Alternative CPI aggregations: two approaches

Plutocratic and democratic approaches for constructing an aggregate price index each incorporate different normative assumptions about the well-being of U.S. households; neither is favored by economic theory

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The theory of the cost-of-living index, which underlies the Consumer Price Index (CPI), is formulated within the context of the preferences and welfare of the individual. To construct an aggregate price index for a population requires that some method of aggregation be used to "average" the effects of price changes on all households in the population. It is intended that this aggregate index represent the "average" or "representative" household.

In most cases (including the CPI), the aggregation method used corresponds to a plutocratic index.[1] Other types of aggregation, such as the democratic index,[2] are also possible, and, in terms of economic theory, equally valid. However, as this article explains in a later section, the plutocratic approach is much more practicable, and it may provide a different measure of price change than the democratic index.

This article provides an empirical analysis of the differences between the plutocratic and democratic price indices, using data from the Consumer Expenditure Survey and the CPI for the 1987–97 period. The analysis constructs household-specific price indices from the Consumer Expenditure Interview sample, using the U.S. national average CPI series for all these households at the most detailed level of commodity disaggregation possible. Because the U.S. economy experienced low inflation during the 1987–97 period, this analysis also includes some hypothetical scenarios of price change. While it is impossible to predict what prices will do in future markets, these scenarios provide some information on the sensitivity of the differences between the plutocratic and democratic indices.

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Theory

The theory of the cost-of-living index, which underlies the consumer price index concept, is based on the observed preferences and implied welfare of a single individual, or a single household, if that household is assumed to behave as a cohesive decisionmaking unit. In practice, however, it is not possible for a government to produce a separate price index for each household in its population. Instead, statistical agencies construct an average, or representative index to measure the effects of price changes on the average or representative, household.

The CPI is the aggregate, representative measure of price change as experienced by households. It is based largely on the Laspeyres index formula and statistical samples of household expenditures, prices, and urban consumers in Metropolitan Statistical Areas.[3] For the CPI, the Consumer Expenditure Survey (CEX) collects information on a representative sample of U.S. urban households to determine their expenditure patterns. In addition, information on prices is collected from a sample of outlets and products based on their likelihood of being patronized and purchased, respectively. The overall CPI is then constructed by taking a weighted average of household information, and the result is a pluto-

cratic Laspeyres price index.

To illustrate this formally, one would first define the Laspeyres price index for each individual household, h, as:

$$(1) \qquad L_h = \sum_n S_n^h P_n,$$

where L_h is the index value for household h, S_n^h is the share of household h's total expenditures devolted to good n, and P_n is the market price for good n. It is assumed that all households face the same market price for goods and services. An aggregate Laspeyres index for a population is therefore, a weighted average of the price index values for all households in the population. If there are H households in the population, the aggregate index would look like:

$$(2) \quad L_H = \sum_{h=1}^{H} w_h \sum_n S_n^h P_n,$$

where w_h represents the weight given to the individual index for household h in computing the average.

The choice of the weighting scheme used to derive the aggregate price index is not prescribed specifically by economic theory. It depends upon the assumptions adopted about the social wefare function for the society whose index it represents.[4] If we decide to accord equal weight to each household in its representation in the aggregate index, then $w_h = 1/H$ for all households h and the aggregate price index follows the democratic formula. If we decide to weight each household in accordance to its total household expenditure, then the weights are determined by:

$$(3) \qquad w_h = E_h \Big/ \sum_h E_h,$$

where E_h is the total expenditure of household h. The plutocratic formula is formed by using this weighting scheme (3) with equation (2).

For the plutocratic formula, expenditure shares for each good, by all households, are treated as if they were those of one aggregate "super-household."[5] This is favorable because the index can be constructed from information just on the prices and mean expenditure shares of all households. In contrast, to produce a democratic index, one must first construct the price indices for each individual household, then average them to produce an aggregate index. This is far less practicable.

