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The Plutocratic Gap in the CPI: Evidence from Spain

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The plutocratic gap is defined as the difference between the inflation measured according to the current official consumer price index (CPI) and a democratic index in which all households receive the same weight. During 1992–97, the plutocratic gap in Spain averaged 0.055 percentage points a year. Since positive and negative gaps cancel out, however, the average absolute gap is significantly larger: 0.090 percentage points a year. For the purposes of accounting for the plutocratic gap, a 53-dimensional commodity space can be conveniently reduced to two dimensions: a luxury index and a necessities index. [JEL C43, D31, D63]

The review of the literature carried out by a U.S. Senate Commission headed by Michael Boskin (Boskin and others, 1996) identified several problems regarding the U.S. consumer price index (CPI) elaborated by the U.S. Bureau of Labor Statistics (BLS). The Boskin Commission focused on five sources of bias in the CPI and estimated that, on average, during the last few decades, the U.S. CPI has been overstating the inflation rate by 1.1 percentage points a year.[1] Despite the importance

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[1]This bias might seem small. When compounded over time, however, the implications for (i) the public deficit created through an indexed budget, (ii) the wage-bargaining process and the determination of the nominal interest rates in the private sector, and (iii) the measurement of the economic performance in real terms are little short of catastrophic.

of the Boskin Commission report,[2] some critics—for example, Pollak (1998), Deaton (1998), and Madrick (1997a and b)—point out some neglected topics and, in particular, the scant attention paid to distributional issues.

In the CPI context, the issues raised by the heterogeneity of the population are usually identified by asking "Whose cost-of-living index?," a question that is viewed in Pollak (1998) as encompassing three issues: "How many cost-of-living indices?"; "Beer or champagne?"; and "What type of group indices?" The first issue refers to whether we should have different indices for different groups: rich and poor, elderly and non-elderly, urban and rural, and so on. The second issue refers to the selection of the appropriate set of items, qualities, and outlets that are to be reflected in the index.

The third issue, which is the topic of this paper, originates with the nature of the CPI as a group index (Pollak, 1980). Given the commodity space and a household budget survey representative of the reference population, we could use each household's budget shares as the fixed weights for the construction of household-specific price indices. It has been known since Prais (1958) that the official CPI is the weighted average of such individual price indices with weights proportional to each household's total expenditures. Because richer households have greater weights than poor ones, Prais called the CPI a *plutocratic* price index. Is there a better alternative to this particular construction?[3]

In this paper, we suggest that the so-called democratic index, in which all households receive the same weight, is an approach worth pursuing. Thus, we define the *plutocratic gap* as the difference between inflation measured according to the current official CPI and according to a democratic index. One reason to pursue such an approach is that it is always interesting to know who suffers the greatest inflation—those households with the largest total expenditures or those at the bottom of the distribution. In the former case, we would say that prices have behaved in an anti-rich manner, and in the latter case, in an anti-poor manner. In the former (latter) case, we should expect mean inflation weighted by total household expenditures to be greater (smaller) than simple average inflation. Thus, the plutocratic gap would be positive or negative according to whether prices have behaved in an anti-rich or an anti-poor manner, respectively (Fry and Pashardes, 1986).

While the importance of the plutocratic gap depends crucially on its magnitude, it must be emphasized that the lack of access to lower-level price data will likely result in an underestimation of the real gap.[4] Our best estimate of the

[2] As Diewert (1998, page 56) puts it, "with a total budget of $25,000, Boskin, Dulberger, Griliches, Gordon and Jorgenson have probably written the most important measurement paper of the century in terms of its impact: Every statistical agency in the world is reevaluating its price measurement techniques as a direct result of their report and the widespread publicity it has received."

[3] As pointed out by Pollak (1998), the first two matters are given a cursory treatment in footnote 2 and on page 71 of Boskin and others (1996). The Boskin Commission never addresses the third problem directly, although Pollak selects some passages of its report that appear to reflect an implicit judgment that the CPI ought to be a plutocratic price index.

[4] Statistical agencies could compute household-specific price indices using prices taken at the maximum level of geographical disaggregation. In this case, analysts would be able to obtain the better estimates of the plutocratic gap. Nonetheless, given the data-collection practices currently in place in most countries, first-level indices can only be constructed on a plutocratic basis, so there is a portion of the real plutocratic gap that can not be recovered. See Chapter 8, "Whose Index? Aggregating Across Households," in Schultze and Mackie (2002) for a review of the practical difficulties involved in the construction of a democratic index in the United States.

plutocratic gap in Spain during the 1990s is 0.055 percentage points a year.[5] Averaging magnitudes of different signs also underestimates the real importance of this gap, however. The gap in specific years oscillates from a maximum of 0.150 percentage points to a minimum of –0.080 percentage points. The mean absolute gap is much larger, 0.090 percentage points. The gap depends negatively on the magnitude of the inflation in that subperiod. Finally, on the basis of total expenditures elasticities, a 53-dimensional commodity space can be conveniently reduced to two dimensions, consisting of a luxury index and a necessity index. The price behavior of these two types of good provides a convincing explanation of the oscillations observed in the plutocratic gap.

The rest of the article is organized as follows. Section I presents the empirical results on the plutocratic gap in Spain during the 1990s. Section II is devoted to examining the robustness of those results with respect to the time period and the use of weighted group indices with weights proportional to household size. Section III summarizes and discusses the political implications of our results in an indexed economy. Appendix I describes the construction of the modified Laspeyres index, and Appendix II, the data sources.

I. The Plutocratic Gap

In order to estimate the plutocratic gap (defined below), we need to construct a series of household-specific Laspeyres price indices. For that purpose, we use the following two pieces of publicly available information for Spain: the 1990–91 household-budget survey used to estimate the weights of the official CPI and a set of price subindices at a certain level of spatial and commodity disaggregation. Using this information, for each household h interviewed in a quarter τ during the 1990–91 period (τ = spring, summer, and autumn of 1990, and winter of 1991), we construct a series of modified Laspeyres statistical price indices,

$$\ell_t^h = \frac{\mathbf{p}_t \cdot \mathbf{q}_\tau^h}{\mathbf{p}_0 \cdot \mathbf{q}_\tau^h},$$

based on period 0 (winter of 1991), which takes as a reference the commodity vector $\mathbf{q}_\tau^h$ actually acquired during the interview quarter τ. (Appendix I describes the notation and the construction of the aggregate CPI. Appendix II describes the data sources and discusses issues regarding the definition of household expenditures.)

The period winter 1991–January 1998 will be divided in the seven subperiods shown in Table 1. For each household h, we define the inflation (or deflation) caused by the evolution of prices in a given subperiod by

$$\pi_t^h = \frac{\ell_t^h - \ell_{t-1}^h}{\ell_{t-1}^h}.$$

The distribution of individual inflation rates in each subperiod is denoted by $\boldsymbol{\pi}_t = (\pi_t^1, ..., \pi_t^H)$. For the entire period, we have $\boldsymbol{\Pi} = (\Pi^1, ..., \Pi^H)$ where $\Pi^H = (\ell_T^h - 1)$ and T refers to the last period available: January 1998.

