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"INFLATION PERCEPTION BIASES AND THE EURO CHANGEOVER"

RELATORE:

CH.MO PROF. STEFANO GALAVOTTI

LAUREANDO: MARCO ANGELI

MATRICOLA N. 1125730

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1. INTRODUCTION

After the euro banknotes and coins introduction in 2002, there was, among the consumers of the European countries, a widespread feeling of an increase of prices due to the new currency, despite the fact that the inflation rate registered by the official statistics didn't show any particular change. The gap between the consumer's perceptions and the real data went on for a significant period in most countries, and as regards Italy it started to diminish only two years later, indelibly marking the memory of the citizens. In fact, from then on, it's a common opinion, among the Italians consumers, that the prices have been converted with an exchange rate of 1000 lire for one euro, namely doubling the prices of goods and services compared to the salaries that had converted with a rate of 1936 lire for one euro.

This feeling was associated to the new currency and to the opportunism of the sellers that had presumably taken advantage of the low transparency of the new prices after the changeover, rounding up and rising the prices. In addition to it, also the media spread these feelings among the population, feeding the discussion and the importance of the topic in the daily life of the consumers. Indeed, they highlighted the price increases occurred, reported the demonstration of the consumers' unions, and also disclosed the opinions of some non-official institutions claiming to have the explanation of the consumers' perception, instilling a sense of distrust about the official indices.

The increase in the perceived prices it's not only an interesting phenomenon but creates many problems in the economy itself. It is closely linked with the sense of purchasing power of the consumers, and then their perceived wealth, it affects the allocation of the resources confusing the reference prices of the various products and services, and in addition to it, it influences the wage negotiation and the labor market dynamics. Eventually, in this particular event, the rise of the perceived price could have nicked the European institutions and the public acceptance of their power and influence.

In this work, we will treat the major points of this topic. We will present the analysis of the actual and perceived inflation's data, and after that, we will see some of the reasons most cited in the literature that could be the cause of the perceptions, including: the possibility that the consumers rely on the price changes of the more frequently purchased products and overlook the impact of the more occasional purchasing, the possibility that they look more to the major changes among the different prices, that they are affected in a greater measure by the increases because of the loss aversion's role, and that the influence of the media could have distorted the consumer's perceptions.

In addition to them, it is proposed a model that tries to explain the consumers' perceptions with another cognitive error, for which the persons tend to confirm their own prior belief ignoring the proof that can debunk them. It is called confirmation bias, and we will treat how the consumers that approach the euro introduction with an expectation and with the willing to verify it, could fall in such error. Thanks to the hypothesis test framework, we will see how the confirmation bias could come from the ambiguity confirmation of the prices close the expectation. And then, we will see the effects on the perceptions of each element of the model by mean of comparative analysis, showing that, depending on the variables, the consumers could perceive an higher inflation than the real one, and that such phenomenon can last for a long period of time.

2. INFLATION IN ITALY AROUND THE EURO CHANGEOVER

In this chapter, we will analyze the inflation by means of the Eurostat data, in order to see if there was an increase in the prices. We will see the changes in the annual indices, on the monthly indices, and some of the major product's price changes occurred at the time of the changeover. Moreover, we will talk about the subjectivity of the inflation suffered by the consumers as well as few reasons that brought the consumers' associations to sustain that the consumers experienced a higher inflation rate than the one reported by the official data.

We can see the price changes in Italy in figure 1, where is represented the Eurostat data relative to the measures of HICP index (Harmonized Index of Consumer Prices, the index usually used to compare the inflation of different European countries), for the period 1996-2007. Here, we can see that there are not any doubling of prices around 2002, concurrently with the euro changeover. Nevertheless, there is a slightly increase of the inflation rate in 2002 (between the 2001 and 2002 there is an increase of 0.3% of inflation rate), but it's not so relevant when compared to the changes of the other years.

Figure 1: Annual Inflation rate (HICP) for Italy
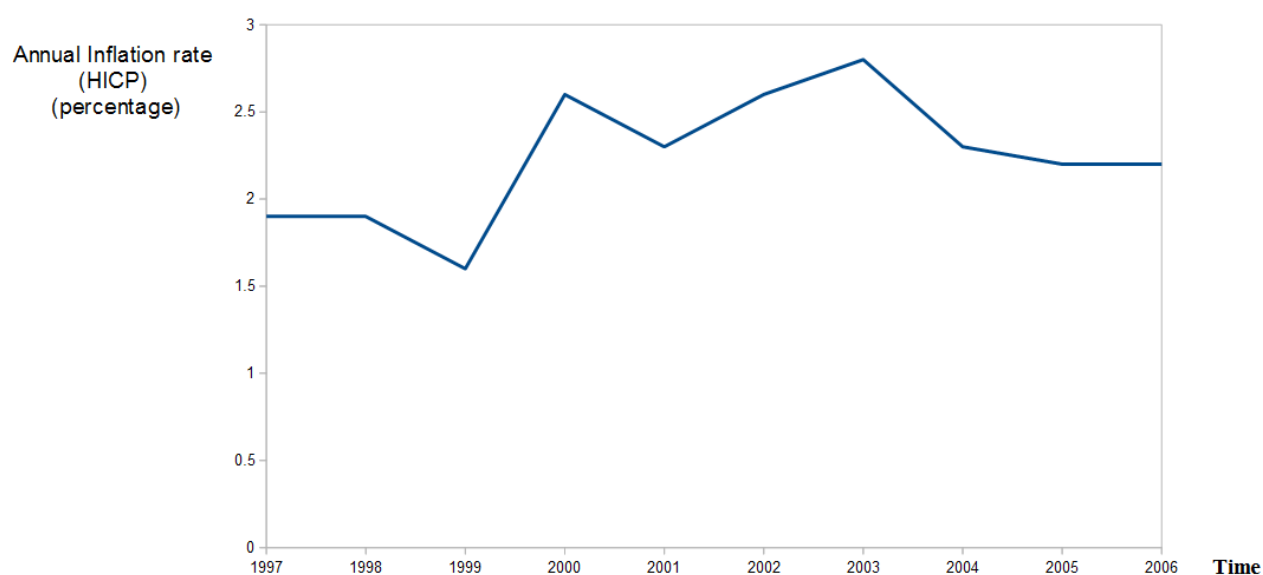
Source: Eurostat

Even if we consider that the increase of inflation rate between 2001 and 2003 it's due only to the euro's impact, we are talking about variations in the region of 0,5%, very light also compared with the variability of the whole period. Given these data, it would be more suspicious if the euro had

been introduced in 1999, seeing the 1% gap between 1999 and 2000. In such case, it'd be present at least an interesting coincidence with the single currency introduction.

Anyway, it's not visible a clear impact of the euro on inflation in these data. Even if it's possible that the euro has had an impact since its placing on the financial market in 1999, and that such impact took place in a longer period of time as could be 1999-2004.

Even if we see through the magnifying glass the moment of the changeover, with the monthly data visible in figure 2, we don't observe any abnormal change. According to these data, in January 2002 there is a downward trend that finds the minimum in the February of the same year, exactly at the moment where it's suppose to be the maximum inflationary impact of the euro. Obviously, we can imagine that the euro starts to exert his inflationary effects after the period where the consumers could still use the old currency, which ended in the March 2002. In such case, we may have a match from the data, that shows a peak in that month. However, the increase in question is probably attributable to the seasonal trend of inflation, rather than the euro changeover, given that similar moves recur with a certain frequency in the time series. In particular, the minimum of February is probably caused by the post-Christmas discounts and other seasonal depreciations, and consequently, the increased inflation in March would correspond to the end of the discount period.

All of this highlights the absence of an abnormal increase of inflation rate either in the two-currencies period or immediately after.

Figure 2: Monthly Inflation rate (HICP) for Italy
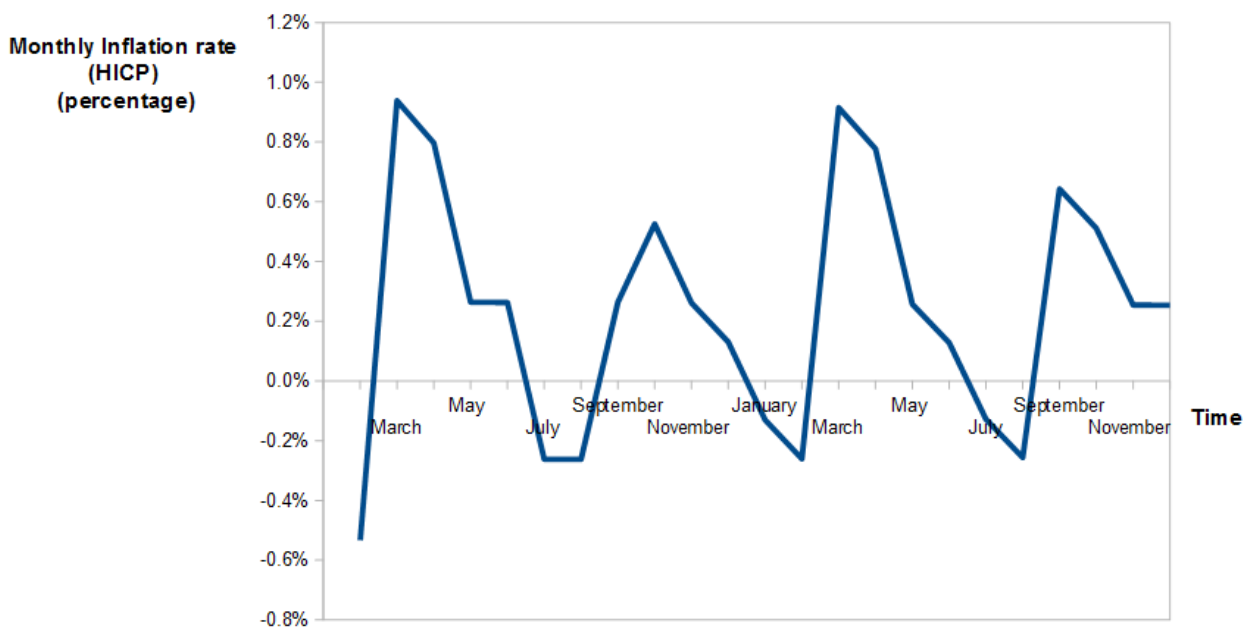
Source: Eurostat

A consideration that must be done is that being the inflation index an average of different price changes, it's possible that the price of some goods went up while the price of others decreased. In such situation it's possible that there are large prices increases, that are not visible in the aggregate picture because compensated by decreases of other prices. Then, if we have that there are some segments of consumer that are more interested to purchase a certain product than others, these segments would suffer a greater increase if the price of the product they are interest in increase. For instance, all the low-income consumers are more affected by the changes in the food products and renting than do higher-income consumers. If these and other particular kinds of goods have really gone through a price increase, then stands to reason that the complaints of consumers came from such increases rather than a general price increase.

Having said that, we can see from figure 3 the product categories that have endured the larger monthly changes in the years 2002 and 2003. Here we have that, a few products have experienced significant increases during 2002, which could be caused by the inflationary impact of the euro. Even if, these increases of prices don't get close to the phantom doubling of prices claimed by the consumers and neither leave room for the 30% stated by some consumer's association, the table shows how there are some products that suffered large increases and, then, the possibility that the consumers that used to buy more of these products could have suffered the inflation more than others.

Among the many products in the table, a category more significant than the others is "fresh vegetables", indeed this category suffers a data elaboration that attenuates the extreme values and could underestimate the inflation rate. Under this circumstances could be partially justified the worries of the consumers, given that this category is one of the most criticized. Seeing closer, the increases of the fresh vegetables and fruits find a possible explanation by the fact that 2001 was a singular year as regards the climatic conditions, that has resulted in a poor harvest. And then, the prices may be increased as consequence of the supply fall. On the other hand, it's still possible that some shopkeeper has exploited the currency changeover and the climatic conditions as an excuse to raise prices. The vegetables and fruits' price increases is, also, one of the reasons why the estimates of the consumers association, that are more based on the food's price, was so much different from the official one. According to Eurispes, one of the most important critics of the Italian official data, the increase of the food's price was closer to 8-9% in 2002, at odds with 2,6% of the official index.

Figure 3: Extreme price changes: 207-item breakdown

2002				2003			
Product item	Weight %| 12-month change %	month	Annual average %change	**Product item**	Weight %	12-month change %	month	Annual average %change

2002					2003				
Upward					*Upward*				
Potatoes	0.28	30.5	Feb.	10.4	Other lodging services	0.31	32.5	Aug.	15.6
Air transport	0.67	22.1	Aug.	6.1	Postal bank services	0.15	26.7	Jan.	26.7
Fresh vegetables	1.22	19.6	Apr.	13.6	Potatoes	0.25	23.6	Nov.	2.6
Insurance services	0.31	18.7	Mar.	11.6	Inland water transport services	0.00	20.8	June	12.8
Bathing stablishments	0.17	15.9	July	6.6	Italian cigarettes	0.49	15.6	Nov.	12.1
Newspapers	0.28	14.9	July	13.0	Lubrificants	0.11	13.6	Mar.	10.6
Maritime transport services	0.14	13.8	June	8.9	Other fuels	0.28	12.6	Mar.	3.4
Fresh shellfish	0.28	12.6	Aug.	11.0	Banking services	0.64	11.9	Jan.	8.9
Fresh fruit	0.96	11.0	May	8.9	Liquid fuels	0.73	11.7	Mar.	2.9
Amusement parks	0.09	9.2	Sept.	6.0	Fresh shellfish	0.34	11.1	Jan.	5.9
Total	4.40				Total	3.29			
Downward					*Downward*				
Air transport	0.67	-3.9	Dec.	6.1	Other fuels	0.28	-2.0	Oct.	3.4
Potatoes	0.28	-4.4	Nov.	10.4	Audiovisual equipment	0.44	-2.3	Nov.	-1.3
Liquid fuels	0.68	-4.5	Jan.	-0.2	Amusement parks	0.09	-2.7	Sept.	0.3
Electricity	1.22	-5.2	Mar.	-1.5	Petrol	1.97	-2.8	Jan.	1.5
Other meats	0.18	-6.7	Apr.	-2.4	Ski lifts	0.09	-3.5	Dec.	2.5
Gas	1.87	-7.3	Apr.	4.8	Medica products	2.92	-6.5	Mar.	-3.8
Petrol	1.97	-7.5	Jan.	-2.7	Maritime transport services	0.13	-8.1	Sept.	-0.5
Poultry	0.65	-7.5	Mar.	-2.4	Telephones and accessories	0.90	-13.6	Dec.	-3.9
Other fuels	0.28	-9.6	Jan.	-2.7	Potatoes	0.25	-13.7	Apr.	2.6
IT equipment	0.24	-14.7	Jan.	-11.5	IT equipment	0.21	-17.0	May	-14.5
Total	8.05				Total	7.28			

Source: Elaboration of Istat data by P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*", Bank of Italy, 2005

   If we consider the Italian official index that aims to the evaluation of the working class' basket changes (the FOI index), looking for some confirmation that the increases affected more the medium and low-income classes, we don't see much difference from the other indices (NIC, HICP). Specifically, the FOI index (figure 4) indicates an increase of prices of 0,1-0,2% higher than HICP in 2002, confirming that, in some way, the low-income consumers suffered more price inflation than the others, but not so much to explain the perceptions.

   If we analyze the data of the different sectors all over the euro countries, we see that some of them, in particular in the services sector, actually suffered an increase of prices at the time of the changeover. For example, the sectors of "Hairdressing salons and personal care establishments", the "Cultural services" and the restaurants, suffered price increases larger than the same sectors in the European countries that didn't join to the euro-zone (M. G. Ercolani and J. Dutta 2006). But, we

have no way to verify that these increases are caused by the euro introduction, and neither that was these increases to influence the consumers' perceptions.

In conclusion, the data don't show a particular increase in the inflation rate at the time of the changeover. There was, as every year, some product whose price increased and others whose price decreased, and at that time of the changeover, there was particular increases of vegetables and fruits prices and also in a few services sectors. So, as regards these sectors, it's still possible that the increases are due to the euro effects and that they have been hidden by the aggregate data of inflation, but we are far to any evidence of it.

Figure 4: Differences between the inflation rates measured by consumer price indices in Italy (percentage points) [1]

(1) Differences calculated with respect to twelve-month percentage changes.

Source: P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005
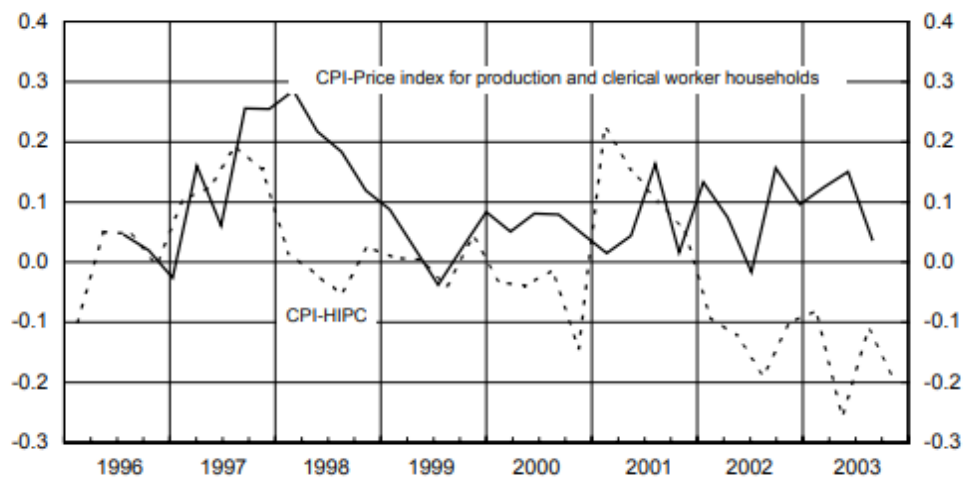
3. NON-OFFICIAL INDICES

Beyond the Istat (the official Italian statistical institution), other organizations at that time proposed different inflation indices in order to explain the consumers' perceptions. A lot of them sustained the version of the consumers, showing higher price increases than official indices did, and criticized the capability of the Istat's indices to account for the price changes. Such discussion could have influenced the consumers' opinion about the rise of prices and hurts the consumers' confidence about the official data, in a moment, like the euro changeover, where such institutions were fundamental in order to reassure the population about the changes, and in the case of the Istat, about the level of prices. As a consequence of the loss of consumers' trust on Istat, it's possible that a part of the consumers trusted the non-official institutes, and then to their estimates, starting to believe in the price increases.

