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April, 2000

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Division of Price and Index Number Research

Abstract

Price indices are constructed to represent a population by using a sample of household expenditure information as weights. This expenditure information must be aggregated across households. In most cases, including the U.S. Consumer Price Index (CPI), the aggregation method used corresponds to a plutocratic index. Other types of aggregation, such as the democratic index, are also possible, and, in terms of economic theory, equally valid. In practice, the plutocratic approach is much more practicable, but it may provide a different measure of price change than the democratic index.

This paper 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 periods 1987-1997, and for simulated price change scenarios. The results show that there is very little difference between the two types of index, and that one index need not always exceed the other. In the simulated scenarios, even the extreme cases where prices changed only for expenditure-inelastic goods and services, the difference between the democratic and plutocratic indices was only about one point for every ten percent increase in the relative prices of these goods.

Introduction:

The theory of the cost-of-living index, which underlies the consumer price index, 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 be representative of the "average" or "representative" household.

In most cases, including the U.S. Consumer Price Index (CPI), the aggregation method used corresponds to a plutocratic index. Other types of aggregation, such as the democratic index, are also possible, and, in terms of economic theory, equally valid. In practice, the plutocratic approach is much more practicable, but it may provide a different measure of price change than the democratic index.

This paper 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 periods 1987-1997. The analysis constructs household-specific price indices for the households in the CEX Interview sample, using the U.S. national average CPI series for all these households at the most detailed level of commodity disaggregation possible for these data sources. Since this was a period of low inflation, the analysis was extended to include 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.

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 it is assumed to behave as a cohesive decision-making 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 in order to measure the effects of price changes on the average or representative, household.

In the US, the Consumer Price Index (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 expenditure, prices, and area population for urban areas. For the CPI, information is collected on a representative sample of US urban households to determine their expenditure patterns by using the Consumer Expenditure Survey (CEX). 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 plutocratic Laspeyres price index.

To see this more formally, one would first define the Laspeyres price index for each individual household, *h*, as follows:

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

where: L_h is the index value for household h, S_n^h is the share of household h's total expenditures devoted to good n, and P_n is the market price relative for good n. It is assumed that all households face the same market prices 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), below:

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

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 welfare function for the society whose index it is to represent. (See Pollak (1981) for more detail on this general issue.) 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 equation (3) below:

$$(3) \quad w_h = \frac{E_h}{\sum_h E_h} \,,$$

where: E_h is the total expenditure of household h. Using this weighting scheme equation (2) becomes the *plutocratic* formula.

The advantage of the plutocratic formula is that the expenditure shares for each good by all households are treated as if they were those of one, aggregate "super-household" (Diewert (1983)). This means that the index can be constructed from information just on the prices and aggregated mean expenditure shares of all households. To produce a democratic index, one must first construct the price indices for each individual household first, 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 differs 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. Richer households are likely to spend more in any given time period than poorer households. They are also more likely to spend a higher proportion

of their total expenditure on different goods and services than are poorer households, specifically those goods which are not income-elastic or "necessities" (e.g. food and shelter, as opposed to 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 an historical empirical analysis. We use the same data as for the CPI, specifically the Consumer Expenditure Survey to provide the household expenditure weights and CPI item price indices for the price changes in goods and services. The CEX sample comprises the 1982/84 households in the Interview Survey. For the CPI, both an Interview and a Diary survey are undertaken to provide the expenditure weights. 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 is administered in two weekly installments. For the CPI, information from the Diary is statistically raked into the expenditure share information from the Interview. For example, while the Interview provides the expenditure share for all food at home, the Diary 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 level of detail. The total number of households in this analysis is 18, 984.

The time period encompassed by the analysis is 1987-1997. By choosing 1987 as the reference period a few more detailed expenditure categories could be included which 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 period 1987-1997 (1987=100) by general expenditure category. As this table shows, the relative prices for fuels and utilities and housefurnishings increased most slowly, while those of medical care and other goods and services increased most rapidly. Overall, however, inflation rates were lower than in other periods such as the 1970s and early 1980s.

Table 1: Price Indices by Major Expenditure Category, 1987=100

Year	Food	Housing	Fuel/Util	Housfurn	Apparel	Transport	Medical	Entertnmt	Other
1987	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
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

Household-specific price indices were constructed for each household in the 1982/84 CEX sample. These indices were then aggregated by both the plutocratic method and the democratic method, following the formulae in the previous section. The resulting aggregate index values are presented in Table 2, below, along with the percentage difference between the plutocratic index value and its corresponding democratic index counterpart by year.