[5] This amounts to about one third of the classical substitution bias estimated for the United States by the Boskin Commission.

The aggregate inflation for the population as a whole according to the plutocratic scheme is

$$PLUT_t = \frac{\sum_h \varphi^h \left(\ell_t^h - \ell_{t-1}^h\right)}{\sum_h \varphi^h \ell_{t-1}^h} = \frac{\sum_h \left(\varphi^h \ell_{t-1}^h\right)\left(\ell_t^h - \ell_{t-1}^h\right)/\ell_{t-1}^h}{\sum_h \varphi^h \ell_{t-1}^h} = \sum_h \psi_t^h \pi_t^h$$

where $\psi_t^h = \varphi^h \ell_{t-1}^h / \left(\sum_h \varphi^h \ell_{t-1}^h\right)$. For the democratic scheme,

$$DEM_t = \frac{\sum_h \left(\ell_t^h - \ell_{t-1}^h\right)}{\sum_h \ell_{t-1}^h} = \sum_h \xi_t^h \pi_t^h$$

where $\xi_t^h = \ell_{t-1}^h / \left(\sum_h \ell_{t-1}^h\right)$. Note that ψ_t^h is proportional to $\varphi^h \xi_t^h$. For the overall period from 0 to T, since $\ell_0^h = 1$, the weights simplify to φ^h and $(1/H)$. Consequently, we have

$$PLUT = \sum_h \varphi^h \left(\ell_T^h - 1\right) \quad \text{and} \quad DEM = \sum_h \left(\ell_T^h - 1\right)/H.$$

The plutocratic gap in the measurement of inflation in subperiod t will be defined by $G_t = PLUT_t - DEM_t$ and for the overall period by $G = PLUT - DEM$.[6] Notice that, as pointed out earlier, if price changes in subperiod t (or for the entire period) are relatively more detrimental to the rich—that is, if π_t^h (or Π^h) are greater for rich households than for poor households—then we expect the plutocratic mean of individual inflations to be greater than the democratic mean. In other words, G_t or G will be positive or negative, according to whether the price change in the corresponding time interval is, respectively, anti-rich or anti-poor.

If we denote by $E_{it} = (p_{it}/p_{i0})$ the elementary price indices (defined in Appendix I) and let x^h represent household h's total expenditures, so that $\overline{x}$ denotes average household total expenditures, then $\zeta = \mathrm{Var}(x^h)/\overline{x}$ is a measure of the inequality of household total expenditures. Further define $\beta_i = \mathrm{Cov}(x^h, w_i^h)/\mathrm{Var}(x^h)$ where w_i^h denotes household h's budget share for good i. Ley (2002) shows that the plutocratic gap may be written as

$$G_t = \zeta\, N \mathrm{Cov}(\beta_i, E_{it}). \tag{1}$$

Note that β_i is a rescaled covariance and therefore may be interpreted as a regression coefficient of the budget shares, w_i^h, on total expenditures, x^h. The plutocratic gap is thus determined by the dispersion of total household expenditures, measured by ζ, and the sample covariance between β_i and E_{it}. The sign of the plutocratic gap is determined by the covariance term. A positive covariance term means that the luxury goods relatively more favored by richer households experience higher than average inflation and, as a consequence, necessities experience lower

[6] Note that the inflation rate does not display temporal separability—that is, the inflation for a given period does not equal the sum of inflations for a partition of that period. If the inflation rate were defined instead as the log-price change, then temporal separability would hold but group separability would be lost.

Table 1. The Plutocratic Gap During the 1990s
(percentage points per year)

		Inflation		
t	Subperiods	Plutocratic	Democratic	Plutocratic Gap
1	Winter 1991 to 1992[1]	6.989	6.911	0.078
2	1992 to January 1993	5.394	5.244	0.150
3	January 1993 to January 1994	5.271	5.165	0.105
4	January 1994 to January 1995	4.621	4.701	–0.080
5	January 1995 to January 1996	4.079	4.130	–0.050
6	January 1996 to January 1997	3.180	3.090	0.090
7	January 1997 to January 1998	2.494	2.369	0.125
	Winter 1991 to January 1998	4.632	4.577	0.055
	January 1993 to January 1998, average absolute gap			0.090

Source: Authors' calculations.
[1]Winter 1991 is the average of January, February, and March of 1991.

than average inflation. Similarly, a negative covariance implies that necessities experience higher than average inflation while luxury goods experience lower than average inflation.

It should be emphasized that the size of the gap is an empirical matter and may vary substantially at different places at different times. In particular, findings for one country may have few implications for other countries with larger income inequality, more consumption heterogeneity, and different price dynamics (equation (1)).

The Main Findings

The first two columns of Table 1 show the plutocratic and the democratic means of both $\boldsymbol{\Pi}$ and $\boldsymbol{\pi}_t$, while the third column shows the mean difference. (All figures are expressed in percentage points per year.) Notice that the aggregate inflation rate keeps decreasing over time, from a high of 6.9 percent during the first subperiod to a low of 2.4 percent during 1997.

Three main findings are as follows. First, for the period as a whole, the estimated plutocratic gap, G, is positive and equal to 0.055 percentage points a year.[7] However, positive and negative gaps offset each other when averaged over the whole period. The mean absolute gap is much larger, 0.090. These figures could be compared with the overall upward bias for the Spanish economy, which—following the Boskin Commission procedures—we have estimated at 0.61 percentage points a year (Ruiz-Castillo, Ley, and Izquierdo, 1999).

Second, price behavior is not uniform over the entire period: G_t is negative during 1994 and 1995, indicating that during these two years prices caused relatively more damage to poorer households than to richer ones.

[7]This is approximately one-third of the substitution bias estimated by the Boskin Commission for the U.S. economy, which is 0.15 percentage points a year.

Table 2. The Plutocratic Gap Versus Inflation

(dependent variable: monthly plutocratic gap G_t, in percentage points)

	Sample (Adjusted)		
	1992:02–1998:01	1980:05–1991:12	1976:02–1981:03
Constant	0.035	0.072	0.124
	(3.80)	(5.95)	(3.54)
Inflation	–0.109	–0.115	–0.073
	(4.66)	(–9.17)	(–3.28)
Lag-12 autoregressive term	0.353	0.470	
	(3.10)	(6.19)	
$\bar{R}^2$	0.32	0.50	0.14
D-W	1.80	1.84	1.60
Ljung-Box *Q*(12)	3.63	14.64	13.19
Ljung-Box *Q*(24)	10.9	30.78	27.45
Number of observations	60	128	62

Source: Authors' calculations.
Note: The *t*-ratios are in parentheses.

Third, at monthly frequencies, the gap is negatively, albeit weakly, associated with the level of inflation. A regression of the monthly gap on monthly (plutocratic) inflation results in a significant negative coefficient, –0.11, and an $\bar{R}^2$ of 32 percent (Table 2).[8] The higher the inflation, the lower the estimated gap, suggesting that at higher inflation rates prices would tend to move more closely together.

In the next subsection, we will show that the gap decreases as the inflation of necessities increases. In addition, at monthly frequencies, inflation of necessities is very volatile and drives most of the movements in general inflation. Consequently, the regression of the gap on inflation produces this negative relationship.