Actually, we are not stating for sure that the estimates of such non-official studies are wrong. There is the possibility that the Istat's indices wronged about the price changes in that period and that the others institutions' estimates were correct. In this case could be that the perception of consumers was justified and that the price increases were not recognized by the official indices because of some errors.

In this chapter we will see some of the fundamental step of the indices construction comparing the official indices with the indices of the Eurispes, one of the most fiercest opponent of Istat in the media discussion, in order to verify if the non-official indices could summarize the price changes better than the official one, and see if there is some room for mistakes in both the indices procedures of estimates.

3.1 The basket of goods

As regards the classification used by Istat, the different indices are gathered in a hierarchical structure of categories. It is composed by five level, where the first three coincide with the international classification Coicop (Classification Of Individual Consumption by Purpose), and the other inferior levels provide a better insight of the data but don't correspond to an official international classification. According to classification used we have, for instance, that a certain price index of yogurt of x brand, is placed in the representative position "yogurt", which is in turn placed in the sub-class "milk products", in the class "milk, cheeses and eggs", in the group "food" and in the "food and non-alcoholic beverages" division.

Figure 5: Aggregation scheme of indices according to the Coicop classification
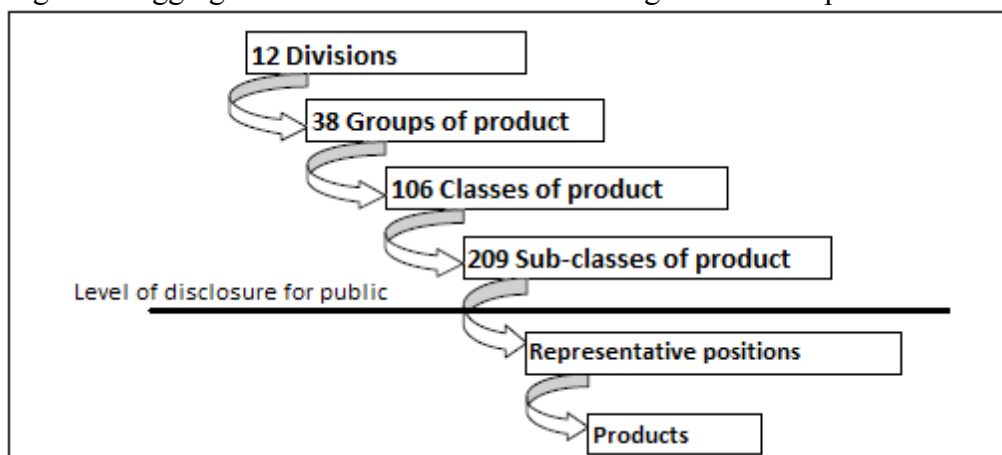
To every category, a certain weight is attributed at any level, in order to reflect the different importance in the typical consumer's basket. These weights are derived from estimates of the final consumption of households calculated by the national accounts and the inquiry of households consumption; and then adapted according to the particular index (NIC, FOI, IPCA). The weights follow the same hierarchical structure of categories, and every weight is divided among the inferior categories. For instance, the weight of 1178 of the "liquor and alcoholic beverages" is divided, basing on the consumption, on "brandy" (124), "aperitivo" (180), "whisky" (252), "grappa" (250) e "limoncello" (372) (Mostacci F. 2004).

The Istat's basket was composed in 2002, by 209 sub-classes of product, 569 representative positions, and 930 products, including 52 sub-classes of products and 154 representative positions in the division "food and non-alcoholic beverages".

Instead, as regards the Eurispes' basket, it includes only the food products, and, as a consequence, it doesn't summarize the overall price changes. Eurispes itself said that, but it's better emphasize this given that often in the media discussion this point has often been ignored. So the classification of the Eurispes' basket is quite smaller of the Istat's basket. Indeed, the Eurispes' basket was composed by only 50 representative positions gathered in 9 categories, that is also less than the only division "food and non-alcoholic beverages" of the Istat basket. The dimension of the Eurispes' basket was one-third of the Istat's food division, and there are no longer different categories of products like chocolate, olive oil, fresh cheese and others. Then, we can state that the Istat's inflation indices are more representative also in the Eurispes' own field and that the Eurispes estimates.

As regards the weights also the 50 representative positions of the Eurispes' basket have some weights to differentiate the different products. However, Eurispes provides no information on how these weights were determined. And there is the risk that such weights were chosen arbitrarily to sustain the Eurispes' opinion, instead of being the result of a serious evaluation of households consumption like those of Istat.

3.2 The data collection

The basic operation to compute the level of prices is the collection of data, that is the recording of the prices over time. For the official indices, this phase is the responsibility of the national statistical institute (Istat) and of the statistical council offices (UCS) scattered in the territory. The Istat gathers some data in a centralized way from its archive, in particular for those goods that don't suffer any price's changes over the country (like the tobacco), or that had to be calculated in a certain way to take account of technological progress. The rest of the prices are gathered by the UCS, that identifies the various point of sale and locally detects the data selecting the product in according with the Istat's instructions that define it. The UCS have the power to choose the points of sale that are, in their opinion, representative of the shopping habits of the consumers in the region, and also the product itself selecting the one that is, in their opinion, the most sold. Once it happened, the UCS operators take note over time of the different product's prices.

This autonomy of the UCS' operators could be a source of errors as far as the operators make a mistake, selecting a product that is undersold or selecting a shop that is not very attended by the consumers of the territory. If that's the case, is understandable the existence of an error due to the discrepancy between the price changes of the product chosen and the other products, as well as between the price changes of the shop chosen and those of the other shops.

But besides the wide-ranging data collection, we need to keep in mind that the collection doesn't gather all the prices, neither considers all the shops, and then, all the variations that may have been noticed by the consumers could not be calculated in the official indices, since not detected. The statement like: "the price of my favorite magazine has increased by the 40% in the newsstand round the corner" cannot be mirrored by an index that aims to summarize the price changes and to do it with low costs. And this fact also applies when the operators don't make any mistake in the collecting data, meaning that there is always a certain error in the estimates.

Possible errors could be found among the numerous methodological notes of the Istat's inflation indices about the data collection. A quite important example of it, concerns the methodological note

about the seasonal products and, in particular, the fruit and vegetable sectors. In fact, the official indices provide a special basket to take into account seasonal differences, in terms of availability of the products and consumer's preferences. Moreover, the calculation process removes the larger price changes from the indices calculation. As an example of it, the calculation of the "fresh fruit" index provides an average of different fruits' prices that exclude 25% of the fruits that suffered the highest increases. The reason is that such calculation is aimed at removing the products that are likely not to be purchased because of the high price and at smooth the seasonal changes. Obviously, it's possible that the consumers continue to purchase the products excluded and it would result in an underestimation of the inflation suffered by them.

As regards the Eurispes' data collection, not much information is provided, but what we have suggests that it was a rough data collection because it used, in order to estimate the pre-euro prices, also the assessment of the consumers and sellers. Despite Eurispes defined these evaluations as reliable, the fact that they rely on these assessment poses problems about the differences on the consumers' perceptions and about the reliability of memory as data source. In these circumstances, it would be better to think about the Eurispes data as a measure of the consumers' perceived inflation than a measure of the real inflation, given that it is based partially on the consumers' evaluation.

As regards the information about the procedures for selecting the point of sale and the specific product, as well as the data collection process, they are not provided. But what we can say is that concerning the coverage of the territory there is an overwhelming difference between the Istat and Eurispes, since the Eurispes contacted 304 shops of which 182 released a valid interview, with respect to the thousands of considered Istat's reporting units.

3.3 The indices construction

Once we have the data, the next step is the index construction. This point, for the Istat, starts with the elaboration of the inferior indices of the local regions. First, it is built the provincial indices of every product, simply computing the geometric mean of the indices of the products collected in the provincial shops. We have then the formula:

$$I_{i,p}^t = \sqrt[n_{i,p}]{\prod_u I_{i,u}^t} = \sqrt[n_{i,p}]{\prod_u \frac{P_{i,u}^t}{P_{i,u}^0}} \qquad \forall i, \forall p$$

where: $n_{i,p}$ is the number of different quotations observed for product I in the province p, u is the sale point, $I_{i,u}^t$, is the index of the price changes for the i product at time t, $P_{i,u}^t$ is the price of the

product i in shop u at time t, and $P^0_{i,u}$ is the starting price of the product. The provincial indices are then aggregated in order to build up the regional index with the formula:

$$I^t_{i,r} = \frac{\sum\limits_{p \in r} I^t_{i,p} \times W_{i,p}}{\sum\limits_{p \in r} W_{i,p}} \qquad \forall i , \forall r$$

where: $I^t_{i,r}$, is the regional index for the product i at time t in the region r, $I^t_{i,p}$ is the provincial index calculated before where p indicates a certain province, and $W_{i,p}$ is a provincial coefficient that weights the indices in according to the amount of population in the territory. We have then the national indices of every product:

$$I_i = \frac{\sum\limits_{r=1}^{20} I_{i,r} \times W^0_{i,r}}{\sum\limits_{r=1}^{20} W^0_{i,r}} \qquad \forall i$$

where: I_i is the national index of the i product, $I^t_{i,r}$ are the regionals indices, and $W_{i,p}$ are the weights used to differentiate the amount of consumption of the product i in the region r in comparison with the national total consumption. Eventually, we have the overall inflation index through the formula:

$$I = \frac{\sum\limits_{i=1}^{n} I_i \times W_i}{\sum\limits_{i=1}^{n} W_i}$$

where: I is the inflation index, I_i are the various indices of the different products and W_i is the weight that reflects the relevance of every product among the household's expenses, namely the amount of consumption of the product over the total consumption.

All the weights present in the formulas are derived, like the classification weights, from the estimates of final consumption of households calculated by the national accounts and the inquiry of households consumption, or they are a mere demographic data.

As regards the Eurispes' procedure of index construction we have no information, but in the case that Eurispes had not calculated any of Istat's steps of construction, there is the risk that they have given too much importance to low relevance places. For instance, they may have assessed as equals an increase of bread prices in the Milan province and in Aosta province (the smallest of Italy), when

it's evident that the second increase influences much less the population. Moreover, also the different importance of the products among the regions may risk being ignored: this can include, for example, that in their evaluation the increase of the heating prices would be considered of the same importance in Piemonte and in Sicily (whenever Sicilians turn the heating system on).

 In conclusion, we have seen that although the official indices are not error-proof and have different limit, they are actually an information source more reliable of the Eurispes' assessment; which, in addition to the problems illustrated, doesn't provide a thorough description of the statistical procedures used, and it is the major issue when comes an analysis of this kind. So, there is no reason to believe that the Eurispes' estimates or others non-official evaluation can summarize the price changes in the period of the euro changeover better than the official indices.

4. ROUNDING EFFECTS

One of the reasons that usually are ascribed to be the cause of the price increases after the euro changeover is the rounding effect of the prices. Namely, the tendency of the shopkeepers to rounding up prices every time the price converted from the old currency into euro fall between two attractive prices. The rounding-up problem was one of the big worries of the institutions and media well before the euro was introduced. The fear was that the shopkeepers that had to translate prices from the old currency to the new one, would exploit the changeover and the confusions of consumers to rounding up and increase the prices.

Given such worries, a few studies were predisposed to checking this particular aspect. The first was the ex-ante studies, that settled before the euro changeover, aimed to identify if the issue was actually a realistic possibility and to assess the potential danger. In particular, the ex-ante studies aimed to assess the presence of the attractive prices in the markets and, by means of that, assess the potential inflation that could unleash by the rounding effects.

4.1 Ex-ante analysis

The study of Mostacci and Sabattini (2001) assessed the potential impact of the rounding effect in Italy before the euro was released. In this study, the authors quantify the presence of attractive prices in the national markets by mean of the checking of 90000 price readings, identifying as attractive price the one included at least in one of these categories:

1. Psychological prices: the prices used because the consumers tend to perceive them as lower prices (for instance 0,99€ instead of 1,00€)
2. Fractional prices: the prices used to simplify the payment and the change (for instance 1,30€ instead of 1,32€)
3. Exact prices: used typically in relative high price to avoid the utilization of coin and low-denomination banknotes (for instance 50€).

The results of these studies corroborated the hypothesis that the rounding effect could have had a significant impact on Italy inflation since about 90% of the readings were attractive prices.

In order to estimate the inflationary impact of the rounding effect, it was assumed that all the shopkeepers that were using attractive prices would continue to use them also after the euro changeover.

Then the impact was calculated over 3 different scenarios:

1. The shopkeepers that have a non-attractive price always choose to round up the price to the next attractive price (worst scenario).
2. The shopkeepers that have a non-attractive price always choose to round down the price to the first attractive price (best scenario).
3. The shopkeepers that have a non-attractive price choose to round the price to the closer attractive price (symmetric scenario)

The estimations of the different scenarios were: a 1% prices increase in the worst scenario, slightly negative inflation (-0.1%) in the symmetric scenario and 1% prices decrease in the best scenario (these results refer to the whole rounding effect impact of the euro changeover, that could have taken place in a period longer than only 2002).

Figure 6: Rules for defining attractive prices in euro

Price in euros	Type of price		
	Exact or fractional	Psychological	Non-attractive
Below €5.00	*.00; *.X0; *.X5	*.X9; *.90; *.95; *.99	*.XX
Over €5.00	*.00; *.50	*.X9; *.90; *.95; *.99	*.XX

Notes: (1) Table gives the two decimals of the price in euros. The asterisk stands for any possible integer; X stands for a digit other than 0 or 9.

Source: Mostacci. F. and Sabbatini (2008), "*The Euro, Inflation and Consumers' Perceptions: Lessons from Italy*", Berlin: Springer-Verlag: 51-69

4.2 Ex-post analysis

After these studies, further analyses were done after the euro changeover occurred, in order to verify the real impact of the rounding effect over time and separately consider categories of product excluded from the ex-ante studies.

In Italy Mostacci and Sabattini (2003) proceeded with the detection of the data that covered the price changes of the products in the period between December 2001 and October 2002, recording the moment when for the first time the prices became attractive prices. In order to establish a range of results, two different estimate methods were considered. The first one, that assesses the

minimum, considers the price changes closely linked to the rounding effect. And the second, that assesses the maximum, considers all the price changes in the period even if they were potentially attributable to other factors.

As regards the first method, once detected that a certain product's price has become attractive at time t, it is compared with the previous product's price at t-1. According to the direction of the change, it is considered the closer attractive price and is identified the rounding effect as the difference between this attractive price and the starting price at t-1. For example, if we have a price at t-1 equal to 1,23€ and a price at t equal to 1,30€ (an attractive price), we identify the closer attractive price of 1,23€ upwards, that is 1,25€ and calculate the rounding effect as the difference between 1,25 and 1,23. So, in this case, the increase due to the rounding effect would result to be 0,02€, while the difference of 0,05€ between 1,25€ and 1,30€ would be ascribed to other factors.

About the second estimating method, it starts with dividing all the prices in according to the table in figure 7.

Figure 7: Divisions of the prices for the analysis

Prices in month *t-1*	Prices in month *t*	
	Attractive	Non-attractive
Attractive	S1A	S1C
Non-attractive	S2	S1B

The table classifies prices according to the status at time t and at time t-1. The purpose of this classification is to isolate those prices that became attractive price for the first time (S2) from all the others (S1), namely the prices that did not become attractive yet (S1B) which changes is not due to the rounding effects of the euro, and the prices that just became attractive in the past (S1A and S1C), that have just exhaust their euro-related rounding effect.

After the classification, the inflationary impact was computed as the results of this formula:

$$IM2= (VC2-VC1)*W2$$

where IM2 is the inflationary impact of the euro changeover, VC2 is percentage change of the prices between t and t-1 for S2 , VC1 is percentage change of the prices between t and t-1 for S1, and W2 is the weight of S2 with respect to all the products.

The advantage of this formulation consists of considering all the change occurred from time t-1 to time t, moreover, removing from VC2 the changes showed among the prices that have no rounding inflationary impact (VC1), it clears out the calculation from the markets trends.

However, this method includes in the calculation also other factors not related to the rounding effect and for this reason, it was considered as an upper limit of the range. For instance, if a restaurant chose to increase the price of a dish concurrently with the change of the menu from the old currency to the new one, it will results that all the change is caused by the rounding effect of the euro, even if the restaurant would have increased the prices in any case.

The final results of the ex-post studies showed how the number of attractive prices was, like the ex-ante studies, the 90% of the prices in Italy in 2001. And that, after the euro changeover in January 2002, the number of attractive prices lowered to 20%, and then gradually recover until the 50% in October 2002.

The rounding effects of the first and second method are summarized in the figures 8 and 9. Overall, we can note that the total impact of the rounding effects is assessed between 0,2% and 0,8% of inflation. And that these price increases were more present in the services market segment than the grocery and non-grocery one, and more in the products sold by the traditional channel with respect to the modern.

A clarification needs to be done about the categories of product that were excluded from this analysis and also from the ex-ante one, as the fresh food, the rents, energetic commodities and financial services. For some of them, it's understandable the decision to exclude from the analysis; the energetic commodities like the gas, generally, don't suffer from rounding effects, maintaining the price determined by the market. Similarly, the rounding effect in the rents, the durable goods and in the insurance services, is marginal given the high unit cost. But as regards the public tariff and the fresh food the exclusion was due to other reasons. The public tariffs were assumed to be stable since the public institutions assured that they would not change them, or that if they would, the changes would be in favor of the consumers. And the fresh food was excluded for difficulty on the detection of the prices.

Seeing among these two categories in the period after the euro changeover, we see that, as regards the public tariff, the promise of the public institutions was honored, indeed we have in such period a historical minimum, and the only prices that actually increased were the prices of some lottery and gambling. More complex is the issue about the fresh food, that, as we have just seen, suffered increases of prices in all the European countries, and about 8-9% of increase for Italy in the period

between January 2001 and January 2002. Considering these data in the ex-post analysis, the inflationary rounding effect impact range becomes between the 0,35% and 1,15% in total.

Although the analysis of Mostacci and Sabbatini is quite good, and the estimates of the rounding effect being relative light, remain some consideration to do before we can acknowledge such results.