In the democratic index, the expenditure pattern of each household counts in equal measure in determining the population index; in essence, it is a case of "one household-one vote." In the plutocratic case, the contribution of each household's expenditure pattern is positively related to the total expenditure of that household, relative to other households—in essence, "one dollar, one vote." If all households, regardless of how much they spend in total, have the same expenditure pattern, then both formulas would give the same index number as a result. Also, if all prices change by the same amount, the two index formulas will give the same result (a trivial case). However, if expenditure patterns differ across households, then there is no reason to expect the democratic and plutocratic indices to provide the same numbers. Most importantly, if the expenditure patterns of households differ systematically according to how much they spend in total, then the differences between the democratic and plutocratic formulas is of more than academic interest.

It is reasonable to assume that household expenditure is strongly related to household income, at least relative to other households. More affluent households are likely to spend more in any given period than poorer households. Such relatively more well-to-do households are also more likely to spend a higher proportion of their total expenditure on different goods and services than are less affluent households, specifically on those goods that are not income-elastic or classified as "necessities" (for example entertainment and travel). In this situation, the democratic index may be more representative of the inflation experience of the less rich households, while the plutocratic index may be more representative of richer households.

Empirical experience

To assess the importance of the choice of a plutocratic, versus a democratic approach for the CPI, we start with a historical empirical analysis. We use the same data as those for the CPI, specifically, the Consumer Expenditure Survey (CEX), to provide the household expenditure weights and CPI item price indices for the price changes in goods and services. The CEX sample comprises the 1982 and 1984 households in the Interview survey. Households participating in the Interview survey provide information on their expenditures on various goods and services in four separate quarterly interviews. The Diary survey complements the Interview by collecting expenditure information on more detailed categories of goods and services, those which are purchased frequently, such as food. This survey comprises a different sample of households than the Interview participants, and it is administered in two weekly

Table 1. Price indices by major expenditure category, 1987–97

[1987=100]

Year	Food	Housing	Fuel/ utilities	House- furnishings	Apparel	Trans– portation	Medical	Entertain– ment	Other[1]
1988	104.1	103.8	101.4	102.2	104.3	103.1	106.5	104.3	106.6
1989	110.0	107.7	104.7	103.8	107.2	108.3	114.8	109.7	114.9
1990	116.4	112.5	108.3	105.8	112.2	114.3	125.1	114.9	123.7
1991	120.5	117.0	111.9	108.3	116.4	117.5	136.1	120.0	133.5
1992	122.2	120.4	114.4	110.2	119.3	120.0	146.1	123.4	142.7
1993	124.8	123.6	117.8	111.4	120.9	123.7	154.8	126.5	150.1
1994	127.7	126.8	119.2	113.0	120.6	127.4	162.9	130.2	154.5
1995	131.2	130.0	120.1	114.8	119.4	132.0	169.5	132.7	161.0
1996	135.4	133.8	123.8	116.4	119.1	135.7	175.4	136.8	167.6
1997	138.9	137.3	127.0	117.1	120.2	136.9	180.3	139.9	174.9

[1] Other includes personal care, education expenses, tobacco products, and legal and funeral expenses.

installments. For the CPI, information from the Diary survey is statistically raked into the expenditure share information from the Interview survey to calculate the expenditure weights. For example, while the Interview survey provides the expenditure share for all food at home, the Diary survey allows this share to be further disaggregated into the various categories of food items. While this works well for the CPI, a plutocratic method, the construction of an alternative, democratic index requires constructing household-level price indices and thus limits the analysis to the Interview sample and that level of detail.

In this empirical analysis, the total number of households is 18,984, and the study period encompasses 1987–97. By choosing 1987 as the reference period, we are able to observe that a few more detailed expenditure categories could be included that did not have separate item price indices in 1984. Beyond 1997, some item category definitions changed, which would have limited the level of detail as well. The total number of expenditure categories is 146. Unfortunately, there are no data available to determine whether there are differences in the prices paid for any goods and services across households. It is assumed that the same U.S. national urban average CPI prices apply to all the households in the sample.

While the household indices were constructed from 146 expenditure categories, it is difficult to get a sense of price change patterns from such a detailed list of item price indices. Thus, to provide a setting for the analysis, table 1 presents an overview of the price changes for the 1987–97 period (1987=100) by general expenditure category. As this table shows, the relative prices for fuels and utilities and house-furnishings increased most slowly, while those of medical care and other goods and services increased most rapidly. Overall, however, inflation rates were lower during the 1987–97 period than in other periods such as the 1970s and early 1980s.

