from December 2012 and earlier. OCACT adjusted the employment series back to 2000.

In January 2014, the U.S. Census Bureau updated their population controls, reflecting net international migration adjustments, updated birth and death statistics and other information, and some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2013 is an increase of 22,000 persons. BLS does not update data from December 2013 and earlier. OCACT adjusted the employment series back to 2000.

In January 2015, the U.S. Census Bureau updated their population controls, reflecting net international migration adjustments, updated birth and death statistics and other information, and some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2014 is an increase of 324,000 persons. BLS does not update data from December 2014 and earlier. OCACT adjusted the employment series back to 2000.

In January 2016, the U.S. Census Bureau updated their population controls, reflecting net international migration adjustments, updated birth and death statistics and other information, and some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2015 is an increase of 265,000 persons. BLS does not update data from December 2015 and earlier. OCACT adjusted the employment series back to 2000.

In January 2017, the U.S. Census Bureau updated their population controls, reflecting net international migration adjustments, updated birth and death statistics and other information, and some methodological changes in the population estimation process. The Census Bureau's methodological improvements included changes in the estimation of the foreign-born emigration subcomponent of net international migration. These method changes resulted in higher foreign-born emigration and lower overall net international migration than previously estimated. The difference between the updated and originally published employment values for December 2016 is a decrease of 831,000 persons. BLS does not update data from December 2016 and earlier. OCACT adjusted the employment series back to 2000.

In January 2018, the U.S. Census Bureau updated their population controls, reflecting net international migration adjustments, updated birth and death statistics and other information, and

some methodological changes in the population estimation process. The difference between the updated and originally published employment values for December 2017 is an increase of 318,000 persons. BLS does not update data from December 2017 and earlier. OCACT adjusted the employment series back to 2000.

3.6 Appendix B

For the 2009 Trustees Report, the ratio of wage and salary disbursements (WSD) to employee compensation (WSS) was assumed to decline at a fixed "ultimate" annual rate in each of the last 65 years of the 75-year projection horizon. The assumed ultimate annual rate of change in the ratio of WSD to WSS was set to -0.1, -0.2, and -0.3 percentage point for alternative I, II, and III, respectively. The assumed average annual rate of change of -0.20 percent for alternative II was roughly consistent with the historical record over the last 50 years and the assumed average annual rate of increase in the ratio of Employer Sponsored Health Insurance (ESI) to WSS over the next 75 years. In turn, the assumed average annual rate of increase in the ratio of ESI to WSS was mostly based on the Centers for Medicare and Medicaid Services' (CMS) assumption that the average annual growth rate in national health care expenditures will be about 1.0 percentage point higher than the average annual growth rate in GDP (and in WSS).

For the 2010 Trustees Report, CMS projected components of national health care expenditures, including ESI, under pre-new-law assumptions and post-law assumptions (i.e., before and after the Affordable Care Act (ACA) legislation enacted in 2010). The more detailed CMS data enabled projection of annual rates of change for the ratio of WSD to WSS.

For alternative II pre-ACA assumptions, the projected annual rate of change in the ratio of WSD to WSS averaged:

- -0.01 percentage point over the first 10 years (i.e., from 2009 to 2019),
- -0.27 percentage point over the next 30 years (from 2019 to 2049),
- -0.20 percentage point over the last 35 years (from 2049 to 2084), and
- -0.20 percentage point over the total 75-year projection horizon (from 2009 to 2084).

Although the projected 75-year average rate of change in the ratio of WSD to WSS was approximately 0.20 percent per year for alternative II in both the 2009 Trustees Report and in the 2010 Trustees Report pre-ACA assumptions, the annual rates of change for each year were different. For alternative II, the projected average annual rate of change in the ratio for the 2010 Trustees Report pre-ACA assumptions, compared to that for the 2009 Trustees Report, was:

- Higher by 0.19 percentage point (-0.01 less -0.20) over the first 10 years of the 75-year projection horizon,
- Lower by 0.07 percentage point (-0.27 less -0.20) over the next 30 years, and
- About equal at -0.20 percentage point over the last 35 years.

For the alternative II post-ACA assumptions, CMS incorporated the effects of the ACA legislation and updated its projection of ESI, which gave a corresponding change in projected annual rates of change for the ratio of WSD to WSS. For the alternative II post-ACA assumptions, the projected annual rate of change in the ratio of WSD to WSS averaged:

- +0.02 percentage point over the first 10 years (i.e., from 2009 to 2019),

- -0.11 percentage point over the next 30 years (from 2019 to 2049),
- -0.15 percentage point over the last 35 years (from 2049 to 2084), and
- -0.13 percentage point over the total 75-year projection horizon (from 2009 to 2084).

The projected average annual rate of change in the ratio of WSD to WSS was higher than in the pre-ACA assumptions by:

- 0.03 percentage point (+0.02 less -0.01) over the first 10 years of the 75-year projection horizon,
- 0.16 percentage point (-0.11 less -0.27) over the next 30 years,
- 0.05 percentage point (-0.15 less -0.20) over the last 35 years, and
- 0.07 percentage point (-0.13 less -0.20) over the total 75-year projection period.

4. UNEMPLOYMENT

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4 Unemployment Rate

4.1 Summary

For the 2019 Trustees Report, the ultimate total civilian unemployment rates (adjusted by the age and sex distribution of the 2011 civilian labor force) are assumed to be 4.5 percent, 5.5 percent, and 6.5 percent for alternatives I, II, and III, respectively (Table 4.1). These assumptions are the same as those used for the 2018 Trustees Report.