The first one regards the analysis that gives the minimum of the range impact. In such analysis is not considered that the prices could have significant changes. For example, if we imagine to have two products with the same non-attractive price 7,24€, and we suppose that one of these is rounding up at 7,29€ that is the closer attractive price, while the other is rounding to 7,00€ when the closer attractive price is 7,19€; we have that the rounding effect estimated by the first method is (7,29-7,24)-(7,19-7,24)= 0 while the true inflation change is (7,29-7,24)-(7,00-7,24)= -0,19. In other words, we can say that this method tends to assess more the numbers of changes going up and down than the true inflationary rounding effect.

As regards the maximum estimate of the range, it doesn't provide so much information. Indeed, the only difference between this estimate and a pure inflation index is that the changes at time t of the prices just became attractive (VC2) are lessened by the changes of the other set (VC1). It means that every time a price becomes attractive with an abnormal change with respect to the other set, such change would be recognized as due to the rounding effect. Such method creates problems when we have a country with a general positive inflation, like was Italy in the first years of 21st century. Because every time a firm updates upwards its prices list, it temporarily steps outside of the market's values in order to catch a part of the future price increases. This leads to the presence of an impact ascribed to the rounding effect but actually due to the natural market dynamics.

To sum up, if we have a general positive inflation, it's almost impossible that the upper limit output of the authors would be 0, and then it probably overestimates the maximum rounding effect. While the lower limit is biased by the number of prices increasing and decreasing and not related to the actual values changes. In the end, given the results of the studies, we can't say that the rounding effect was enough significant to be accused to be the reasons of the consumers' complaints about the prices.

Figure 8: Inflationary effect of rounding in the broad sense (Method 1)

by the type of product and distribution channel

2002	Inflation in month (2)	Rounding effect	Type of product			Distribution channel	
			Groceries (3)	Other goods	Services	Modern	Traditional
January	0.43	0.01	0.00	0.00	0.01	0.00	0.01
February	0.34	0.02	0.00	0.00	0.02	0.00	0.02
March	0.25	0.02	0.00	0.01	0.01	0.00	0.02
April	0.25	0.01	0.00	0.00	0.01	0.00	0.01
May	0.25	0.02	0.01	0.01	0.00	0.00	0.02
June	0.08	0.01	0.00	0.00	0.00	0.00	0.01
July	0.17	0.01	0.01	0.00	0.00	0.00	0.01
August	0.17	0.01	0.00	0.00	0.01	0.00	0.01
September	0.17	0.02	0.01	0.00	0.01	0.00	0.02
October	0.25	0.02	0.00	0.01	0.01	0.00	0.02
Cumulative inflation, Jan.-Oct.	2.40	0.16	0.04	0.04	0.08	0.02	0.14

Notes: (1) The impact is in percentage points. It is estimated by multiplying the percentage change in each price becoming attractive during the month to the nearest attractive level by its weight in the basket, assuming that the items not included underwent no rounding effect in that month. (2) CPI (percentage change on previous month). (3) Foods, home cleaning and personal hygiene products.

Source: P. Del Giovane and R. Sabbatini,"*The Euro, Inflation and Consumers' Perceptions: Lessons from Italy*", Springer Science & Business Media, 2008

Figure 9: Inflationary effect of rounding in the strict sense (Method 2)

by the type of product and distribution channel

2002	Inflation in month (2)	Rounding effect	Type of product			Distribution channel	
			Groceries (3)	Other goods	Services	Modern	Traditional
January	0.43	0.07	0.01	0.00	0.06	0.01	0.06
February	0.34	0.13	0.00	0.03	0.10	0.00	0.13
March	0.25	0.06	0.01	0.02	0.03	0.00	0.06
April	0.25	0.06	0.01	0.02	0.03	0.00	0.06
May	0.25	0.12	0.01	0.04	0.07	0.01	0.11
June	0.08	0.03	0.01	0.01	0.01	0.01	0.02
July	0.17	0.03	0.01	0.01	0.01	0.01	0.02
August	0.17	0.05	0.00	0.01	0.04	0.00	0.05
September	0.17	0.12	0.02	0.03	0.07	0.01	0.11
October	0.25	0.09	0.01	0.05	0.03	0.00	0.09
Cumulative inflation, Jan.-Oct.	2.40	0.75	0.09	0.22	0.44	0.05	0.70

Notes: (1) The impact is in percentage points. It is estimated by multiplying the percentage change in each price becoming attractive during the month by its weight in the basket, assuming that the items not included underwent no rounding effect in that month. (2) CPI (percentage change on previous month). (3) Foods, home cleaning and personal hygiene products.

Source: P. Del Giovane and R. Sabbatini,"*The Euro, Inflation and Consumers' Perceptions: Lessons from Italy*", Springer Science & Business Media, 2008

5. EXPLANATIONS OF THE INFLATION PERCEPTION BIAS

Not always the population is aware of the current moves of inflation and sometimes their perspective is not even close to the actual data. This was probably the case of the perceptions after the euro changeover since the inflation data don't show any peculiar change with respect to other periods. At this point, all that's left to do is to explore the dynamics beyond the inflation indices and analyze the consumers' perception and how they could be born.

Firstly, it has to be said that the discrepancy is probably the result of the fact that the human's brain is not built to assess the phenomenon in a systematic and rational way like do the official indices. So much so that a first problem regards the limited knowledge of the consumers about economic phenomena and in particularly inflation. Indeed, Behrend (1977) highlights, among the consumers, a lack of understanding of the inflation meaning, and in particular the difference between the level of prices and the purchasing power.

However, other studies showed how the individuals, even though they may have an imperfect understanding of the economic notions, are able to give a rudimentary interpretation of them and their interconnections (Williamson and Wearing 1996). Jonnung (1981) have experimented a study on the inflation in Sweden, finding that, despite the presence of some errors, a lot of consumers were able to give a pretty accurate estimate of inflation, while a minority showed a poor or absent knowledge of the matter. Some studies have noticed how there is some structural tendency to overestimate the inflation rate. For instance, Bates and Gabor (1986), in their study regarding the UK consumers' knowledge of prices and price changes in specific product, showed how the consumers perceived increase of prices was up to four times higher of the actual increases.

Even if these studies report different results, what we can conclude is that: there are some circumstances that could lead the consumers to overestimate inflation.

In order to have some ideas of the phenomenon and of the variables that can affect the perceived inflation, we can see the scheme in the figure 10 elaborated by Ranyard, R., Del Missier, F., Bonini, N., Duxberry, D., Summers, B. (2008). Where we can see that the perceptions are affected by the real inflation rate, the expectations of the future inflations, the social amplification of belief and also the attitudes that can affect the assessment by mean of previous experiences. Even if the scheme is quite clear we need to keep in mind that the factors are not limited to reported one. Indeed, there is a lot of others factor that can affect the perceived inflation. In particular, the individual characteristics determine, to a certain extent, the level of understanding about inflation and then the precision of the consumer estimation. For instance, we can agree that the level of education can have a

significant impact on the consumer's precisions of estimate (especially when the education concerns economic studies), or that the age can affect the knowledge of some product (it's not unrealistic to think that the young people have not knowledge about the prices of the old people health-care).

Figure 10: A conceptual framework for understanding perceived and expected inflation.
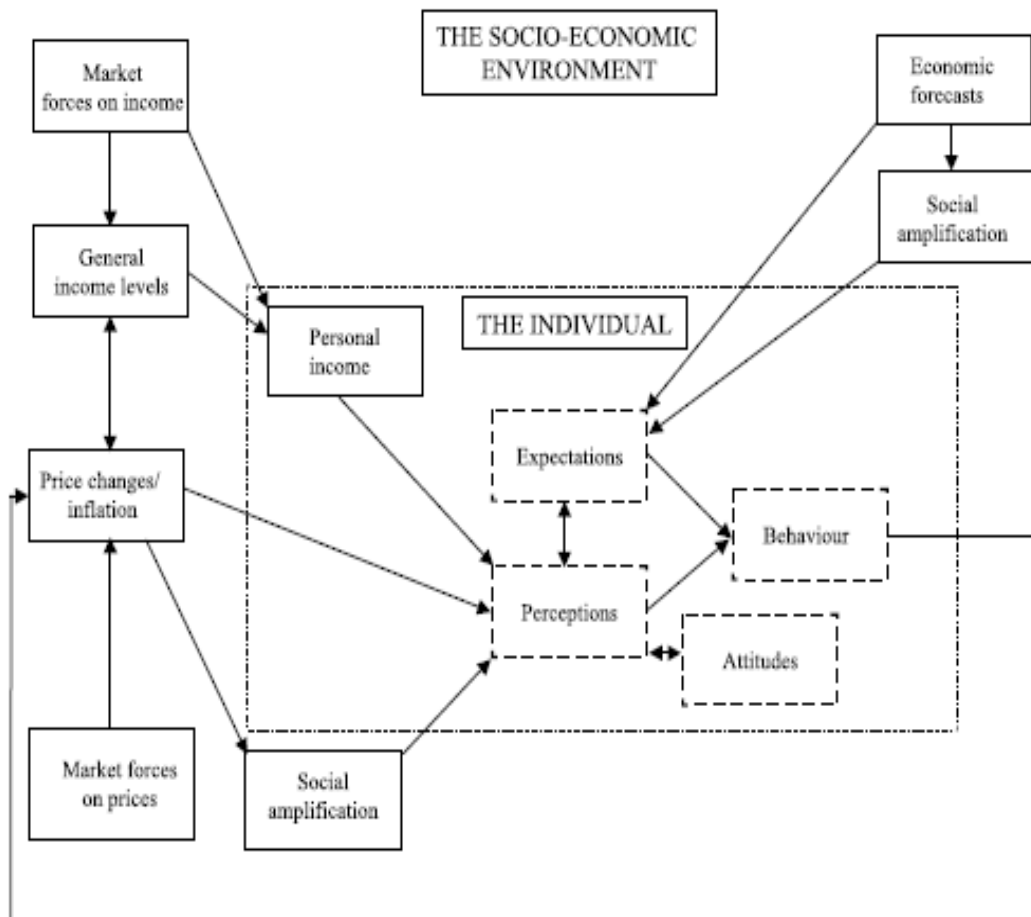
Source: Ranyard, R., Del Missier, F., Bonini, N., Duxberry, D., Summers, B. (2008). "*Perceptions and expectations of price changes and inflation: A review and conceptual framework*". Journal of Economic Psychology, 29, 378–400.

Another factor, that could be partially included in attitudes, is that the people build their assessment on fragmented information from the past, that suffer further elaborations at the moment the consumer bring them back to mind. Related to the memory topic, there are a lot of possible sources of error, for instance, the study of Kemp (1999), illustrates how the individual fill the lack of information by mean of association. Referring to our case, a consumer well informed about the price of the oranges could start thinking that the price of the fruits increase whenever the price of oranges increase, even if actually the price of the other kind of fruit have different patterns.

Summarizing, we can say that the perceived inflation is the results of a lot of different factors that could lead far from the actual inflation rate in some circumstances.

Given the importance of the perceived inflation among the consumers, and given the worry that the euro changeover aroused about the stability of prices, a lot of European countries commissioned studies to observe the changes on the perceived inflation during the euro introduction. As regards Italy, the observation of the perceived inflation was carried out by the Isae (an Italian public institution of economic analysis), and once finished, published by the European Commission with the surveys of the other countries. The Isae study actually regards different aspects of the economy and is performed by the interview of about 2000 people in all the country.

What let us develop an understanding of the perceived inflation by the consumers is the question: "How do you think prices in Italy have developed in the last 12 months?" with the following available answers: "risen a lot" (N1), "risen moderately" (N2), "risen slightly" (N3), "stayed about the same" (N4), "fallen" (N5), and "don't know". Given the structure of the answers, the Isae derives an index of the perceived inflation by computing a weighted average of the different answers. The formula used by the Isae is $S = N1 + 0,5N2 - 0,5N4 - N5$, where S is the index of the perceived inflation, and the different N are the answers of the question. It was used as reference value "risen slightly" because it was considered the "real answer", and measured the other different answers as results of the distance from this one (except "don't know" that was excluded).

Even if this perception index data can't be directly compared with the actual inflation ones, since they refer to different scales, they are proposed in the graph (figure 11) together, in order to note possible similarity in the trends of the two series and, most of all, if there is a discrepancy at the time of the changeover between the perceptions and the official data.

We can note that since the early years reported in the graph there is some correlation between the two series, that last until 2002 where there was an abnormal discrepancy between the two indices with the perceived inflation index that suffered a great increase and greatly overcome the actual inflation rate. Looking at the data we see in this moment that the percentage of consumers that believe the prices have "risen a lot" grew up, between the end of 2001 and the beginning of 2003, from 10% to 49%, and that the percentage of consumers that answered "risen moderately" risen from 48% to 89%. Only from 2004, there was a gradual comeback of the perceived inflation to the actual inflation rate.

Comparing the data of Italy with those of the euro-zone we note that also in other countries, there is a general increase perceived inflation with respect to real inflation, but we can note also that such discrepancy started in the 2000, well before the euro changeover.

Figure 11: Inflation measured by the statistical institute and inflation perceptions

(twelve-month percentage change in harmonized consumer price index, percentage balances of responses)

(a) Italy

(b) Euro area
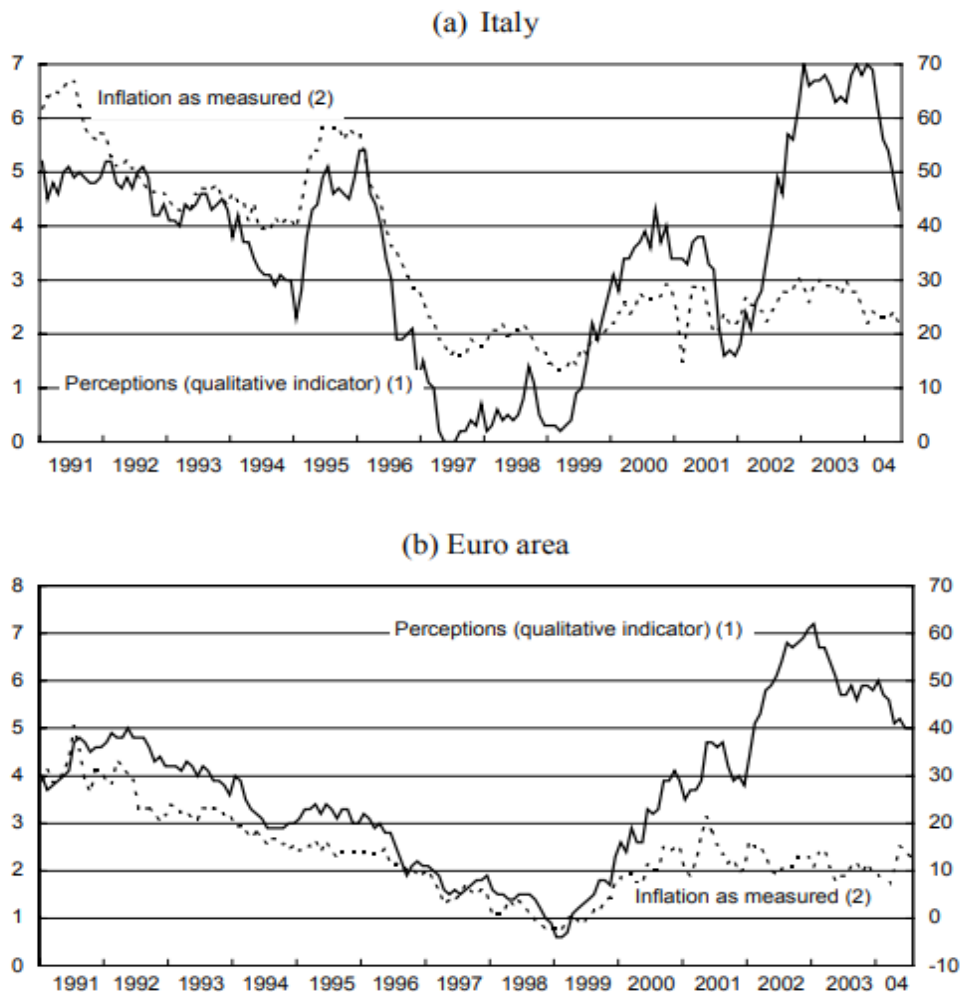
(1)Qualitative indicator obtained as the percentage balance of responses to the monthly consumer survey (right-hand scale)

(2)Twelve-month rate of increase in the harmonized index of consumer prices (left-hand scale).

Source: P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005

The Italian data actually showed a perfect coincidence with new currency introduction, but it is caused by the sudden fall of the perceived inflation in the second half of 2001. If we exclude such period we can see how the Italian's trend is quite similar to the rest of the euro-zone. This would suggest that the discrepancy of the two series was born at the eve of the new millennium from factors probably not related to the euro changeover.

It's not excluded, however, that the discrepancy in 2000 could be the results of some anticipation effects related to the euro that could have affected the inflation expectations. For instance, it's

30

possible that consumers expected some homogenization of the prices due to the liberalization of the markets and the customs tariff disposal, and that have shifted these beliefs in the present behavior.

Anyway, it's unlikely that such anticipation effects could have affected the data with so much advance, in the end, we are talking about consumers and not financial operators. Rather it's more realistic that the discrepancy was caused by some other independent event like 2000 crisis, a decrease of the trust about the economic system, a change of the consumer information sources or simply by the increase of inflation in 1999. Anyway, even if the euro introduction wasn't the starting point of the increase perceived inflation, it is likely that it has strengthened this phenomenon, given that the perceptions have worsened after 2002.

5.1 Individual characteristics and subjectivity

Also, the individual characteristics can affect the perceived inflation of the consumers. One variable that can be more significant than others could be the personal income, since to different income usually we have different consumption habits. For instance, foods have a heavier presence on the low-income consumers, and the luxury goods have more space for high-income ones. In such situation, if the price of the food or the goods typically bought by the low-income consumers increase, then these consumers would suffer the price increase more than high-income ones.

Obviously, besides the income, there are other characteristics that can affect the perceptions, including the type of employment and level of education. About these variables, the Isae reconstructed the data of the surveys dividing the data in reason of the different variables. The data of perceived inflation obtained in this way (figure 12) show that there was a difference between the high and low-income consumers and that the latter perceived far more inflation than the others.

As regards the education degree the dynamics were quite similar to the income. The consumers with lower degree perceived more inflation of the consumers with a high degree. And about the job status, the higher perception came from the households and from the pensioners, while the workers perceived less inflation than the others.

These data confirm that the inflation perceptions depend on the individual characteristics in some extent, and it takes on greater significance whenever the segments of consumers like the pensioners, with low-income or low-degree, make up a great part of the whole population. Moreover, it doesn't finish with the mathematical increase of the perception, because these segments could have affected the rest of population by means of the media and word of mouth.

