APPENDIX C. HISTORICAL INCOME ALTERNATIVE INFLATION SERIES

To accurately assess changes in income and earnings over time, it is necessary to adjust for changes in prices (inflation), which affect the cost of living. There are varieties of different consumer price indices currently produced by federal statistical agencies that can be used to make this adjustment. They vary in how they answer three fundamental questions concerning inflation measurement: (1) what population is the index designed to represent (all urban consumers, all urban workers, people aged 65 and over, etc.), (2) which goods and services should have their prices included in the index, and (3) what is the most appropriate way to measure changes in prices among different goods and services?

The Consumer Price Index for All Urban Consumers (CPI-U) and Consumer Price Index Research Series using Current Methods (CPI-U-RS) are two indices used to adjust for price changes in this report.[1] Both measure changes in the cost of living for all urban consumers and are produced by the Bureau of Labor Statistics (BLS). However, measuring inflation is challenging and both measures may have biases that may cause them to under- or over-state changes in prices.

In 1995, Congress commissioned a group of economists, led by Michael Boskin, to write a report on potential biases in price indices. The report (Boskin et al., 1996) asserted that the CPI-U overstated inflation for three reasons: (1) the measure did not

account for consumer substitution, (2) it did not fully account for changes in the quality of existing goods and services, and (3) it did not properly account for new goods and services.[2]

In response to that report, BLS modified the CPI-U methodology.[3] However, historical CPI-U estimates were not updated to reflect the improved methodology. Due to interest from researchers, the CPI-U-RS was created to adjust the historical series (back to 1978) to reflect changes that resulted from these methodological improvements.[4] After years of public consultation, in 2001 the U.S. Census Bureau began using the CPI-U-RS to adjust historical income estimates for changes in the cost of living (DeNavas-Walt, Cleveland, and Roemer, 2001). In this way, the methodological improvements implemented in the CPI-U would also be accounted for, to the extent possible, in the years prior to their implementation.[5]

In 2002, BLS introduced the Chained Consumer Price Index for all Urban Consumers (C-CPI-U). The C-CPI-U is designed to

account for an additional source of bias, upper-level substitution bias. BLS provides an example of how the CPI-U and C-CPI-U would differ. "For example, pork and beef are two separate CPI item categories. If the price of pork increases while the price of beef does not, consumers might shift away from pork to beef. The C-CPI-U is designed to account for this type of consumer substitution between CPI item categories. In this example, the C-CPI-U would rise, but not by as much as an index that was based on fixed purchase patterns."[6] In practice, the information on purchasing patterns is updated more frequently in the C-CPI-U than in the CPI-U and other nonchained price indices.
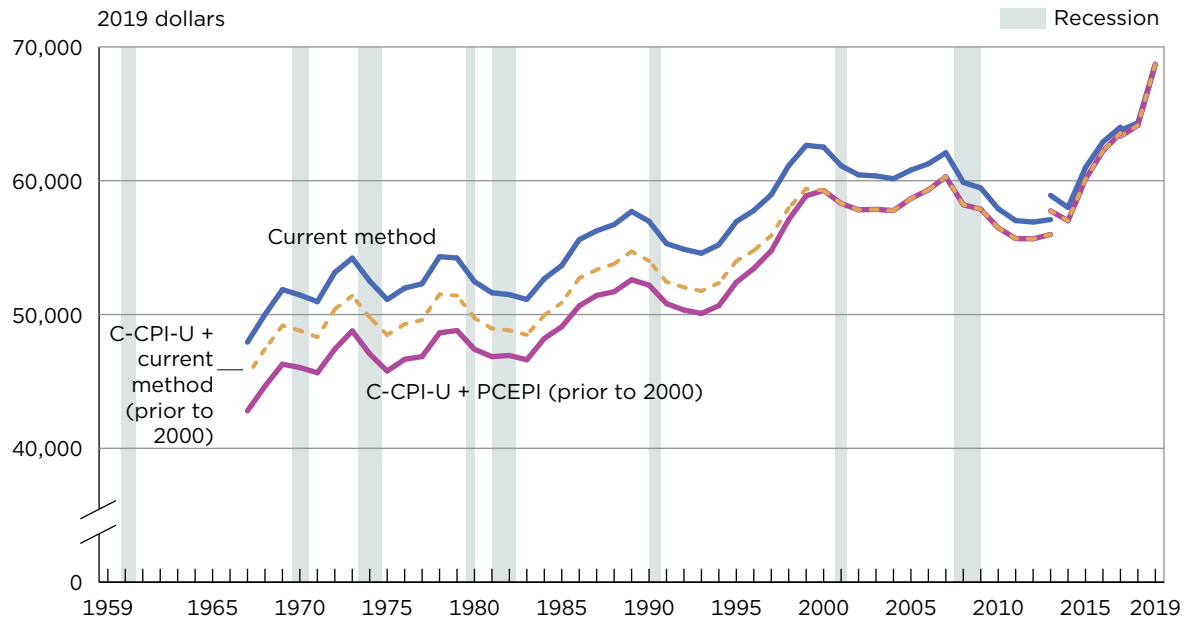
The C-CPI-U is available from 2000 onward. From 2000 to 2018, the year-to-year change in the C-CPI-U has been an average of 0.26 percentage points lower than for the CPI-U. Over time, these small annual differences compound to have large impacts on the inflation-adjusted value of income.