Table 4.1: Assumed Ultimate Total Civilian Unemployment Rate

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Civilian Unemployment Rate	4.5	5.5	6.5	4.5	5.5	6.5	0.0	0.0	0.0

4.2 Past Experience

BLS publishes civilian unemployment rates, defined as the proportion of unemployed persons in the civilian labor force, by sex and age group as part of its Current Population Survey. The ultimate civilian unemployment rate assumptions are based on analysis of historical experience and expected future conditions and trends. Because the aggregate unemployment rate is sensitive to changes in the age-sex composition of the civilian labor force, OCACT constructed an age-sex-adjusted unemployment rate by weighting the unadjusted age-sex unemployment rates by the age-sex distribution of the 2011 civilian labor force. Since the civilian unemployment rate varies significantly over an economic cycle, it is useful to look at averages over complete economic cycles or long periods (decades). Table 4.2 shows average civilian unemployment rates over complete (peak-to-peak) economic cycles. Over the last two (1990-2007), three (1979-2007), four (1973-2007), and five (1969-2007) complete economic cycles, the age-sex adjusted unemployment rate averaged 5.1, 5.5, 5.5, and 5.2 percent, respectively.[52] Table 4.3 shows annual values for both the adjusted and unadjusted civilian rates. Average rates over economic cycles and long periods suggest an ultimate age-sex adjusted unemployment rate in the 5.1 to 5.5 percent range.

[52] Peaks in economic cycles roughly follow the NBER cycle dating, except for short recoveries such as 1980-81, which are not counted as separate cycles.

Table 4.2: Civilian Unemployment Rates over Complete Economic Cycles (Peak-to-Peak)

	Total Rate	Age-Sex Adjusted Rate
Individual Cycle:		
1969-1972	5.0	4.0
1973-1978	6.6	5.5
1979-1989	7.1	6.1
1990-2000	5.6	5.2
2001-2007	5.2	5.0
2008-2017 (Incomplete Cycle)	7.0	7.0
Last Two Cycles		
1990-2007	5.4	5.1
Last Three Cycles		
1979-2007	6.1	5.5
Last Four Cycles		
1973-2007	6.2	5.5
Last Five Cycles		
1969-2007	5.9	5.2

It is also useful to look at unemployment rates over specific periods. Beginning around 1975, and lasting through about 1994, the U.S. experienced generally high unemployment rates. There are several possible explanations for why these higher levels of unemployment occurred during this period. Firstly, due to rapid changes in technology and increased global competition, job searches and retraining may have become more frequent and lasted for longer periods. Secondly, the huge influx of women and baby boomers into the labor market may have increased the quantity of labor supplied beyond the quantity demanded in the 1970s and 1980s. Between 1997 and 2000, rapid economic expansion reduced unemployment rates to unusually low levels. A mild recession raised rates above the ultimate assumed level in 2002 and 2003. In addition, the most recent recession has resulted in rates that were well above the ultimate assumed level. Currently, rates are well below the ultimate assumed level. OCACT believes this is a temporary effect of the slow movement of discouraged workers back into the labor force after a long period of weak demand for labor. As the labor force participation rate (adjusted for age and sex composition) approaches a more stable level, OCACT believes the unemployment rate will increase somewhat from its current level.

4.3 Future Expectations

It is not clear how the aging baby boomers will affect the unemployment rate into the future. As these workers age, the working-age population is expected to grow more slowly, particularly in relation to the size of the total population. This demographic shift can be expected to increase the demand for older workers. Meanwhile, the supply of potential older workers is expected to increase, as a significant portion of the baby boomers is expected to remain in the labor force, in many cases, out of necessity (as their life expectancies increase). Even with increases in labor supply from older workers, it seems likely that the increasing age-dependency ratio could exert downward pressure on the age-sex-adjusted unemployment rate.

OCACT expects that future age-sex adjusted unemployment rates will be similar to the 5.5 percent rates in the 1973-2007 and 1979-2007 economic cycles. Therefore, the assumed ultimate average unemployment rate is 5.5 percent (age-sex adjusted to the 2011 labor force) for alternative II.

4.4 Projections from Other Sources

IHS Markit (formerly Global Insight, Inc.) provides projections through 2048 in its latest long-run trend forecast (see *The 30-Year Focus, Third Quarter*, August 2018). IHS Markit projects the civilian unemployment rate will be 4.6 percent in 2028 and 4.8 percent in 2048. The Moody's Analytics' September 2018 forecast shows a civilian unemployment rate of 4.7 percent in 2028 and 4.6 percent in 2048.

The OMB Mid-Session Review of the 2019 Fiscal Year Budget includes projections through 2028. OMB projects an aggregate civilian unemployment rate of 4.8 percent for 2027 and later. The Congressional Budget Office (CBO) report, *2018 Long-Term Budget Outlook* (published in June 2018), includes projections through 2048. CBO projects an aggregate civilian unemployment rate of 4.8 percent for 2028 and 4.7 percent for 2048. The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended assuming an ultimate (i.e., long-range average) aggregate civilian unemployment rate of 5.5 percent for alternative II.

