THE DISTRIBUTIONAL IMPACT OF INFLATION IN ITALY

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Paper prepared for the XXI Conferenza SIEP,
Pavia, September 24-25, 2009

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Abstract

The entrance of Italy in the Euro area in 2001 has risen a great debate about the perception of inflation on households' well-being. However, most of the debate has been macroeconomic in nature, involving how to measure the "correct" common consumer price index. Much less analysis has been carried out on the microeconomic side, i.e. on the consequences of inflation on "every" household given its own consumption path. This paper addresses this issue by calculating the distributional impact of inflation for Italian households from 1997 to 2007 using data on households' consumer expenditures. Both a descriptive and welfare analysis of price changes are performed, showing that inflation has followed an uncertain path of distributional impacts over time, yet with a large concentration of welfare losses in the period surrounding the introduction of the euro currency.

JEL Classification: D12, D60, H22, I31

Keywords: Redistribution, Inflation, Households, Welfare.

Introduction

After the entrance of Italy in the Euro area in 2001, the issue of the distributional impact of inflation has revived, mostly because of the wide perception that the change of currency could have worsened the position of the bulk of Italian households.[1] A great debate has arisen around the ability of the official Consumer Price Index (CPI) to fully reflect the 'true' impact of currency-induced inflation, especially because official estimates of the general price index have given no evidence of any structural break before and after the adoption of the Euro currency, despite a wide popular perception in that direction. In this paper, we investigate whether the lack of an "average" structural break is to some extent hidden in the presence of systematic distributional impacts of inflation in the period surrounding the introduction of the euro area, where distributional impacts directly derive from price changes of elementary items to deviate from CPI changes associated to different households' consumption baskets. To this purpose, we provide both a descriptive and a welfare analysis for the period 1997-2007, by using two complementary approaches.

First, a "synthetic" welfare-based approach has been applied to assess the welfare consequences of price changes. The framework used draws on the theory of marginal changes as applied by Newbery (1995) in the context of the evaluation of the distributional impact of price changes in Hungary. The basic idea is that inflation rates can originate relative price changes having selective effects on the purchasing power of households located at different points in the consumption distribution. Second, a complement to this analysis is the use of the theory of marginal dominance (a non-synthetic approach) – in its standard and sequential version – developed by Mayshar and Yitzhaki (1995, 1996) in the field of marginal indirect tax reforms and applied to the Italian VAT by Liberati (2001).

Results suggest that both from a welfare-based and a marginal dominance perspective, the distributional impact of inflation in Italy lacks a systematic pattern over the period of analysis. However, there is evidence that the period surrounding the introduction of the euro currency gives rise to a large cumulative welfare loss mainly involving poorest and larger – and therefore needier – households.

[1] Other studies on the same topic in various countries are Michael (1979); Hagemann (1982); Boskin and Hurd (1986); Crawford (1994); Creedy and Van de Ven (1997); Crawford and Smith (2002); Hobijn and Lagakos (2003); Lieu *et al*. (2004); Leicester *et al.* (2008); Baldini (2005); Chelli *et al*. (2009).

1. A descriptive analysis of the impact of price changes

1.1. General issues

It is well established that the general consumer price index would represent a satisfactory measure of the household cost-of-living only in the very special case in which households' consumption patterns would be identical to those adopted for the average measure. Usually, different households consume different goods in different proportions. Furthermore, prices of goods and services usually do not vary in the same proportion as the general price index. The contemporaneous occurrence of different consumption patterns and differentiated price increases would imply that different households may be attached household-specific inflation rates. Household-specific inflation rates are therefore a fundamental variable to calculate the distributional impacts of inflation. In order to achieve this outcome, detailed information on households' consumption and characteristics is required as well as price indices for a large number of elementary commodities.

This information, in Italy, is available in two different sources of data collected by the Italian Institute of Statistics (Istat). The first is the dataset reporting the Consumer Price Index (CPI) for the whole nation and measuring the price index (with base 1995) separately for 208 commodities that is the base for the calculation of the national inflation rate (for the representative basket of goods bought by households on the market for final use). The detail of this dataset also allows to build aggregate sub-indices for categories of goods and services.

The second dataset is the Household Expenditure Survey (HES), built on a yearly basis since 1968 and recording expenditures on goods and services on about 28,000 households resident in 480 municipalities. This dataset gives information on households' expenditure patterns including 279 goods and services, beyond information on their social, economic and geographical characteristics.[2]

Since CPI and HES give non-homogenous classification of commodities, the first step has been that of matching the information offered by the two surveys, to associate each consumption item in HES with its own price index in CPI. Given non-homogeneity and various cases in which a perfect correspondence cannot be achieved (see the details in Appendix A), this procedure yields an outcome in which 145 commodities are associated with corresponding price indices in the period 1997-1999 and 147 commodities associated with the same number of price indices in the period 2000-2007.[3] This homogeneous basket over time has allowed to take into account heterogeneity of consumption among households and to calculate, for each year, households specific inflation rates $P^h = \sum_i \omega_i^h p_i$ where P^h is the price index attached to a generic household h, $\omega_i^h = \frac{x_i^h}{X^h}$ is the expenditure share of each good on total household's expenditures X^h and p_i is

[2] Istat does not bear any responsibility for the elaborations presented in this paper.

[3] On this issue, see the methodology developed in Liberati (2007).

the price of the *i*-th commodity. One preliminary summary information on household-specific inflation rates can be obtained by taking the annual average across households of the estimated P^h. By this way, one can compare the path of the estimated average Household Price Index (HPI) with the official CPI calculated by Istat for the total population. The average P^h can have either a *democratic* or a *plutocratic* nature (see Prais, 1959 and more recently Ley, 2005 and Ley, 2002 for a description). The democratic method requires to calculate $HPI^D = H^{-1}\sum_h \sum_i \omega_i^h p_i = H^{-1}\sum_h P^h$, where H is the total number of households. In other words, the democratic price index HPI^D is the unweighted average of household-specific price indices.

Using the plutocratic method, instead, implies to weight household-specific price indices by the contribution of each household on total expenditure in the economy. In symbols, $HPI^P = X^{-1}\sum_h x^h \sum_i \omega_i^h p_i = X^{-1}\sum_h x^h P^h$. Unlike the previous case, in this case household-specific inflation rates will be "heavier" in the calculation of the mean when belonging to households with relatively high share of total expenditures.[4]

Figure 1 illustrates the difference between the official CPI and the estimated democratic and plutocratic household-specific price indices. It clearly emerges that CPI always underestimates HPI^D and HPI^P, with a progressively cumulative wider deviation over the period 1997-2007 and a final cumulative difference of about 5 percentage points. It implies that the average yearly inflation rate is estimated by CPI at 2.2 per cent, against about 2.6 per cent of either the democratic or the plutocratic price index.[5]

In what follows, and considering the narrow average gap between the estimated plutocratic and democratic indices, HPI^D will be taken as the standard average measure of inflation, if not differently stated. For simplicity of notation, the superscript will be dropped, and the democratic price index will be denoted simply by *HPI*.

1.2. *Commodity-specific inflation rates*

One fundamental determinant of HPI is the differentiation of inflation rates among commodities. In the absence of this differentiation (i.e. with all

[4] As also noted in Chelli *et al.* (2009), the weighting structure of CPI is based on data from National Accounting System. CPI is therefore expected to deviate from the calculated HPIs.

[5] It is also worth noting that the plutocratic method can either underestimate or overestimate inflation measured with the democratic method. The two methods can therefore affect the results for groups of households in different ways. On average, the difference is usually small, but as shown by Chelli *et al*. (2009), the gap can be quantitatively more important for specific categories of households. Hobijn and Lagakos (2003), however, state that differences between plutocratic and democratic indices seem negligible. See also Izquierdo *et al*. (2002) for Spain and Kokoski (2000).

commodities having the same inflation rates), all households would experience the same average inflation rate regardless of the specific consumption pattern.

Therefore, a preliminary issue to investigate is whether different groups of commodities have actually followed a different path of price increases over time, using averages of the official CPI for single items.

Table 1 shows commodity-specific inflation rates for 21 groups of goods ranked in a decreasing order by the overall price change between 2007 and 1997 (column A). The cumulative large increases are for tobacco (63.4 per cent, where the heavy tax burden also plays a role), travels (45.2 per cent) and fuels (39.5 per cent). On the other hand, the cumulative small increases are for cars (16.8 per cent), entertainment and cultural goods (16.5 per cent) and home durable goods (2.5). The liberalization process of public utilities seems to have impacted in a positive way in the communication sector, where prices have decreased by about 28.7 per cent in the period.

By disaggregating the period of observation in three sub-periods (from 1997 to 1999; from 1999 to 2003, corresponding to the period surrounding the entrance of Italy in the euro area; from 2003 to 2007) may help understanding the cumulative price increases. In particular, there is a striking difference between price increases in the period 2003/1999 and those in the previous and in the following period. In 2003/1999, large price increases are recorded on those goods having the largest (official) weight in the households' expenditures (food, food away from home and clothes – totalizing on average about 36 per cent of total households' expenditures on the list of goods of table 1). As a consequence, the average inflation rates are also higher in this period. In the following period, instead, large price increases are mainly attached to groups of goods with smaller (official) weights in total households' expenditures (fuels, personal items, public transport, domestic services), by this way cushioning their impact on the average inflation rates between 2004 and 2007. An analogous effect can also be appreciated in the previous period.

1.3. *Decile-specific inflation rates*

Higher or lower than average commodity-specific inflation rates give rise to different household-specific price indices with different households' consumption patterns. A natural dimension of investigation is whether inflation rates differ by income levels. This information is reported in table 2, showing the yearly change of HPI by deciles of equivalent expenditures, where these latter are taken as a proxy of households' permanent income (corrected by family size).[6] A discussion

[6] The equivalence scale applied for the estimation of HPI is 1 to the first adult, 0.7 to other adults and 0.5 to children. The use of the proxy of permanent income has required to distribute the purchase of durable goods in either a five-year or a three-year period regardless of the period in which they have been purchased. The ranking by equivalent expenditures, therefore, includes the flow of expenditures generated by durable goods under the hypotheses made.

of this table is best addressed by again dividing the total period of observations in three sub-periods.