Even if these data showed how some segments of the population could have perceived more inflation than others, the data don't explain so much about the perceived inflation of the euro changeover. Indeed, such differences are more or less constant in time and not specific related to the euro introduction. And moreover all the consumers also those with high income and high degree complained about an increase in prices. Thus, it is not among these differences that lie the answer to our problem.

Figure 12: Inflation perceptions in Italy by income bracket, educational attainment and work status of the respondents
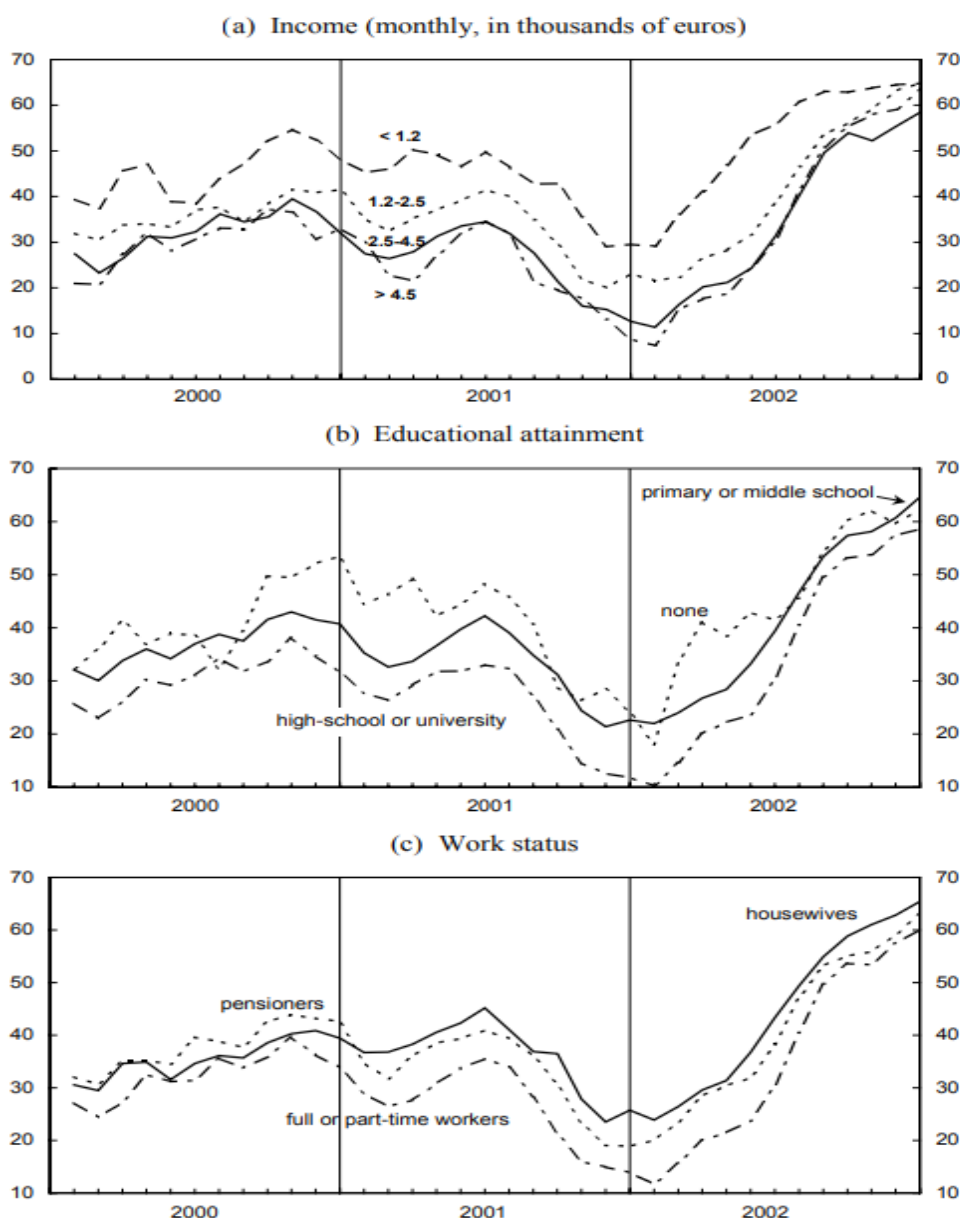

Source: Isae data by P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005

5.2 Purchasing power

A possible explanation to the conventional wisdom that prices have risen could be that consumers have not experienced the prices risen, but rather a reduction of the individual income, and then, of the purchasing power. In order to verify if this could be the cause, we can see the data referring to the economic situation of the households in figure 13.

Figure 13: Household income and equivalised income: average value at constant prices (index numbers, 1991=100)
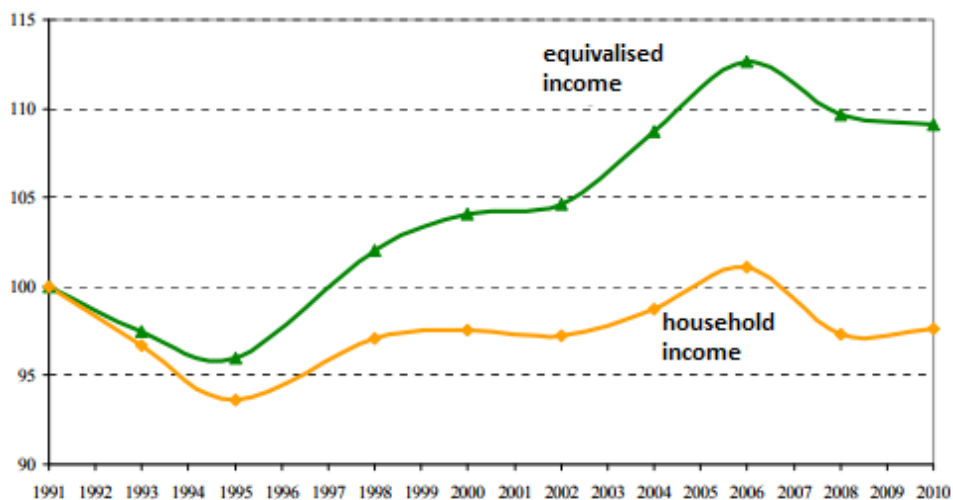
Source: Banca d'Italia (2012). "*I bilanci delle famiglie italiane nell'anno 2010*", Supplemento al Bollettino Statistico - Indagini campionarie. Anno XXII, numero 6. Banca d'Italia: Roma.

In the graph, we can see either the households' income or the equivalised income (that is an elaboration of the households' income that takes into account the different size and composition of the family). In both cases, it's notable a substantial stagnation of data in the period between 2001 and 2002, that exclude the decrease of purchasing power from the possible causes of the abnormal inflation perceptions.

However, there still is the possibility that a concentration of wealth happened so that a great part of the population became poorer. In order to verify it, we can rely on the Gini's index that gives us a clear picture of the evolution of inequality among the population of a certain country.

As regards Italy we have in figure 14 the Gini's index, that shows how in the period of interest around 2002, the index had a significant reduction compared with previous years, that means inequality have contracted and the people's wealth has become more equal.

Indeed, the wealth of the richest decile decreased in such period for the benefit of the rest of the population that have increased their wealth. As regards the 50% of the poorest population the situation has not changed, whilst there was a slight increase in population with a negative wealth.

What we can deduce from these results is that in around 2002 the wealth moved from the 10% richest people to the upper-middle class, whilst the rest of the population has not seen any peculiar move of their wealth, neither in worse or better. And eventually, there is no way that the abnormal perceived inflation of 2002 could be caused by a decrease in purchasing power.

Figure 14: Distribution of households net wealth in the period 1991-2010
(percentage)
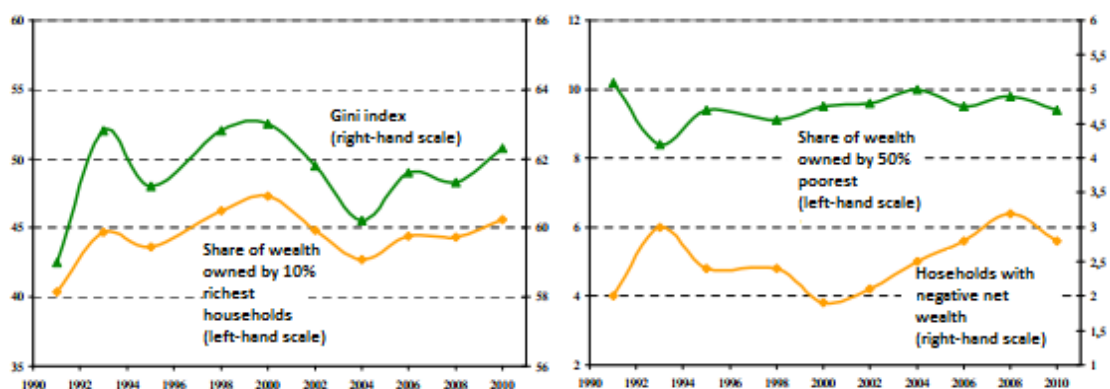
Source: Banca d'Italia (2012). "*I bilanci delle famiglie italiane nell'anno 2010*", Supplemento al Bollettino Statistico - Indagini campionarie. Anno XXII, numero 6. Banca d'Italia: Roma.

5.3 Frequency bias

Among the theories proposed to explain the abnormal perceived inflation, one of the more treated is the frequency bias, according to which the consumers have the tendency to give an excessive weight to the products purchased more frequently when comes to assess the inflation rate. In other words, the consumers lack the ability to determine the weight of every product rationally like do the official indices, weighting the products with their actual weight in the family budget. For instance, it's not absurd to think that the average consumer pays more attention to the prices of foods, rather than the travel expenses or car, which could be underestimated because considered rare or as unique costs.

The theory of the frequency bias become more relevant if we consider the fact that, in January 2002, the euro changeover had washed away the reference prices of the different products from the consumers' mind, triggering a new learning process about the new prices. Indeed, this process may

not have been homogeneous because the consumers learn faster the price of the products purchased more frequently, since more visible; and learn much slower the prices about the rarer purchased ones. The result of it would be that the perception of inflation in the first period after the euro changeover was based almost entirely on the frequent purchased product changes.

On this matter, some studies were just present in the literature but was the abnormal inflation perceptions of the euro changeover that promoted more studies about the frequency bias. Indeed, after 2002, different studies tried to verify this kind of error among the consumers. One of them was done by Georgans, Healy and Li (2014), that set up an experiment in order to test if actually the consumers rely more on the frequent purchased products' prices to estimate the overall inflation. And the results of this study, like the others, showed how there is this kind of bias among the consumers.

In order to determine if this theory can be plausible in our case, it must be that the price of frequent products, in the period considered, increased more than the others products did. Indeed, if it would not be the case, there is no reason to think it could be the cause of the abnormal inflation perception.

We can analyze the price changes of the different frequency products thanks to the Istat's inflation data elaborated by Del Giovane and Sabattini.

Figure 15: Inflation rates for goods and services in Italy according to frequency of purchase

(quarterly data; twelve-month percentage changes of the sub-indices)
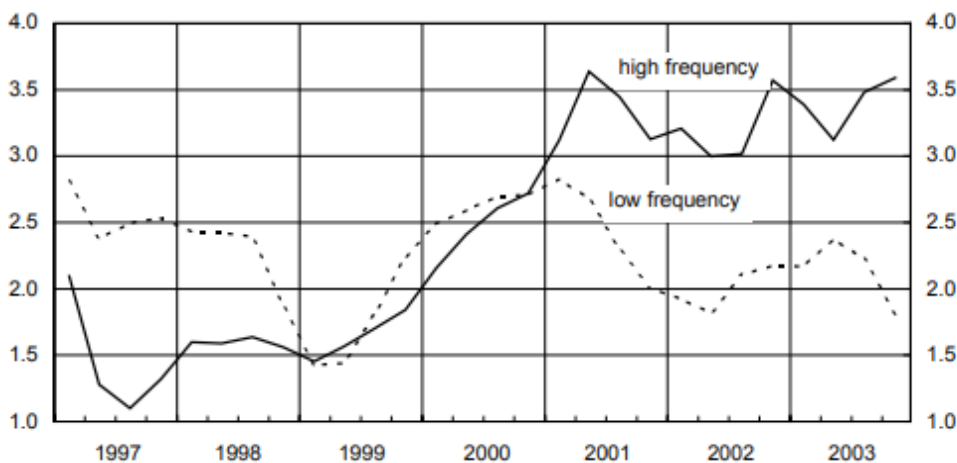
Source: P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005

In the graph (Figure 15), is summarized the changes of two different sets of prices, the first named "high frequency" contains the prices of the product purchased at least one time a month like the food goods, the cigarettes and fuel, and the second called "low frequency" that regards all the others

products. We can note that starting from 2000 there is a discrepancy between the two series that for two years until then were well correlated. It seems, then, that it's plausible that the rise in perceived inflation could have been caused by an increase of the high frequency purchased product.

These values, however, are not enough in order to clarify the great difference between the perceived inflation and the actual inflation rate, since the difference between the two series is only about 1-2%. It would explain it if the perceived inflation of the consumer was lower, but it's hard to believe that they could explain the survey's data. Moreover, we need to say that the discrepancy between the two series started in 2001, i.e. far ahead from the increased perceived inflation of 2002. And it would suggest that there is no relation between the two phenomena.

On the other hand, the consumers could have paid attention to the frequency product's prices only once the euro was introduced, ignoring them for all the period until then. If this was the case, there is the risk that if the consumers had ignored the inflation of the frequency product, they had ascribed all the increases of 2001 to 2002 and then to the euro changeover. However, if we take a look to the rest of the euro-zone, we will see that not always to the rise of the high frequency purchased prices corresponds an increase of the price perceptions (Insee 2003), implying that there are other causes that could affect the perception (or that switch on the frequency bias).

About the analysis of Del Giovane and Sabattini, the choices of the two sets might have hidden other phenomena, indeed it's possible that the sets that affect the consumers perception are smaller and may be linked with some routine situations, like eating at the restaurant or buying the usual newspaper; and that other products have much less impact on the perceptions. In such case, it's possible that the products with more impact suffered more inflation than 2%, and they may be the cause of the inflation perceptions. Another point is that maybe if we consider a different frequency to distinguish the "high frequency" product to the "low frequency" the data may be more pronounced, since it's hard to believe that all the products have as breakthrough point one month, where if the product is purchased more often than monthly is important otherwise not. Probably it would be wiser to consider both the frequency and price itself, since both of them can affect the visibility of the purchase, and build up different sets based on visibility.

In conclusion, even if it's not possible to verify a clear impact of the frequency bias, the data gathered confirm an increase of the frequent purchased products in Italy and then we cannot exclude that this may have affected the consumers' perception, either be only the cause of it or at least one the factors at stake.
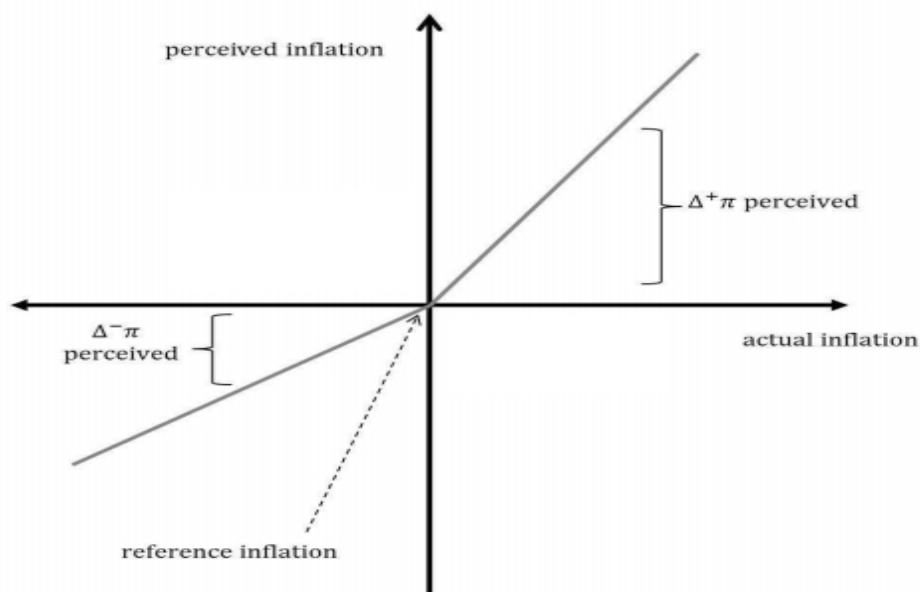
5.4 Loss aversion

Another factor that could have affected the consumers' opinion is the so-called loss-aversion, that is the tendency of consumers to perceive the losses somewhat stronger than the gains of equal extent.

The phenomenon of loss aversion came out thanks to Daniel Kahneman and Amos Tversky (1979) and their prospect theory, that tries to explain the behaviors of consumers by mean of different factors detected by experiments over the years. And some of these experiments highlighted that individuals ascribe different importance to gain and losses of the same extent, where the losses are perceived as twice relevant.

In our case, if we assume that the price increases are perceived as a loss by the consumers (and the decreases as a gain), it leads to a concrete possibility that the consumers are biased from such loss aversion.

Figure 16: Prospect Theory and Inflation Perceptions

Source: L. Dräger, J. Menz, U. Fritsche, " *Perceived Inflation under Loss Aversion*", No 201105, Macroeconomics and Finance Series from Hamburg University, Department Wirtschaft und Politik, 2011

If we consider, for instance, to have a basket of two goods (A and B) of equal prices, and let A increase by 0,50€, and B decreases by 0,50€; if we calculate the inflation rate of the basket, we will get a 0 percentage change. However, if we are under the loss aversion the consumers wouldn't do a simple average of the prices but would assign a heavier weight to the loss, since consumers are

more concerned about the increase of A's price than satisfied of the B's price decrease. According to this second case, and assuming the losses importance to be twice the gains one, we will have that the perceived inflation are equals to 2/3*0,50+1/3*(-0,50)=0,17€, which means that the consumers could perceive a positive inflation when actually there is a stability of prices.

As regards the real data, a suggestion of a possible impact of the loss aversion in the inflation perception of 2002, came out by the study of Lena Dräger, Jan-Oliver Menz and Ulrich Fritsche (2011), who analyzed the data of ten countries of the euro-zone. In their study they tried to explain the euro inflation perceptions by making a regression between the actual inflation and the perceived inflation, first looking for some linear relationship, and then if a non-linear bound was present.