An Economic Interpretation

Which goods are primarily consumed by the richer households? Ley (2002) shows that we can relate the parameter β_i in the expression of the plutocratic gap (equation (1)) to a measure of the elasticity of the demand for good *i* to total expenditures, η_i,

$$\beta_i = \frac{\bar{w}_i}{\bar{x}} \sum_h \theta^h \left(\eta_i^h - 1\right), \tag{2}$$

where $\bar{w}_i$ is the average expenditure share for good *i*, the weights are given by $\theta^h = (x^h - \bar{x})^2 / \left(\sum_h (x^h - \bar{x})^2\right)$, and η_i^h is the ratio of the percent deviation of household *h*'s consumption of good *i* with respect to its mean, divided by the percent deviation of total household expenditures with respect to its mean:

[8] Fourteen percentage points of the explained variance are due to the seasonal autoregressive term—that is, the $\bar{R}^2$ drops to 18 percent when the lag-12 autoregressive term is dropped.

$$\eta_i^h = \frac{\left(q_i^h - \overline{q}_i\right)}{\left(x^h - \overline{x}\right)} \frac{\overline{x}}{\overline{q}_i}. \tag{3}$$

Thus, for each household h, η_i^h can be interpreted as good i's total-expenditure elasticity. Moreover, for each good i, the overall-demand elasticity with respect to total household expenditures can be estimated by $\eta_i = 1 + (\overline{x}/\overline{w}_i)\beta_i$. Whenever $\beta_i > 0$, it follows that $\eta_i > 1$. If $\eta_i = 1$, then the plutocratic and democratic shares for good i are identical and the price behavior of this good cannot contribute to the plutocratic gap.

Although the Spanish statistical agency, the Instituto Nacional de Estadística, collects prices for 471 goods, we have access to price data only at higher aggregation levels. For instance, we can access national price data for only 110 aggregate goods, regional price data for 57 aggregate goods, or provincial price data for only 33 aggregate goods. Our calculations are based on 53 goods (21 food commodities at a regional level and 32 nonfood commodities at the provincial level). The boxplots in Figure 1 show the narrowing of the distribution of the η_is toward 1 as a result of aggregation (110 goods, 53 goods, and 19 goods). As noted before, if η_i is genuinely unity for a good at the lowest level of aggregation, it means that this particular good does not contribute to the plutocratic gap. However, when η_i artificially approaches unity owing to aggregation, then there is no chance for the researcher to recover it, regardless of the underlying contribution to the plutocratic gap of the goods included in this aggregate commodity. This lack of lower-level price data is a serious shortcoming for researching the topics in this paper. Consequently, the actual plutocratic gap could easily be substantially larger than our estimates.

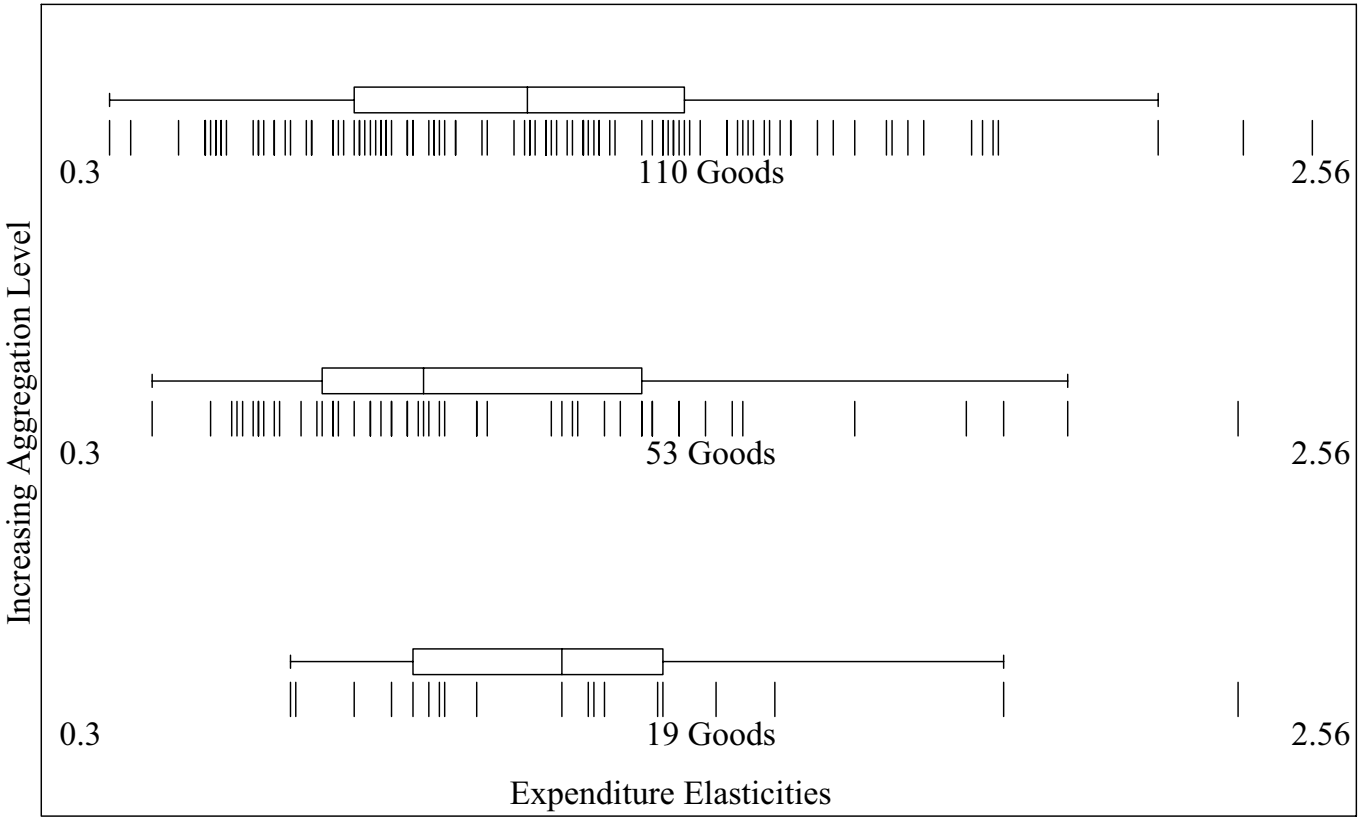
The initial 53 goods are classified into four groups of goods according to their total expenditure elasticity. Group I (necessities) includes 20 goods with an elasticity considerably smaller than 1 ($\eta_i < 0.9$); Group III (other) includes 5 goods with an elasticity relatively close to 1 ($0.9 < \eta_i < 1.1$); and Group IV (luxuries) includes 20 goods that have an elasticity significantly greater than 1 ($\eta_i > 1.1$). Group II is housing ($\eta_i = 0.9$), which requires special treatment, since it accounts for 20 percent of total household expenditures and expenditures on goods in Group I move in opposite directions.[9]

The price indices of the goods in each group are then aggregated into four indices: necessities, housing, other, and luxuries. In Table 3, for presentation purposes, the 53 goods are aggregated into 19 goods consistent with this classification. Table 3 shows the budget shares for the quintiles of the distribution of total expenditures.