Household-specific price indices were constructed for each household in the 1982 and 1984 CEX sample. These indices were then aggregated by both the plutocratic method and the democratic method (from the formulae in the previous section). The resulting aggregate index values for 1987–97 are presented in table 2, along with the percentage difference between the plutocratic index value and its corresponding democratic index counterpart.

Generally, it appears that there is very little difference between the two types of indices over the 1987–97 study period, with the democratic index usually slightly higher in value. The largest differences are about 1 index point, and occur from 1990 through 1992. The inflation rates for most commodities appear to be somewhat higher during this 3-year period, compared with other rates within the study period. Although in one year, 1995, that the plutocratic index value appears to exceed its democratic counterpart, there is no overall trend or divergence between the two index series. It is difficult to draw quantitative conclusions from the index values because the statistical significance of these results is not known. Qualitative conclusions, however, can be made.

The practical implications of using the plutocratic versus

Table 2. Plutocratic and democratic index values, (whole sample), 1987–97

[1987 = 100]

Year	Plutocratic	Democratic	Percentage difference
1988	103.76	103.84	–0.077
1989	108.38	108.90	–.480
1990	113.71	114.93	–1.073
1991	117.95	119.14	–1.009
1992	121.27	122.22	–.783
1993	124.95	125.57	–.496
1994	128.30	128.59	–.226
1995	132.05	132.03	.015
1996	135.61	135.92	–.229
1997	138.01	138.70	–.500

the democratic price index formula depend upon the extent of systematic differences in expenditure patterns across households and the patterns of price changes experienced by these households. Because the plutocratic index will likely be more representative of those households with higher total expenditures, it would be of interest to examine the differences between the plutocratic and democratic aggregations by population subgroups defined by different levels of total expenditure. Therefore, we divided the household sample into expenditure quintiles and constructed separate plutocratic and democratic indices by quintile. The lowest quintile (1) includes those households that are in the lowest 20 percent of the CEX sample, as ranked by total household expenditure. The highest quintile (5) is, therefore, the highest 20 percent of households in terms of expenditure. While each quintile includes the same number of households, the range and mean of total expenditures by quintile varies, as shown in the following tabulation:

Quintile	*Mean expenditure*	*Range of expenditure amounts*
1	$1,066.57	$6.00 – $1,737.13
2	2,389.00	1,737.14 – 3,069.69
3	3,863.32	3,069.80 – 4,730.88
4	5,933.02	4,730.99 – 7,522.17
5	13,195.87	7,522.20 – 89,561.12

This tabulation also shows the range of total expenditure values encompassed by each quintile varies from about $1,600 (quintile 1 through quintile 3) to a high of more than $80,000 in quintile 5. Doubtless there are a few "outlier" households in the highest quintile. However, because they are legitimate members of the sample and represent the very high-expenditure households in the population, they are not eliminated from this study.

The plutocratic and democratic index values by expenditure quintile are presented in table 3. The percentage difference between the plutocratic value and its democratic counterpart (based on the values in table 3) are provided in table 4. As for the sample taken as a whole, the differences between the plutocratic and democratic indices within each quintile are generally quite small. The largest differences appear in the first and fifth quintiles, which was expected in the latter case. In quintile 5, there are a very few households with very high expenditures, which therefore have a larger effect on the plutocratic index. In comparison, the democratic index within quintile 5 diminishes the disproportionate contribution that those households make to the index value. Still, while the democratic index for quintile 5 rises more quickly than its plutocratic counterpart, the differences are generally less than 1 index point. In other quintiles there is no consistent pattern; the plutocratic index value often exceeds the democratic index value. By comparing index values by index type across quintiles an interesting pattern emerges. For the plutocratic index, there is a general inverted U-shaped pattern, with higher index values in the middle three quintiles and lower values in quintile 1 and quintile 5. The cross-quintile pattern for the democratic index is different, with generally the lowest index values in the highest quintile, quintile 5. Again, the differences are quite small.