The results of the analysis suggested that a non-linear relationship was present between the real data and the perceptions, where the non-linear relation takes a similar shape of the relevance function between the losses-gains in the prospect theory (figure 16). In particular, they got that the worsening of the consumers' perception became more pronounced after the overcoming of a certain inflation rate value (or reference point in the prospect theory), detected to be around the 1,8% and 3,3%. In other words, assuming that this behavior is due to the loss aversion effect, the consumers, expecting an inflation rate of 1,8-3,3%, perceive far more inflation for every increase of the real inflation rate whenever these values are overcome. And that, they perceive less inflation when the real data are under this point.

Given the similarity of the perceive patterns of this study with the prospect theory's loss aversion, it's quite likely that we're talking of the same phenomenon, even if we can't prove it. Another coincidence is that the study showed that at time of the euro changeover there was a reinforcement of the non-linear relationship. This is interesting because it shows how the environment or other factors could affect the "loss aversion" phenomenon enhancing it in same circumstances, and that may mean that there are hidden other factors which may be the true cause of the abnormal perceptions.

Even if there are some clues that the loss aversion could be one of the factors liable of 2002's perceptions, we have to say that the overall inflation in 2002 was not so much higher than the reference point of the study, actually, it might be less than it. However, if we apply the logic not to the overall inflation but to every product's price change then it could work, but there is no evidence of such approach by the consumers.

In conclusion, these results showed how there could be a relation between the abnormal inflation perception and the loss aversion, but like the other psychological factors we can't state for sure that it is the cause of the inflation perception of 2002, even if it is likely that it played a role.

5.5 Focus on extreme variations

A similar bias of the loss aversion is the tendency to pay more attention to the larger variations of the prices and ignore the small changes. For example, if we imagine that there is a large increase of a certain product, that is compensated by other small changes of many other products in a way that the overall inflation is equal to zero, the consumer could assign too much relevance to the increase, since more visible than the other changes.

We can see if in 2002 there was a particular increase of the relevant increases prices looking at the price changes distribution. Figure 17 shows the price changes distribution dividing the changes into a few classes based on the extent of the annual percentage change of prices, in the period 1999-2002. It's obtained then the frequencies of the various changes classes (without any interference by the relevance of the product in the basket).

Figure 17: Distribution in percentage classes of the annual average price changes
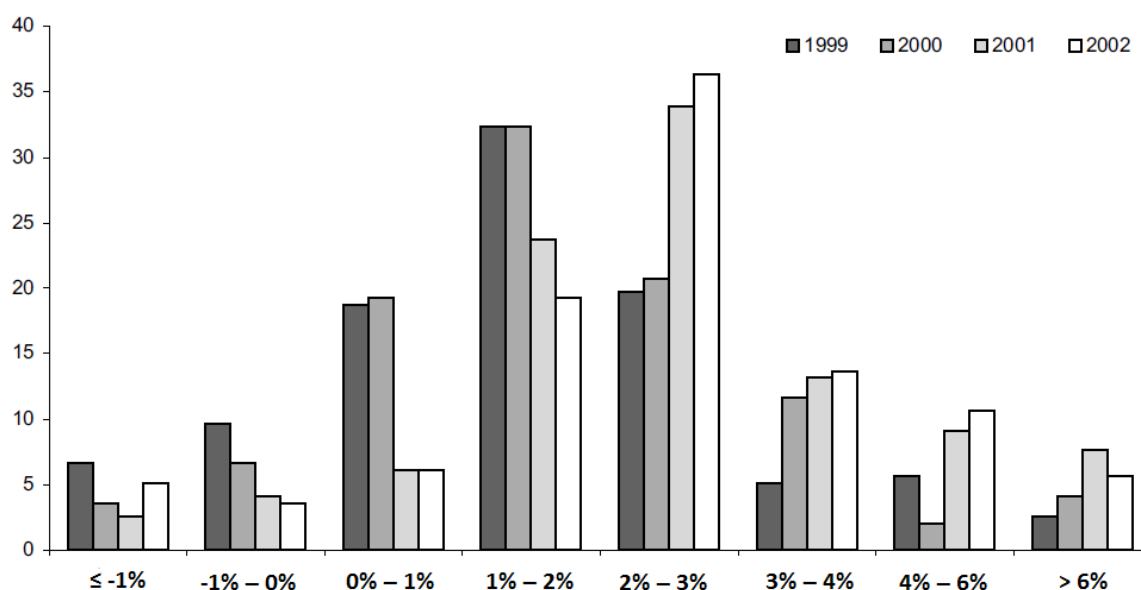
Source: Istat (2003), "*Rapporto annuale. La situazione del Paese 2002*", Roma

We can note that, as regards 1999 and 2000, the changes of prices are included mostly in the range of 0-3%, while in the year 2001 and 2002 they are located in a greater extent in the upper-classes of changes. This difference would sustain the possibility that it is the cause of the abnormal inflation perceptions since the increases have become higher in absolute value respect the previous years. However, like the frequency bias, also 2001 shows a similar changes distribution and we'd expect to be in this year that the perceived prices arose, instead of 2002. Obviously here, like for the

frequency bias, it is possible that the euro introduction had triggered new forces, absent in the previous years, and that the distortion effect in the perceptions started only once euro was introduced. Another consideration is that the distribution of the changes regards the Istat data of inflation and then it inherits also the limitation of them. Indeed, it could be that the consumers looked at the prices that were not detected by the Istat indices, and then noticed prices absent and not considered by the graph.

In conclusion, the data show the possibility that a particular high attention for the high changes could be one of the causes of the consumers' 2002 perceptions, even if we can not prove if it was the cause or not.

5.6 Media influence

It's not so strange that the social interaction plays an important role in building the consumers' perceptions since it is the main source of information for a great part of the population. Indeed, with the word social interaction we mean all external factors to the consumer that through communication can affect the consumer's perceptions, like the television, the word of mouth and the media in general.

This large set of means could influence the consumers' perception in different ways. First of all, the number of information conveyed by the media could be by itself a significant factor, since it focuses the attention of the audience on certain topics so that other topics go unnoticed. Secondly, being the media the main source of information for the consumers they are able to affect the perceptions, not only choosing which topics talk about, but also by mean of the way they do it, and by the interpretations they give of each information. The media should give a complete overview of the news, but often we see how the media operators give a personal interpretation of them depending on which political opinion they have (or their opinion in general), and that's why we usually have contrasting messages by the media. And this translates into a diversification of the opinions among the audience of the different media, which further exacerbate the opinions distances.

Regards the abnormal perceived inflation of 2002, it's possible that the media influence would lead to an amplification of the negative opinion because of the preference to spread and communicate the bad news, in order to get more audience. This possibility was explored by the study of Soroka (2006) that analyzed the time series of some UK economic indicators, observing the relative media

coverage of these issues and the public opinion (1986-2000). And he has found that the media tends to focus more on disclose the bad news rather than the good changes.

Seeing the situation in Italy, we see that the media relevance of inflation, in the years following the euro introduction, was exceptionally high. And, also seeing the period previous the euro changeover, there is a high attention, caused by the high inflation rate recognized in 1999-2000 years and by the imminent new currency introduction and the potential risk of inflation due to it.

Once the euro was introduced, the media had assiduously followed the topic checking the price changes, and even calling into question the capability of the official indices to represent the actual price changes, comparing them with non-official indices, like the Eurispes, which sustained to be able to explain the consumers perceptions showing higher prices inflation with their indices.

We can see the media coverage of the euro inflation thanks to Del Giovane and Sabbatini, that gathered the articles that talked about the euro inflation of two Italian major newspapers: La Stampa and Il sole 24 ore. The authors selected the articles of these two newspapers with two searches criteria in order to detect those are talking about our topic:

1. Articles in whose title was present at least one of these keywords: "caro-vita","caro-prezzi", "costo della vita" (all three of them mean cost of living);

2. Articles with "inflazione" (inflation) or "caro-vita"(cost of living) in the title, and "associazioni" (associations) or "consumatori" (consumers) in the text.

After the selection, it was compiled the time series of the frequency of such articles over time. We can see in the first graph (figure 18) that the first search criteria shows no evidence of an increase in the articles in the period 2002-2003 as regards Il sole 24 ore, indeed we see similar attention to the topic in the previous years. The significant increase of attention there was in 2000, probably due to the high inflation rate of that year and to the warnings about the coming of the new currency potential inflation effect. Otherwise, as regards the second key research, it detected a slight increase in the number of articles after 2002, and again the attention increase in 2000.

Similar results, but more pronounced, came from the data of La Stampa (figure 19), that shows a significant increase starting in 2002 but show no peculiar change about 2000, probably due to the lower specialization of La Stampa in the economic fields compared to Il Sole 24 ore.

Such data show how there is a relation between the perceived inflation and the attention of the media. However, the connection may be less informative than it appears to be, given that there is the possibility that the articles were only capturing the feelings of the population and not some driving effect of the news. Probably the interest of the media to the phenomenon and the increasing

interest of the population on following that topic reinforces each other, rising the extent of the consumers' worries.

However, about the analysis, it refers to the topic attention by the media, but there is no evidence that they accused the euro to be the cause of inflation, and actually neither that the prices arose. Then the data catch only the quantitative dimension of the media coverage. If we imagine the scenario where the media are well divided between those who claim that prices were increased due to the euro introduction and those sustain there was not an abnormal increase of prices, it is likely that a certain part of the population would believe to the first. In the worst scenario where the media is more inclined to disclose the bad version of the news there would be a greater part of the population that believe them, and then that believe the prices are increased.

In conclusion, even if we can't state that the media were responsible of the abnormal perceived inflation in 2002, we can state that there was a particular attention to the phenomenon and that probably it could be a cause of the abnormal perception in some extent. Moreover, it's possible that the media spread a certain dose of concerns and skepticism about the euro in the years before the changeover, that could have affected the perception and the consumers' approach to the new currency.

Figure 18: Inflation perceptions and number of related articles in Il Sole 24 Ore
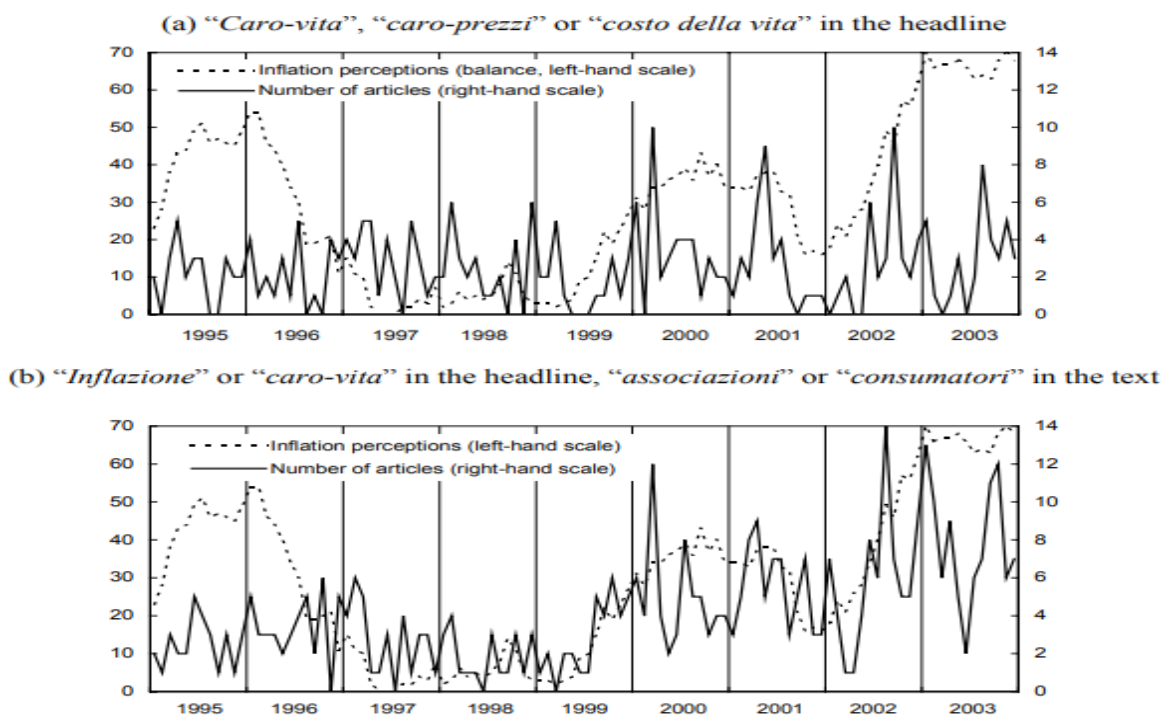
Source: P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005

Figure 19: Inflation perceptions and number of related articles in La Stampa

(a) "*Caro-vita*", "*caro-prezzi*" or "*costo della vita*" in the headline
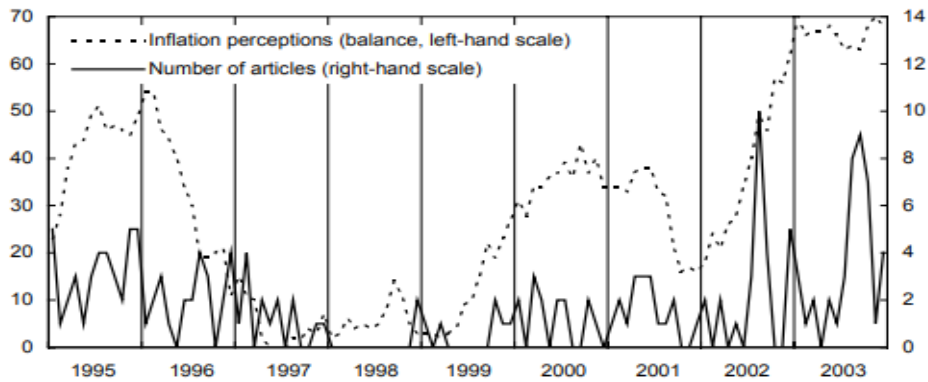
(b) "*Inflazione*" or "*caro-vita*" in the headline, "*associazioni*" or "*consumatori*" in the text
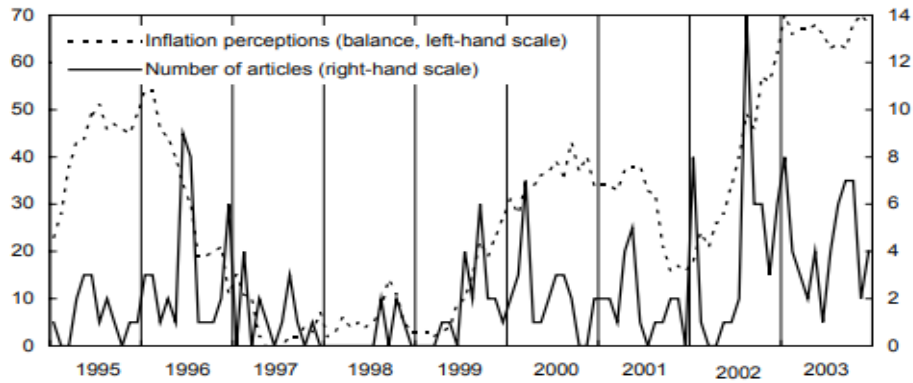
Source: P. Del Giovane and R. Sabbatini,"*The Introduction of the euro and the divergence between officially measured and perceived inflation: the case of Italy*",Bank of Italy, 2005

6. AN EXPLANATION BASED ON CONFIRMATION BIAS

Until now we have seen how the consumers' perceptions are not reflected by the real data and that, maybe, it is due to the perception biases. We have discussed how the perceptions can depend on the individual characteristics, the theory of a major influence of the frequently purchased products, of a possible selective attention to certain variations and, eventually, the media influence.

In addition to such explanations, here we propose a new possible interpretation of the phenomenon, based on the tendency of the consumers to confirm their own expectations. This tendency is known in the literature as confirmation bias, and we can define it as the tendency of people to consider only the proof that sustains their hypothesis and ignore the ones which could debunk them. An example of the confirmation bias could be seen when an individual who sustains a certain politic party tends to read the newspapers of similar political thinking in order to receive satisfaction to be right. Indeed, these newspapers usually bring out every positive aspect of the party actions and put in a bad light the other factions, preventing the reader to have a clear vision of the facts and to change their political thinking. Another, more intuitive, example is when a scholar working on a thesis gathers only the literature that sustains his arguments avoiding to report the articles that could give rise to doubts about his conclusions.

One of the first authors that faced this kind of cognitive biases was Wason with his famous experiment (Wason P. C.1960), that is still today one of the most reported in the literature. Imagine you are being asked to detect a logic rule about the series of numbers $2 - 4 - 6$, by mean of others series proposing that could be: accepted if it follows the rule, or refused if it doesn't. You may note that all three numbers are even, so you might propose a series like $2 - 6 - 10$ that will be accepted, or you could try "the multiple of two" hypothesis with the $8 - 10 - 12$ series, that will also be accepted. Actually, neither of them is the true rule, and a lot of subjects wronged to supply the exact response. Indeed the major part of them, after a certain amount of propose acceptations, were sure of their answers and stated that the logic rule was an increasing series of even numbers or an increasing series of multiple of 2. In reality, they wronged since the right rule was a merely series of increasing numbers, regardless of whether they were even or multiple of 2. Eventually, the experiment showed how the subjects tried to, almost solely, verify their hypothesis, while only a small part of them tried to test their hypothesis proposing series that could debunk it. Indeed, if they would want to verify their ideas they should have proposed a series like $7 - 9 - 11$ in order to find out that neither the multiple of 2 nor the even number hypothesis were the right answer.