It is worth noting that, with the exception of 2002, the second sub-period (1999-2003) has the highest average estimated HPI and that – again with the exception of 2002 – the path of inflation rates is significantly regressive across deciles. Outside this period, regressive and progressive paths alternate, as in the case of 2004 to 2007. A clearer picture is obtained by calculating the average yearly inflation rate by decile for the three sub-periods. This information is reported in the far-right panel of table 2. While moderately progressive in the first period (1999/1997) – with a range across deciles of 0.6 percentage points – and in the last period (2007/2003) – with a range of 0.3 percentage points –inflation has a regressive impact in the second sub-period (2003/1999) – with a range of 0.4 percentage points on average. There is, therefore, a first preliminary evidence that in the period surrounding the introduction of the euro, the "inflation tax" has initially hurt more low-income households, especially in those years where the (estimated) average inflation rate has been higher.

On the other hand, there is no evidence that inflation has systematically affected households in the lowest deciles when considering the overall period, as the years in which they experience a higher HPI almost compensate with the years in which they are associated to a lower HPI. Almost the same line of reasoning holds for the 10th decile, where again positive and negative deviations alternate across years. In the case of the 5th decile, instead, the decile-specific HPI is generally closer to the overall HPI, if one makes exception for 2007. In other words, as expected, the 5th decile is more "representative" of the general path of HPI than the 1st and the 10th deciles are.

Overall, table 1 gives no evidence of decile-specific persistence of deviations of HPI from the average inflation.[7] Of course, this may also be the effect of a wider dispersion of HPI within the first and the 10th decile, compared with what occurs within the 5th. Especially within the first decile, the standard deviation of HPI is between 15 and 50 per cent higher than the corresponding standard deviation in the 5th decile, depending on years.

A synthetic visual impact of how the cumulative effects of inflation have shaped the distribution of the household-specific price index can finally be obtained by looking at figure 2. The solid continuous line represents the kernel density estimation of household-specific P^h in 2007 had all households experienced the same average inflation rate equal to the overall HPI change from 1997 to 2007 (indicated by Ph07_PROP in figure 1). The tiny dashed line, instead, represents the actual distribution of the cumulative P^h in 2007, which is flatter and wider. This means that, having as a benchmark an equal inflation rate for all households, the actual changes of HPI have caused a non-proportional (redistributive) impact, with some households having a cumulative price index in 2007 well below the average and some other households having a cumulative price index well above the average.

[7] An analogous result for the United States is found in Hobijn and Lagakos (2003).

1.4. *Household-type-specific and region-specific inflation rates*

The calculation of HPI allows for other dimensions of analysis. In particular, it is of some interest in itself to understand whether inflation affects groups of households in a different way. To this purpose, the first panel of table 3 reports HPI changes by the main household types: singles, couples with no children, couples with children (with one, two and three or more children) and lone parents. Differentiation among households types are lower than differentiation by income levels. However, two points are worth noting. The first is that singles and couples with no children usually experience lower inflation rates, especially in the first two sub-periods. This means that the basket of goods typically consumed by larger households could be systematically associated to higher price increases than the basket of goods typically consumed by singles.

The second is that, among couples with children, couples with one child are usually hurt most by inflation, while couples with three or more children appear more "protected". This may be partially explained by the intuition that the first child adds more to the total cost of running a households, while some degree of economies of scale in rearing babies may help larger households to resist to larger price increases.

Overall, there is therefore a first preliminary evidence that larger households may have paid a relatively larger "inflation tax", an intuition that will be prove useful later in the paper, when the sequential marginal dominance will be addressed.

Finally, the impact of inflation may depend on where households locate their residence. Starting again from HPI, the second panel of table 3 shows the estimated territorial breakdown of inflation, considering four macro-areas: North, Centre, South and Islands. There is evidence that the average growth of inflation is rather homogenous across regions, if one makes exception for the first sub-period (1997 to 1999), where slightly higher increases are attached to North and Centre. In the second and third sub-periods the same occurs only in three years (in 2000, 2002 and 2005), therefore without any systematic territorial pattern.

1.5. The analysis of variance

A good synthesis of the descriptive analysis, keeping together the two factors affecting HPI – heterogeneity of consumption patterns and heterogeneity of commodity prices – may be carried out by using the analysis of variance over the period considered.

Following Hobijn and Lagakos (2003), the heterogeneity of household-specific inflation rates can be explained by two elements: the variation in expenditure patterns and the cross-strata variation of inflation. The first element measures the deviation of household's consumption share from the average consumption share, capturing heterogeneity by consumption preferences. This element is analysed performing an analysis of variance (ANOVA) of consumption shares in order to

highlight the two components of this source of heterogeneity: *within* and *between* variance. Analytically, the total variance of consumption shares (s^2) may be expressed by $s^2 = (N_t)\sum_{t=1}^{T}\sum_{h=1}^{h_t}(\omega_{hit} - \overline{\omega}_{it})^2 + (N_t)\sum_{t=1}^{T} n_t(\overline{\omega}_{it} - \overline{\omega}_i)^2$, where T is the number of periods considered, h_t is the number of households in year t, $N_t = \left(\sum_{t=1}^{T} n_t\right)^{-1}$ and ω_i is the consumption share of good i. The first term on the right hand side of the expression for total variance gives the *within-period* variance, capturing the variation in budget shares across households. The second term of the same expression, instead, gives the *between-period* variance, capturing the importance of the fluctuations of households' average budget shares over time.

Finally, the second element (the cross-strata variation of inflation) measures the deviations of inflation of each item from the general inflation index, capturing heterogeneity by prices.

Table 4 shows the results of the decomposition. Columns A and B reports the results of the decomposition in within- and between-variance in expenditures shares. It is worth noting that the *within-period* variance of shares is the main factor explaining the total variance, as it greatly outweighs the *between-period* variance for all groups of goods. In other words, consumption shares do not vary very much across periods, but they significantly vary among households. This differentiation of "preferences" is therefore potentially able to partially explain the wide dispersion of household-specific inflation rates, as already discussed in figure 2.

Looking at the second source of heterogeneity, there are two main findings to underline. First, the average inflation rate of the period is widely differentiated among items, which means that relative prices of goods (relative to the general price index) can move significantly over time. This may also partially affect the variability of household-specific inflation rates. Second, the variability of inflation rates of each item across periods is also non negligible, as can be observed by the estimated standard deviation.

Finally, columns E and F compare the official CPI weights and average expenditure shares of goods as estimates in our sample. As can be easily seen, it turns out that CPI weights may significantly either underestimate or overestimate actual consumption shares. A striking example of the first case is for food, where the official CPI weight is 15.6 per cent against an estimated average of about 28 per cent in HES. But similar examples may be found for home services and maintenance (about 8 per cent in CPI and 13.3 per cent in HES) and for fuels (4.7 per cent in CPI and 7.1 per cent in HES). Significant overestimation in CPI occurs, instead, for vehicles, health, food away from home and clothes.

2. The welfare impact of price changes

The descriptive analysis of the previous paragraph does not allow to derive a synthetic indicator of the distributional impact of inflation able to make a synthesis of the various dimensions analysed. To this purpose, in this section we will make recourse to a simple theoretical framework proposed by Newbery (1995) and applied to indirect tax changes by Liberati (2001). The framework is based on the theory of marginal tax reforms developed by Feldstein (1972) and summarised in Newbery and Stern (1987) and Ahmad and Stern (1991). The basic idea is that the distributional impacts of inflation may be treated as a sequence of small price changes. In this case, a first-order approximation can be used to derive the sign of the welfare change caused by the increase in price indices of individual goods over the period analysed.

In order to develop this idea, one must pay the price of assuming that government ranks distributional outcomes according to a utilitarian social welfare function, which in its most general form can be represented by:

$$W = W\left(v^1, v^2, ..., v^h, ..., v^H\right) \tag{1}$$

where $v^h = v^h\left(y^h, \mathbf{p}\right)$ is the indirect utility function of a generic agent *h*, *y* is income and **p** is the consumer price vector. From (1), the impact of a price change on social welfare can be easily derived as:

$$\frac{\partial W}{\partial p_i} = \sum_h \frac{\partial W}{\partial v^h}\frac{\partial v^h}{\partial p_i} = -\sum_h \beta^h x_i^h \tag{2}$$

where $\beta^h \equiv \frac{\partial W}{\partial v^h}\frac{\partial v^h}{\partial y^h}$ is the social weight attached to an increase in income of individual *h*, and the last equation in (2) is obtained by making use of the Roy's identity. An alternative way of expressing (2) is by using the concept of *distributional characteristic* of the good (ϕ). This indicator gives information on the distribution of consumption across individuals and it is expressed by:

$$\phi_i = \frac{\sum_h \beta^h x_i^h}{\bar{\beta} X_i} \tag{3}$$

where $\bar{\beta}$ is the average social weight and $X_i = \sum_h x_i^h$ is total consumption of the *i*-th good. As the numerator of (3) is equivalent to the impact of a price change on social welfare (expression 2), combining the two expressions gives rise to:

$$\frac{\partial W}{\partial p_i} = -\bar{\beta}\phi_i X_i \tag{4}$$

Expression (4) is an operational tool allowing to separate the two effects playing a role in the change of social welfare. On the one hand, this change depends on how much of the good subject to a price change is consumed; on the other hand, its impact on welfare depends on how its consumption is distributed across population. To this purpose, it can be easily seen that under the assumption that individuals have the same social weight ($\beta^h = \bar{\beta}$ for each h), the distributional characteristic would be equal to one, and the change in social welfare will only depend on the level of consumption. Alternatively, if all individuals consume the same amount of good $x_i^h = \bar{x}_i$ for each h, the distributional characteristic will again be equal to 1.

Expressions (3) and (4) require a method to calculate social weights. Following Newbery (1995), one can assume $\beta^h = \left(y^h\right)^{-\rho}$, where ρ is the coefficient of inequality aversion (a greater ρ implies a greater inequality aversion).[8] Expression (4) would therefore quantify what happens to social welfare when prices vary. In the standard case where all prices increase from year to year, expression (4) gives a loss in social welfare.

More interestingly, one can address the measurement of either the welfare gain or loss originated by price changes that move differently compared with the average inflation rate. Suppose that the prices of all goods move as the general inflation rate. In this case, the variability of consumption patterns across households would play no role, as whatever goods they consume, the measured inflation rate would be the same for all households. In other words, inflation, in this particular case, would not redistribute purchasing power among different households.

But if – as in the general case – prices of goods move differently with respect to the average inflation rate (some increase less and some increase more), different consumption baskets may give rise to a welfare gain or loss compared with the benchmark case in which all prices move in the same proportion. From a welfare perspective, therefore, it could be of interest in itself to calculate the differential impact of differentiated price changes with respect to a hypothetical benchmark of a proportional increase of all prices.