Intuitively, we understand how the evolution of prices affects richer households compared with poorer ones depends upon whether luxury goods (43.86 percent of total expenditures) or necessities (30.36 percent of total expenditures) experience the greatest relative increase. For the entire period studied, the average inflation experienced by luxury goods is 4.33 percent a year while that of necessities

[9] As pointed out in Appendix II, the official CPI system based in 1992 includes only rental housing, resulting in a total housing share of only 7.17 percent of total expenditures. In this paper, by contrast, the housing share also includes the rental equivalent of owner-occupied housing and the rest of nonrental housing, using available rent data from the rental housing sector to approximate rents for owner-occupied housing. See Ruiz-Castillo, Ley, and Izquierdo (1999) for a justification of this procedure.

Figure 1. Boxplots of Expenditure Elasticities at Different Levels of Aggregation



Source: Authors' calculations.

Table 3. Budget Shares in the Distribution of Total Household Expenditures and Total Elasticities for 19 Aggregate Goods

		Budget Shares (*in percent*)							
		Quintiles						Elasticity	Inflation[1]
		Q1	Q2	Q3	Q4	Q5	All	η_i	π_i
1	Food and non-alcoholic beverages[2]	33.28	27.74	24.08	20.31	14.59	19.95	0.65	2.43
2	Utilities and house maintenance	7.65	6.10	5.14	4.34	3.23	4.36	0.64	2.41
3	Telephone and communication expenses	1.76	1.53	1.35	1.17	0.98	1.19	0.76	4.48
4	Therapeutic aides	0.31	0.29	0.25	0.26	0.21	0.24	0.83	2.64
5	Other food and alcoholic beverages[3]	5.23	5.40	5.25	4.87	3.98	4.62	0.87	3.45
	Group I: Necessities (1+...+5)	**48.23**	**41.06**	**36.07**	**30.95**	**22.99**	**30.36**	**0.68**	**2.67**
6	**Group II: Housing (6)**	**26.70**	**22.45**	**20.18**	**18.29**	**19.82**	**20.20**	**0.90**	**5.84**
7	Tobacco	1.45	1.74	1.77	1.74	1.30	1.54	0.92	11.31
8	Durables	1.04	1.05	1.08	0.98	0.90	0.97	0.93	1.20
9	Other in Group III	2.99	3.31	3.44	3.43	3.11	3.25	0.99	3.40
	Group III: (7+8+9)	**5.48**	**6.11**	**6.29**	**6.15**	**5.31**	**5.76**	**0.96**	**5.49**
10	Transportation services	0.86	0.91	1.04	1.17	1.21	1.12	1.15	5.73
11	Medical services and health insurance	1.16	1.31	1.36	1.57	1.77	1.57	1.20	5.25
12	Personal care goods and services	1.45	1.90	2.14	2.39	2.52	2.30	1.21	4.05
13	Clothing	4.64	6.19	7.36	8.15	8.57	7.79	1.23	2.76
14	Furniture, furnishings, and household items	1.17	1.62	2.03	2.26	2.69	2.28	1.34	3.67
15	Leisure, education, and culture	2.40	4.11	5.42	6.47	7.58	6.30	1.44	3.83
16	Restaurant, hotel, and tourist services	4.67	7.27	8.91	10.43	11.51	9.99	1.33	4.97
17	Domestic service	0.37	0.37	0.29	0.47	1.28	0.78	1.98	6.03
18	Transportation	2.87	6.70	8.91	11.70	14.74	11.54	1.55	4.87
19	Financial services	0.00	0.00	0.00	0.01	0.01	0.01	2.42	5.42
	Group IV: Luxuries (10+...+19)	**19.59**	**30.38**	**37.46**	**44.60**	**51.87**	**43.68**	**1.37**	**4.33**
	Total household expenditure	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**1.00**	**4.21**

Source: Authors' calculations.

[1]Average inflation rate 1992:02–1998:01, percent per year.

[2]Excludes beef, prepared seafood, and "other food products."

[3]Includes beef, prepared seafood, and "other food products."

Table 4. Regression of Plutocratic Gap on Inflation Rates of Aggregate Subindexes

(dependent variable: monthly plutocratic gap G_t, in percentage points)

	Coefficient	
Inflation rate of:		
Group I: Necessities	–0.073	–0.071
	(–23.4)	(–26.3)
Group II: Housing		–0.024
		(–4.5)
Group IV: Luxuries	0.081	0.098
	(12.2)	(14.3)
Lag-12 autoregressive term	0.474	0.450
	(6.2)	(4.9)
$\bar{R}^2$	0.920	0.940
D-W	1.87	1.76
Ljung-Box *Q*(12)	13.00	15.45
Ljung-Box *Q*(24)	17.73	24.70
Number of observations	60	60

Source: Authors' calculations.
Notes: Adjusted samples for 1993:02–1998:01. The *t*-ratios are in parentheses.

is only 2.59 percent a year. Housing experiences considerably greater inflation of 5.86 percent a year.

The inflation rates for luxury goods (Group IV) and necessities (Group I) are the main variables responsible for the positive sign of the plutocratic gap. Table 4 shows the results of regressing the monthly plutocratic gap G_t on the corresponding monthly inflation rates of the three price subindices for Groups I, II, and IV.[10] The coefficients have the expected signs and the results show that the inflation rates of the luxury goods and necessities explain most of the behavior of the plutocratic gap. Consequently, for the purpose of explaining the plutocratic gap during the period studied (1992:01–1998:01), the commodity space of 53 goods could be conveniently reduced to two aggregate goods that explain 92 percent of its variance. While the housing (Group II) coefficient is statistically significant, it contributes only 2 percentage points of the 94 percentage points of the explained variance when it is included in the regression (Table 4, column 2).

II. Robustness

The Time Period

In this section, we study the robustness of our results on the *G* trend in two different directions. First, we consider the period covered by the two previous Spanish CPI systems, which were used from August 1985 to December 1992

[10]The constant term, as well as the index for Group III, are not statistically significant. Inspection of the correlogram indicates existence of autocorrelation of order 12. After the inclusion of the lag-12 autoregressive term, there is no evidence of further serial correlation. The estimation is carried out using nonlinear least squares.

(base year = 1983) and from January 1977 to July 1985 (base year = 1976). (See the subsection on the "Data for 1970s and 1980s" in Appendix II for details.) The main findings are the following.

(a) From winter 1981 to winter 1991, we estimate that $G = 0.091$ percentage points a year, a positive gap larger than what we saw for the 1990s. During some subperiods, the gap is negative; and it oscillates from a maximum of 0.380 percentage points to a minimum, in absolute value, of 0.025 percentage points.
(b) From 1973–74 to winter 1981, the plutocratic gap is always positive and reaches very high annual maxima from 1976 to 1979, becoming equal to 0.833 percentage points in 1979. For the period as a whole, $G = 0.264$ percentage points a year, a gap whose size is equal to the sum of the classical substitution bias and the outlet bias according to the Boskin Commission.
(c) Spanish inflation during the second part of the 1970s and during the 1980s is considerably greater than during the 1990s. (The mean annual inflation from the midpoint of 1973 and 1974 to winter 1981 is 17.9 percent, and from winter 1981 to winter 1991 it is 8.5 percent.) As before, however, there is a negative relationship between the size of the aggregate inflation in a given subperiod and the plutocratic gap (Table 2).