Table 2: Index Values, Plutocratic and Democratic, (whole sample), base=1987

Year	Plutocratic (P)	Democratic (D)	Percentage Difference
1987	100.00	100.00	0
1988	103.76	103.84	-0.077
1989	108.38	108.90	-0.480
1990	113.71	114.93	-1.073
1991	117.95	119.14	-1.009
1992	121.27	122.22	-0.783
1993	124.95	125.57	-0.496
1994	128.30	128.59	-0.226
1995	132.05	132.03	0.015
1996	135.61	135.92	-0.229
1997	138.01	138.70	-0.500

Generally, it appears that there is very little difference between the two types of indices over this study period, with the democratic index usually slightly higher in value. The largest differences are about one index point, and occur in years 1990 through 1992. The inflation rates for most commodities appear to be somewhat higher during this three-year period within the study period. In one year, 1995, it appears that the plutocratic index value exceeds its democratic counterpart. There is no overall trend or divergence between the two index series. Since the statistical significance of these results are not known, it is difficult to draw quantitative, rather than qualitative conclusions from the index values.

The practical implications of using the plutocratic versus 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. Since 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 have divided the household sample into expenditure quintiles and constructed separate plutocratic and democratic indices by quintile. The lowest quintile (Q1) includes those households which are in the lowest 20% of the CEX sample, as ranked by total household expenditure. The highest quintile (Q5) is, therefore the highest 20% 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 described in Table 3, below:

Table 3. Mean and Range of Total Expenditures by Expenditure Quintile

Quintile	Mean Expenditure	Range of Expenditure Amounts
Q1	$1066.57	$6.00- $1737.13
Q2	$2389.00	$1737.14- $3069.69
Q3	$3863.32	$3069.80- $4730.88
Q4	$5933.02	$4730.99- $7522.17
Q5	$13195.87	$7522.20- $89561.12

       As Table 3 shows, the range of total expenditure values encompassed by each quintile varies from about $1600 (Q1 through Q3) to a high of over $80,000 in Q5. Doubtless there are a few "outlier" households in the highest quintile. However, since 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 4A., where P= the plutocratic index and D= the democratic index. Table 4B. provides the percentage difference between the plutocratic value and its democratic counterpart, based on the values in Table 4A.

Table 4A: Index Values by Expenditure Quintile, base=1987

	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5	
Year	P	D	P	D	P	D	P	D	P	D
1987	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
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	168.04
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 4B: Percentage Difference between Plutocratic and Democratic Index, by Year and Quintile

Year	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
1987	0	0	0	0	0
1988	9.64E-03	0	0	0	-0.116
1989	-0.027	0	-9.2E-03	0	-55.968
1990	-0.069	-0.017	-8.7E-03	-0.017	-0.499
1991	-0.025	-8.3E-03	-8.4E-03	-0.025	-0.524
1992	0.0652	0	-8.1E-03	-0.016	-0.509
1993	0.1277	0.0159	0	-7.9E-03	-0.509
1994	0.1643	0.0233	7.75E-03	0	-0.439
1995	0.1834	0.0227	7.55E-03	0.0151	-0.448
1996	0.1481	0.022	0	7.32E-03	-0.527
1997	0.1955	0.0144	0	0	-0.629

As for the sample taken as a whole, the differences between the two types of index within each quintile are generally quite small. The largest differences appear in the first and fifth quintiles, not unexpected in the latter case. In Q5 there are a very few households with very high expenditures which therefore have a larger effect on the plutocratic index, while the democratic index diminishes their disproportionate contribution to the index value. Still, while the democratic index for Q5 rises more quickly than its plutocratic counterpart, the differences are generally less than an index point. In other quintiles there is no consistent pattern; the plutocratic index value often exceeds the democratic index value. 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 Q1 and Q5. The cross-quintile pattern for the democratic index is different, with generally the lowest index values in the highest quintile, Q5. 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 (Michael (1979), Hagemann (1982)) and separate indices for different demographic groups do not necessarily better represent subgroups within larger groups (Kokoski (1987)). For most *a priori* definitions of demographic groups, there is generally more variation across households within each group than there is across groups. Since the statistical significance of any differences observed here between quintile indices is unknown, one should not draw quantitative conclusions from these results.

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 smaller than 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 one might ask what price change scenarios would make this issue of practical importance. 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.