A straightforward way to implement this analysis is to calculate the redistribution of purchasing power originated by a *real relative price change*. Concentrating on the welfare impact of *relative price changes* amount to assume that money incomes varies proportionally to the general price index. According to this assumption one can indeed disregard the welfare change attributable to the change of real income for a given set of relative prices (real income is kept constant) and to isolate the impact of price changes. To this purpose, a real relative price (RRP) can be defined by the following ratio:

[8] In the practical application, welfare weights will be calculated using equivalent household consumption.

(5) $$\pi_i = \frac{p_i}{HPI}$$

where p_i is the price of the *i*-th good. Also in this case, the calculation of *HPI*, i.e. the weighted average of individual prices, can in principle either be plutocratic or democratic. Using $HPI^P = X^{-1}\sum_h x^h P^h$ and $P^h = \sum_i \omega_i^h p_i$ the plutocratic index can be defined as $HPI^P = \sum_i \sum_h \frac{x_i^h}{X} p_i = \sum_i \omega_i p_i$ (which is the version used in Newbery (1995), Liberati (2001) and in this paper), where $\omega_i = \frac{x_i}{X}$ is the aggregate share of each good in total expenditures.

The democratic scheme, instead, would require $HPI^D = H^{-1}\sum_h P^h$ (i.e. the average of the household-specific price indices). Using again the definition of P^h, $HPI^D = H^{-1}\sum_i \sum_h \omega_i^h p_i = \sum_i \overline{\omega}_i p_i$, where $\overline{\omega}_i = H^{-1}\sum_h \omega_i^h$ is the average budget share of good *i* across households.[9] The difference between the democratic and the plutocratic price index is therefore here characterised by the different budget share used to weight individual prices. In the plutocratic case, the relevant variable is the *aggregate* budget share. In the democratic case, the relevant variable is the *average of household-specific* budget shares.

Whatever the aggregate price index chosen, after a price change, the new RRP of each good could be defined by:

(6) $$\pi_i^* = \frac{p_i^*}{HPI^*}$$

where p_i^* is the new consumer price and HPI^* is the new general price index with fixed weights referring to the base period.[10] The period change of RRP can therefore be easily defined by $\Delta\pi_i = \pi_i^* - \pi_i$. This framework helps clarify in what sense a proportional increase of all prices represents a benchmark case for welfare analysis. If one normalize the RRP of the base year to 1 in (5) and assume that a price of a given good grows in the same proportion as the general inflation rate, the RRP in (6) will also be equal to 1 and the RRP change would be equal to zero. This means that the price of that good does not contribute to differential welfare gains or losses compared with the general price index.

If the price of the good would grow less than *HPI*, the RRP in the final year will instead be less than 1, and the RRP change would be negative. The meaning of this negativity is simple. By consuming that good, one has a welfare gain

[9] See, for example, Hobijn and Lagakos (2009).

[10] Technically, a Laspeyres index.

compared with the case in which the price would have increased by the same proportion as the *HPI*.

On the contrary, if the price would grow more than the general price index, the RRP in the final period would be higher and the RRP change would be positive. By consuming that good, now, one has an additional loss compared with the case in which that price would have increased by the same proportion as *HPI*.

The last step is to link the RRP approach to the welfare analysis. Using the indirect utility function and exploiting its homogeneity of degree zero in nominal prices and money income, one can replace its arguments by dividing all prices and money income for the general price index *HPI* to obtain the following:

$$v^h = v^h\left(Y^h, \pi\right) \tag{7}$$

where Y is households' real income. Accordingly, social welfare in (1) may be expressed as a function of these transformed indirect utility functions. Using (2) and (3) and generalising expression (4) to multiple price changes gives rise to the following operational formula for welfare analysis:

$$\Delta W = -\bar{\beta}\sum_i \phi_i X_i \Delta\pi_i \tag{8}$$

Expression (8) clarifies the essence of the welfare analysis. If all prices would change in the same way as the general price index, all $\Delta\pi_i$ would be equal to zero and the welfare change would also be zero. In other words, when all prices increase in the same proportion there is no redistribution of purchasing power among households originated by their different consumption baskets. This difference becomes relevant when prices – as in the standard case – change more of less proportionally than the general price index. In particular, if a price grows less than the general price index, $\Delta\pi_i < 0$ and $\Delta W > 0$ for that specific change. The opposite occurs when a price grows more than the general price index. The algebraic sum of gains and losses across households gives the total impact on social welfare for the society as a whole. In other words, each non-zero value of (8) can be interpreted as the gain or the loss of differentiated price changes compared with the benchmark case in which all prices would have grown in the same proportion.

Expression (8) can be further elaborated as a proportional change in welfare, i.e. $\Delta W / W$. For small changes of prices, W is the initial level of welfare characterised by the base level of real relative prices. In symbols $W = \bar{\beta}\sum_i \phi_i X_i \pi_i$. By first multiplying (8) by total expenditures X, and then dividing numerator and denominator of $\Delta W / W$ again by X, one can get the following expression:

$$\frac{\Delta W}{W} = -\frac{\sum_i \phi_i \omega_i \Delta\pi_i}{\sum_i \phi_i \omega_i \pi_i} = -\frac{\sum_i \phi_i \omega_i \Delta\pi_i}{\sum_i \phi_i \omega_i} \tag{9}$$

where the last term in (9) holds if all relative prices in the base year are normalised to one.

Finally, the use of (9) gives the opportunity to find sufficient conditions for a positive change in welfare, an approach that has been developed by Yitzhaki and Thirsk (1990), Yitzhaki and Slemrod (1991) as *marginal dominance*. Focusing on the numerator of (9), and using $\omega_i = \frac{x_i}{X}$ and the definition of the distributional characteristic in (3) one can write $\Delta W = -X^{-1}\sum_h \beta^h \sum_i x_i^h \Delta\pi_i$. Now, define $dB^h = -\sum_i x_i^h \Delta\pi_i$. Then, $\Delta W = -X^{-1}\sum_h \beta^h dB^h$. Since β^h are non-increasing with income social weights, a sufficient condition for $\Delta W \geq 0$ is $\sum_{k=1}^{h} dB^k \geq 0$ for $h = 1,...,H$. It means that by progressively cumulating the changes attached to every household over a rank by welfare level (e.g. equivalent income), the non-negativity of the cumulated sum over the whole range would unambiguously identify a social welfare improvement regardless of the specific expression of social weights, an approach that will be used later in the paper to complement the welfare analysis

3. Empirical findings

3.1. Comparing distributional characteristics

Some preliminary details on the possible impact of inflation on consumers' welfare can be gained by looking at one important indicator, i.e. the distributional characteristics. The top graph of figure 3 reports the path of the distributional characteristics (see formula (3)) for 2007 (the latest available year) of the 147 goods included in the analysis ranked by decreasing level at $\rho = 1$ for three levels of inequality aversion ($\rho = 0.5, \rho = 1$ and $\rho = 2$) and plotted against the cumulative budget share of the same goods (again ranked by $\rho = 1$). For the calculation of the distributional characteristics, a normalisation of social weights has been chosen, such that $\overline{\beta} = 1$.

If the distributional characteristics were all the same for all goods (either because consumption of all goods is equally spread across population or because social weights were all equal to 1), the graph would be a horizontal straight line. Therefore, the decreasing path observed at the various degree of inequality aversion means that different commodities are differently consumed by different households. The higher the degree of inequality aversion used, the steeper is the curve in figure 3, signalling that commodities consumed mainly by richer households deserves less relevance.[11] In figure 3, one can also identify that the ranking of goods may change when changing the degree of inequality aversion,

[11] Distributional-insensitive social weights can be easily obtained by setting $\rho = 0$.

and this especially occurs at $\rho = 2$, as represented by the non-monotonic segments of the graph.

Since the path of the distributional characteristics is a rough indicator of inequality in consumption, it is of some interest to verify whether this inequality has changed over time. To this purpose, for the same degree of inequality aversion $\rho = 2$, the central graph of figure 3 reports the path of the distributional characteristics in the two extreme years of the analysis (1997 and 2007). Although the position of specific commodities has widely changed over time (as inferred by the non-monotonic path of 1997 when superimposed on the budget share of goods ranked according to $\rho = 2$ in 2007), the overall shape of the distribution remains remarkably unchanged. The correlation between distributional characteristics at $\rho = 2$ in 1997 and 2007 is very high (0.96), even though some commodities (especially durable goods) have changed place in the general ranking. Overall, there is no significant evidence of a large shift in the consumption pattern over time.

It is therefore of some interest to understand whether distributional characteristics are somehow related to the change of RRP calculated in (5) and (6). This correlation, if any, would give some preliminary indication of the possible impact of inflation on both poorer and richer households. If RRP changes would be positively correlated with distributional characteristics, one could expect a negative impact of inflation, as higher prices would impact on commodities consumed mostly by poorer households. The opposite would hold if RRP changes would be negatively correlated with distributional characteristics. The bottom graph of figure 3 clearly shows that RRP changes are hardly correlated with distributional characteristics both in 1997 and 2006 (and almost the same occurs in the other years not reported in figure 3), as high and low RRP changes are associated to both high and low distributional characteristics. Inflation may therefore have an impact on different goods that is not clearly interpretable in distributive terms. Moving towards a welfare analysis could therefore improve our knowledge of the overall distributional impact of price changes.

3.2. Welfare changes

By applying the methodology discussed in section 2, one can get a synthetic indicator of the overall welfare impact of price changes occurred in the period 1997-2007. However, since that methodology performs better if small changes in prices are evaluated, the strategy has been that of measuring the welfare impact in every two consecutive years of the period. This implies that each welfare impact of a given year is measured taking as a base the prices of the previous year. The absence of a panel structure does not allow to follow the same households over the whole period. On the other hand, the attempt to get additional information compared with that obtained by the descriptive analysis of section 1 has also discouraged from grouping households over time.

According to the theoretical framework, welfare changes have been calculated for three levels of inequality aversion. Table 5 shows the results of the welfare analysis, reporting the estimated proportional changes in welfare estimated according to formula (9). The changes occurring in 2000, 2001, 2003 and 2006 are all characterised by a welfare decreasing impact of RRP changes (particularly pronounced in 2001) for all levels of inequality aversion. In all cases, the welfare loss is also positively related to the degree of inequality aversion, implying that the adverse distributional impact has been more significant for households in the lowest part of the income distribution, by this way giving normative content to the result already obtained in table 2. This suggests that most of the years surrounding the entrance of Italy in the Euro area were associated to a redistribution of purchasing power that is negative for social welfare. Some of these losses have been compensated, over the period, by the positive welfare impact estimated for all other years, even though comparable welfare gains for poorest households appear only in 2004 and 2005.