Past empirical studies have shown that differences in expenditure patterns based on household demographic attributes are generally not statistically significant and separate indices for different demographic groups do not necessarily better represent subgroups within larger groups.[6] For most *a priori* definitions of demographic groups, there is generally more variation across households within each group than there is across groups. Again, one should not draw quantitative conclusions from these results because the statistical significance of any differences observed in this analysis between quintile indices is unknown.

Empirical analysis relies upon observed information. In recent years (the study period), both overall inflation and variability of price changes relative to each other have been

Table 3. Index values by expenditure quintile,1987–97

[1987 = 100]

Year	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5	
	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic
1988	103.74	103.73	103.86	103.86	103.89	103.89	103.97	103.97	103.62	103.74
1989	109.32	109.35	109.19	109.19	108.99	109.00	108.90	108.90	107.74	108.04
1990	116.11	116.19	115.63	115.65	115.15	115.16	114.79	114.81	112.26	112.82
1991	120.06	120.09	119.90	119.91	119.51	119.52	119.14	119.17	116.41	117.02
1992	122.62	122.54	122.96	122.96	122.73	122.74	122.50	122.52	119.87	120.48
1993	125.28	125.12	126.08	126.06	126.05	126.05	126.08	126.09	123.89	124.52
1994	127.85	127.64	128.93	128.90	129.02	129.01	129.24	129.24	127.59	128.15
1995	130.84	130.60	132.14	132.11	132.37	132.36	132.87	132.85	131.68	132.27
1996	135.05	134.85	136.26	136.23	136.30	136.30	136.66	136.65	134.85	135.56
1997	138.09	137.82	139.36	139.34	139.31	139.31	139.47	139.47	136.72	137.58

Table 4. Percentage difference between plutocratic and democratic index, by year and quintile, 1987–97

Year	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
1987	0	0	0	0	0
1988	.00964	0	0	0	–0.116
1989	–.027	0	–.0092	0	–.033
1990	–.069	–.017	–.0087	–.017	–.499
1991	–.025	–.0083	–.0084	–.025	–.524
1992	.0652	0	–.0081	–.016	–.509
1993	.1277	.0159	0	–.0079	–.509
1994	.1643	.0233	.0075	0	–.439
1995	.1834	.0227	.0076	.0151	–.448
1996	.1481	.022	0	.0073	–.527
1997	.1955	.0144	0	0	–.629

smaller than those in other historical periods. Thus, price index values have exhibited very little change. If plutocratic and democratic indices do not differ much over the period of empirical observation, conclusions from an empirical analysis cannot be easily generalized and the sensitivity of the issue to more extreme experiences of price change has not been tested. In the context of the Laspeyres index, because of its fixed weight property, it is fairly straightforward to perform a simple sensitivity test of this issue. This is done by posing hypothetical scenarios of price change and assessing the resulting effects on the comparison of plutocratic and democratic index formulations.

Hypothetical scenarios

If the historical period of study does not provide much evidence of a difference between the plutocratic and democratic index alternatives, then what price change scenarios could be used to highlight this issue? Granted, it is impossible to predict what specific price regimes might occur in the future, or how consumer behavior might change and make the fixed-weight Laspeyres assumption untenable. It is also impractical to simulate large numbers of hypothetical price change scenarios and attempt to summarize them in a meaningful way. Nevertheless, it may be illuminating to simulate a few scenarios for price change, including a few extremes, and make a qualitative assessment of their effects.

Because the issue of plutocratic and democratic index differences is driven by differences in expenditure patterns among households, which are correlated with total expenditure (and, thus, likely income), we have framed this hypothetical analysis within this context. First, we pose several degrees of price change, from a decline of 10 percent to an increase of 500 percent. Using the observed relative prices for 1987 as the reference, we pose these hypothetical price change scenarios on the CEX sample in the previous analysis for two different groups of commodities and services, while all other prices are held the same (that is at the 1987 level).