Table 4.3: Total and Age-Sex Adjusted Civilian Unemployment Rates over Selected Intervals (%)

	Total Rate											Age-Sex Adjusted Rate										
	Annual Average over the Following Number of Years											Annual Average over the Following Number of Years										
Year	1	5	10	15	20	25	30	35	40	45	50	1	5	10	15	20	25	30	35	40	45	50
1961	6.7											6.3										
1962	5.6											5.2										
1963	5.6											5.2										
1964	5.2											4.7										
1965	4.5	5.5										4.0	5.1									
1966	3.8	4.9										3.3	4.5									
1967	3.8	4.6										3.3	4.1									
1968	3.6	4.2										3.0	3.7									
1969	3.5	3.8										2.9	3.3									
1970	5.0	3.9	4.7									4.2	3.4	4.2								
1971	6.0	4.4	4.6									5.1	3.7	4.1								
1972	5.6	4.7	4.7									4.7	4.0	4.0								
1973	4.9	5.0	4.6									3.9	4.2	3.9								
1974	5.6	5.4	4.6									4.5	4.5	3.9								
1975	8.5	6.1	5.0	5.2								7.2	5.1	4.2	4.5							
1976	7.7	6.5	5.4	5.3								6.4	5.3	4.5	4.5							
1977	7.1	6.7	5.7	5.4								5.8	5.6	4.8	4.5							
1978	6.1	7.0	6.0	5.4								4.9	5.8	5.0	4.5							
1979	5.9	7.0	6.2	5.4								4.7	5.8	5.1	4.5							
1980	7.2	6.8	6.4	5.6	5.6							5.9	5.5	5.3	4.7	4.8						
1981	7.6	6.8	6.6	5.9	5.6							6.3	5.5	5.4	4.9	4.8						
1982	9.7	7.3	7.0	6.2	5.8							8.3	6.0	5.8	5.2	4.9						
1983	9.6	8.0	7.5	6.7	6.0							8.3	6.7	6.2	5.5	5.1						
1984	7.5	8.3	7.7	6.9	6.1							6.5	7.1	6.4	5.8	5.2						
1985	7.2	8.3	7.5	7.1	6.3	6.1						6.3	7.1	6.3	5.9	5.3	5.2					
1986	7.0	8.2	7.5	7.1	6.4	6.1						6.1	7.1	6.3	6.0	5.4	5.2					
1987	6.2	7.5	7.4	7.2	6.6	6.2						5.4	6.5	6.3	6.0	5.5	5.2					
1988	5.5	6.7	7.3	7.2	6.7	6.2						4.9	5.9	6.3	6.1	5.6	5.2					
1989	5.3	6.2	7.3	7.2	6.7	6.2						4.7	5.5	6.3	6.1	5.7	5.2					
1990	5.6	5.9	7.1	7.0	6.8	6.2	6.1					5.0	5.2	6.2	6.0	5.7	5.3	5.2				
1991	6.9	5.9	7.0	6.9	6.8	6.3	6.1					6.2	5.2	6.2	6.0	5.8	5.4	5.2				
1992	7.5	6.1	6.8	7.0	6.9	6.5	6.2					6.9	5.5	6.0	6.0	5.9	5.5	5.3				
1993	6.9	6.4	6.5	7.0	7.0	6.6	6.2					6.4	5.9	5.9	6.1	6.0	5.7	5.3				
1994	6.1	6.6	6.4	7.0	7.0	6.7	6.2					5.7	6.0	5.8	6.2	6.1	5.8	5.4				
1995	5.6	6.6	6.2	6.9	6.9	6.7	6.3	6.2				5.2	6.1	5.6	6.1	6.0	5.8	5.4	5.4			
1996	5.4	6.3	6.1	6.8	6.8	6.7	6.3	6.1				5.0	5.8	5.5	6.1	5.9	5.8	5.5	5.3			
1997	4.9	5.8	6.0	6.5	6.7	6.7	6.4	6.1				4.6	5.4	5.5	5.8	5.9	5.8	5.5	5.3			
1998	4.5	5.3	5.9	6.1	6.6	6.7	6.4	6.1				4.2	4.9	5.4	5.5	5.8	5.8	5.5	5.3			
1999	4.2	4.9	5.8	5.9	6.5	6.6	6.4	6.0				3.9	4.6	5.3	5.4	5.8	5.8	5.6	5.2			
2000	4.0	4.6	5.6	5.7	6.4	6.4	6.4	6.0	6.0			3.7	4.3	5.2	5.2	5.7	5.7	5.6	5.2	5.2		
2001	4.7	4.5	5.4	5.6	6.2	6.3	6.3	6.1	5.9			4.5	4.2	5.0	5.1	5.6	5.6	5.5	5.3	5.2		
2002	5.8	4.6	5.2	5.5	6.0	6.3	6.3	6.1	5.9			5.5	4.4	4.9	5.1	5.5	5.6	5.6	5.3	5.2		
2003	6.0	4.9	5.1	5.6	5.8	6.3	6.4	6.2	5.9			5.8	4.7	4.8	5.2	5.3	5.6	5.6	5.4	5.2		
2004	5.5	5.2	5.1	5.6	5.7	6.3	6.4	6.2	5.9			5.3	5.0	4.8	5.2	5.3	5.6	5.7	5.5	5.2		
2005	5.1	5.4	5.0	5.5	5.6	6.2	6.3	6.2	6.0	5.9		4.9	5.2	4.8	5.2	5.2	5.6	5.6	5.5	5.2	5.2	
2006	4.6	5.4	4.9	5.4	5.5	6.1	6.2	6.2	6.0	5.9		4.5	5.2	4.7	5.1	5.1	5.5	5.5	5.5	5.3	5.2	
2007	4.6	5.2	4.9	5.2	5.4	5.8	6.1	6.2	6.0	5.8		4.5	5.0	4.7	4.9	5.1	5.4	5.5	5.5	5.3	5.2	
2008	5.8	5.1	5.0	5.1	5.5	5.7	6.1	6.2	6.1	5.8		5.7	5.0	4.8	4.9	5.1	5.3	5.5	5.5	5.4	5.2	
2009	9.3	5.9	5.5	5.3	5.7	5.8	6.2	6.3	6.2	5.9		9.2	5.8	5.4	5.1	5.3	5.4	5.6	5.7	5.5	5.3	
2010	9.6	6.8	6.1	5.6	5.9	5.9	6.3	6.3	6.3	6.0	6.0	9.6	6.7	6.0	5.4	5.6	5.5	5.8	5.7	5.7	5.4	5.4
2011	8.9	7.6	6.5	5.8	6.0	5.9	6.3	6.4	6.4	6.2	6.0	8.9	7.6	6.4	5.7	5.7	5.6	5.9	5.8	5.8	5.5	5.4
2012	8.1	8.3	6.8	6.1	6.0	6.0	6.3	6.4	6.5	6.3	6.1	8.1	8.3	6.7	5.9	5.8	5.7	5.9	5.9	5.8	5.6	5.5
2013	7.4	8.7	6.9	6.2	6.0	6.1	6.2	6.4	6.5	6.3	6.1	7.4	8.6	6.8	6.1	5.8	5.8	5.8	5.9	5.9	5.7	5.5
2014	6.2	8.0	7.0	6.4	6.0	6.1	6.1	6.5	6.5	6.4	6.1	6.2	8.0	6.9	6.3	5.8	5.9	5.8	6.0	6.0	5.8	5.6
2015	5.3	7.2	7.0	6.5	6.0	6.1	6.1	6.4	6.4	6.4	6.2	5.3	7.2	6.9	6.4	5.8	5.9	5.8	6.0	5.9	5.8	5.6
2016	4.9	6.3	7.0	6.5	6.0	6.0	6.0	6.3	6.4	6.4	6.2	4.9	6.4	7.0	6.4	5.8	5.8	5.7	5.9	5.9	5.8	5.6
2017	4.4	5.6	7.0	6.4	5.9	5.9	5.9	6.2	6.3	6.4	6.2	4.4	5.6	7.0	6.3	5.8	5.7	5.7	5.8	5.8	5.8	5.6