Since 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% to an increase of 500%. 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 (i.e. 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 which 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 in necessities the following: 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 since 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, and this is 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 for food, housing, and fuels and utilities. Private transportation, because it includes not only motor fuels, and maintenance and repair, but also vehicle purchases themselves, has a higher relative share for higher quintile groups. Higher quintile groups also spend relatively more on entertainment and housefurnishings.

Table 5: Expenditure Shares, Average, by Expenditure Quintile

Commodity	Quintile 1	Quintile 2	Quintile3	Quintile 4	Quintile 5
Food	0.302	0.294	0.271	0.268	0.241
Housing	0.170	0.185	0.181	0.157	0.103
Fuels/Utilities	0.168	0.170	0.156	0.156	0.116
Furnishings	0.033	0.044	0.049	0.055	0.073
Apparel	0.057	0.049	0.053	0.055	0.069
Private Trans.	0.069	0.105	0.129	0.150	0.229
Medical Care	0.108	0.072	0.072	0.071	0.060
Entertainment	0.025	0.027	0.031	0.033	0.050
Other	0.067	0.055	0.057	0.055	0.059

The index values for the hypothetical scenarios are presented in Table 6 for the aggregate sample of households. In Tables 7A and 8A we provide the index values for the same scenarios by expenditure quintile. Tables 7B and 8B provide the corresponding differences between the plutocratic and democratic index values by expenditure quintile and price change scenario. The results in Table 6 show the expected result 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 one index point for every 10% change in necessities prices. Thus, if necessities prices should rise by 100%, the democratic index will be 10 points higher, or 14% higher, than the plutocratic. 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 one index point, or 0.4%, when luxury prices rise by the extreme of 500%.

Table 6: Simulated Price Change Scenarios

	Necessities			Luxuries		
Price Change	P	D	% Change	P	D	% Change
0%	100	100	0	100	100	0
-10%	96.17	94.18	2.0692524	98.04	98.06	-0.0204
-5%	97.58	97.09	0.5021521	99.02	99.03	-0.010099
-1%	99.51	99.42	0.0904432	99.8	99.81	-0.01002
1%	100.48	100.58	-0.0995223	100.2	100.19	9.98004E-03
5%	102.42	102.91	-0.4784222	100.98	100.97	9.90295E-03
10%	104.83	105.82	-0.9443861	101.96	101.94	0.0196155
15%	107.25	108.73	-1.3799534	102.93	102.91	0.0194307
20%	109.67	111.64	-1.796298	103.91	103.88	0.0288711
50%	124.17	129.11	-3.9784167	109.78	109.7	0.072873
100%	148.34	158.21	-6.6536335	119.56	120.22	-0.552024
120%	158.01	169.85	-7.4931966	123.47	123.27	0.1619827
130%	162.84	175.67	-7.8788995	125.42	125.21	0.1674374
50%	172.51	187.31	-8.5792128	129.38	129.09	0.2241459
200%	196.68	216.42	-10.0366077	139.11	138.78	0.2372223
250%	220.85	245.52	-11.1704777	148.89	148.48	0.2753711
300%	245.02	274.63	-12.0847278	158.67	158.18	0.308817
350%	269.19	303.73	-12.8310859	168.44	167.87	0.3383994
400%	293.36	332.84	-13.4578675	178.22	177.57	0.3647178
450%	317.53	361.94	-13.9860801	188	187.26	0.393617
500%	341.7	391.05	-14.4424934	197.78	196.96	0.4146021

Table 7A: Simulated Price Changes, Necessities, by Quintile

Price Change	Quintile 1 P	Quintile 1 D	Quintile 2 P	Quintile 2 D	Quintile 3 P	Quintile 3 D	Quintile 4 P	Quintile 4 D	Quintile 5 P	Quintile 5 D
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

Table 7B: Percentage Differences Between Plutocratic and Democratic Index, by Scenario and Quintile, Necessities