Based on a survey of the empirical literature, and the observed expenditure shares by quintile in our CEX sample, we identify a set of commodities and services as "necessities" and "luxuries." Necessities are those goods and service categories that are expenditure (or income) inelastic. "Luxuries" are expenditure (and income) elastic goods. This is not a finely detailed, or by any means, a definitive categorization, but we have included the following items in the necessities group: food at home, shelter, fuels and utilities, motor fuel, vehicle maintenance and repair, tobacco products, and personal care. Among luxuries we include alcoholic beverages, food away from home, housefurnishings, and entertainment. These two groups are not mutually exhaustive because several categories of goods and services appeared to be ambiguous or their elasticities unknown, based on the existing literature. Any number of groupings of item categories is possible, even given this elasticity criterion; these groupings are intended to be illustrative.

While it may not be informative to provide the expenditure shares by 146 detailed categories, table 5 presents a summary for more aggregate categories by expenditure quintile. These shares generally corroborate the economic literature, with lower quintiles having higher shares of expenditures for food, housing, and fuels and utilities. Private transportation has a higher relative share for higher quintile groups because it includes not only motor fuels, and maintenance and repair, but also vehicle purchases themselves. Higher quintile groups also spend relatively more on entertainment and housefurnishings.

The index values for the hypothetical scenarios are presented in table 6 for the aggregate sample of households. The results in table 6 show the expected outcome that the democratic index will increase more rapidly than the plutocratic as the relative prices of necessities increase. It appears that the democratic index will exceed its plutocratic counterpart by 1 index point for every 10-percent change in prices for necessities. Thus, if those prices should rise by 100 percent, the democratic index will be 10 points higher, or 14 percent higher,

Table 5. Average expenditure shares, by expenditure quintile and commodity

Commodity	Quintile 1	Quintile 2	Quintile3	Quintile 4	Quintile 5
Food	0.302	0.294	0.271	0.268	0.241
Housing	.170	.185	.181	.157	.103
Fuels and utilities	.168	.170	.156	.156	.116
Furnishings	.033	.044	.049	.055	.073
Apparel	.057	.049	.053	.055	.069
Private transportation	.069	.105	.129	.150	.229
Medical care	.108	.072	.072	.071	.060
Entertainment	.025	.027	.031	.033	.050
Other[1]	.067	.055	.057	.055	.059

[1] Other includes personal care, education expenses, tobacco products, and legal and funeral expenses.

Table 6. Simulated price change scenarios for necessity and luxury items

Price change (in percent)	Necessities			Luxuries		
	Plutocratic	Democratic	Percent difference	Plutocratic	Democratic	Percent difference
0	100	100	0	100	100	0
–10	96.17	94.18	2.07	98.04	98.06	–.02
–5	97.58	97.09	.50	99.02	99.03	–.01
–1	99.51	99.42	.09	99.8	99.81	–.01
1	100.48	100.58	–.10	100.2	100.19	.01
5	102.42	102.91	–.48	100.98	100.97	.01
10	104.83	105.82	–.94	101.96	101.94	.02
15	107.25	108.73	–1.38	102.93	102.91	.02
20	109.67	111.64	–1.80	103.91	103.88	.03
50	124.17	129.11	–3.98	109.78	109.7	.07
100	148.34	158.21	–6.65	119.56	120.22	–.55
120	158.01	169.85	–7.49	123.47	123.27	.16
130	162.84	175.67	–7.88	125.42	125.21	.17
150	172.51	187.31	–8.58	129.38	129.09	.22
200	196.68	216.42	–10.04	139.11	138.78	.24
250	220.85	245.52	–11.17	148.89	148.48	.28
300	245.02	274.63	–12.08	158.67	158.18	.31
350	269.19	303.73	–12.83	168.44	167.87	.34
400	293.36	332.84	–13.46	178.22	177.57	.36
450	317.53	361.94	–13.99	188.00	187.26	.39
500	341.7	391.05	–14.44	197.78	196.96	.41

than the plutocratic index. The designated luxury goods group represents a smaller proportion of the average household's total expenditures than necessities, so the impact of radically changing its prices is much less. As expected, under these scenarios, the plutocratic index will rise more quickly than its democratic counterpart. The maximum difference, however, is less than 1 index point, or 0.4 percent, when luxury prices rise by the extreme of 500 percent.