Later, authors like Joshua Klayman and Young-Won Ha sustained that the Wason experiment didn't show a confirmation bias as formulated by Wason, but rather a preference for the positive tests, that is "testing a hypothesis by examining instances in which the property or event is expected to occur, to see if it does occur" (Klayman, J., and Y. Ha, 1987, "Confirmation, disconfirmation and information in hypothesis testing", Psychological Review 94, 212)
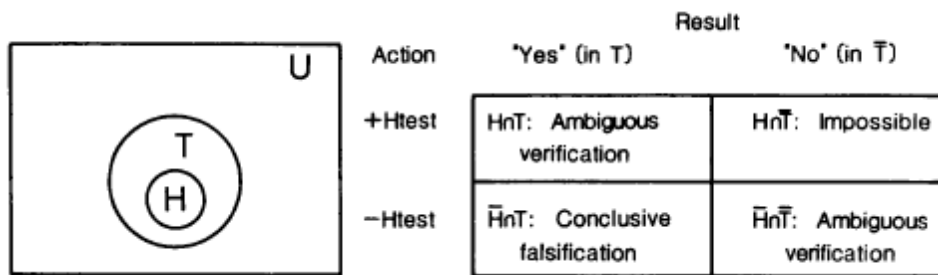
The difference between the two interpretations is that, according to Wason, people, regardless of the kind of question, tends to look for the confirmation of their ideas and ignore the proof that debunks them; instead, according to Klayman and Ha, people tend to do positive test in order to verify the hypothesis and such strategy brings, only in certain circumstances, to an error. Indeed, the mistake that the subjects make depend on the nature of the relationship between the subjects' hypothesis and the true rule. There are cases where the positive test brings to an error and other cases in which it results to be an effective verification method. In order to see each of these cases we report an example by Klayman and Ha, that can illustrate every possible situation, and then we will see what happen in the different cases.

Imagine being an astrophysicist that wants to identify the rule over the presence of planets around the stars. We have a domain composed of all the stars in the universe, part of them have some planets (set T) and some not, and there is a rule that could exactly identify every one of them. Our purpose is to find out what this rule is by testing our hypothesized rule (stars supposed to have planets: set H) and see if it can be assumed to be the true rule. Within the example we can imagine testing our hypothesis by pointing a telescope at the stars: if we point a star that, under our hypothesized rule, should have planets we are doing a positive test; otherwise, if we are pointing to a star that shouldn't have any planets, it's a negative test.

Supposing that our hypothesized rule is H:"the yellow stars have planets", we will see what happen with different true rules. In the first case (figure 20), we can imagine a situation in which our hypothesis is more strict than the true one, for example with T: "the red and yellow stars have planets".

In this case, we can note that with a positive test there is no possibility to obtain a falsification of our hypothesis even if it is wrong. Indeed pointing a yellow star, we would have every time a confirmation of our hypothesis, but we'd never be able to know that also the red stars have planets. If we'd do a negative test, seeing if a non-yellow star has no planets we have two cases: we are seeing a no-red star that has no planets or we are seeing a red star that has planet. In the first case we have an ambiguous verification like the positive test, but in the second case we would know for sure that our hypothesis H:"the yellow stars have planets" is wrong.

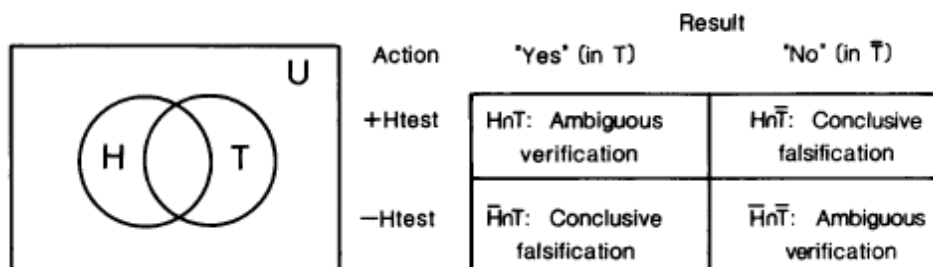Figure 20: Representation of a situation in which the hypothesized rule is embedded within the correct rule

Action	Result	
	"Yes" (in T)	"No" (in T̄)
+Htest	HnT: Ambiguous verification	HnT̄: Impossible
−Htest	H̄nT: Conclusive falsification	H̄nT̄: Ambiguous verification

This is also the case for the Wason experiment, since the hypothesized rule of the subjects (H:"increasing series of even number" or H:"increasing series of multiple of 2") was more strict of the actual rule (T:"increasing series of numbers"). Indeed, even in that case, once the subjects have done the hypothesis there was no way to reach the true rule by mean of a positive test since there would be a confirmation every time.

The second case occurs when the set of the hypothesized rule and that of the true rule partially overlap (figure 21). For example, if the true rule is T:"the big stars have planets", we have that there are the big yellow stars that have planets and the small yellow stars that have no planets, then a positive test could find that the hypothesized rule is wrong. And also a negative test has the possibility to debunk the hypothesis whenever we are pointing the telescope towards a big no-yellow star.

Figure 21: Representation of a situation in which the hypothesized rule overlaps partially the correct rule

Action	Result	
	"Yes" (in T)	"No" (in T̄)
+Htest	HnT: Ambiguous verification	HnT̄: Conclusive falsification
−Htest	H̄nT: Conclusive falsification	H̄nT̄: Ambiguous verification

The third case is the opposite of the first, we have that the true rule is more strict of the hypothesized rule (figure 22). We can imagine a true rule T:"the big yellow stars have planets". In such case is the negative test that has no utility since the test would result always in an ambiguous verification. Pointing a no-yellow star we would see always that it has no planets since being yellow it's a requirement to have planets. With a positive test, instead we would debunk our hypothesis whenever we are testing a small yellow star, that would result to have no planets and bring us at the conclusion that our rule was wrong.
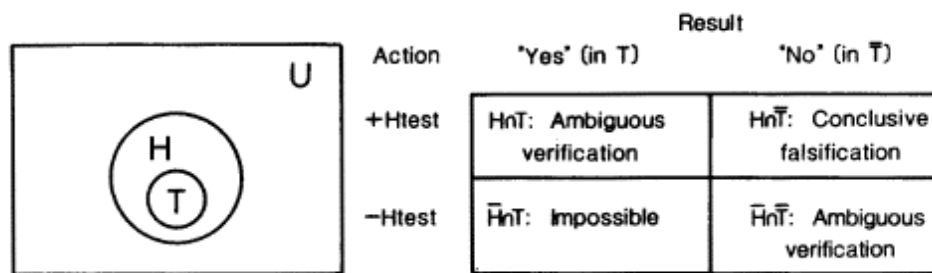
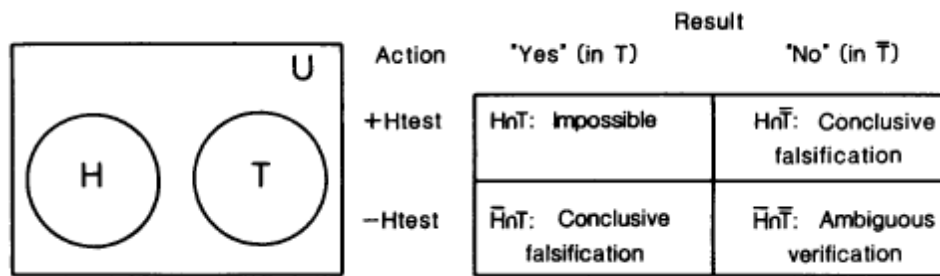Figure 22: Representation of a situation in which the hypothesized rule surrounds the correct rule.

Source: J. Klayman and Y. Ha (1987). Confirmation, disconfirmation, and information in hypothesis testing. Psychological Review, 94, 211-228.

The fourth case occurs when our hypothesis is completely wrong and doesn't include any overlapping (figure 23). In the star-planets example, it could be T:"the green stars have planets", in such case both the positive test and the negative test could bring to falsification. Indeed, if we'd do a positive test we will see suddenly that no yellow stars has planets, while with the negative test there is less efficiency since we will see that if we are pointing to a no-green star there is an ambiguous confirmation and only if we are pointing to a green star there is a falsification, but potentially it could serve our purpose as well.

The last case (figure 24) occurs when we have that the hypothesized rule and the actual rule is the same and we are right. Obviously, in such case, no test will result in a falsification and we will have always confirms to our hypothesis.
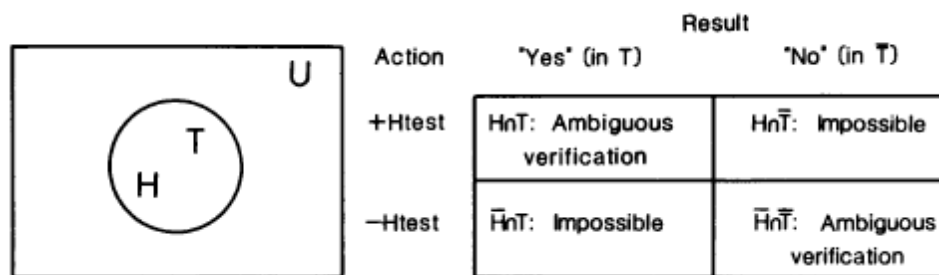
We have seen how depending on the relation between the hypothesized rule and the actual rule, either the positive or negative test could bring to mistakes. Then it would be wrong to define the positive test strategy as a mistaken strategy since in certain circumstances it could serve better than the negative one.

Figure 23: Representation of a situation in which the hypothesized rule and the correct rule are disjoint.

Action	Result	
	'Yes' (in T)	'No' (in T̄)
+Htest	HnT: Impossible	HnT̄: Conclusive falsification
−Htest	H̄nT: Conclusive falsification	H̄nT̄: Ambiguous verification

Source: J. Klayman and Y. Ha (1987). Confirmation, disconfirmation, and information in hypothesis testing. Psychological Review, 94, 211-228.

Figure 24: Representation of the situation in which the hypothesized rule coincides with the correct rule.

Action	Result	
	'Yes' (in T)	'No' (in T̄)
+Htest	HnT: Ambiguous verification	HnT̄: Impossible
−Htest	H̄nT: Impossible	H̄nT̄: Ambiguous verification

Source: J. Klayman and Y. Ha (1987). Confirmation, disconfirmation, and information in hypothesis testing. Psychological Review, 94, 211-228.

  Obviously, we don't manage to know the relationship before having some results, since the relationship is what we are trying to find. Then we have no information to assess which test would be better to use in a specific situation. However, knowing the consequences of each case, we can decide which one use based on some characteristic of the phenomenon. For example, if we are more concerned about an error rather than another. Indeed, if we want to assess if a man is ill, we will be more worried to state that a man is sane when actually he is ill, than stating that the man is ill when he is sane. Under these circumstances, we will invest more resources to seek among the sane men the sick one (negative test) rather than seek the sane among the infirmed (positive test). On the contrary, we would invest in the positive test in the case we have to assess the guilt of a crime, since it's generally preferable to let a criminal go free than lock in prison an innocent, so we will spend more energy seeking among the criminal an innocent (positive test) than seeking among the

innocent a criminal (negative test). If possible, it would be better to do both the tests, but it's not always recommended, especially in the cases with a too high number of elements to analyze. For example, even if we want to make sure that every sick person is treated, it would be too expensive to analyze every person in the country, looking for HIV-positive people (negative test). Rather, it'd be indicated to make sure that the persons supposed to have HIV, make a test to verify it, given that it would result a reasonable cost given the low amount of tests.

In the Wason experiment there was no information about which test perform so it's possible that the consumers would have chose a different approach if they would have more details about the consequences and characteristics of the experiment. So Wason probably highlighted only a preference for the positive test by the subjects on equal terms. However, we have seen that also the PTS which is not a biased strategy, could bring to an error that can be recognized as confirmation bias.

In order to have a true confirmation bias (like imagined by Wason), we should have an alteration of the verification towards the belief, regardless of the relation between the rule hypothesized and the true rule. We may have some evidence of it in the dissonance theory literature, where the individuals tend to avoid the sources of information that are probable to question the decision made by them (Frey 1981). Another phenomenon may be the higher relevance of the confirming information compared with the disconfirming one, when a certain attitude was present. For instance, the experiment of Gadenne and Oswald(1986) showed that the subjects of the experiment, that had to assess the relevance of the statement regarding the guilt or innocence of a man, who just have a prior belief about the guilty of the man tended to weights more the information supporting their own ideas.

In conclusion, we have seen how the confirmation bias can be the result of a diagnostic strategy like the PTS. And that the literature doesn't provide a unique definition of the phenomenon. There is, only, a common presence of a cognitive error that can sometimes be recognized as confirmation bias. Despite it, we will try to use the confirmation bias in order to explain the high inflation perception of 2002 in the next chapters, building up a model that takes up the confirmation ambiguity, like the PTS, to illustrate the effects of a possible presence of a confirmation bias.

6.1 Expectations origins

The fundamental condition so that the confirmation bias could be a possible explanation for the abnormal consumers' perception, is that they start with the opinion that prices are increased. Since the confirmation bias amplifies the existing belief but cannot explain how they are born.

The reasons for the pessimistic expectations of the consumers can be partially explained by the phenomenon described in the previous chapters. For example, the frequency bias maybe led to a negative expectation because the more frequently purchased products had increased of price, or maybe the consumers noticed more the larger changes of prices that, being negative, led to a negative perception about the overall price changes, or maybe the consumers were simply more affected by the losses and have seen only the negative changes. Moreover, the media could have affected the consumers' perception by leaving too much room to the euro-critics and the consumers' associations, or could have used a kind of alarming language that caused plenty of concerns. Probably, the media have taken special care of the euro-related news, simply because of the great importance of the phenomenon in the economy and in the country, but it has led to a focus of the consumers' attention on the prices much more than in the past and encouraged them to notice each singular increase of price.

Another possible explanation could come from the political dynamics among the parties of the country. We are wondering if it could be possible that some political factions has fueled the belief of an increase of the prices, in order to obtain some advantage in terms of popular support. If that's the case, this phenomenon could have pushed the population to partially believe in the price increases as consequence of wrongful information provided by the parties. We can think that the consumers make a sort of average of the politicians' statement in order to obtain an estimate of the inflation rate, so in a case where a party provides a wrongful information, there is also a biased perception among the population. Especially, for the supporters of the party fueling the belief.

Imagine that a voter chooses who vote based only on the presence or not of the increases of prices caused by the euro, rewarding the governing party in the case of no increase prices and punish him if the increases occur. We will call Alpha the governing party and Beta the opposition party. We can imagine also that the consumer infers the outcome of the euro changeover by the statement of the two parties. We have, then, that:

- If the parties agree the voter believes them;
- If the parties disagree the voter will get confused and will give a random vote.

We can summarize the possibilities by mean of a game representation in the figure 25.

Figure 25: Representation of the game and payoff of the parties

Alpha party

	prices increased	Stability of prices
Beta party prices increased	**1 , 0**	**0.5 , 0.5**
Stability of prices	**0.5 , 0.5**	**0 , 1**

Source: personal elaboration

From this representation, we can note how Alpha has a clear advantage to state that the euro has not caused price increases and that everything has gone without problem. On the contrary, the party Beta has a clear advantage to state that actually the prices have increased, since if he doesn't say that would be equivalent to donate a vote to the opponent. We can infer from the game that there is always a part of the politicians that have the incentive to state there was a price increase and that it was caused by the euro changeover, regardless of fact that it is true or not. And, on the other hand, there is always someone that has incentive to say that the prices were stable, even if they've increased.

But, is it what happened in Italy? It's possible that some party led the consumers to believe that the prices have increased? Regarding the situation in Italy at that time, the political landscape involved a few parties gathered in two big coalitions, the right coalition that was the majority and was leading the government, and the left coalition at the opposition. Such situation derived by the recent elections held on 2001, after different years of left-wing's government that was the greater supporter of the monetary union and of the various integration proceedings of the European economies. Before 2002, the right parties were cautious and slightly critics about the euro and his effects on the economy, while the lefts were, along with the general feeling of the population, excited and optimistic.

Later, after the euro introduction, the general optimism of the population was gradually replaced by dissatisfaction about the euro and by the complaints about the prices increase, that reached the

pinnacle in the summer season. At the same time, the left-wing parties started to accuse the majority to not control the sellers' behavior and to not monitoring the price changes.

"Therefore the increases are not due to the introduction of the euro but to the lack of government control. The euro was not the cause, but the opportunity to exercise illegitimate and surprisingly uncontrolled increases"

Translation of: Romano Prodi, interview to La Reppublica, 31/12/2002

The right-wing parties kept a practical position for a long period after the changeover, reassuring that the inflation was very low, but also warning the consumers to pay attention to potential increases and inviting them to change shops if the prices rose. Only later, the right parties came back to support the critics of the euro, once the pressures about the euro inflation from the unions lessened.

"... Italian families have suffered an increase. And therefore, a decrease in their purchasing power, but this is due to the introduction of the euro, which I remember was not decided by this government but was decided by the previous governments."

Translation of: Silvio Berlusconi End of year press conference, 20/12/2003

Probably, the choice to indulge the population's feeling give to every party more communicative advantages than insist to claim that the prices have not had particular increases. However, from the consumers' point of view, it was a confirmation that their belief was right and probably worsened the general opinion.

In conclusion, it's unlikely that the political discussion created the perceptions of an increase of prices, given the delay on the topic, but it is realistic to think that the reciprocal accusations could have enhanced the worries of the consumers. And in addition to that, the other factors like the frequency bias, the loss aversion, and the media effects, could altogether have built up the sentiment of pessimism on the topic.

6.2 The model

In general, we expect that a rational consumer, that tries to estimates the inflation rate, performs an adequate analysis of the prices and, in the end, will reach an unbiased estimate. However, we have seen how the individuals could make erroneous estimate also with a valid strategy as the positive test (PTS), thanks to the ambiguous verification that it's mistaken for a valid confirmation of the beliefs by the consumers. Also the model proposed here tries to catch the phenomenon of

ambiguous verification, assuming that the consumer uses a confirmation strategy, in a certain way similar to the PTS, in order to verify his beliefs about an increase of prices.

First of all, we assume that the consumer don't know the price level in the new currency, but have an expectancy of it (p_0). After the changeover, the consumer, in order to know the prices level, visit the closer shop to see if his expectation is correct or not, and he notes down the first price he sees (p). Once he has done it, the consumer will believe his expectancy is correct if the price p is sufficiently close to his expectation p_0 (E_1). Otherwise, if the price is too far from the expectation the consumer will realize that his expectation is unrealistic and that it is wrong, and then, he will perform a thorough analysis that will bring him to the true value of inflation rate (p*).

We will take one representative product in order to keep the model as simple as possible, but obviously, we can apply the concepts to every singular product of the market as well as all the aggregate.

In order to determine the consumer's expectation after the test (p_1), we have that the consumer has a probability $P(E_1)$ to draw a price near his expectation p_0 and confirm it (where E_1 is the event: draw a price that confirms the consumer's expectation), and a probability of $1-P(E_1)$ to draw a price far from the expectation that debunks it, and that brings the consumer to know the real price level p*.

$$\begin{cases} p_1 = p_0 & P\left(E_1\right) \\ p_1 = p^* & 1 - P\left(E_1\right) \end{cases}$$

The point now is to assess the expected perceived level of prices $E(P_1)$. It will be the results of consumers' test approach described above, and it depends on: the expectancy of the consumer, the actual level of price and the probability that the consumer see in the shop a price near enough to the expectancy to supports his hypothesis.

$$E\left(P_1\right) = p_0 P\left(E_1\right) + p^* \left(1 - P\left(E_1\right)\right)$$

We can imagine the test performed by the consumer as a test hypothesis on his expectancy. Since it can summarize different aspect of our assumed situation, and could be taken as the reflection of the preference of the consumer for his belief, especially when we consider the classic test based on the first type of error.