Finally, to appreciate the variability of the plutocratic gap during the entire period considered in this study, Figure 2 shows the evolution of the annual G_t, t = January 1977, . . . , January 1998, as well as of the annual inflation rate for the same period.

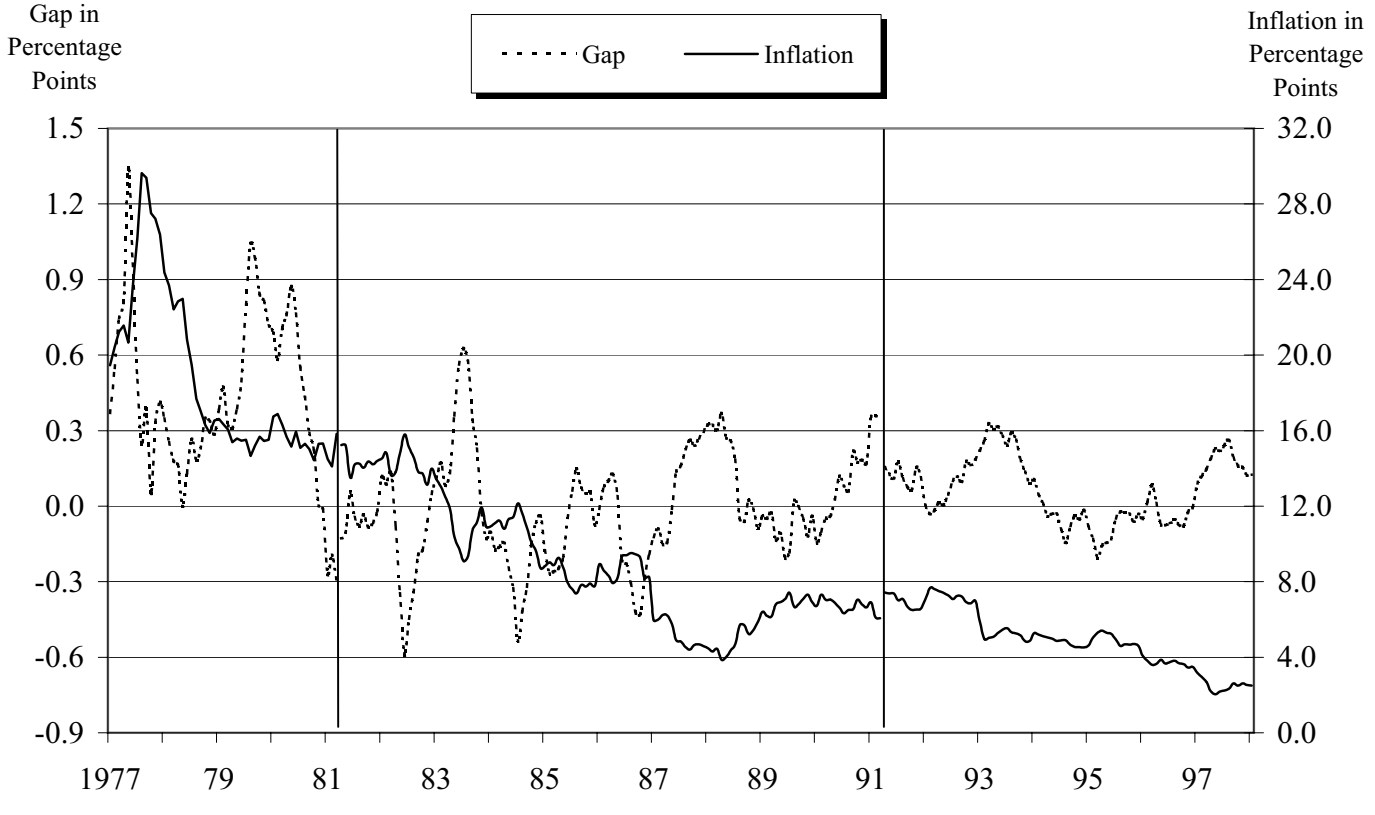
The Aggregation Scheme

Second, it is interesting to experiment with other aggregation schemes to map a distribution of household-specific inflations to an aggregate index. We therefore examine the consequences of estimating the inflation for the population as a whole as the weighted mean of individual inflations with weights proportional to household size (Nicholson, 1975).[11]

Table 5 presents mean total household expenditures at winter 1991 prices by household size in the 1990–91 household survey, as well as the mean annual inflation from the winter of 1991 to January of 1998 for that same partition. As in the majority of other countries, there is a positive association between total expenditures and household size. Therefore, weighting household inflation by household size should have a similar effect, although of a lesser magnitude, than weighting directly by total household expenditures as in the plutocratic scheme. Households with two, four, or more members have a mean annual inflation below that of the population as a whole, however, which works in the opposite direction. The net result is that the new gap—defined as the difference between the plutocratic and the household-size weighted mean—is equal to 0.088 percentage points a year. Since this figure is greater than the previous estimate of 0.055 percentage points a year for the plutocratic gap, it follows that, during this period, the second factor has had a greater impact than the first.

[11] Alternatively, one could define an aggregate price index that gives greater weight to poorer households. Given the results of this study, the corresponding gap in the measurement of inflation should be greater than the plutocratic gap. See Ley (2002) for several other possible aggregation schemes.

Figure 2. Spain: Interannual Plutocratic Gap and Inflation, 1977–98



Source: Authors' calculations.

Table 5. Average Household Expenditures at Winter 1991 Prices and Average Annual Inflation in the Partition, by Household Size

Household Size (*number of persons*)	Frequency Distribution (*percent*)	Average Expenditures (*pesetas*)	Average Annual Inflation (*percent*)[1]
1	9.99	1,147,338	4.842
2	22.30	1,795,808	4.625
3	20.77	2,559,993	4.634
4	24.97	3,091,959	4.611
5	13.22	3,277,244	4.623
6	5.44	3,516,374	4.627
7 or more	3.31	3,629,602	4.619
All	100.00	2,563,502	4.632

Source: Authors' calculations.
[1]Winter 1991–January 1998.

The same computations for the 1980s and 1970s lead to estimates for the new gap of 0.064 and 0.254 percentage points, respectively, *versus* estimates for the plutocratic gap of 0.091 and 0.264 percentage points, respectively. The fact that the new gap is smaller than the plutocratic gap indicates that the positive association between total household expenditures and household size dominates the size of the new gap during these two periods.

III. Concluding Remarks

In Spain, more than twenty-four thousand price movements are aggregated into a single index.[12] What are the distributional implications of such an aggregation scheme?