5. ANNUAL TRUST FUND REAL INTEREST RATE

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5 Annual Trust Fund Real Interest Rate

5.1 Summary

For the 2019 Trustees Report, the assumed ultimate real interest rates (effective annual real yields on special public debt obligations issuable to the trust funds by the U.S. Treasury) are 3.0 percent, 2.5 percent, and 2.0 percent for alternatives I, II, and III, respectively (Table 5.1). These assumed rates are 0.2 percentage point lower than the rates used for the 2018 Trustees Report.

Table 5.1: Assumed Ultimate Real Interest Rates

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Real Interest Rate	3.0	2.5	2.0	3.2	2.7	2.2	-0.2	-0.2	-0.2

Since October 1960, interest rates on special public debt obligations issuable to the trust funds each month have been set equal to the average market yield on all marketable fixed-rate Federal obligations that are not callable and do not mature within the next 4 years. As such, the rate on new issues to the trust funds represents a fair market return for longer-term, highly liquid, default-risk-free obligations. The real interest rate (real effective annual yield) on these obligations can be computed either as an expected yield (i.e., nominal effective annual yield less expected future inflation rate) or as the actual realized yield over some period after issue (i.e., nominal effective annual yield less the actual increase in price levels after issue). For the purpose of this analysis, actual realized yields over the year after issue will be examined for obligations issuable each year. Real interest rates over periods of two or more years are computed as the average annual yield of an investment at the beginning of the period that is reinvested annually at the new issue rate.

5.2 Past Experience

Tables 5.2 and 5.3 show the average annual real interest rates over various decades and economic cycles, using an adjusted CPI-W that reflects BLS improvements to the Index.[53] (See Section 2.6 Appendix.)

The average annual real interest rate on trust fund assets over the last five complete economic cycles was 3.30 percent (computed as the average annual return for investments in 1969 that were reinvested annually at the new issue rates for years 1969 through 2007). Annual real interest rates for individual years within this period varied substantially from this average of 3.30 percent. Even the average rates of 2.01, -0.12, 5.38, 4.34, and 1.96 percent for each economic

[53] Peaks in economic cycles roughly follow the NBER cycle dating, except for short recoveries such as 1980-81, which are not counted as separate cycles.

cycle beginning with the 1969-1973 cycle, respectively, varied substantially from one another. The large differences among these periods indicate substantially different conditions across these cycles.

Table 5.2: Average Annual Real Interest Rate (calculated using the adjusted-CPIW)

Period	Average Annual Real Interest Rate (percent)		
Historical:			
By Decade			
1977-1987	4.50		
1987-1997	4.62		
1997-2007	2.66		
2007-2017	0.91		
By Complete Economic Cycle (Peak-to-Peak)			
Individual Cycle			
1969-1973	2.01		
1973-1979	-0.12		
1979-1990	5.38		
1990-2001	4.34		
2001-2007	1.96		
Last Two Cycles			
1990-2007	3.49		
Last Three Cycles			
1979-2007	4.23		
Last Four Cycles			
1973-2007	3.45		
Last Five Cycles			
1969-2007	3.30		
		Alternative	
Ultimate Assumptions	I	II	III
2018 Trustees Report	3.2	2.7	2.2
2019 Trustees Report	3.0	2.5	2.0

After experiencing negative real yields in the investments in U.S. Treasury securities from 1974 through 1980, caused largely by higher-than-expected price inflation, investors demanded higher interest rates to protect their investments. Sustained high real interest rates in the years after 1981 resulted from the following factors: constrained money supply growth, increased borrowing by businesses, reduced savings rates in the U.S. economy, deregulation of banks and other financial institutions, and lower than expected inflation in the beginning of that period.