In order to get more evidence on this latter point, the previous framework has been adjusted to accommodate a poverty analysis. This would help locate the position of the welfare change. For comparability of results, the method used is consistent with the social welfare theoretical model and it has been implemented by setting $\beta^h = 0$ for all households above the poverty line (assumed equal to 50 per cent of the median equivalent expenditures). The bottom panel of table 5 shows that the sequence of the signs is almost equivalent to those of the top panel, with the interesting caveat that the price change occurred between 2007 and 2006 is now negatively signed in the lowest part of the income distribution. However, the entrance of Italy in the euro area does not seem path-breaking for the sequence of price changes, as negative and positive signs emerge both before and after the event.

3.3. The analysis of marginal dominance

A further investigation on the welfare impact of RRP changes is based on the marginal dominance approach. As discussed in section 2, this approach does not allow to get a synthetic indicator as in the case of table 5, rather it investigates sufficient conditions for welfare improvements on the whole relevant interval. When a RRP change is considered, the sufficient condition $\sum_{k=1}^{h} dB^k \geq 0$ for $h = 1,...,H$ is calculated. Just recall that this expression gives the partial cumulated sums, over households, of household-specific total impact of RRP changes. Non-negativity of all partial cumulative sums assures that the loss of an additional household is lower than the cumulative net benefit of all preceding households in the social rank. This would imply that social welfare increases. To some extent, the marginal dominance has a link with the Dalton (1920) principle of transfers, according to which a given income transfers from a richer to a poorer households would diminish inequality.

By construction of RRP changes, our application of the marginal dominance implies that $\sum_{h=1}^{H} dB^h = 0$, i.e. society as a whole does not lose or gain by RRP changes. Yet, RRP changes may cause redistribution of purchasing power, if assessed against the benchmark of a redistributive-neutral impact of proportional increases of all prices.

Figure 4 illustrates the outcome of the marginal dominance calculated as a sequence of RRP changes in each year. The figure has three panels, corresponding to the sub-periods defined in section 1. In all graphs, cumulated changes are normalised with respect to the absolute value of the maximum observed cumulated change, the reason why the scale of the graph extends from -1 to +1. This implies that the relevant information of the graph is the shape and the position of the lines (either in the positive or the negative quadrant) and not their relative heights.

The top graph shows the outcome in the first sub-period, where two changes are considered (1998 over 1997 and 1999 over 1998). In both cases – and with the exception of some noise at the top of the expenditure distribution – the sufficient condition for a welfare improving change are verified, as the cumulated sum always lies on the positive quadrant in both years. It is worth recalling that this does not mean that all households gain from the price change, as can be appreciated by the fact that a negative slope of each line identifies which households are bearing a welfare loss. In aggregate, however, welfare gains are cumulatively higher and redistribution of purchasing power occurs from richest to poorest households.

The central graph of figure 4, instead, clearly depicts the situation surrounding the entrance of Italy in the euro area. With the exception of price changes occurred between 2002 and 2001, all changes are distributionally adverse, as the corresponding lines lie in the negative quadrant of the graph. It means that the poorest households cumulate welfare loss more rapidly than welfare gains and that a redistribution of purchasing power has been carried out from poorer to richer households. This graph strongly confirm the synthetic indicator elaborated in table 5, by extending the negative welfare impact to a larger class of social welfare function implied by the use of the marginal dominance approach, i.e. regardless of the exact specification of welfare weights introduced instead for the calculation of table 5.

Finally, the bottom graph of figure 4 shows the most recent welfare performance of inflation. In this case, a negative welfare impact is traceable only with regard to the price change occurred between 2006 and 2005. All other changes are positive and satisfy sufficient condition for welfare improvement. There is therefore a strong characterization of the impact of inflation on Italian households in the period observed, with the most problematic period being that surrounding the introduction of the euro currency.

3.4. The sequential marginal dominance

The standard marginal approach gives useful information on the impact of inflation on households. Yet, it is not able to distinguish which household types have either suffer or benefited most of welfare gains or losses. A remedy to this shortcoming is to introduce a *sequential marginal dominance approach*. Following Atkinson and Bourguignon (1987), social ranking of households can be set by considering two dimensions of welfare, income and household size. In the standard marginal dominance approach, these two dimensions usually collapse into the equivalent income (or expenditure), i.e. a measure of income normalised by some equivalence scale to take into account family size.

With the sequential approach, a set of sufficient conditions for welfare improving can be derived by considering $\sum_{h\in H(\bar{x},\bar{n})} dB^h \geq 0$, where $H(\bar{x},\bar{n}) = \left\{h \middle| x^h \leq \bar{x}, n^h \geq \bar{n}\right\}$, $\forall \bar{x}$, $\forall \bar{n}$.[12] This condition is developed by sequentially considering groups of households with increasing levels of needs. For our purposes, households have been split in five groups: more than five members; more than four (therefore including previous households), more than three, more than two, more than one and singles. The dominance condition has then been sequentially checked by ranking households by their *total* expenditures rather than by their *equivalent* expenditures. As before, non-negativity of the resulting curve would imply a welfare-improving RRP change, while the opposite would hold in the presence of negative dominance.

In line with the previous analysis, figure 5 contains three graphs corresponding to the three sub-periods for larger households (three or more members). Some important insights for the welfare analysis emerge. In the top graph, for example, it is shown that the welfare-improving condition obtained in figure 4 for the corresponding period is violated for the price change occurred between 1999 and 1998. In this latter case, indeed, there is evidence of a cumulated loss. It means that the positive welfare impact obtained when considering all households must be mainly imputed to singles and households with two members (mainly couples without children), which might not be a distributional desirable improvement to the extent that larger households are thought to be the neediest ones. When considering only larger households (the bulk of households with children), the gain turns out to be a loss, by this way reducing the normative content of the welfare gain measured in figure 5.

In the central graph, some caveats can also be highlighted. While the negative dominance obtained for the total number of households in 2000, 2001 and 2003 is confirmed when confining the attention to larger households, the positive impact of 2002 is not unanimously agreed by all social welfare functions. Indeed, the sufficient condition is violated at the very top of the expenditure distribution, implying that social welfare functions with higher degree of inequality aversion are likely to positively evaluate this welfare change. It also implies that the overall

[12] See Mayshar and Yitzhaki (1996).

positive welfare impact of the price change occurred in 2002 has interested larger and relatively poorer households, with households from about the seventh decile onwards cumulating welfare losses eventually originating a crossing at the 9th decile.

Finally, the bottom graph of figure 5 also introduces some amendments to the general conclusions obtained in figure 4. In particular, the price change occurred between 2005 and 2004 is not unanimously agreed by all social welfare functions when considering larger households. As a whole, this group of households experience a welfare loss, again signalling that the bulk of welfare gains must be concentrated on singles and small households (two members). By using the approach of sequential marginal dominance, therefore, helps qualify that welfare losses are particularly concentrated among poorest and larger households, while welfare gains are particularly concentrated among singles and smaller households.

3.5. A long-run perspective

An aggregate synthesis of yearly changes so far discussed can be implemented by enlarging the perspective of the marginal dominance analysis. To this purpose, three methods may be employed. Along the lines of the welfare analysis of Section 2, one can simply compare the outcome of the dominance by considering the whole period 1997-2007, by alternatively using either the initial (1997) or the final year (2007) as the base year.

By setting the base year to the initial year of the period analysed and assessing the total RRP change of 2007 over 1997 against the same baseline amounts to calculate a Laspeyres index. In symbols, for each good *i*, one can have a sequence of $\Delta\pi_i = \left(\pi_i^{07} - \pi_i^{97}\right)$ with weights ω_i^{97}. For each household *h*, this gives rise to an aggregate Laspeyres-based dB^h.

Since the use of the Laspeyres index becomes less satisfactory when the base year is far distant from the final year, (as for the overall period), a second way to aggregate the information is to replicate the analysis using a Paasche version of the index, where the total RRP change is assessed by using the consumption baskets of the final year. This second method is therefore equivalent to calculate $\Delta\pi_i = \left(\pi_i^{07} - \pi_i^{97}\right)$ with weights ω_i^{07}. For each household *h*, this gives rise to an aggregate Paasche-based dB^h.

The comparison between Laspeyres-based and Paasche-based marginal dominance would allow to appreciate the impact of the adjustments in the consumption baskets and, therefore, to check for the robustness of the results. Since both methods are based on the consideration of only two points in time, both aggregations would disregard the information on what happens to consumption paths *within* the end points. To remedy this shortcoming, the marginal dominance approach can be roughly adapted to *cumulate* the whole sequence of yearly changes calculated in the previous section. This is the third way to give a synthesis of the impact of inflation over the whole period, i.e.

algebraically summing all changes for households at the same point in the social ranking over the years and then cumulating the aggregate changes over all households as required by the standard marginal dominance approach. [13]

This third method amounts to use the sequence of $\Delta\pi_i = \left(\pi_i^t - \pi_i^{t-1}\right)$ with weights ω_i^{t-1}, where t is the final year of the period considered. In this case, however, we first calculate $\theta^h = \sum_t dB_t^h$ and then their cumulated sum, then checking whether $\sum_{k=1}^{h} \theta^k \geq 0$ for $h = 1,...,H$, which is the standard marginal dominance requirement. This gives rise to a unique marginal dominance cumulating the impact of all RRP changes in the period.

The top graph of figure 6 shows the results of the three methods, again by normalising all cumulative welfare changes by their highest absolute value. This again implies that meaningful comparisons must consider only the position of the lines (either in the positive or in the negative quadrant) rather than their absolute values.

A first general observation is that the result obtained when using the Laspeyres-based marginal dominance (a positive welfare-increasing outcome) is reversed when considering the Paasche-based marginal dominance, at least for a large number of households. The *aggregate* welfare change captured by Paasche is indeed negative until around the ninth decile, yet welfare gains are evident for households from the sixth decile onwards (a positive slope). When considering the different consumption structures, the Paasche-based marginal dominance gives evidence that the poorest households may have found harder to avoid the aggregate burden of inflation. Technically, no unambiguous welfare conclusions can be drawn from the path of the Paasche-based marginal dominance (crossing at the top of the expenditure distribution), but if the interest would lie in what happens at the lowest part of the income distribution, the aggregate change is neatly welfare-decreasing, at least for social welfare functions giving more weight to poorest households.