Price Change	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
0%	0	0	0	0	0
-10%	-0.064	0.0107	0.0213	0.0212	0.4252
-5%	-0.021	0	0.0103	0.0206	0.2138
-1%	0	0	0.0101	0	0.0401
1%	9.93E-03	0	-9.9E-03	0	-0.04
5%	0.029	0	-9.7E-03	-9.7E-03	-0.206
10%	0.0563	-9.4E-03	-0.019	-0.028	-0.405
15%	0.0818	-9.1E-03	-0.018	-0.037	-0.579
20%	0.1059	-0.018	-0.027	-0.054	-0.765
50%	0.2176	-0.038	-0.069	-0.101	-1.738
100%	0.3544	-0.067	-0.228	-0.178	-3.033
120%	0.3893	-0.067	-0.12	-0.196	-3.455
130%	0.4183	-0.076	-0.121	-0.207	-3.65
150%	0.4406	-0.081	-0.134	-0.221	-4.013
200%	0.5021	-0.095	-0.156	-0.257	-4.794
250%	0.5484	-0.103	-0.168	-0.285	-5.428
300%	0.5876	-0.108	-0.181	-0.303	-5.952
350%	0.6161	-0.116	-0.188	-0.318	-6.388
400%	0.6393	-8.3E-03	-0.2	-0.336	-6.769
450%	0.6612	-0.122	-0.205	-0.348	-7.089
500%	0.6775	-0.127	-0.211	-0.359	-7.372

Table 8A: Simulated Price Change, Luxuries, by Quintile

Price Change	Quintile 1 P	Quintile 1 D	Quintile 2 P	Quintile 2 D	Quintile 3 P	Quintile 3 D	Quintile 4 P	Quintile 4 D	Quintile 5 P	Quintile 5 D
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 8B: Percentage Differences Between Plutocratic and Democratic Index, by Scenario and Quintile, Luxuries

Price Change	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
0%	0	0	0	0	0
-10%	0.0611	0	-0.01	-0.01	0.102
-5%	0.0202	-0.01	0	0	0.0505
-1%	0	0	0	0	0.01
1%	0	0	0	9.98E-03	-1E-02
5%	-0.03	9.91E-03	0	9.89E-03	-0.05
10%	-0.059	9.83E-03	9.81E-03	9.79E-03	-0.098
15%	-0.088	9.74E-03	9.72E-03	9.69E-03	-0.146
20%	-0.106	9.66E-03	0.0193	0.0192	-0.193
50%	-0.266	0.0276	0.0365	0.0451	-0.465
100%	-0.484	0.0425	0.0754	0.0658	-0.856
120%	-0.561	0.0495	0.0811	0.0795	-1.00
130%	-0.593	0.0488	0.0878	0.086	-1.064
150%	-0.671	0.0474	0.1007	0.0983	-1.188
200%	-0.834	0.0664	0.1296	0.1189	-1.481
250%	-0.977	0.0762	0.1481	0.1366	-1.73
300%	-1.109	0.0914	0.1706	0.152	-1.948
350%	-1.221	0.0987	0.1845	0.1712	-2.141
400%	-1.328	0.1112	0.197	0.1828	-2.313
450%	-1.418	0.1112	0.2134	0.1932	-2.468
500%	-1.505	0.1219	0.2232	0.2025	-2.607

In Table 7 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 when necessities prices rise, but, again the differences are very small. The largest divergence between index types is, as expected, within the highest quintile, Q5, but, still, only 4 index points with a doubling of necessities prices. In Table 8, the pattern comparing index types across quintiles is the opposite of Table 7. The largest divergence is, again, in quintile 5, at about one index point for a doubling of luxuries prices.

While in some cases extreme, these scenarios give some indication of the maximum effects that price changes could impose on the comparison of plutocratic and democratic indices. It is the pattern of price changes, not the general level of inflation, which matters for this issue. In the empirical analysis of the previous section, the democratic index exceeded the plutocratic by about 0.6 points in 1997, when prices were less than 40% higher than the reference period. If the prices of only necessities were to increase by 50% the simulated democratic index exceeded the simulated plutocratic index by 5 points. Since patterns of price change cannot be predicted, this leaves the issue as an empirical matter.

Conclusions:

The foregoing 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 and depends upon systematic difference in household expenditure patterns, the patterns of price changes which occur, and the assumptions about household behavior which underlie the index formula used to construct a household-level index. This empirical and hypothetical analysis used data from the Consumer Expenditure Survey 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 period 1987-1997, and that the one index type need not always exceed the other. Extreme scenarios for price changes for only expenditure-inelastic goods showed a difference between the democratic and plutocratic index values of about 1 index point for every 10% increase in the relative prices of these goods.

A complete examination of this issue would take into consideration other aspects for which empirical information are not, at present, available:

(1) 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. (2) 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"), (Erickson (1998)). (3) 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. 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. (4) The assumption of a fixed weight index, or the choice of which index formula to employ to best describe a household's behavior to minimize the impact of price increases, can affect the comparison. The expenditure shares observed in a given sample of households in a given survey period might well be different from those of households in another period, under different relative prices and other economic conditions.

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