As the rate of inflation declined from the highs of the early 1980s and remained under control, the real interest rate slowly followed suit, declining to 2.34 percent in 2000. In October 2001, the

federal government, in response to its favorable budget situation, suspended the sale of 30-year Treasury securities (leaving the 10-year notes as the longest duration being issued). Since then, the budget has fallen back into deficit and, beginning in February 2006, the Treasury re-introduced regular semi-annual auctions of the 30-year nominal Treasury bond. Neither the budget deficits nor the federal funds rate hikes by the Federal Reserve between 2004 and 2006 resulted in a spike in real interest rates, due in part to foreigners' increased willingness to accumulate Treasury securities. Instead, the real interest rate continued to trend downward, reaching 0.60 percent in 2008. Since 2008, the annual real interest rate has averaged only 0.94 percent, largely due to slow economic growth, unconventional monetary policies such as quantitative easing, a global savings glut, as well as a strong demand for safe assets in order to satisfy regulatory requirements in the financial sector.

5.3 Future Expectations

Real interest rates have been unusually low during the 2001-2017 period, and are not expected to remain as low in the future. Real interest rates were unusually low during the 2001-2007 as rates were distorted by large purchases of safe assets (including Treasury securities) by foreign central banks as their foreign exchange reserves accumulated. The low interest rates helped fuel the housing bubble, and when the bubble burst in 2007, investors sought a safe haven in Treasury securities. The sluggish economic growth in the United States together with financial instability abroad contributed to the low real interest rates in the post-2009 period. In addition, during most of this period, foreign central banks continued to accumulate foreign exchange reserves, which also contributed to the low real interest rates. While foreigners' holdings of Treasury securities have leveled off, the proportion of marketable Treasury securities held by foreigners has declined from 55 percent in 2008 to 43 percent in 2017.

Over the near term, yields on Treasury securities can be expected to rise moderately as long as the economy continues to improve and the Federal Reserve continues with its interest rate normalization process. The Federal Reserve, which ended its asset-purchase program (quantitative easing) in October 2014, has raised its Federal funds rate eight times since December 2015, and started its balance sheet normalization process in October 2017 by gradually reducing its securities holdings. This balance sheet normalization process is expected to continue as long as the economy continues to grow as anticipated and should put upward pressure on longer-term interest rates.

Over the longer term, several factors are expected to result in a return to higher yields on Treasury securities. First, federal deficits and debt are expected to rise in the future. For example, CBO projects that budget deficits will exceed one trillion dollars by 2020. They also project the amount of publicly held debt will rise to 96 percent of GDP by 2018, and reach 152 percent of GDP by 2048. The high level of debt may eventually lead to sharp and sudden increases in the yields on Treasury securities. Second, with the passage of the financial deregulation bill (Economic Growth, Regulatory Relief and Consumer Protection Act) in 2018, banks have less of a need to hold Treasury securities in order to satisfy liquidity requirements as

they may hold investment-grade municipal bonds instead and enjoy the tax advantages of such securities. Third, continued growth in the global economy may reduce the demand for safe assets such as Treasury securities.

OCACT examined whether estimates of market expectations for future real interest rates might be useful for developing the long-range real interest rate assumption. OCACT examined historical data from the Department of Treasury on 10-year forward rates for 10-year TIPS, and found that market expectations were a poor predictor of the actual experience. Further, a study by the Congressional Budget Office (CBO) found that estimates of market expectations have been worse predictors of long-term interest rates than the *Blue Chip* consensus forecasts over the past three decades.[54] CBO also found that the *Blue Chip* consensus forecasts, "consistently missed the decline in long-term nominal interest rates over the past three decades, estimating rates that were higher (and, in some cases, much higher) than what actually occurred." While methods used to estimate market expectations may have value for other purposes, OCACT concluded that the 10-year forward rates for 10-year TIPS tend to be more representative of initial market conditions, not future rates. Given the changes observed in the historical period and the conditions that have contributed to low interest rates, it seems unlikely that the current low-interest rate environment will persist over a 75-year time horizon.

When determining the assumed ultimate real interest rate for the long-range period, OCACT believes it is important to take into consideration the real interest rates experienced over long historical periods as well as whether or not the relatively low real interest rates experienced in the recent past can continue well into the long-range period. Over the last five economic cycles (1969-2007), which included the 2001-2007 cycle during which real interest rates averaged only 1.96 percent, the real interest rate averaged 3.30 percent. Even if only the post-1987 period (through 2017) is considered, the real interest rate averaged 2.72 percent, while the CPI growth rate averaged 2.4 percent.

The low real interest rates experienced for trust fund new issues in the 2007-2017 period (averaging 0.91 percent) do not make a compelling case for significantly changing the ultimate assumption. However, in light of the recent low real interest rate experience and the possibility that relatively low real interest rates may persist into the future, the Trustees lowered ultimate real interest rate assumption by 0.2 percentage point to 3.0 percent, 2.5 percent and 2.0 percent for alternatives I, II and III, respectively. However, should the government debt in the future grow to a level higher than what investors are willing to absorb, then a higher real interest rate assumption would be reasonable.