To illustrate the index values for the hypothetical scenarios, we provide the values for the same scenarios by expenditure quintile for necessities and luxuries. Table 7 provides the corresponding differences between the plutocratic and democratic index values by expenditure quintile and price change scenario and table 8 provides the corresponding percentage differences.

In table 7 (top panel), the pattern of differences between index types across quintiles, is somewhat more interesting. In the lowest quintile, the plutocratic index exceeds the democratic, but by a very small amount. In the other quintiles, the democratic index exceeds the plutocratic index when prices for necessities rise, but again, the differences are very small. The largest divergence between index types is, as expected, within the highest quintile, quintile 5, but still, only 4 index points with a doubling of prices for necessities. In table 7 (lower panel), the pattern comparing index types across quintiles is the opposite of table 7 (top panel). The largest divergence is, again, in quintile 5, at about 1 index point for a doubling of prices for luxuries.

In some extreme cases, hypothetical scenarios give some indication of the maximum effects that price changes could impose on the comparison of plutocratic and democratic indices. However, it is the pattern of price changes, not the general level of inflation, which matters for this issue. In the empirical analysis (in the previous section), the democratic index exceeded the

plutocratic by about 0.6 points in 1997, when prices were less than 40 percent higher than the reference period. If the prices of only necessities were to increase by 50 percent, the simulated democratic index exceeds the simulated plutocratic index by 5 points. Because patterns of price change cannot be predicted, such analysis is an empirical matter.

Conclusions

This analysis examines the issue of the choice between the plutocratic ("one dollar-one vote") approach and the democratic ("one household-one vote") approach to constructing an aggregate price index for a society. Neither is favored by economic theory, but each incorporates different normative assumptions about the social welfare function. The extent to which the two types of index formulation will give different index values is an empirical issue; the divergence depends upon the systematic difference in household expenditure patterns, the patterns of price changes which occur, and the assumptions about household behavior which underlie the