In this case we have three random variable: the real prices P* (p^*, σ^{*2}) that include all the different prices in the market across the shops, from which the consumer draws the prices to test the hypothesis; the expected prices distribution P_0 (p_0, σ_0^2), since we assume that the consumer has a certain expectation but also that he knows there are different prices across the shops for a certain product and P_1 that is the expectation of the consumer after the test. We have that: if the consumer draws from P* a price p that confirms the hypothesis, the ex-post belief will be the random variable $P_1 = P_0$(p_0, σ_0^2), and if the price p doesn't confirm the hypothesis, $P_1 = P^*$ (p^*, σ^{*2}).

Figure 26: Representation of a hypothesis testing on expectation price
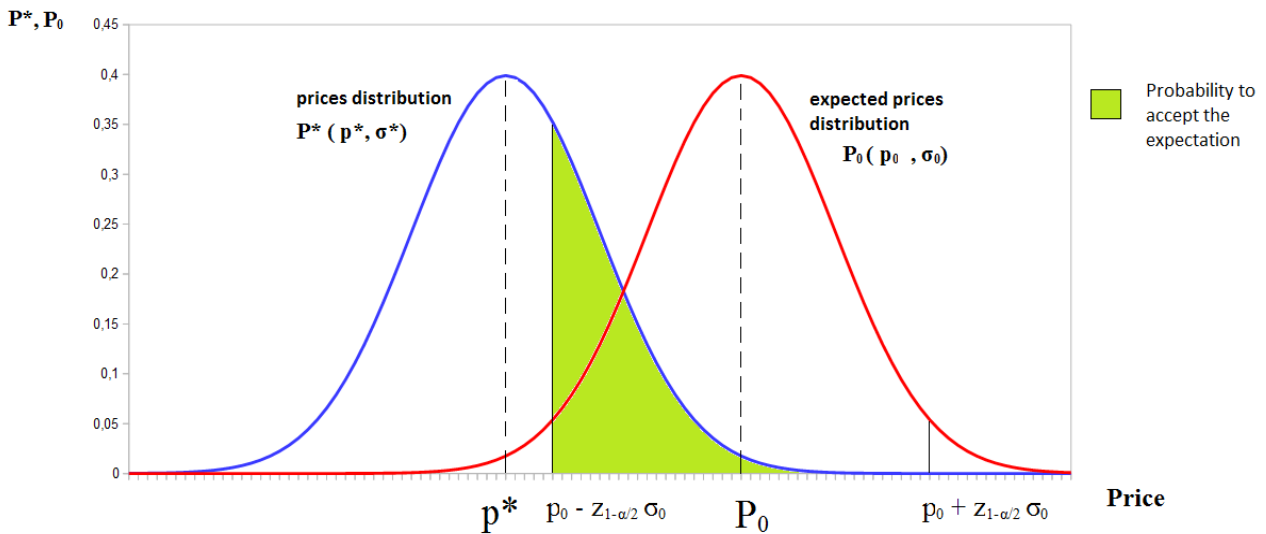
For simplicity we assume that both the distributions P* (p^*, σ^*) and P_0(p_0, σ_0) are normally distributed . Moreover, we can normalize and assume $p^* = 0$ in order to see only the effect of the bias. Then we can obtain the interval of confidence of the consumer's expectation test, namely the range of prices able to confirm the consumer's expectation: IC= $p_0 \pm z_{1-\alpha/2} \sigma_0$.

We can, then, define the test as:

$$H_0: p_1 = p_0 \qquad \text{If } p \in \text{I. C. of } P_0$$
$$H_1: p_1 = p^* \qquad \text{If } p \notin \text{I. C. of } P_0$$

Translating the variables in the normalized form they become:

$$z_p^* = 0 \qquad z_{Po} = p_0 - p^* \qquad z = p - p^*$$
$$z_{Inf.limit} = z_{Po} - z_{1-\alpha} \sigma_{Po} \qquad z_{Upp.limit} = z_{Po} + z_{1-\alpha} \sigma_{Po}$$

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In order to calculate the probability to accept the hypothesis, we have to calculate the value of the area under the P* density functions, between the upper and lower limits of the I.C. range of H_0 (the green area of figure 26), that represent the probability to draw a price that will confirm the expectation of the consumer. It is obtained by the formula:

$$P(E_1) = \int_{p_0 - z_{1-\alpha}\sigma_{P0}}^{P_0 + z_{1-\alpha}\sigma_{P0}} \frac{1}{\sigma_P^* \sqrt{2\pi}} e^{-\frac{(p-p^*)^2}{2\sigma_P^{*2}}}$$

That can transformed in:

$$P(E_1) = \frac{1}{2} \left[erf \frac{(p_0 + z_{1-\alpha}\sigma_{Po})}{\sqrt{2}\sigma_P^*} - erf \frac{(p_0 - z_{1-\alpha}\sigma_{Po})}{\sqrt{2}\sigma_P^*} \right]$$

From this formulation, we can know how the different variables affect the probability of acceptance. In particular, we have that the probability that the consumer will confirm his hypothesis is inversely proportional to the expectation (p_0). In other words further is the expectation of the consumer from the real prices mean, less is the probability that it will be verified.

We have, after, the variability of the expected prices distribution σ_0, that is directly proportional to the probability of acceptance. Indeed is logic that a consumer who believes the distribution of prices is large is not willing to admit he is wrong unless he draws a very distant price. If it happens to draw a closer price the consumer will attribute the draw to the variance of the prices in the market and go on believing that the average of the prices is equal to his expectation.

Eventually, we have the variability of the real prices σ^*, that has a more ambiguous relationship with the probability of acceptance. Indeed, if the expectation is close to the real mean a higher variance of the prices bring to a less probability of acceptance. And, on the other hand, if the expectation is relatively distant from the actual mean, increasing the variance of the real prices has a different effect depending on the value. If we have a relatively low variance it would be difficult that the consumer draws a price able to confirm his hypothesis, and the same happens if the variance is extremely high. The maximum of the probability of acceptance would be somewhere in the middle, where the variance of the real prices let the drawing of a confirming price possible but it doesn't include a lot of prices more.

6.2.1 Comparative statics

In order to see better the effects of the expectations on the probability of acceptance and on the perception, imagine that a consumer wants to verify the price of the t-shirts after the euro changeover. Assume that the t-shirts are sold by different shops with different prices, with an average price of 10€ and a standard deviation of the distribution prices of 1€. Similarly, the consumer also supposes the standard deviation of the prices to be 1€. Moreover, knowing that even if his hypothesis was right he could draw prices different from it, he decides to assume a confidence level of 95% for the test.

Figure 27: Representation of the probability of acceptance depending on the expectation

| $z_{p_0}=?$	$\sigma_0=1$	$\sigma^*=1$	Confidence level=95%						
z_{p_0}	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
$P(E_1)$	95%	92%	83%	68%	48%	29%	15%	6%	2%
$E(P_1)$	0.00	0.46	0.83	1.02	0.97	0.74	0.45	0.22	0.08
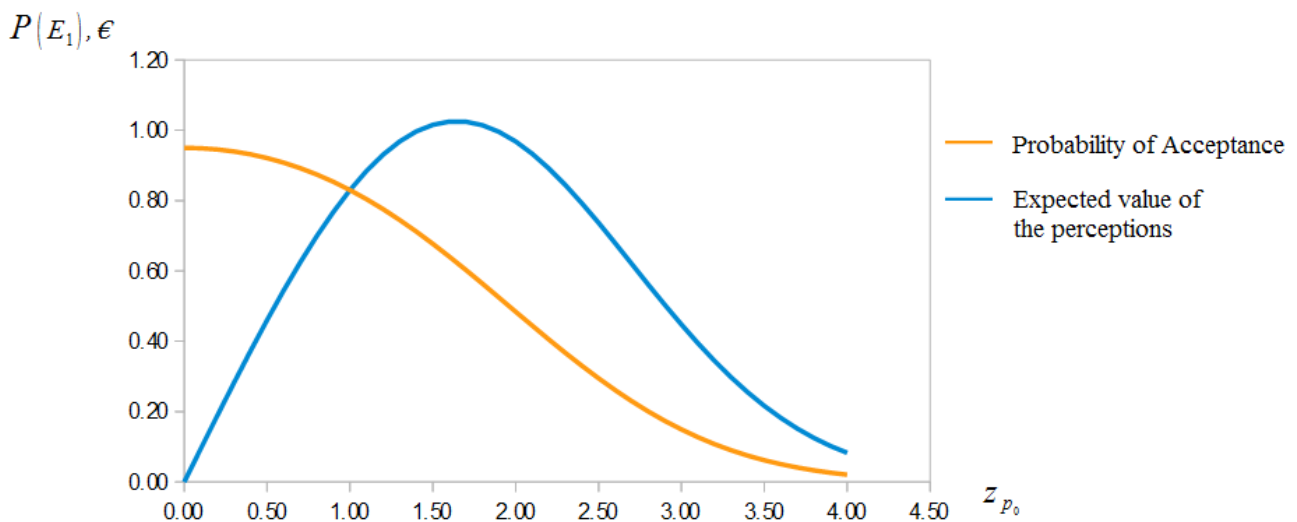
Source: personal elaboration

In figure 27, we can see the impact of expectation on the probability that the beliefs were confirmed and on the perceived level of prices. In this case, the expectation that maximizes the expected value of the perceived inflation is between 1,5 and 2. In particular, it is p_0=1,645 which corresponds to an expected value of $E(P_1)$= 1,025. Generalizing to all the population, it'd mean that in the worst scenario the consumers expect the price to be 11,645€, and after the test, the 62,31% of consumers don't change such belief, while the other 37,69% of the consumers have understood that the average price is 10€.

If the consumer expects a price higher than 11,645€, then the probability of confirming the expectation will reduce so much that would be not offset by the higher perception of whom still confirm the expectation, and then it would decrease the expected value of the perceived price. Similarly, if the expectation would be less than 11,645€ the higher number of people that confirm a higher hypothesis would not offset the fact that the consumer's hypothesis is closer to the real average than before. Now having seen that, we can state that: at low expectations, there is a high number of consumers that will believe the prices are "slightly increase", while at high expectations there are a few consumers that believe the prices are "risen a lot".

Should be clear now, that is not possible have a very high impact of the expectation on the perceived prices of the consumers simply with a high expectation. It is needed that also the probability that the consumers accept their belief is high so that the tests can confirm the wrong expectation more often.

Figure 28: Representation of the probability of acceptance and the impact, depending on the expected variability σ_0
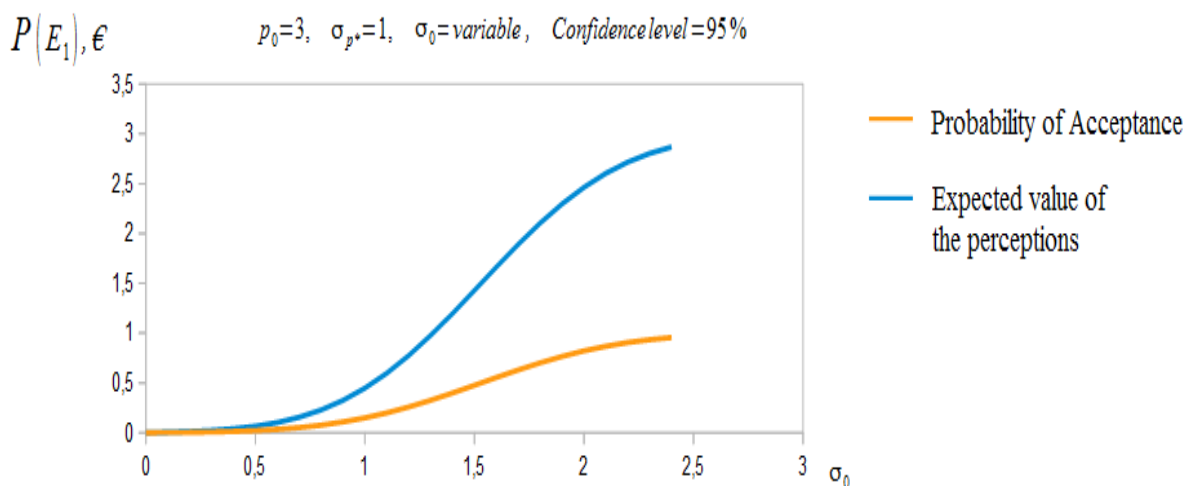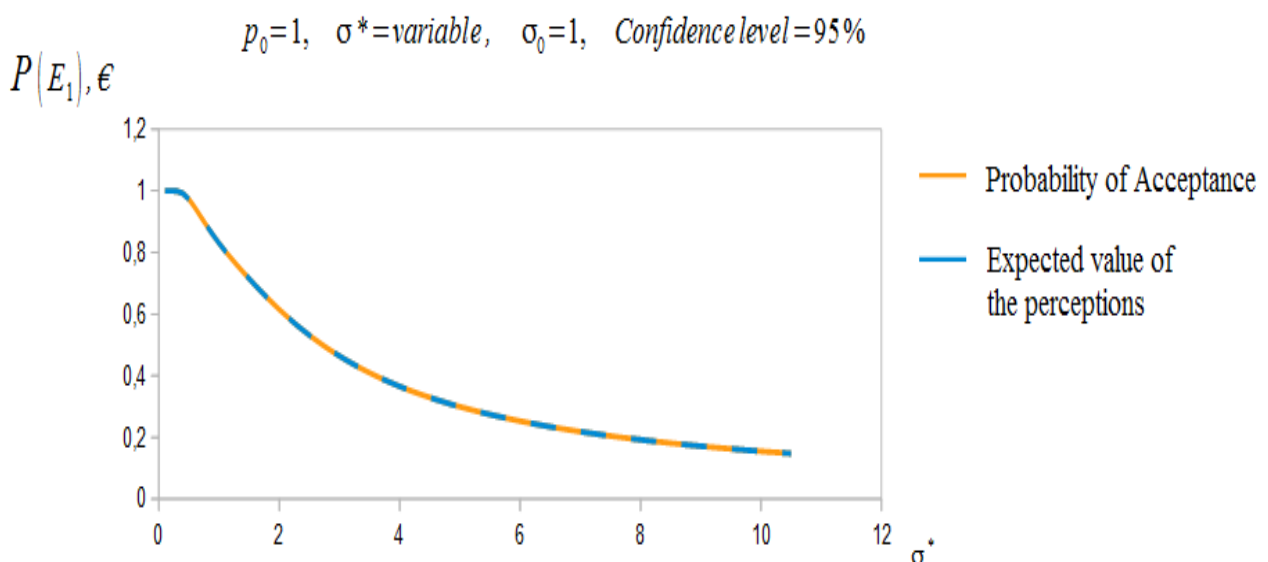

Source: personal elaboration

One possibility in order to have a high probability of acceptance could be that the consumer thinks that the variability (σ_0) of the prices is high. Indeed, a higher variance leads to a lower number of prices able to disconfirm the belief (figure 28). In the previous example, if the consumer thinks that the standard deviation of the t-shirts prices is $\sigma_0 = 3€$ with an expectation price of $p_0 = 3€$, and he

draws a price of p = 6€, then he will ascribe the price to be fault of the variability and he will not change his mind. On the contrary, if the consumer in the same situation, think that the standard deviation of the t-shirts prices is 0,50€, then he will conclude that is unlikely that the price can be explained by the variability, and that he's wrong.

As regards the variability of the real prices (σ^*), we have two different behaviors depending on the distance of the expectation from the real mean. In the case where the expectation is closer, we can see the graph in figure 29, which shows that there is an inversely proportional relationship between the actual prices' standard deviation and the expected value of the perceived prices for relatively low expectations (p_0=1 in this case). The maximum of the expected perception is at σ^*=0, and every increase in the variance lead to a lower impact on the perceptions. Intuitively if σ^*=0 all the prices in the market are equals, so if this unique price is near the expectation (namely inside the range of acceptance), the price will always confirm it. As regards the relationship with the expectation p_0 , the maximum effect is 1€ added up to the real price since the expectation is assumed to be 1€ more, but if the expectation would be 1.50€ higher than the real price it would lead to a maximum effect of 1.50€. As regards the tail of the function, it reflects the fact that with a higher variance there are more prices falling far from the mean p* and since the expectation p_0 is, in this case, close to it, it means a higher number of prices falling outside the range of acceptance.

Figure 29: Representation of the probability of acceptance and the impact, depending on the expected variability σ^*, in the case of an low expectation

Source: personal elaboration

The second case, in the graph in figure 30, we have that if the consumer has a high expectation there is a different behavior by the function. It is due to the fact that if the expectation is far from the real price level and we increase the prices' variance, there is a higher probability to draw a price able to confirm a far expectation, but going on increasing the variance we will reach a point where our probability of acceptance result to have nothing to gain by a higher variance, since would be more difficult draw in a greater pool a price able to make accept the expectation. Indeed, if we think to the extreme case, where the variance is infinite, we have zero probability to draw a price inside the acceptance range because there is infinite prices.