We propose examining two elements. First, whether price behavior in a given period hurts rich or poor households relatively more can be expressed in terms of a single scalar: the plutocratic gap. The plutocratic gap is the difference between inflation measured using the official CPI and inflation measured using an alternative group index in which all households are weighted equally. Second, we are able to reduce the size of the price space to only two dimensions: a luxury good and a necessity with considerably different total expenditure elasticities. Price behavior at this level provides an intelligible explanation of the sign and magnitude of the plutocratic gap, accounting for 92 percent of its variance.[13]

[12] A commodity basket of 471 goods is priced in each of the 52 provinces in order to construct the set of 24,492 elementary price indices that form the core of the current 1992 CPI system. A few goods are priced at the national level, however, slightly reducing this number.

[13] As we show in Ruiz-Castillo, Ley, and Izquierdo (2002a), the gap between the change in money income inequality and the socially relevant change in real income inequality is given by a term that captures the distributional role of price changes. The sign of this term is largely determined by the sign of the plutocratic gap. In consonance with the results of the present study, using the mean logarithmic deviation and a value of 0.5 for the parameter that reflects the economies of scale within the household, in Ruiz-Castillo, Ley, and Izquierdo (2002a) we find that this term is positive. Thus, we conclude that the decreases in real household expenditure inequality in Spain during the second part of the 1970s and the 1980s and 1990s have, respectively, been 9.07, 4.82, and 2.97 percent larger than the decrease in nominal household expenditure inequality owing to the distributive role of price changes during these periods.

In most countries, income taxes, public pensions, other public transfers, and minimum wages are revised in terms of a plutocratic CPI. Why should a dollar logic rather than a household or personal logic be followed in this matter?[14] The answer may lie in the widespread belief that the CPI represents an "average consumer." The consumer whose expenditure pattern is represented by the CPI, however, turns out to be less than fully representative. For the United Kingdom, Muellbauer (1976) found this "average consumer"—whose budget shares correspond to the official CPI—in the seventy-first percentile in the household expenditure distribution. For the United States in 1990, Deaton (1998) estimates that this consumer occupies the seventy-fifth percentile; for Spain during the 1990s, we find the CPI-represented consumer in the sixty-first percentile of the mean-adjusted household expenditure distribution.

Indexing by the current CPI has the following perverse effects that have not been sufficiently emphasized before. When prices behave in an anti-poor way—that is, when the plutocratic gap is negative—then spending on public programs, which primarily benefit the poor, is revised below what it would have been if a democratic group index had been used. (The reverse is true when prices behave in an anti-rich way.) Similarly, if the plutocratic gap is negative, then direct tax revenues would be larger than they would have been if a democratic group index had been used.

From this point of view, the current plutocratic formula can be conceptually criticized. Admittedly, this matter would be more important, the greater the size of the plutocratic gap (and, perhaps, depending on the sign of the gap). For Spain, we have shown that this gap (i) has had a positive sign over an extended period, (ii) presents a rather unstable pattern over the short run, and (iii) has been large during certain periods. There is relatively little information on this issue for other countries,[15] particularly in developing countries where changes in the relative prices of a few staples may cause havoc in the standard of living of the majority of the population. It may be advisable for their governments to estimate the plutocratic gap on a regular basis.

Statistical agencies could compute and make available, at least annually, sets of household-specific price indices. Given the set of (official) individual price indices, anyone could study the differential inflation suffered by various subgroups

[14] For a discussion of this issue, see Triplett (1983), Fry and Pashardes (1986), Griliches (1995), and Pollak (1998); and, in connection to the poverty line, see National Research Council (1995).

[15] For the United Kingdom, Carruthers, Sellwood, and Ward (1980) indicate that from January 1975 to January 1979 the democratic index has increased by around 0.1 percentage points a year faster than the official CPI. Fry and Pashardes (1986) also find that from 1974 to 1982 the plutocratic gap was negative. For 1975–76, Deaton and Muellbauer (1980) report that the inflation rate for the poor was around two percentage points higher than for the rich. Crawford (1996) finds, however, that between 1979 and the end of 1992, inflation for richer households was 0.16 percentage points higher than the average for all households. Newberry (1995) finds that the distributional effects were negligible and not significantly different from zero in Hungary and the United Kingdom during the 1980s. For the United States, Kokoski (2000) finds that from 1972 to 1980 the democratic and the plutocratic Laspeyres indices are rather close in value for most demographic groups, but, in general, the former exceeds the latter by 1 to 3 index points. Slesnick (1991) finds that cost of living indices are surprisingly insensitive to the choice of the form of the index. Garner, Ruiz-Castillo, and Sastre (1999) find evidence that the plutocratic gap during the 1980s indicates that prices behaved in a slightly anti-rich way. See Ley (2002) for a summary of studies.

of the population—something that needs to be considered before attempting to formulate a political solution to the issue of "How many cost of living indices?" Similarly, anyone would be in a position to estimate the difference in the measurement of inflation created by the use of the current plutocratic CPI, as opposed to other, politically interesting alternative group price indices. Note that reporting household-specific price indices goes beyond the simple reweighting of the CPI with group-specific weights as practiced by some statistical offices, since price information from the relevant geographical area for each household should be used—there is empirical evidence that geography is an important determinant of price variation.[16] Moreover, anybody could evaluate the distributional consequences of the methodological decisions of statistical offices. Take, for example, the Boskin Commission's analysis of the quality issue and the introduction of new products—surely the most debated and criticized part of their report. Various social critics—Madrick (1997a and b) and Deaton (1998), for instance—conjecture that new goods and goods affected by quality effects are disproportionately consumed by the rich. The impact of quality correction on household inflation could be investigated if household price indices were available from the statistical office.[17]

Finally, Muellbauer (1976) indicates that he does not regard the historical bias of inflation as the most important issue. Given that keeping down inflation is such an important policy goal, it is natural that any government should be very sensitive to the effects of policy change on the official CPI. Thus, the aggregate weights are the forces that drive government policies affecting relative prices and attempting to shift them in particular directions. Within this context, a set of publicly available household-specific price indices would allow both the government and others to evaluate, both ex ante and ex post, the distributional consequences of different policies.

[16] Cechetti, Mark, and Sonora (2000) study the dynamics of price indices for major U.S. cities using panel econometric methods and find that relative price levels in different cities revert to the mean at an exceptionally slow rate. The surprisingly slow rate of convergence can be explained by a combination of the presence of transportation costs, differential speeds of adjustment to small and large shocks, and the inclusion of nontraded goods prices in the overall price index. Alberola and Márques (1999) present similar evidence for Spain.

[17] In our context, this implies that the set of household-specific price indices after the correction of this bias should exhibit a smaller plutocratic gap. Are these critics correct? In Ruiz-Castillo, Ley, and Izquierdo (2002a), we have tested this idea by combining the structure of the bias for the U.S. economy with the consumer behavior of Spanish households as revealed in the 1990–91, 1980–81, and 1973–74 household surveys. The plutocratic gaps after the correction of the quality bias in the intervals (winter 1991 to January 1998, winter 1981 to winter 1991, and 1973–74 to winter 1981) are 0.035, 0.073, and 0.249 percentage points a year, respectively. Since, as we have seen, the plutocratic gaps before the correction are 0.055, 0.091, and 0.264 percentage points a year, respectively, we can conclude that there is some evidence indicating that the point made by those social critics is well taken.