The Bureau of Economic Analysis (BEA) also releases price indices. Once such index is the Personal Consumption Expenditures Price Index (PCEPI), which BEA describes as "[a] measure of the prices that people living in the United States, or those buying on their behalf, pay for goods and services. The PCE price index is known for capturing inflation (or deflation) across a wide range of consumer expenses and reflecting

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[1] The CPI-U is used to adjust poverty thresholds and the CPI-U-RS is used to adjust historical income series.

[2] There is much ongoing research into possible biases and improvements in price index measurements. A new Consumer Price Index Manual is currently in draft form, see <www.imf.org/en/Data/Statistics/cpi-manual>. Some academic work includes Melser and Syed (2017), Kaplan and Schulhofer-Wohl (2017), Goolsbee and Klenow (2018), and Jaravel (2019) to name just a few from recent years.

[3] See Johnson, Reed, and Steward (2006) for a discussion of how these issues were addressed. See Reed and Ripley (2012) for a discussion of potential sources of bias even after these changes were made in response to the Boskin Commission.

[4] See <www.bls.gov/cpi/research-series/home.htm>.

[5] See Appendix A section Cost-of-Living Adjustment for a detailed description of the methodology currently used to adjust historical income estimates for inflation.

[6] See <www.bls.gov/cpi/additional-resources/chained-cpi-questions-and-answers.htm>.

Figure C-1.
Historical Median Income Using Alternative Price Indices: 1967 to 2019

Note: Inflation-adjusted estimates may differ slightly from other published data due to rounding. For more details on the alternative price indices shown and historical footnotes, see Table C-1. For information on confidentiality protection, sampling error, nonsampling error, and definitions, see <https://www2.census.gov/programs-surveys/cps/techdocs/cpsmar20.pdf>.

Source: U.S. Census Bureau, Current Population Survey, 1968 to 2020 Annual Social and Economic Supplements (CPS ASEC).

changes in consumer behavior."[7] Over the period from 2000 to 2018, year-to-year changes in the PCEPI have been largely consistent with the changes in the C-CPI-U. Over that period, the average year-to-year change in prices as measured by the C-CPI-U was 1.87 percent, as compared to 1.83 percent in the PCEPI, 2.12 percent in the CPI-U, and 2.14 percent in the CPI-U-RS.