Remarkably, when considering the *cumulative* change, the path is very similar to the outcome of the Paasche-based marginal dominance, again with the poorest households cumulatively penalised by inflation.[14] Looking at the bottom graph of figure 6 qualifies the outcome of the cumulative change, by showing that the path is entirely driven by what happened around the introduction of the euro currency. Since the only negative dominance is attached to that sub-period (the other two showing cumulative welfare gains), it must be that the negative impact of inflation (yet mitigated within the period by the welfare improving price change of 2002) has greatly outweighed the welfare gains calculated both before and after that period.

[13] As the HES does not include a panel, we cannot follow the same households over time. Hence, to approximate this outcome, we need to sum welfare changes for different households at the same point of the social ranking for the various years.

[14] Removing durable goods from the analysis does not change the outcome.

Such a finding provide evidence that, even though the introduction of the euro currency cannot be assumed as a structural break in the distributional effects of inflation, the overall redistribution of purchasing power over the last decade has been unequivocally negative, suggesting that the perception of an adverse welfare impact is more grounded on a "*cumulative effect*" rather than to a specific event. The years around the introduction of the euro currency may have performed as an upward step in the perception of inflation by part of Italian households, from which a full recovery does not yet seem realized.

4. Conclusions

Even though inflation seem to have had an uncertain path in defining welfare gains and losses when analysed on a yearly basis, a long run perspective allows better insights on the welfare impact of price changes. Results suggest that the cumulative impact of price changes is unequivocally welfare decreasing around the introduction of the euro currency. Furthermore, the sequential dominance approach has revealed that in most cases, larger – and therefore needier – households have suffered most from price changes. This suggests that households with children may have more difficulties to protect themselves from inflation, a conclusion that finds some justification on the relatively more rigid consumption pattern of these households. From a welfare perspective, this means that the bulk of gains are concentrated among smaller and relatively richer households and that when attached to poorer households, welfare gains are smaller in magnitude compared with what usually happens when inflation shows its adverse distributional impact.

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Table 1 – Commodity – specific inflation rates

											Average inflation rate			
Commodity	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2007/1997*	*1999/1997*	*2003/1999*	*2007/2003*
											A	***B***	***C***	***D***
Tobacco	5.51	2.09	1.10	2.67	1.87	8.29	9.86	8.91	6.27	4.22	*63.4*	*3.8*	*3.4*	*7.3*
Travels	4.48	4.24	4.82	5.27	5.20	4.41	3.14	2.27	2.45	1.77	*45.2*	*4.4*	*4.9*	*2.4*
Fuels	-2.86	4.40	12.99	-2.19	-2.77	1.73	5.91	10.21	6.70	1.06	*39.5*	*0.7*	*2.3*	*5.9*
Home maintenance	2.08	2.79	5.82	2.54	0.48	3.42	2.18	4.27	5.73	2.05	*36.0*	*2.4*	*3.0*	*3.5*
Personal items	-0.80	3.49	1.49	2.56	2.86	1.84	1.71	2.16	6.82	8.60	*34.9*	*1.3*	*2.2*	*4.8*
Transport services	2.33	2.23	2.42	2.92	3.07	3.86	3.76	2.57	3.10	3.87	*34.5*	*2.3*	*3.1*	*3.3*
Restaurants	2.30	2.01	2.63	3.27	4.28	3.78	3.32	2.53	2.32	2.85	*33.4*	*2.2*	*3.5*	*2.8*
Public transport	0.30	-2.08	1.25	3.34	4.23	2.53	6.41	9.99	2.18	0.39	*31.8*	*-0.9*	*2.8*	*4.7*
Domestic services	2.42	2.70	2.74	1.21	2.71	3.02	3.31	2.72	1.99	4.19	*30.5*	*2.6*	*2.4*	*3.0*
Education	2.21	1.93	2.41	3.03	2.85	2.82	2.28	3.29	2.56	2.21	*28.7*	*2.1*	*2.8*	*2.6*
Clothes	2.63	2.15	2.13	2.85	2.88	2.92	2.17	1.59	1.25	1.45	*24.3*	*2.4*	*2.7*	*1.6*
Personal hygiene	2.44	1.55	2.07	2.29	2.85	2.43	2.21	1.52	1.34	1.71	*22.4*	*2.0*	*2.4*	*1.7*
Furnitures	2.20	1.33	2.00	2.19	1.95	2.02	2.35	2.23	1.99	2.08	*22.3*	*1.8*	*2.0*	*2.2*
Small electric appliances	1.97	2.10	1.85	2.35	2.18	2.72	2.07	0.13	1.85	1.75	*20.7*	*2.0*	*2.3*	*1.4*
Health	2.47	2.49	2.78	2.36	2.29	1.27	1.90	0.28	0.84	1.70	*19.9*	*2.5*	*2.2*	*1.2*
Beverages	2.34	0.01	1.24	2.76	2.53	3.21	2.64	0.72	1.17	1.31	*19.4*	*1.2*	*2.4*	*1.5*
Food	-0.23	1.03	0.64	1.61	4.23	3.71	3.28	1.97	-0.09	1.83	*19.4*	*0.4*	*2.5*	*1.7*
Car purchase	2.81	0.71	2.00	1.87	2.66	1.40	-0.36	2.06	1.46	1.07	*16.8*	*1.8*	*2.0*	*1.1*
Entertainment and culture	1.40	2.21	-0.28	2.91	3.23	1.80	1.91	0.87	1.62	-0.25	*16.5*	*1.8*	*1.9*	*1.0*
Durable goods	0.49	0.33	0.06	0.32	0.41	0.48	0.27	-0.13	-0.08	0.32	*2.5*	*0.4*	*0.3*	*0.1*
Communications	0.60	-1.78	-3.63	-2.09	-1.39	-1.73	-6.39	-4.59	-3.45	-8.43	*-28.7*	*-0.6*	*-2.2*	*-5.7*
CPI (*)	1.99	1.66	2.55	2.75	2.50	2.69	2.21	1.92	2.12	1.85	*24.6*	*1.8*	*2.6*	*2.0*

(*) CPI is the official price index

Source: Authors' elaboration on Istat data.

Table 2 – Decile – specific inflation rates

											Average inflation rate			
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2007/1997*	*1999/1997*	*2003/1999*	*2007/2003*
Decile											***A***	***B***	***C***	***D***
1	1.7	1.6	3.5	4.2	1.9	3.6	2.2	1.3	2.8	2.5	28.4	*1.6*	*3.3*	*2.2*
2	1.7	2.0	3.8	3.5	2.0	3.7	2.5	1.9	2.7	2.0	28.9	*1.9*	*3.2*	*2.3*
3	1.8	2.1	3.7	3.7	2.0	3.5	2.4	2.0	2.7	2.0	29.1	*1.9*	*3.2*	*2.3*
4	1.9	2.1	3.5	3.7	2.1	3.5	2.6	2.1	2.7	2.1	29.5	*2.0*	*3.2*	*2.3*
5	1.9	2.1	3.6	3.4	2.3	3.3	2.4	2.5	2.8	1.7	29.1	*2.0*	*3.1*	*2.3*
6	2.0	2.0	3.7	3.4	2.2	3.2	2.5	2.2	2.9	1.9	29.3	*2.0*	*3.1*	*2.4*
7	2.0	2.1	3.6	3.1	2.4	3.2	2.5	2.4	2.6	1.8	29.0	*2.0*	*3.1*	*2.3*
8	2.0	2.2	3.5	3.3	2.4	3.2	2.6	2.2	2.8	2.1	29.5	*2.1*	*3.1*	*2.4*
9	1.9	2.2	3.4	3.2	2.4	3.0	2.8	2.5	2.4	2.2	29.5	*2.1*	*3.0*	*2.5*
10	1.9	2.4	3.1	3.2	2.6	2.9	2.9	2.5	2.7	2.0	29.5	*2.2*	*2.9*	*2.5*
HPI (*)	1.9	2.1	3.5	3.5	2.2	3.3	2.5	2.2	2.7	2.0	29.2	*2.0*	*3.1*	*2.4*

(*) HPI is the estimated (democratic) price index

Source: Authors' elaboration on HES data.

Table 3 – Inflation rates by household type and region of residence

											Average inflation rate			
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2007/1997*	*1999/1997*	*2003/1999*	*2007/2003*
Household type											***A***	***B***	***C***	***D***
Single	1.8	1.7	3.1	3.4	2.0	3.2	2.5	1.9	2.7	2.0	27.3	1.7	2.9	2.3
Couple no children	1.8	2.1	3.6	3.5	2.2	3.3	2.4	2.3	2.6	2.1	29.1	1.9	3.2	2.3
Couple with children	2.0	2.3	3.8	3.5	2.4	3.4	2.6	2.3	2.8	2.0	30.5	2.1	3.3	2.4
- 1 child	2.0	2.2	3.9	3.5	2.5	3.2	2.7	2.4	2.6	2.0	30.4	2.1	3.2	2.4
- 2 children	1.9	2.3	3.7	3.4	2.3	3.5	2.6	2.3	2.8	2.1	30.2	2.1	3.2	2.4
- 3+ children	1.9	2.2	3.7	3.5	2.1	3.8	2.4	2.2	3.2	1.9	30.5	2.1	3.3	2.4
Single parent	1.9	2.2	3.5	3.6	2.3	3.1	2.8	2.0	3.0	1.9	29.7	2.1	3.1	2.4
Region of residence														
North	2.0	2.2	3.6	3.4	2.3	3.2	2.5	2.3	2.7	2.0	29.5	*2.1*	*3.1*	*2.4*
Centre	1.9	2.2	3.6	3.4	2.4	3.4	2.5	2.2	2.7	2.2	29.7	*2.0*	*3.2*	*2.4*
South	1.7	2.0	3.3	3.7	2.1	3.2	2.6	1.9	2.7	1.8	28.1	*1.8*	*3.1*	*2.3*
Islands	1.8	1.8	3.6	3.5	1.7	3.5	2.7	2.0	2.6	2.4	28.6	*1.8*	*3.1*	*2.4*
HPI (*)	1.9	2.1	3.5	3.5	2.2	3.3	2.5	2.2	2.7	2.0	29.2	2.0	3.1	2.4

(*) HPI is the estimated (democratic) price index

Source: Authors' elaboration on HES data.