[54] See Gamber, Edward N. 2017. *Did Treasury Debt Markets Anticipate the Persistent Decline in Long-Term Interest Rates?* CBO Working Paper 2017-07.

5.4 Projections from Other Sources

IHS Markit (formerly IHS Global Insight, Inc.) includes projections through 2048 in its August 2018 *30-Year Focus Trend Forecast*. They project real yields on 10-year U.S. Treasury notes to rise from 0.7 percent for 2018 to 1.5 percent for 2025 and 2026, and then decline gradually to 1.1 percent for 2047 and 2048. Moody's Analytics' September 2018 forecast projects real yields on 10-year U.S. Treasury notes to rise from 0.6 percent in 2018 to an ultimate rate of 2.2 percent for 2039 through 2048 (their final projection year).

The Office of Management and Budget (OMB) Fiscal Year 2019 Budget projects the real yield on the trust funds' special-issue securities to reach 1.4 percent by 2023 and remain at that level for the remainder of the projection period (through 2096). The Congressional Budget Office (CBO) *2018 Long-Term Budget Outlook* (published in June 2018) includes projections through 2048. CBO projects real yields on 10-year Treasury notes of 2.4 percent in 2048 and later. The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended lowering the alternative II real interest rate assumption to 2.5 percent. The prior technical panel, which met in 2011, recommended lowering the alternative II real interest rate assumption to 2.7 percent.

Table 5.3: Real Interest Rates for OASDI Trust Fund New Issues and the Compound Average Real Yield over Selected Intervals

		Average Annual Percentage Change over the Following Number of Years:										
To	RYINDEX	1	5	10	15	20	25	30	35	40	45	50
1961	22.32											
1962	23.00	3.03										
1963	23.63	2.74										
1964	24.29	2.81										
1965	24.96	2.74										
1966	25.35	1.56	2.58									
1967	25.88	2.08	2.39									
1968	26.26	1.49	2.14									
1969	26.59	1.27	1.83									
1970	27.13	2.00	1.68									
1971	27.99	3.18	2.00	2.29								
1972	28.79	2.85	2.16	2.27								
1973	28.80	0.04	1.86	2.00								
1974	27.98	-2.84	1.02	1.42								
1975	27.91	-0.25	0.57	1.12								
1976	28.45	1.92	0.32	1.16	1.63							
1977	28.75	1.08	-0.02	1.06	1.50							
1978	28.91	0.54	0.08	0.97	1.35							
1979	28.59	-1.10	0.43	0.73	1.09							
1980	28.16	-1.53	0.17	0.37	0.81							
1981	28.61	1.61	0.11	0.22	0.81	1.25						
1982	30.74	7.45	1.34	0.66	1.15	1.46						
1983	33.42	8.73	2.94	1.50	1.62	1.75						
1984	35.74	6.92	4.56	2.48	1.99	1.95						
1985	39.02	9.18	6.74	3.41	2.45	2.26						
1986	42.65	9.32	8.32	4.13	2.85	2.64	2.62					
1987	44.67	4.74	7.76	4.50	2.97	2.77	2.69					
1988	46.85	4.87	6.99	4.95	3.30	2.94	2.78					
1989	48.98	4.54	6.51	5.53	3.80	3.10	2.84					
1990	50.89	3.91	5.46	6.10	4.09	3.20	2.89					
1991	53.48	5.09	4.63	6.46	4.30	3.29	3.03	2.96				
1992	56.48	5.60	4.80	6.27	4.60	3.43	3.17	3.04				
1993	59.16	4.75	4.78	5.88	4.89	3.67	3.30	3.11				
1994	61.58	4.08	4.69	5.59	5.25	4.02	3.42	3.15				
1995	64.41	4.60	4.82	5.14	5.67	4.27	3.52	3.21				
1996	67.18	4.30	4.67	4.65	5.86	4.39	3.56	3.30	3.20			
1997	70.18	4.47	4.44	4.62	5.66	4.56	3.63	3.38	3.24			
1998	74.02	5.47	4.58	4.68	5.44	4.81	3.85	3.51	3.32			
1999	76.66	3.56	4.48	4.58	5.22	5.05	4.11	3.59	3.34			
2000	78.45	2.34	4.02	4.42	4.77	5.26	4.22	3.60	3.33			
2001	81.24	3.56	3.87	4.27	4.39	5.36	4.29	3.62	3.38	3.28		
2002	84.35	3.83	3.75	4.09	4.33	5.18	4.40	3.65	3.43	3.30		
2003	86.56	2.62	3.18	3.88	4.18	4.87	4.48	3.74	3.47	3.30		
2004	87.82	1.46	2.76	3.61	3.97	4.60	4.59	3.89	3.47	3.27		
2005	88.50	0.77	2.44	3.23	3.76	4.18	4.69	3.92	3.44	3.22		
2006	89.51	1.15	1.96	2.91	3.49	3.78	4.67	3.90	3.38	3.20	3.13	
2007	91.24	1.93	1.58	2.66	3.25	3.63	4.45	3.92	3.35	3.20	3.11	
2008	91.81	0.63	1.19	2.18	2.97	3.42	4.12	3.93	3.37	3.18	3.06	
2009	95.79	4.33	1.75	2.25	2.99	3.41	4.02	4.11	3.58	3.26	3.10	
2010	96.60	0.84	1.77	2.10	2.74	3.26	3.69	4.19	3.61	3.23	3.05	
2011	95.90	-0.72	1.39	1.67	2.40	2.96	3.29	4.11	3.53	3.13	3.00	2.96
2012	96.20	0.31	1.06	1.32	2.12	2.70	3.12	3.88	3.51	3.06	2.96	2.90
2013	96.30	0.11	0.96	1.07	1.77	2.47	2.92	3.59	3.50	3.06	2.93	2.85
2014	96.65	0.36	0.18	0.96	1.56	2.28	2.76	3.37	3.54	3.15	2.91	2.80
2015	99.26	2.71	0.55	1.15	1.58	2.19	2.71	3.16	3.67	3.22	2.92	2.80
2016	100.30	1.04	0.90	1.14	1.41	2.02	2.55	2.89	3.65	3.20	2.88	2.79
2017	100.00	-0.30	0.78	0.92	1.14	1.79	2.31	2.72	3.43	3.17	2.81	2.74
		Note: The index for each year is the accumulated value in that year of an investment made in the prior year in the amount of the prior year's index, with interest paid at the average rate for special public debt obligations issuable to the OASI and DI Trust Funds during the prior year.										