Both the C-CPI-U and the PCEPI are deemed "superlative" indices, as both account for consumer substitution among goods and services as relative prices change. Since the PCEPI includes purchases from nonprofit institutions in addition to households, the

C-CPI-U is the superlative price index that most closely matches the sampling frame of the CPS ASEC and other Census Bureau household surveys.[8]

Figure C-1 and Table C-1 show historical income adjusted using the C-CPI-U compared to the CPI-U-RS from 2000 onward. For 2000, the income estimate in 2019 dollars adjusted using the CPI-U-RS is $62,512, compared to $59,275 when adjusted using

[7] See <www.bea.gov/data/personal-consumption-expenditures-price-index>.

[8] The item weights in the C-CPI-U and CPI-U are derived from household survey data in the Consumer Expenditure Survey, which is conducted by the Census Bureau on behalf of BLS. The PCE item weights are derived from surveys such as the Census Bureau's annual and monthly retail trade surveys, the Service Annual Survey, and the Quarterly Services Survey. See McCully, Moyer, and Stewart (2007) for more information on the differences between the BLS's price indices (CPI-U and C-CPI-U) and BEA's price indices (PCEPI).

the C-CPI-U, a difference of 5.2 percent.

Since the C-CPI-U only exists from 2000 onward, an alternative price index must be used to adjust income for prior years. Figure C-1 and Table C-1 show historical income adjusted using two different methods for the pre-2000 period: the CPI-U-RS and the PCEPI. The CPI-U-RS is the method used currently by the Census Bureau for income estimates and is more reflective of the price changes experienced by households. The PCEPI has historically more closely matched the C-CPI-U and, like the C-CPI-U, is a chained, superlative price index.

For 1967, the estimate of median household income in 2019 dollars using the CPI-U-RS and shown in

the principal figures and tables in this report is $47,938. When adjusted using the C-CPI-U from 2000 onward and the PCEPI for prior years, the estimate is $42,801, 10.7 percent lower. Using the C-CPI-U from 2000 onward and the CPI-U-RS for the period prior to 2000, real median household income in 1967 is $45,456, 5.2 percent less than the estimate using the CPI-U-RS for the entire period and 6.2 percent higher than the estimate using the C-CPI-U/PCEPI.

Given the additional bias corrected for by the C-CPI-U and the close correspondence between the PCEPI and C-CPI-U in the years both are available, the Census Bureau is considering the adoption of the C-CPI-U series using the PCEPI prior to 2000 as the price index used to adjust historical income tables for changes in the cost of living over time.

The Census Bureau would like to receive views and evidence on the relative technical merits of income series deflated by the C-CPI-U/PCEPI index as compared to our current CPI-U-RS-based adjustment. Please send comments on this issue to:

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Table C-1.
Historical Median Income Using Alternative Price Indices: 1967 to 2019

(For information on confidentiality protection, sampling error, nonsampling error, and definitions, see
<https://www2.census.gov/programs-surveys/cps/techdocs/cpsmar20.pdf>)