Table 4 – Heterogeneity of households' expenditures and prices

	Heterogeneity of expenditure shares		Heterogeneity of prices		Weights	
	Within (*)	Between (*)	Average	St. Deviation	CPI weight (%)	HES weight (%)
	A	**B**	**C**	**D**	**E**	**F**
Beverages	6.2	0.0038	1.79	1.0410	1.63	2.50
Clothes and shoes	81.2	0.0617	2.20	0.6183	10.15	8.25
Communications	8.0	0.0132	-3.32	2.6396	2.72	3.30
Household services	20.7	0.0240	2.70	0.7804	1.78	0.80
Education	17.5	0.0278	2.56	0.4278	1.25	0.93
Entertainment and culture	48.0	0.1819	1.54	1.1723	7.64	6.64
Food	200.8	0.2870	1.79	1.5433	15.56	27.96
Food away from home	29.7	0.0989	2.93	0.7219	7.80	3.60
Furnishing and other articles	78.3	0.0679	2.03	0.2776	2.51	2.23
Fuels	41.7	0.1005	3.39	5.5080	4.71	7.07
Health	103.1	0.4320	1.83	0.8131	7.45	5.64
Home durable goods	5.6	0.0029	0.25	0.2223	0.93	0.39
Home services and Maintenance	169.6	0.1890	3.12	1.7006	7.97	13.30
Small elettric equipment and home accessories	3.7	0.0017	1.90	0.6818	1.04	0.78
Other vehicles expenditures	36.6	0.0121	3.80	1.2880	4.94	2.49
Personal care	15.8	0.0213	2.04	0.4910	2.81	3.80
Personal items	5.6	0.0034	3.04	2.7244	1.86	0.52
Public Transport	10.0	0.0149	2.80	3.4262	1.86	1.02
Tobacco	5.9	0.0048	5.03	3.1811	1.92	1.24
Transport services	57.3	0.0076	3.01	0.6373	2.90	1.69
Vehicles	76.7	0.0537	1.56	0.9432	4.07	1.30

(*) Multiplied by 10^4

Source: Authors' elaboration on HES data.

Table 5 – Welfare changes

Total population

Years		Baseline	Inequality aversion (*)		
Final	Initial		0.5	1	2
1998	*1997*	1997	0.023	0.046	0.089
1999	*1998*	1998	0.018	0.041	0.112
2000	*1999*	1999	-0.061	-0.108	-0.155
2001	*2000*	2000	-0.058	-0.117	-0.245
2002	*2001*	2001	0.047	0.090	0.161
2003	*2002*	2002	-0.035	-0.067	-0.129
2004	*2003*	2003	0.064	0.126	0.252
2005	*2004*	2004	0.043	0.085	0.179
2006	*2005*	2005	-0.043	-0.083	-0.162
2007	*2006*	2006	0.020	0.030	0.024
2007	*1997*	1997	0.042	0.080	0.165
2007	*1997*	2007	-0.028	-0.057	-0.130

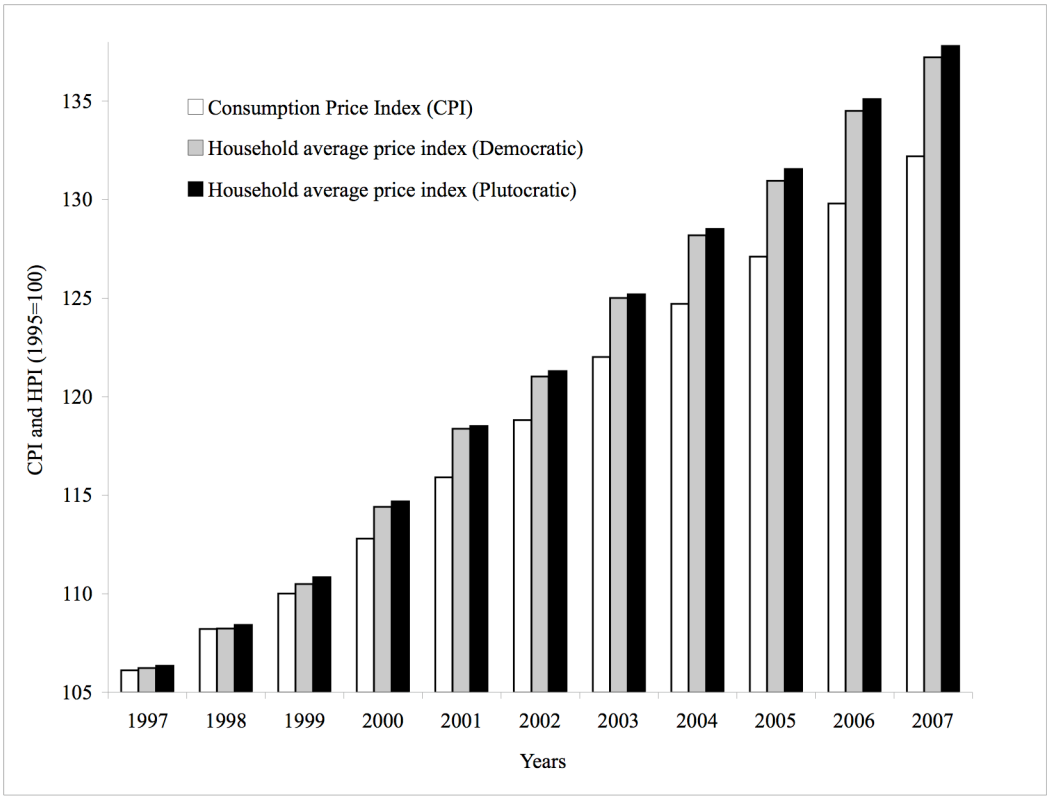
Population below the 50 per cent of median equivalent income

Years		Baseline	Inequality aversion (*)		
Final	Initial		0.5	1	2
1998	*1997*	1997	0.193	0.193	0.193
1999	*1998*	1998	0.250	0.266	0.319
2000	*1999*	1999	-0.282	-0.271	-0.184
2001	*2000*	2000	-0.472	-0.485	-0.522
2002	*2001*	2001	0.211	0.216	0.238
2003	*2002*	2002	-0.261	-0.263	-0.267
2004	*2003*	2003	0.480	0.494	0.532
2005	*2004*	2004	0.343	0.359	0.400
2006	*2005*	2005	-0.285	-0.297	-0.328
2007	*2006*	2006	-0.010	-0.019	-0.049

(*) All values are on a monthly basis multiplied by 100

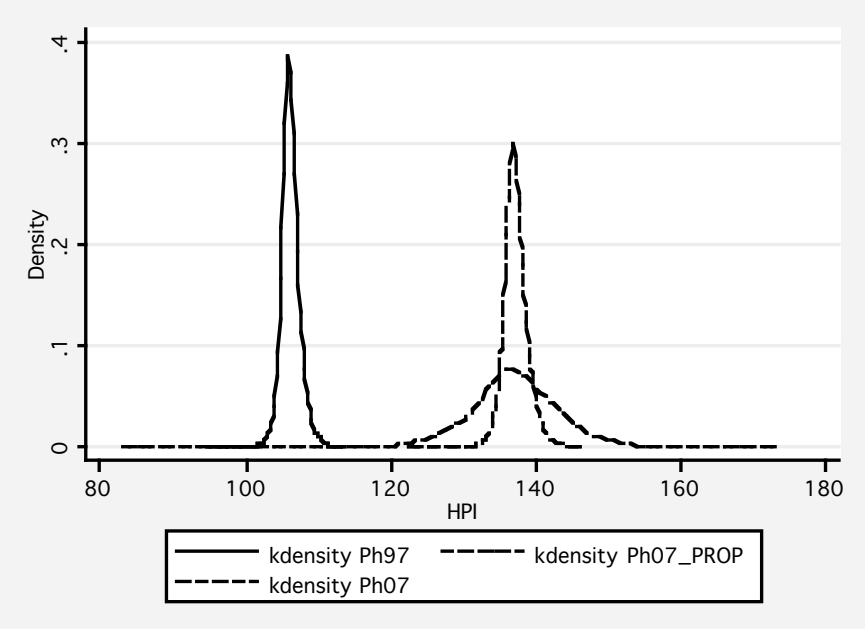
Source: Authors' elaboration on HES data.

Figure 1 – Official and estimated price index



Note: 1995=100
Source: Authors' elaboration on CPI and HES.

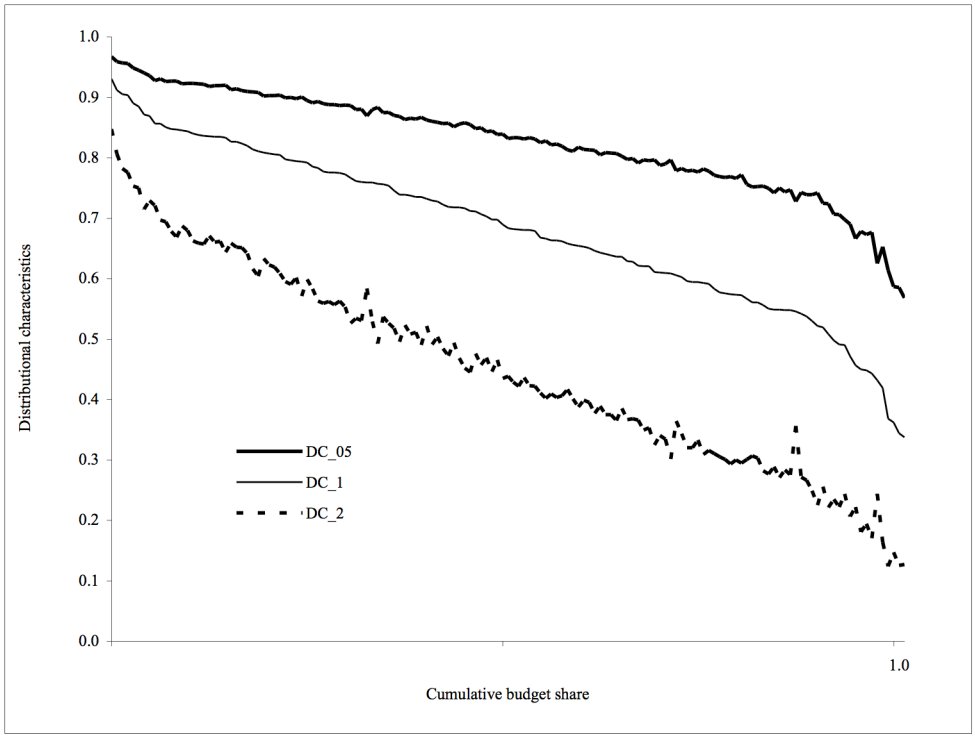
Figure 2 – The distribution of household-specific price indices



Note: Actual 1997, actual 2007 and simulated 2007 with all prices increased by the same proportion (1995=100).
Source: Authors' elaboration on HES.