Table 7. Simulated price changes for necessities and luxuries, by quintile

Price change (in percent)	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5	
	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic	Plutocratic	Democratic
Necessities:										
0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
–10	93.35	93.41	93.47	93.46	93.76	93.74	94.31	94.29	96.42	96.01
–5	96.68	96.70	96.73	96.73	96.88	96.87	97.16	97.14	98.21	98.00
–1	99.34	99.34	99.35	99.35	99.38	99.37	99.43	99.43	99.64	99.60
1	100.67	100.66	100.65	100.65	100.62	100.63	100.57	100.57	100.36	100.40
5	103.33	103.30	103.27	103.27	103.12	103.13	102.84	102.85	101.79	102.00
10	106.65	106.59	106.53	106.54	106.24	106.26	105.69	105.72	103.58	104.00
15	109.98	109.89	109.80	109.81	109.37	109.39	108.53	108.57	105.38	105.99
20	113.30	113.18	113.06	113.08	112.49	112.52	111.37	111.43	107.17	107.99
50	133.25	132.96	132.66	132.71	131.22	131.31	128.44	128.57	117.92	119.97
100	166.50	165.91	165.31	165.42	162.44	162.81	156.87	157.15	135.83	139.95
120	179.80	179.10	178.38	178.50	174.92	175.13	168.25	168.58	143.00	147.94
130	186.45	185.67	184.91	185.05	181.17	181.39	173.93	174.29	146.58	151.93
150	199.75	198.87	197.97	198.13	193.65	193.91	185.31	185.72	153.75	159.92
200	233.00	231.83	230.62	230.84	224.87	225.22	213.74	214.29	171.66	179.89
200	266.25	264.79	263.28	263.55	256.09	256.52	242.18	242.87	189.58	199.87
300	299.50	297.74	295.94	296.26	287.31	287.83	270.62	271.44	207.49	219.84
350	332.75	330.70	328.59	328.97	318.53	319.13	299.05	300.00	225.41	239.81
400	366.00	363.66	361.25	361.28	349.74	350.44	327.49	328.59	243.32	259.79
450	399.25	396.61	393.91	394.39	380.96	381.74	355.92	357.16	261.24	279.76
500	432.50	429.57	426.56	427.10	412.18	413.05	384.36	385.74	279.15	299.73
Luxuries:										
0	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
–10	98.23	98.17	98.23	98.23	98.06	98.07	97.85	97.86	98.08	97.98
–5	99.11	99.09	99.11	99.12	99.03	99.03	98.93	98.93	99.04	98.99
–1	99.82	99.82	99.82	99.82	99.81	99.81	99.79	99.79	99.81	99.80
1	100.18	100.18	100.18	100.18	100.19	100.19	100.22	100.21	100.19	100.20
5	100.89	100.92	100.89	100.88	100.97	100.97	101.08	101.07	100.96	101.01
10	101.77	101.83	101.77	101.76	101.94	101.93	102.15	102.14	101.92	102.02
15	102.66	102.75	102.66	102.65	102.91	102.90	103.22	103.21	102.88	103.03
20	103.55	103.66	103.55	103.54	103.89	103.87	104.30	104.28	103.84	104.04
50	108.87	109.16	108.87	108.84	109.71	109.67	110.75	110.70	109.60	110.11
100	117.74	118.31	117.73	117.68	119.43	119.34	121.49	121.41	119.20	120.22
120	121.29	121.97	121.28	121.22	123.31	123.21	125.79	125.69	123.04	124.27
130	123.07	123.80	123.05	122.99	125.25	125.14	127.94	127.83	124.96	126.29
150	126.61	127.46	126.59	126.53	129.14	129.01	132.24	132.11	128.80	130.33
200	135.49	136.62	135.46	135.37	138.85	138.67	142.98	142.81	138.40	140.45
250	144.36	145.77	144.32	144.21	148.56	148.34	153.73	153.52	148.00	150.56
300	153.23	154.93	153.19	153.05	158.28	158.01	164.47	164.22	157.60	160.67
350	162.10	164.08	162.05	161.89	167.99	167.68	175.22	174.92	167.20	170.78
400	170.97	173.24	170.92	170.73	177.70	177.35	185.96	185.62	176.80	180.89
450	179.84	182.39	179.78	179.58	187.42	187.02	196.71	196.33	186.40	191.00
500	188.71	191.55	188.65	188.42	197.13	196.69	207.45	207.03	196.00	201.11

Table 8. Percentage differences between plutocratic and democratic index for necessities and luxuries, by scenario and quintile

Price change (in percent)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Necessities:					
0	0	0	0	0	0
–10	–0.064	0.0107	0.0213	0.0212	0.4252
–5	–.021	0	.0103	.0206	.2138
–1	0	0	.0101	0	.0401
1	.00993	0	–.0099	0	–.04
5	.029	0	–.0097	–.0097	–.206
10	.0563	–.0094	–.019	–.028	–.405
15	.0818	–.0091	–.018	–.037	–.579
20	.1059	–.018	–.027	–.054	–.765
50	.2176	–.038	–.069	–.101	–1.738
100	.3544	–.067	–.228	–.178	–3.033
120	.3893	–.067	–.12	–.196	–3.455
130	4183	–.076	–.121	–.207	–3.65
150	.4406	–.081	–.134	–.221	–4.013
200	.5021	–.095	–.156	–.257	–4.794
250	.5484	–.103	–.168	–.285	–5.428
300	.5876	–.108	–.181	–.303	–5.952
350	.6161	–.116	–.188	–.318	–6.388
400	.6393	–.0083	–.2	–.336	–6.769
450	.6612	–.122	–.205	–.348	–7.089
500	.6775	–.127	–.211	–.359	–7.372
Luxuries:					
0	0	0	0	0	0
–10	.0611	0	–.01	–.01	.102
–5	.0202	–.01	0	0	.0505
–1	0	0	0	0	.01
1	0	0	0	.00998	–.01
5	–.03	.00991	0	.00899	–.05
10	–.059	.00983	.00981	.00979	–.098
15	–.088	.00974	.00972	.00969	–.146
20	–.106	.00966	.0193	.0192	–.193
50	–.266	.0276	.0365	.0451	–.465
100	–.484	.0425	.0754	.0658	–.856
120	–.561	.0495	.0811	.0795	–1.00
130	–.593	.0488	.0878	.086	–1.064
150	–.671	.0474	.1007	.0983	–1.188
200	–.834	.0664	.1296	.1189	–1.481
250	–.977	.0762	.1481	.1366	–1.73
300	–1.109	.0914	.1706	.152	–1.948
350	–1.221	.0987	.1845	.1712	–2.141
400	–1.328	.1112	.197	.1828	–2.313
450	–1.418	.1112	.2134	.1932	–2.468
500	–1.505	.1219	.2232	.2025	–2.607