| Year | Current dollars | | CPI-U-RS/current method | | Chained CPI-U (2000–2019) | | | |
| | | | | | PCEPI (1967–1999) | | CPI-U-RS/current method (1967–1999) | |
	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)	Estimate	Margin of error[1] (±)
2019	68,703	904	68,703	904	68,703	904	68,703	904
2018	63,179	691	64,324	704	64,135	702	64,135	702
2017[2]	61,136	530	63,761	553	63,314	549	63,314	549
2017	61,372	550	64,007	574	63,558	570	63,558	570
2016	59,039	716	62,898	763	62,220	755	62,220	755
2015	56,516	527	60,987	569	60,118	561	60,118	561
2014	53,657	645	58,001	697	57,008	685	57,008	685
2013[3]	53,585	1,076	58,904	1,183	57,755	1,160	57,755	1,160
2013[4]	51,939	453	57,095	498	55,981	489	55,981	489
2012	51,017	344	56,912	383	55,660	375	55,660	375
2011	50,054	413	57,021	470	55,674	459	55,674	459
2010[5]	49,276	535	57,904	628	56,483	613	56,483	613
2009[6]	49,777	350	59,458	418	57,871	407	57,871	407
2008	50,303	225	59,877	268	58,208	261	58,208	261
2007	50,233	230	62,090	285	60,296	276	60,296	276
2006	48,201	340	61,268	433	59,319	419	59,319	419
2005	46,326	254	60,794	334	58,667	322	58,667	322
2004[7]	44,334	322	60,150	438	57,769	420	57,769	420
2003	43,318	309	60,360	431	57,860	413	57,860	413
2002	42,409	229	60,435	326	57,825	312	57,825	312
2001	42,228	212	61,126	308	58,297	293	58,297	293
2000[8]	41,990	218	62,512	324	59,275	307	59,275	307
1999[9]	40,696	312	62,641	480	58,876	451	59,398	455
1998	38,885	379	61,128	595	57,095	556	57,963	565
1997	37,005	281	58,961	447	54,767	416	55,908	424
1996	35,492	294	57,772	479	53,442	443	54,781	454
1995[10]	34,076	324	56,945	541	52,407	498	53,996	513
1994[11]	32,264	242	55,215	415	50,664	380	52,356	393
1993[12]	31,241	240	54,581	419	50,082	385	51,755	398
1992[13]	30,636	239	54,874	428	50,336	392	52,033	406
1991	30,126	238	55,302	438	50,817	402	52,439	415
1990	29,943	252	56,966	479	52,197	439	54,016	454
1989	28,906	261	57,705	521	52,602	475	54,717	494
1988	27,225	219	56,725	456	51,707	415	53,788	432
1987[14]	26,061	203	56,261	438	51,429	400	53,348	415
1986	24,897	212	55,597	474	50,647	432	52,718	449
1985[15]	23,618	211	53,664	479	49,090	438	50,885	454
1984[16]	22,415	168	52,679	395	48,215	361	49,951	374
1983	20,885	157	51,126	383	46,620	349	48,479	363
1982	20,171	150	51,487	382	46,942	348	48,821	362
1981	19,074	165	51,627	446	46,854	405	48,954	423
1980	17,710	150	52,461	444	47,402	401	49,745	421
1979[17]	16,461	128	54,222	423	48,804	380	51,414	401
1978	15,064	100	54,326	362	48,630	324	51,513	343
1977	13,572	84	52,302	324	46,861	290	49,594	307
1976[18]	12,686	77	51,973	317	46,652	285	49,282	301
1975[19]	11,800	79	51,124	342	45,774	306	48,477	324
1974[19, 20]	11,197	71	52,499	332	47,055	298	49,781	315
1973	10,512	66	54,216	339	48,775	305	51,409	321
1972[21]	9,697	61	53,143	334	47,416	298	50,391	317
1971[22]	9,028	58	50,960	326	45,650	292	48,321	309
1970	8,734	53	51,461	311	46,040	278	48,796	295
1969	8,389	51	51,863	316	46,289	282	49,178	299
1968	7,743	46	50,004	298	44,648	266	47,415	282
1967[23]	7,143	43	47,938	286	42,801	256	45,456	271

See footnotes on next page.

[1] A margin of error (MOE) is a measure of an estimate's variability. The larger the MOE in relation to the size of the estimate, the less reliable the estimate. This number, when added to and subtracted from the estimate, forms the 90 percent confidence interval. The MOEs shown in this table are based on standard errors calculated using replicate weights. For more information, see "Standard Errors and Their Use" at <https://www2.census.gov/library/publications/2020/demo/p60-270sa.pdf>.

[2] Estimates reflect the implementation of an updated processing system and should be used to make comparisons to 2018 and subsequent years.