Figure 3 – Distributional characteristics of goods

2007



1997 and 2007

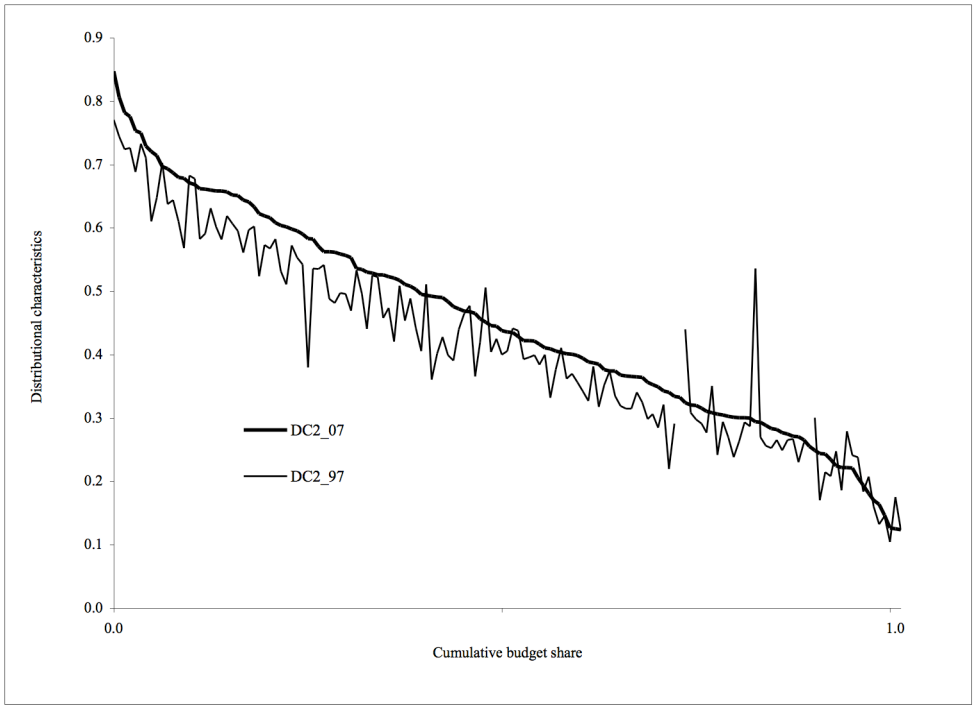
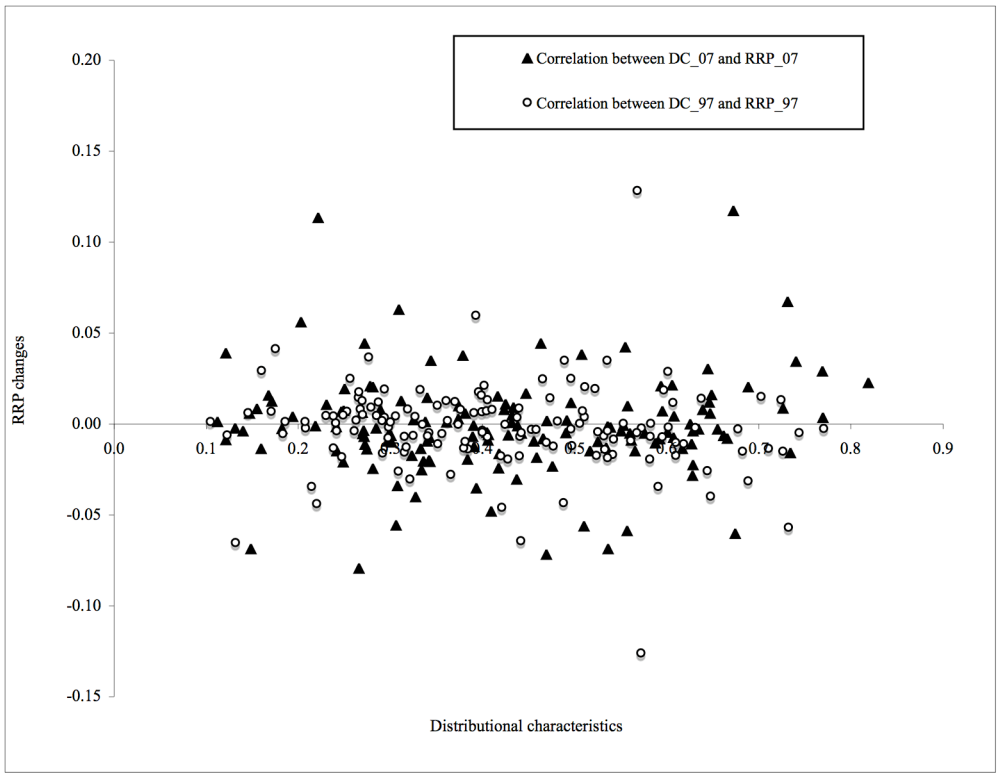


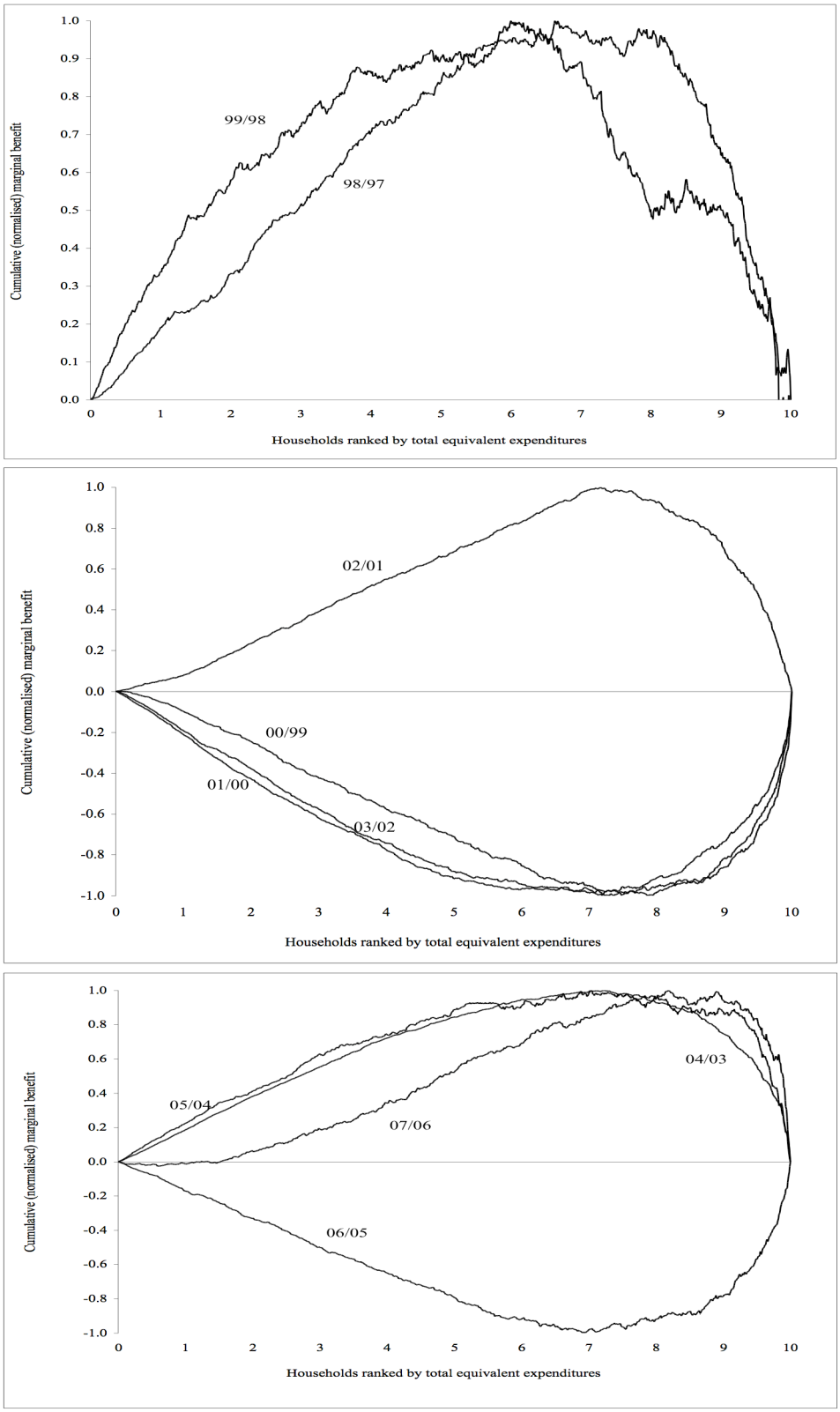
Figure 3 – Distributional characteristics of goods (continued)

1997 and 2007



Source: Authors' elaboration on HES.