APPENDIXES

I. The Modified Laspeyres Price Index

First, a word on notation. Subscripts will be used for goods, $i = 1,\ldots,N$, and time, $t = 1,\ldots,T$, while superscripts will be used for households, $h = 1,\ldots,H$. Boldface symbols denote vectors. Price vectors, $\mathbf{p}_t = (p_{1t},\ldots,p_{Nt})$, will be row vectors while quantity vectors, $\mathbf{q}_t^h = (q_{1t}^h,\ldots,q_{Nt}^h)'$, will always be column vectors; and '$\cdot$' will be used to denote the inner product: $\mathbf{p}_t \cdot \mathbf{q}_s^h = \sum_{i=1}^{N} p_{it} q_{is}^h$. Household h's budget shares will be denoted by w_i^h and its total household expenditures by x^h. Finally, uppercase symbols will be used for aggregation over households—for example, $X = \sum_h x^h$—while a bar over a symbol will denote an average quantity—for example, $\bar{x} = X/H$.

To understand the relation between a CPI and an aggregate Laspeyres statistical price index (SPI), we have to start by recognizing that statistical agencies partition the country's physical space into a set of J geographical areas, which we index by $j = 1,\ldots,J$. For every item i in every area j, during each period t (typically a month), statistical agencies collect price quotes for a number of previously determined item specifications in a certain predetermined sample of outlets. (This is where Pollak places the "beer or champagne" issue.) These price quotes are aggregated in elementary price indices E_{ijt}. (This is where the Boskin Commission places the "lower substitution level" problem. Neither this problem nor the "beer or champagne" issue should concern us in this study.)

Conceptually, we can view an elementary price index as the relative price of item i in area j in period t with respect to the base period 0—that is,

$$E_{ijt} = \frac{p_{ijt}}{p_{ij0}}.$$

Household budget surveys provide information, however, not on individual prices and quantities, which are often hard to define, but on individual expenditures in each good, $x_{i\tau}^h$; total household expenditures, $x_\tau^h = \sum_h x_{i\tau}^h$; and budget shares, $w_{i\tau}^h = x_{i\tau}^h / x_\tau^h$. For each area j, we observe the aggregate expenditures on each good, $X_{ij\tau} = \sum_{h \in j} x_{i\tau}^h$, and aggregate budget shares, $W_{ij\tau} = X_{ij\tau}/X_\tau$, where $X_\tau = \sum_h x_\tau^h$ is the aggregate total expenditure for the entire population. Under the assumption that all households living in the same area face the same prices, we can view observable household expenditures on item i by a household h living in area j and that is interviewed in period τ as the product of (generally unobserved) prices $p_{ij\tau}$ and (unobserved) quantities $q_{i\tau}^h$—that is, $x_{i\tau}^h = p_{ij\tau} q_{i\tau}^h$. Denote the vector of aggregate quantities actually purchased during the survey period τ by $\mathbf{Q}_\tau = (Q_{1\tau},\ldots,Q_{N\tau})$ where $Q_{i\tau} = \sum_j Q_{ij\tau}$ and $Q_{ij\tau} = \sum_{h \in j} q_{i\tau}^h$. Then we have

$$W_{ij\tau} = \frac{X_{ij\tau}}{X_\tau} = \frac{p_{ij\tau} Q_{ij\tau}}{\mathbf{p}_\tau \cdot \mathbf{Q}_\tau}.$$

If we define the plutocratic weights $\varphi_\tau^h = x_\tau^h / X_\tau$, then

$$W_{ij\tau} = \sum_{h \in j} \frac{x_\tau^h}{X_\tau} \frac{x_{i\tau}^h}{x_\tau^h} = \sum_{h \in j} \varphi_\tau^h w_{i\tau}^h.$$

If we have information on what we call the *adjustment factors* for each i, $A_{ij\tau} = (p_{ij\tau}/p_{ij0})$, then we can define the elementary price index based in period τ as

$$E_{ijt}(\tau) = \frac{E_{ijt}}{A_{ij\tau}} = \frac{p_{ijt}}{p_{ij\tau}}.$$

For each household h living in area j, the Laspeyres SPI that takes as a reference the quantity vector $\mathbf{q}_\tau^h$, is defined as

$$\ell\left(\mathbf{p}_t,\mathbf{p}_\tau;\mathbf{q}_\tau^h\right)=\sum_i w_{i\tau}^h E_{ijt}(\tau)=\frac{\mathbf{p}_{jt}\cdot\mathbf{q}_\tau^h}{\mathbf{p}_{j\tau}\cdot\mathbf{q}_\tau^h},$$

where $\mathbf{p}_{jt}=(p_{1jt},\ldots,p_{Njt})$.

At the aggregate level, let $\mathbf{p}_t=(p_{1t},\ldots,p_{Nt})$, where $p_{it}=\sum_j(Q_{ij\tau}/Q_{i\tau})p_{ij\tau}$. Then the aggregate Laspeyres SPI that takes as a reference the vector $\mathbf{Q}_\tau$ is given by

$$\begin{aligned}L\left(\mathbf{p}_t,\mathbf{p}_\tau;\mathbf{Q}_\tau\right)&=\sum_i\sum_j W_{ij\tau}E_{ijt}(\tau)=\frac{\mathbf{p}_t\cdot\mathbf{Q}_\tau}{\mathbf{p}_\tau\cdot\mathbf{Q}_\tau}\\&=\sum_i\left(\sum_j\sum_{h\in j}\varphi_\tau^h w_{i\tau}^h\right)E_{ijt}(\tau)=\sum_j\sum_{h\in j}\varphi_\tau^h\sum_i w_{i\tau}^h E_{ijt}(\tau)\\&=\sum_h\varphi_\tau^h\frac{\mathbf{p}_{jt}\cdot\mathbf{q}_\tau^h}{\mathbf{p}_{j\tau}\cdot\mathbf{q}_\tau^h}=\sum_h\varphi_\tau^h\ell\left(\mathbf{p}_t,\mathbf{p}_\tau;\mathbf{q}_\tau^h\right).\end{aligned}$$

For each good i in an area j, let $W_{ij}=p_{ij0}Q_{ij\tau}/(\mathbf{p}_0\cdot\mathbf{Q}_\tau)$. The CPI based on period 0 is an aggregate SPI defined by

$$CPI\left(\mathbf{p}_t,\mathbf{p}_0;\mathbf{Q}_\tau\right)=\sum_i\sum_j W_{ij}E_{ijt}=\frac{L\left(\mathbf{p}_t,\mathbf{p}_\tau;\mathbf{Q}_\tau\right)}{L\left(\mathbf{p}_0,\mathbf{p}_\tau;\mathbf{Q}_\tau\right)}=\frac{\mathbf{p}_t\cdot\mathbf{Q}_\tau}{\mathbf{p}_0\cdot\mathbf{Q}_\tau},$$

which is what the Bureau of Labor Statistics calls a *modified Laspeyres* aggregate price index (Moulton, 1996), with base year 0 and reference consumption patterns surveyed at τ.