[3] The 2014 CPS ASEC included redesigned questions for income and health insurance coverage. All of the approximately 98,000 addresses were eligible to receive the redesigned set of health insurance coverage questions. The redesigned income questions were implemented to a subsample of the 98,000 addresses using a probability split panel design. Approximately 68,000 addresses were eligible to receive a set of income questions similar to those used in the 2013 CPS ASEC and the remaining 30,000 addresses were eligible to receive the redesigned income questions. The source of these 2013 estimates is the portion of the CPS ASEC sample that received the redesigned income questions, approximately 30,000 addresses.

[4] The source of these 2013 estimates is the portion of the CPS ASEC sample that received the income questions consistent with the 2013 CPS ASEC, approximately 68,000 addresses.

[5] Implementation of 2010 Census-based population controls.

[6] Median income is calculated using $2,500 intervals. Beginning with 2009 income data, the Census Bureau expanded the upper income intervals used to calculate medians to $250,000 or more. Medians falling in the upper open-ended interval are plugged with "$250,000." Before 2009, the upper open-ended interval was $100,000 and a plug of "$100,000" was used.

[7] Data have been revised to reflect a correction to the weights in the 2005 CPS ASEC.

[8] Implementation of a 28,000 household sample expansion.

[9] Implementation of 2000 Census-based population controls.

[10] Full implementation of 1990 Census-based sample design and metropolitan definitions, 7,000 household sample reduction, and revised editing of responses on race.

[11] Introduction of 1990 Census sample design.

[12] Data collection method changed from paper and pencil to computer-assisted interviewing. In addition, the 1994 CPS ASEC was revised to allow for the coding of different income amounts on selected questionnaire items. Limits either increased or decreased in the following categories: earnings limits increased to $999,999; social security limits increased to $49,999; supplemental security income and public assistance limits increased to $24,999; veterans' benefits limits increased to $99,999; child support and alimony limits decreased to $49,999.

[13] Implementation of 1990 Census population controls.

[14] Implementation of a new CPS ASEC processing system.

[15] Recording of amounts for earnings from longest job increased to $299,999. Full implementation of 1980 Census-based sample design.

[16] Implementation of Hispanic population weighting controls and introduction of 1980 Census-based sample design.

[17] Implementation of 1980 Census population controls. Questionnaire expanded to show 27 possible values from 51 possible sources of income.

[18] First year medians were derived using both Pareto and linear interpolation. Before this year, all medians were derived using linear interpolation.

[19] Some of these estimates were derived using Pareto interpolation and may differ from published data, which were derived using linear interpolation.

[20] Implementation of a new CPS ASEC processing system. Questionnaire expanded to ask 11 income questions.

[21] Full implementation of 1970 Census-based sample design.

[22] Introduction of 1970 Census sample design and population controls.

[23] Implementation of a new CPS ASEC processing system.

Note: Inflation-adjusted estimates may differ slightly from other published data due to rounding. For details of the Consumer Price Index for All Urban Consumers (CPI-U), see <www.bls.gov/cpi/questions-and-answers.htm>. The CPI Research Series Using Current Methods (CPI-U-RS) is described at <www.bls.gov/cpi/research-series/home.htm>. The Chained Consumer Price Index for All Urban Consumers (C-CPI-U) is described at <www.bls.gov/cpi/additional-resources/chained-cpi.htm>. The Personal Consumption Expenditure Prices Index (PCEPI) is described at <www.bea.gov/data/personal-consumption-expenditures-price-index>. The current method for historical income adjustment uses the CPI-U-RS from 1978 to the present and the CPI-U-X1 from 1967–1977. The CPI-U-X1 was an experimental series that preceded the CPI-U-RS and shows what the inflation rate in the CPI-U might have been, if the current rental equivalence method of measuring the cost of homeownership had been in place prior to 1983.

Source: U.S. Census Bureau, Current Population Survey, 1968 to 2020 Annual Social and Economic Supplements (CPS ASEC).