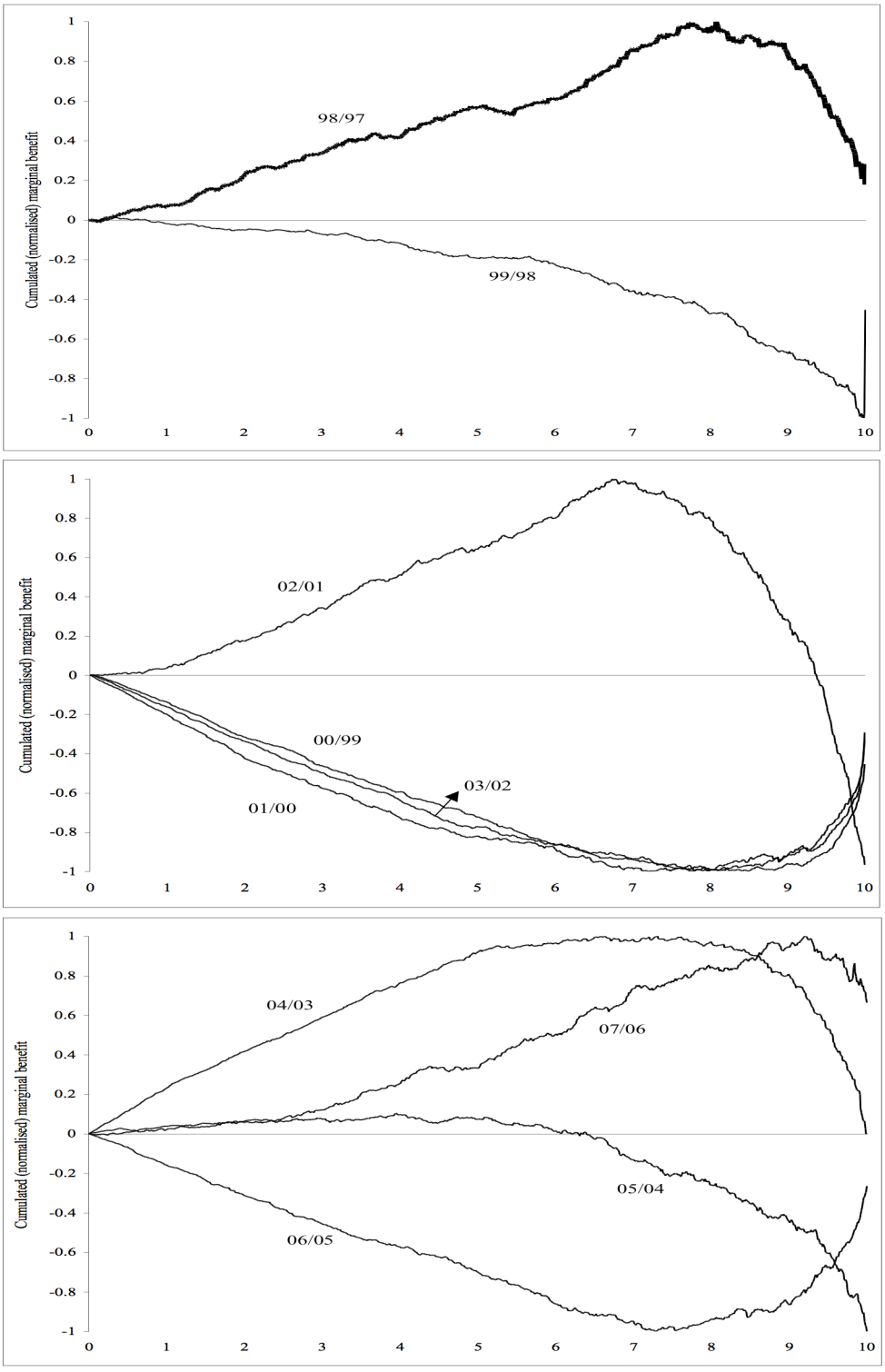
Figure 4 – Marginal dominance



Source: Authors' elaboration on HES.

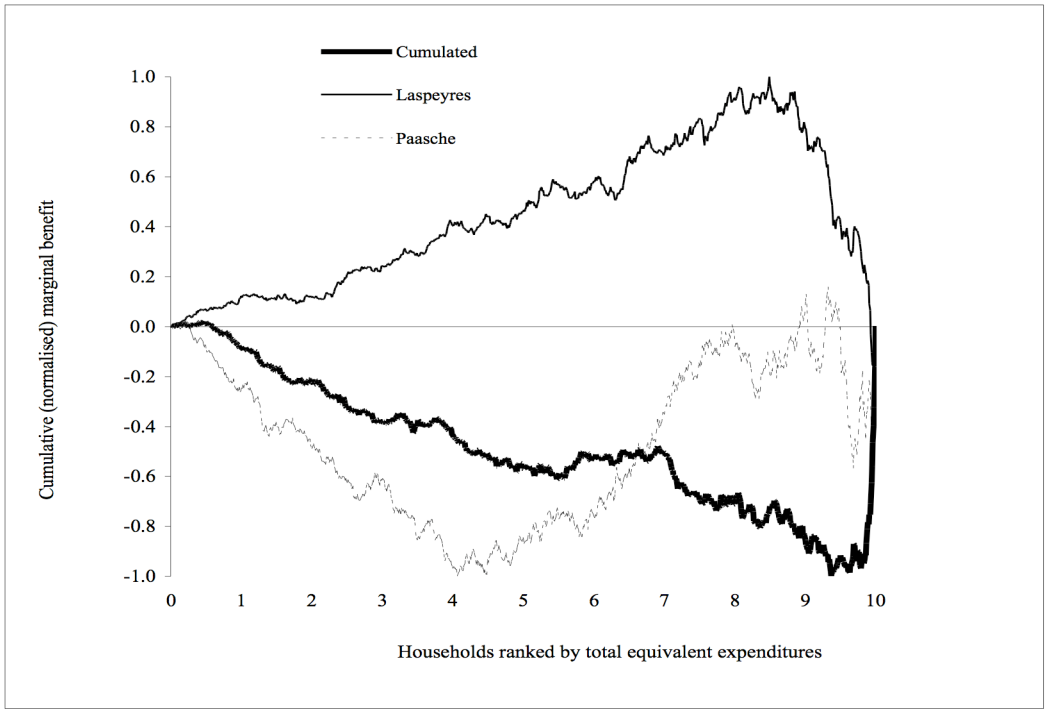
Figure 5 – Sequential marginal dominance

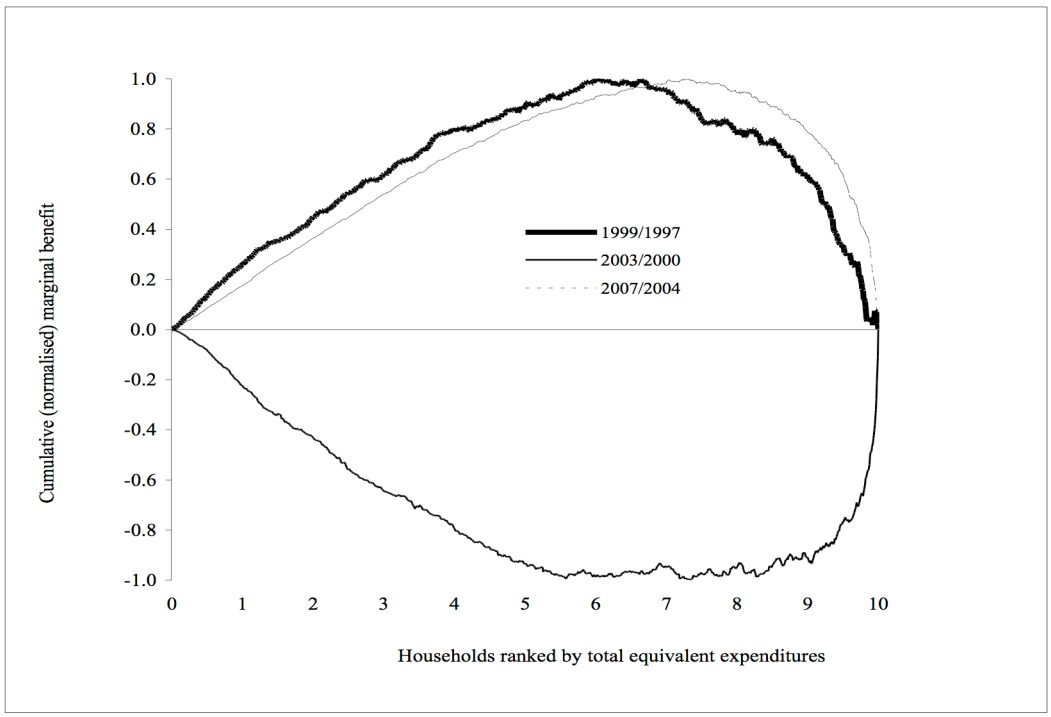
Households with more than three members



Source: Authors' elaboration on HES.

Figure 6 – The cumulative impact of inflation (1997-2007)





Source: Authors' elaboration on HES.

Appendix A

Matching CPI and HES has given rise to various possibilities of correspondence between goods in CPI and goods in HES: a) perfect correspondence; b) no correspondence; c) more commodities in CPI correspond to one commodity of HES; d) one commodity of CPI correspond to more commodities of HES; e) more commodities in CPI correspond to more commodities in HES.

a) Perfect correspondence occurs in 76 cases in our analysis. In this case, the price index in CPI is directly applied to the corresponding commodity in HES.
b) No correspondence occurs in two ways. The first is when the commodity in HES have not a matching item among those included in CPI (26 cases). The second is when the commodity in CPI is not representative of commodities consumed by households (14 cases). In both cases, these are goods that cannot be considered in the construction of HPI, as either there is no price index in CPI or there is no consumption in HES.
c) There are 27 cases where more commodities of CPI are associated to one commodity in HES. In this case the problem arises of what price index to choose among those available in CPI. The procedure has been followed of building a weighted mean of all relevant price indices in CPI, using official weights used for each product for the calculation of the general price index. Of course, this procedure introduces an error, as it "averages" the price index using "average" weights and not household-specific weights. Therefore, if the *j*-th commodity of HES, x_j^{HES}, is associated to a certain number *k* of commodities in CPI, the weighted price index is given by $\lambda_j^{HSC} = \sum_k \lambda_k^{CPI} \omega_k$, where ω_k is the weight and $\sum_k \omega_k$ is normalised to 1 within the group of *k* commodities.
d) There are 37 cases where one commodity in CPI is associated to more commodities in HES. This case is simpler to handle, as the price index in CPI is applied to the aggregate of goods in HES. In other words, λ_j^{CPI} is now applied to $X_j^{HES} = \sum_m x_m^{HES}$, with *m* equal to the number of goods in HES, X_j^{HES} is the aggregate good *j* and x_m indicates the goods forming the *j*-th aggregation.
e) Finally, there are 10 cases where more commodities of CPI are associated to more commodities in HES. This case in handled by first building $X_j^{HES} = \sum_m x_m^{HES}$ and then calculating $\lambda_j^{HES} = \sum_k \lambda_k^{CPI} \omega_k$. It is therefore a combination of c) and d).

Finally, durable goods have been treated by recalculating the total amount spent in the year of survey on each durable good (surveyed quarterly by Istat) and by assuming a depreciation period of either 36 (mainly home durable goods) or 60

months (mainly cars, motorcycles, etc.). In this case, the monthly expenditure on durable goods is the expenditure flow originated by each good, given the depreciation period.