Finally, for each household h in an area j, we now redefine the plutocratic weights as $\phi^h=(\mathbf{p}_{j0}\cdot\mathbf{q}_\tau^h)/(\mathbf{p}_0\cdot\mathbf{Q}_\tau)$ and the budget shares as $\omega_i^h=(p_{ij0}q_{i\tau}^h)/(\mathbf{p}_{j0}\cdot\mathbf{q}_\tau^h)$. Then, as before, aggregate expenditure shares can be expressed as a plutocratic-weighted mean of individual expenditure shares:

$$\sum_{h\in j}\phi^h\omega_i^h=\sum_{h\in j}\frac{\mathbf{p}_{j0}\cdot\mathbf{q}_\tau^h}{\mathbf{p}_0\cdot\mathbf{Q}_\tau}\frac{p_{ij0}q_{i\tau}^h}{\mathbf{p}_{j0}\cdot\mathbf{q}_\tau^h}=\frac{p_{ij0}Q_{ij\tau}}{\mathbf{p}_0\cdot\mathbf{Q}_\tau}=W_{ij},$$

and

$$\begin{aligned}CPI\left(\mathbf{p}_t,\mathbf{p}_0;\mathbf{Q}_\tau\right)&=\sum_i\sum_j W_{ij}E_{ijt}=\sum_i\sum_j\sum_{h\in j}\phi^h\omega_i^h E_{ijt}\\&=\sum_j\sum_{h\in j}\phi^h\sum_i\omega_i^h E_{ijt}=\sum_h\phi^h cpi\left(\mathbf{p}_{jt},\mathbf{p}_{j0};\mathbf{q}_\tau^h\right).\end{aligned}$$

II. The Data

Data for 1990s

The EPF (Encuesta de Presupuestos Familiares) collected by the Spanish statistical agency, INE (Instituto Nacional de Estadística), from April 1990 to March 1991 is a household budget survey of 21,155 household sample points representing a population of approximately 11 million households and 38 million persons occupying residential housing in all of Spain, including the North African cities of Ceuta and Melilla.

The INE collects elementary price indices (denoted by E_{ijt} in Appendix I) for a commodity basket consisting of 471 items in each of the country's 52 provinces under the present CPI system, based in 1992. For confidentiality reasons, the INE does not publish this information at the maximum disaggregation level. Instead, it publishes on a monthly basis price subindices for January 1993 to January 1998 for a commodity breakdown of 110 *subclases*, 57 *rúbricas*, 33 *subgrupos*, and 8 *grupos* at the national level; the *rúbricas*, *subgrupos*, and *grupos* at the 18 Autonomous Community level;[18] and the *subgrupos* and *grupos* at the 52-province level.

For any commodity breakdown, it is possible to reconstruct the official CPI series using an appropriately defined aggregate-budget-shares vector. Similarly, defining a budget-shares vector for every household in the 1990–91 sample, we can obtain a series of household-specific CPIs for any commodity breakdown. In principle, the only difference between alternative specifications of the commodity space is that the dispersion of the set of individual CPIs should be greater, the greater the disaggregation level of the price information used in their construction. Unfortunately, in spite of the fact that we used the same informational basis as the INE—namely, the 1990–91 EPF—we found several small discrepancies between our estimates of the aggregate-budget-shares vectors and those published by the INE—for the details, see Ruiz-Castillo, Ley, and Izquierdo (1999). Thus, the CPI series that we can reconstruct vary slightly, depending on the different commodity breakdowns characterizing the price information we use. Ruiz-Castillo, Ley, and Izquierdo (1999) find that the specification consisting of the 21 food *rúbricas* at the Autonomous Community level and the 32 nonfood *subgrupos* at the provincial level outperforms the rest of the alternatives according to various statistical and economic criteria.

It should be emphasized that our series of household-specific price indices defined over this 53-commodity space differs from the series underlying the official CPI in two ways. First, there are several practices incorporated in the official definition of total household expenditures for which we believe there are superior alternatives. We specifically refer to (i) the definition of housing expenditures for households occupying nonrental housing; (ii) the inclusion of imputations for home production, wages in kind, and subsidized meals; and (iii) the estimation of annual food and drink expenditures using all the available information on bulk purchases in the 1990–91 EPF. The joint impact of these modifications is important: because of them, the official CPI understates true Spanish inflation from 1992 to January of 1998 by 0.241 percentage points a year.

Second, it should be noted that the Spanish CPI is not the modified Laspeyres price index that takes as a reference the mean quantity vector actually acquired by the EPF households when they were interviewed in the 1990–91 survey period. The reason is that the INE does not use the adjustment factors $A_{ij\tau}$ defined in Appendix I (Ruiz-Castillo, Ley, and Izquierdo, 2002b). Fortunately, Lorenzo (1998) provides such factors for the 110 *subclases* at the national level. Using this information, for each household h interviewed in a quarter τ during the 1990–91 period (τ = spring, summer, and autumn of 1990, and winter of 1991), we construct a series of modified Laspeyres SPIs, $\ell(\mathbf{p}_t, \mathbf{p}_0; \mathbf{q}^h_\tau)$ based on period 0 = winter of 1991, that take as a reference the commodity vector $\mathbf{q}^h_\tau$ actually acquired during the interview quarter τ. If we normalize this series at prices of period 0 = 1992, we can obtain the conceptually correct CPI for household h—that is, $cpi(\mathbf{p}_t, \mathbf{p}_0; \mathbf{q}^h_\tau) = \ell(\mathbf{p}_t, \mathbf{p}_\tau; \mathbf{q}^h_\tau)/\ell(\mathbf{p}_0, \mathbf{p}_\tau; \mathbf{q}^h_\tau) = (\mathbf{p}_t \cdot \mathbf{q}^h_\tau)/(\mathbf{p}_0 \cdot \mathbf{q}^h_\tau)$.

[18] The 52 Spanish provinces are grouped in 18 Autonomous Communities.

Data for 1970s and 1980s

The EPFs that serve to estimate the official weights were conducted from April 1980 to March 1981 and from July 1973 to June 1974. These are household budget surveys strictly comparable to the 1990–91 EPF, containing 23,972 and 24,151 household sample units, respectively, that approximately represent a population of 9–10 million households and 34–37 million persons in 1980–81 and 1973–74, respectively. In this case, we do not depart from the official definition of household total expenditures, but, as before, we must take into account the fact that the Spanish CPI is not a modified Laspeyres price index.

We construct two series of appropriate household-specific price indices with the information provided by (i) the 1980–81 and 1973–74 EPFs; (ii) the official monthly price information for 106 and 88 *subclases* at the national level using the 1983 and 1976 bases, respectively; and (iii) a series of adjustment factors for 52 goods that constitute the minimum common denominator between the 58 official *rúbricas* and the 60 goods provided by Catasús and others (1986) for the first period and for the 5 goods at the national level provided by García España and Serrano (1980) for the second period.

Further details can be found in Ruiz-Castillo and others (1999) and Ruiz-Castillo, Ley, and Izquierdo (1999). All the datasets used in this paper, including the series of modified Laspeyres price indices, are available at *http://www.eco.uc3m.es/investigacion/epf.html*.

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