6. RATIO OF OASDI TAXABLE PAYROLL TO COVERED EARNINGS

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6 Ratio of OASDI Taxable Payroll to Covered Earnings

6.1 Summary

For the 2019 Trustees Report, the assumed ultimate ratios of OASDI effective taxable payroll to covered earnings (taxable ratio) are 84.0 percent, 82.5 percent, and 81.0 percent for alternatives I, II and III, respectively (Table 6.1). These assumed ultimate ratios are the same as those used for the 2018 Trustees Report.

Table 6.1: Assumed Ultimate Taxable Earnings Ratios

	2019 Trustees Report Alternative			2018 Trustees Report Alternative			2019 Trustees Report Less 2018 Trustees Report		
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Taxable Ratio (percent)	84.0	82.5	81.0	84.0	82.5	81.0	0.0	0.0	0.0

OASDI effective taxable payroll (or taxable payroll) is the effective amount of covered earnings subject to the full Social Security payroll tax rate (12.4 percent since 1990). Taxable wages for an employee are the total covered wages from all wage employment up to the taxable maximum (also known as the.contribution and benefit base). Taxable wages for an employer are the sum of all covered wages paid to each employee up to the taxable maximum. Employees with multiple jobs whose total wages exceed the taxable maximum are eligible for a refund of excess employee taxes withheld; employers are not eligible for a refund on this basis. For self-employed workers with no taxable wages, taxable earnings are the amount of covered self-employment net earnings up the taxable maximum. For self-employed workers with taxable wages, covered self-employment net earnings are taxable up to the excess (if any) of the taxable maximum over their taxable wages for the year. The taxable ratio is essentially the proportion of covered earnings that is at or below the taxable maximum.

6.2 Past Experience

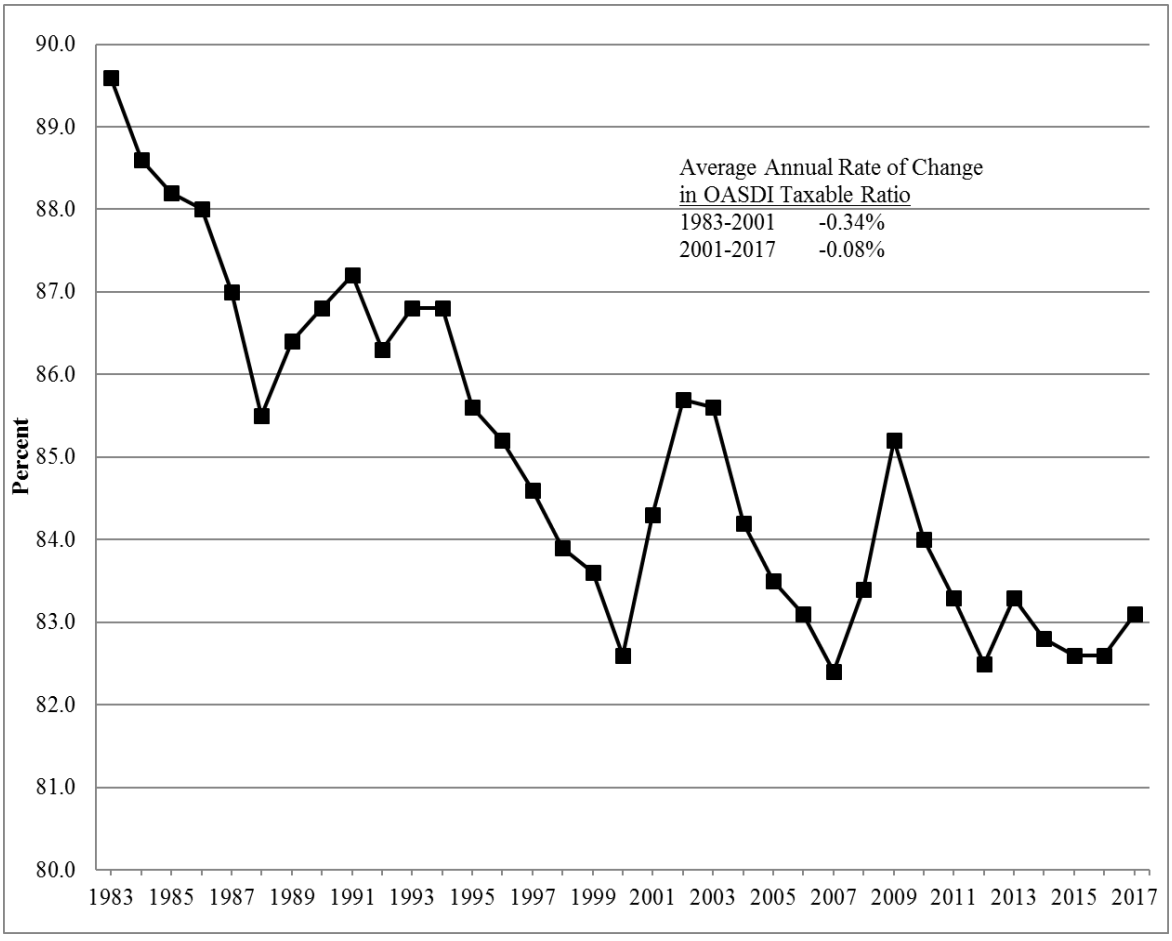
Table 6.2 shows historical values for the taxable ratio from 1983 through 2017. The taxable ratio fell from over 89 percent in 1983 to 84.3 percent in 2001, resulting in an average annual rate of change in the taxable ratio of about -0.34 percent (see Figure 6.1). The decline was related to several factors that increased the concentration of earnings among the very high earners compared to all other earners. Some of the drop in the taxable ratio in the late 1980s was due to the Tax Reform Act of 1986, which lowered the top marginal income tax rate from 50 percent in 1986 to 28 percent in 1988. The drop in the income tax rate influenced some high earners to shift some non-covered income to covered earnings, thereby lowering the taxable ratio. In the 1990s, the growth in the use of stock options[55] in the pay packages of the very high earners, combined