index formula used to construct a household-level index.

This empirical and hypothetical analysis used data from the CEX and the CPI, at the greatest level of commodity disaggregation possible. The results show that there is little difference between the democratic and plutocratic index values for the 1987–97 period, and that the one index type need not always exceed the other. Only in extreme scenarios, in which price changes were measured for expenditures on inelastic goods, did the democratic and plutocratic index values show a difference between of about 1 index point for every 10-percent increase in the relative prices of these goods.

A complete examination of this issue would take into consideration other aspects for which empirical information is not presently available:

- Differences in price changes faced by different households, or different demographic groups of households, remains an empirically elusive issue. Unfortunately, data collected for the CPI do not identify the prices paid by survey households for the goods and services they purchase. It is possible that poorer households are restricted in their choice of outlets and, thus, prices they pay for goods, but there is no definitive empirical information on this.
- The treatment of quality change in durable goods can affect the choice of index type. This is especially true for those goods for which the purchase decision may be discrete

(not "how much," but, "do I buy one or not").[7]

- The level of detail at which commodities and services are defined for the CPI also does not allow a fine discrimination of which specific items within a goods category are being purchased by individual survey households. For example, expenditure shares can be derived for steak, but not the grade or the cut (filet mignon or top sirloin). In a very complex economy, such a level of detail would be extremely difficult to capture for price index computation. Yet, it may be at this level of detail that differences in expenditure patterns, and thus the experience of inflation, may differ across household groups.

- The assumption of a fixed weight index, or the choice of which index formula to employ that best describes a household's behavior when it tries to minimize the impact of price increases, can affect the comparison. The expenditure shares observed in a given sample of households during a given survey period might well be different from those of households during another period, under different relative prices and other economic conditions. □

Notes

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[1] The plutocratic index is an aggregate price index in which the relative level of total expenditures of each household provides the weights. For more information, see W. E. Diewert, "The Theory of the Cost-of-Living Index and the Measurement of Welfare Change," in W. E. Diewert and C. Montmarquette, eds., *Price Level Measurement* (Statistics Canada, 1983), pp. 163–233.

[2] The democratic index is an aggregate price index in which each household's expenditure patterns are equally weighted. For more information, see W. E. Diewert, "The Theory of the Cost-of-Living Index," pp. 163–233.

[3] See *BLS Handbook of Methods*, Bulletin 2490 (Bureau of Labor Statistics, April 1997), p. 167.

[4] The "social welfare function" is a formula that measures the aggregate level of welfare or satisfaction of a group of persons or households. For more detail on this general issue, see R. Pollak, "The Social Cost-of-Living Index," *Journal of Public Economics,* 1981, vol. 26, pp. 126–34.

[5] W. E. Diewert, "The Theory of the Cost-of-Living Index," pp. 163–233.

[6] R. T. Michael, "Variation Across Households in the Rate of Inflation," *Journal of Money, Credit, and Banking*, 1979, vol. 11, pp. 32–46; R. P. Hagemann, "The Variability of Inflation Rates across Household Types," *Journal of Money, Credit, and Banking*, 1982, vol. 14, pp. 494–510; and M. F. Kokoski, "Consumer Price Indices by Demographic Group," BLS Working Paper No. 167 (Bureau of Labor Statistics, April 1987).

[7] T. Erickson, "The Ambiguous Effect of New and Improved Goods on the Cost-of-Living," *Economics Letters,* August 2000, pp. 143–47.