[55] Nonqualified stock options are subject to the OASDI tax. For more information on the tax treatment of stock options, see publication by Grant Thornton's G. Edgar Adkins, Jr., entitled "Taxation of Stock Options and Restricted Stock: the Basics and Beyond" (https://www.grantthornton.com/~/media/content-page-files/tax/pdfs/white-papers-survey-reports-

with a fast increase in stock prices, contributed to the drop in the taxable ratio. An unprecedented expansion of the financial sector in the 1980s and 1990s also contributed to the concentration of very high earnings.

Between 2001 and 2017, the taxable ratio has varied with the business cycle, rising during economic downturns and falling during economic recoveries and it changed at a much slower annual rate of -0.08 percent. This was also a period when there was a rapid growth in cash balance plans, which are qualified retirement plans with features of both a traditional defined contribution plan and a traditional defined benefit plan. These plans enabled small business owners and high-earning service professionals, such as doctors and lawyers, to shift some of their earnings out of OASDI covered earnings and into retirement savings.

Figure 6.1:Percentage of OASDI Covered Earnings Below the Taxable Maximum: 1983 to 2017



articles/2013/Taxation-of-stock-options-Adkins.ashx.)

6.3 Future Expectations

In spite of eight years of economic expansion since 2009 and record stock prices as measured by the S&P 500 index, which have been positively correlated with the share of income reported by the very high earners, the taxable ratio for 2017 (83.1 percent) has not fallen below the lows reached in previous economic cycle peaks. In fact, the rate of annual decline in the taxable ratio from 1983 to 2001 has reduced by about two-thirds for the period 2001 to 2017. OCACT expects the taxable ratio will continue the trend of slowing decline in the near future and will stabilize to reach its ultimate value of 82.5 percent by the end of 2028 for the alternative II assumption.

6.4 Projections from Other Sources

The Congressional Budget Office also makes projections of the taxable earnings ratio. In *The 2018 Long-Term Budget Outlook* published in June 2018, CBO projects the taxable ratio to fall to 81 percent by 2028 and to fall below 80 percent by 2048. One year earlier, in *The 2017 Long-Term Budget Outlook* published in March 2017, CBO projected the taxable ratio to fall from 82 percent in 2017 to 79 percent in 2017 and remain at that level thereafter (through 2047). Two years earlier, in *The 2016 Long-Term Budget Outlook,* CBO projected the taxable ratio to fall to about 77.4 percent in 2027 and remain in the 77.4 to 77.5 percent range thereafter (through 2090).

The Social Security Advisory Board's 2015 Technical Panel on Assumptions and Methods recommended lowering the alternative II ultimate taxable ratio from 82.5 percent to 82.2 percent. For alternatives I and III, the Technical Panel recommended ultimate taxable ratios of 84.0 percent and 79.0 percent, respectively. The 2011 Technical Panel recommended ultimate taxable ratios of 84.3 percent, 82.2 percent, and 80.0 percent for alternatives I, II and III, respectively.

Table 6.2: OASDI Taxable Ratio, 1983 to 2017

Year	OASDI Taxable Ratio (percentage)
1983	89.6
1984	88.6
1985	88.2
1986	88.0
1987	87.0
1988	85.5
1989	86.4
1990	86.8
1991	87.2
1992	86.3
1993	86.8
1994	86.8
1995	85.6
1996	85.2
1997	84.6
1998	83.9
1999	83.6
2000	82.6
2001	84.3
2002	85.7
2003	85.6
2004	84.2
2005	83.5
2006	83.1
2007	82.4
2008	83.4
2009	85.2
2010	84.0
2011	83.3
2012	82.5
2013	83.3
2014	82.8
2015	82.6
2016	82.6
2017	83.1