Figure 30: Representation of the probability of acceptance and the impact, depending on the expected variability σ*, in the case of an high expectation
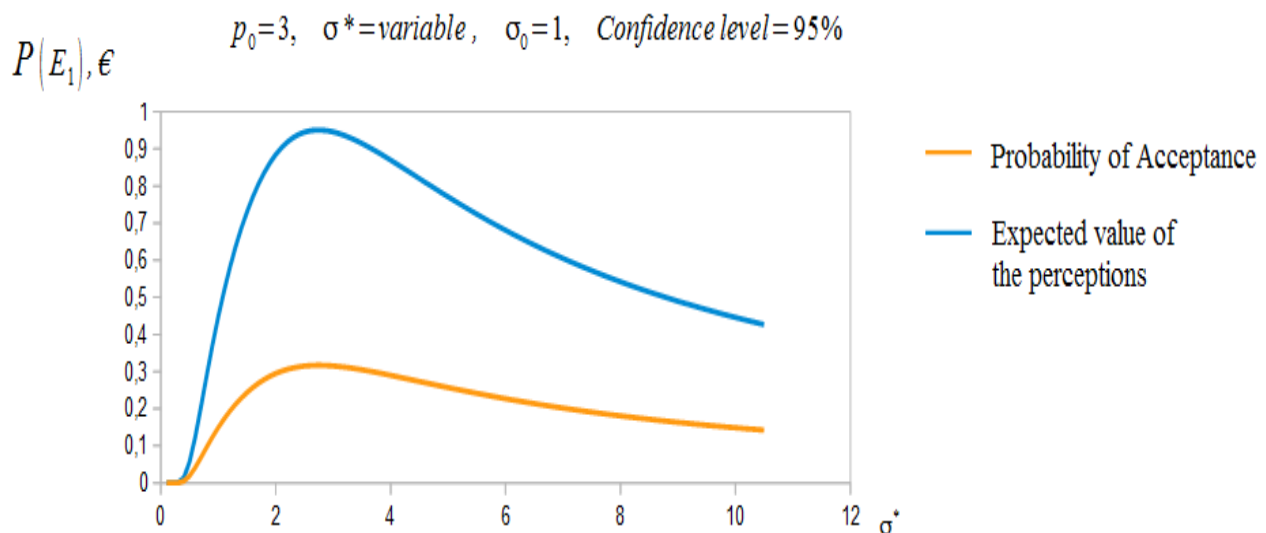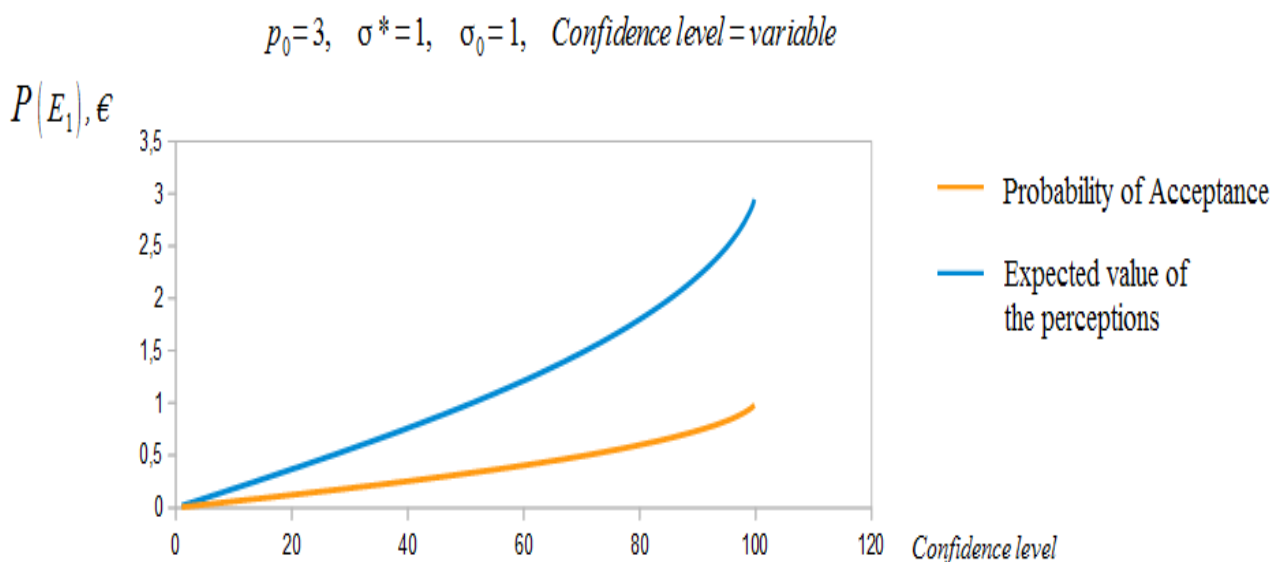

Source: personal elaboration

We can note that in both the cases, a contraction of the prices variability could increase the expected value of the perceived prices if we have a relatively high variance. Such phenomenon is interesting since it seems that in some countries, the euro could have led to a concentration of the prices, especially, where the exchange between the euro and new currency was high. The reason is that it caused a reduction of the possibles attractive prices in the various bands. An example of it, in Italy, is 250gr ground coffee which prices were, before the euro, scattered among 27 attractive prices, while after the changeover they had reduced to 14 (Guido G. 2002), causing probably a prices concentration in such attractive prices that could have increased the probability of a mistake by the consumers respect to the case where the variance was higher.

Would be interesting know the changes of variability before and after the changeover for all the product's prices, in order to know in which case we are, and get to know if the variance of prices could be a significant factor on the 2002's price perception. But we leave to other studies the task to analyze if that's the case.

The confidence level, represented in figure 31, is the less interesting variable. Briefly, if the confidence level of test increases, the probability of acceptance and the impact of the starting expectation on the expected perceived prices are higher, since it would mean being more strict about the prices able to debunk the expectations. It is similar to the increase of the variance of the expectation σ_0 , since both provide a larger I. C. range, and then a higher number of prices that confirm the hypothesis. In the extreme case (confidence level= 100%) it would mean that there is not price able to debunk the expectation and that the consumer is uncompromising about changing his mind. The effect on the impact on the perception would derive directly by the expectations, so if the consumer expects a price of $p_0=150€$ for a t-shirt, the percived price after the test would be $p_1=150€$, without exception.

Figure 31: Representation of the probability of acceptance and the impact, depending on the confidence level

$$p_0=3, \quad \sigma^*=1, \quad \sigma_0=1, \quad Confidence\ level=variable$$
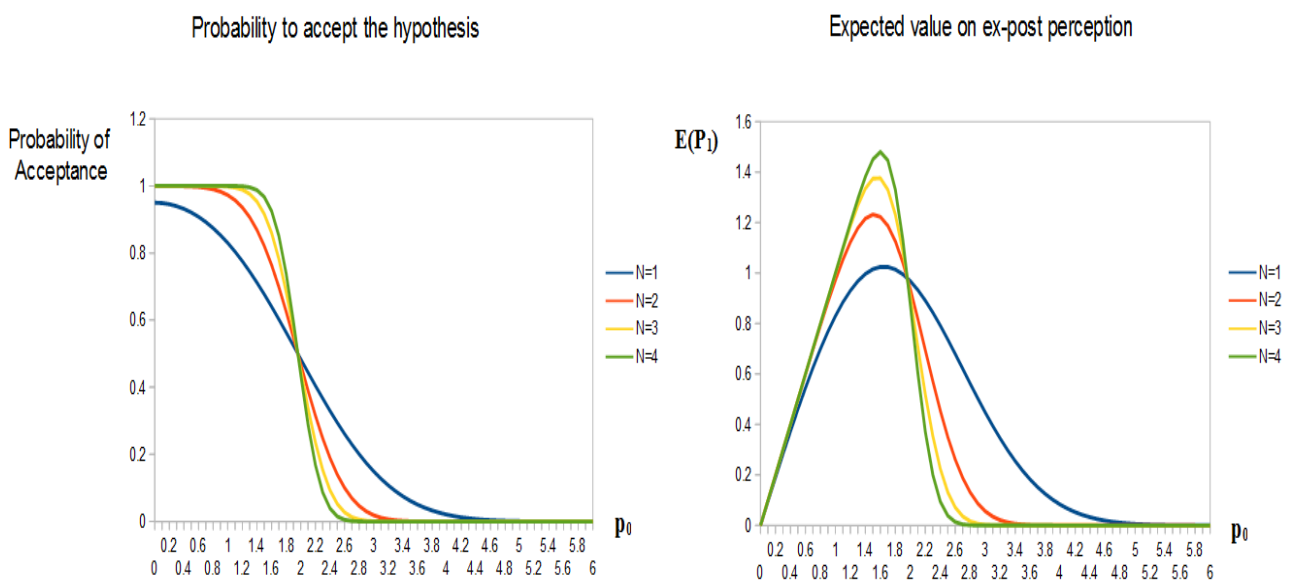
Source: personal elaboration

6.2.2 Sample size

Contrary to what might be though, even if the consumers want to use a great number of samples, the confirmation bias still affects the perceptions. As we can see in figure 32, the fact that a consumer uses more than one price to verify his hypothesis change the relation among the expectation and probability of acceptance; and then also the expected value of the perceptions. It, actually, increases the chances that a "low" expectation will be confirmed, but reduces the probability of acceptance for the further expectations.

Figure 32: Representation of the probability of acceptance and the expected value of perceived prices with different sample's sizes

Source: personal elaboration

In order to understand that, just imagine the extreme case where the consumer considers a sample of all the prices in the market, with the sample mean exactly equals to the average of the real prices. In this case, if the mean is inside the interval of acceptance the consumer will confirm his belief for sure because there is no room for mistakes, whereas if it is outside the range the belief of the consumer will be, as sure as the other case, debunked. In the graph 26 such situation would be represented by a shrinkage of the actual price distribution caused by the reduction of the sample's standard deviation, until the point where it will be (in the extreme case) a unique point.

This phenomenon is interesting since it affects also the consumers that perform, from their point of view, an analysis statistically valid. And it could explain why also the people with a high educational level and the discerning consumers fell into the trap of the euro-inflation beliefs.

6.2.3 Model over time and rational behavior

So far, the model built doesn't provide any change after a consumer has done the test over his hypothesis confirming it, however is not realistic thinking that the consumer won't have any further questions about his belief. If we assume that the consumer keeps making tests about his expectation with a certain frequency, it leads to a decreasing probability that he will keep his starting beliefs over time.

In order to see it, we can use the example of the t-shirt used in the previous chapters and see in the figure 33 what happen to the probability of acceptance with a certain testing frequency.

Figure 33: Representation of the probability of acceptance over time
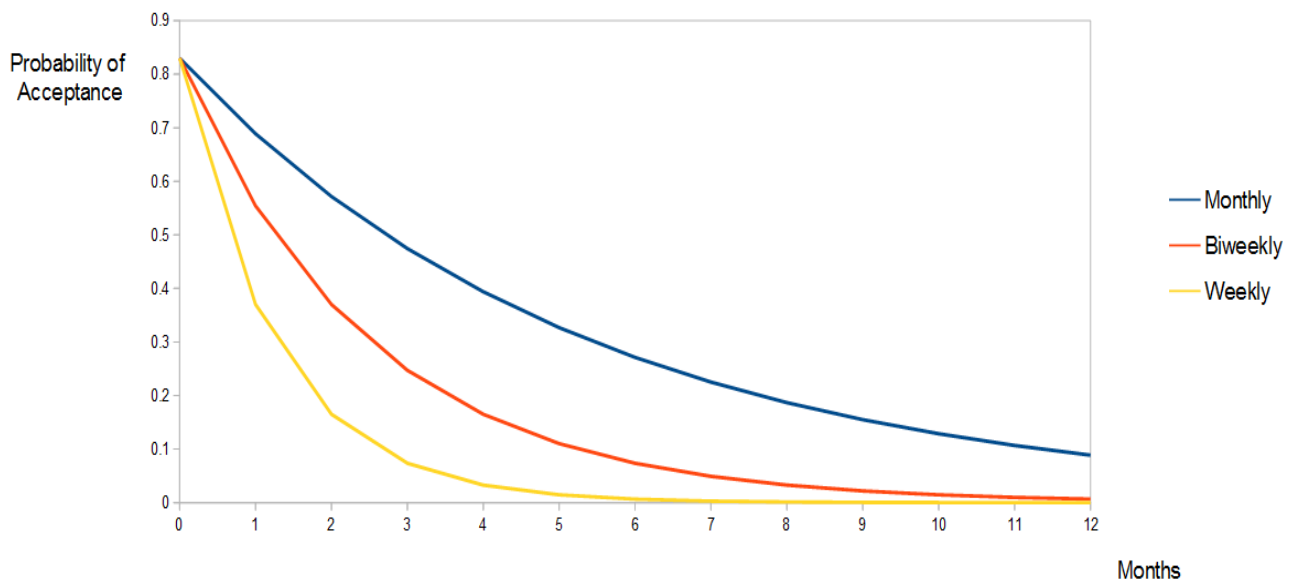
Source: personal elaboration

We can see how the probability decrease and tends to 0 as time goes by, and with it also the expected value of the perceptions reduces. After 12 months we have that the probability that someone still believes in his expectation is about the 9% with monthly tests, about 1% with biweekly tests and about the 0% with a test every week. In this particular case, we can say that, since we have a 10% difference between the expected inflation rate and the real one, the impact of the confirmation bias on the perceived inflation is equal, after 12 months, respectively, to the 0.9%, 0.1% and 0%. These results maybe don't seem to be enough to explain the perception of the 2002, but we have to remember that, we assume that the tests are strictly fixed over time and maybe it's not case, since probably the tests have been done for the major part immediately after the changeover or as soon as the consumer see for the first time the product after it. Moreover, we

assume that the consumer sees all the products' prices the day after the changeover, but it's not realistic. And if the consumer sees for the first time the price of a product six months after the changeover, that's when the impact on perception occurs. Moreover, the expectation of the consumer can be affected by exogenous factors that make it increase or decrease at any time.

Obviously, the frequencies showed are completely arbitrary, and there is no reason why the tests couldn't be daily or even more frequent. In these cases, is evident that the impact of the confirmation bias is negligible since it came to zero too fast.

In order to estimate the real frequency, we could consider the purchasing frequency of the products, but we would not be sure that the consumers perceive the real prices in a currency changeover context, or that the consumer pays attention to the price every time that he purchases something testing his beliefs. On this topic would be useful some more information over when the consumers mend their ways, and when they are actually aware of the prices.

If we link up to the sample size topic in the previous chapter, we can say that in a situation where the sample size is high an high expectation will be quickly debunked by the tests, since it's unlikely that some sample mean would be enough "extreme" to confirm the hypothesis. Instead, the relatively low expectations will persist for a longer time.

Our model provides that the consumer adopts a binary strategy: "or the consumer has the reason or not". And in order to do that, we have seen that he considers a range of prices that confirm his hypothesis, while the other prices debunk him. The question coming is: what else he can do? Which is the rational behavior? For this question there are different answers since there is more than one rational behavior. One of them could be approaching the price level assessment without expectation, evaluating empirically the inflation by means of sampling. Another rational strategy could be consider different hypothesis and verify them independently from each other in order to identify the more realistic one. From the point of view of the government, the best behavior of the consumers would be that they test first the official indices value. In that case, the consumers' estimate would be just correct and wouldn't be any significant bias. But seeing from the consumer point of view, there is no reason to think that the government couldn't modify the data for his purpose, and he wants to make an estimation of his own to be sure his perception fits the official indices.

Probably the most rational behavior that the consumer can perform is an adjustment of the expectation based on the price drawn. If, for example, he does an average between his expectation and the price drawn every time, he would reach the real price level (or get close to it) faster than in our model. Taking the t-shirt example we can see in figure 34 both our model behavior and the adjustment case (where the consumer doesn't make a test but simply update the expectation with a

simple average between the expectation and the new price drawn). Seeing that the ambiguous confirmation effect of our model shows a higher impact of the expectation over the perceived prices with higher value all along the period. Obviously is not always the case, it is true as far as the probability of acceptance is higher of the 50%. Indeed, with a lower probability of acceptance, there would be a major impact by the adjustment process.

Figure 34: Comparison of the model with the adjustment process
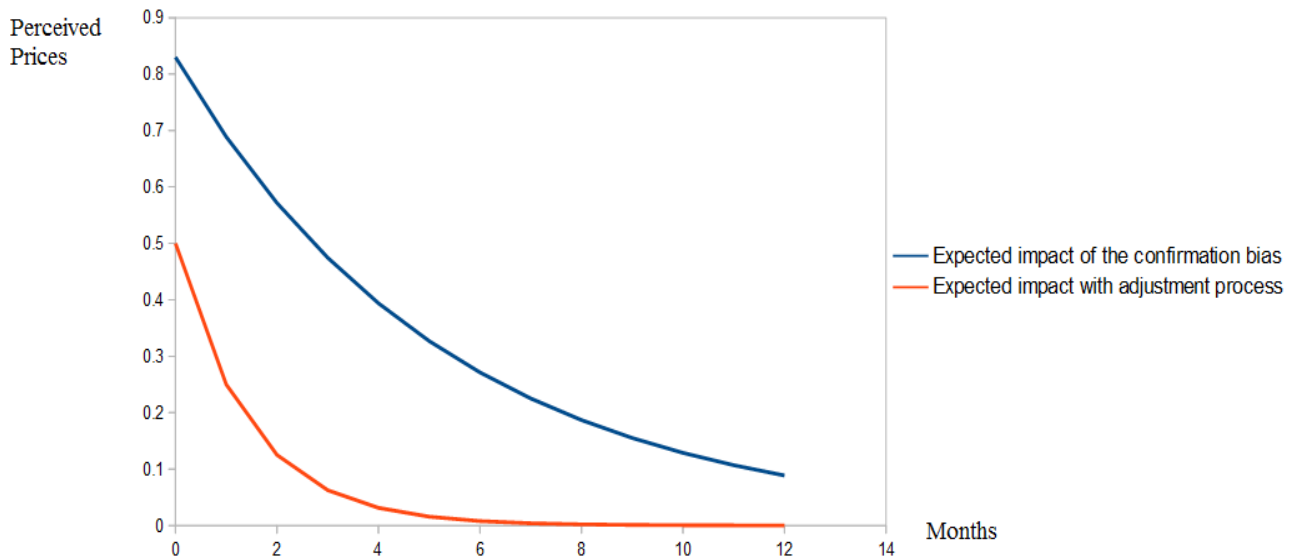
Source: personal elaboration

6.2.4 Positive test strategy

Our model has both some differences and similarities respect the PTS. As regards the differences, the sets of the PTS were clearly defined, but now only the target set (I.C.) is defined while the other set P* is virtually all the prices present in the market even if they have a different probability to be drawn. Moreover our purpose it's not identify the logic of the sets' definition, but it is find out what is the price that better summarized the prices of the market.

Even if our model is fundamentally different from the classic PTS, we have also some similarities. Indeed, in figure 35, we can see how the cases of the PTS can reappear also in our model. Here, we have similar cases to the PTS with the difference that the case creating more problem is the second one (b), while in the examples of Klayman and Ha the problems occurred in the case (a). It is due to the fact that we are testing an item drawn from the real prices, while in the PTS we have that the item to be tested is provided by our rule. But obviously, in our model, we have no power to chose the item to be tested. For the rest we have one to one the same cases and the consequent problems

coming from the overlapping of the sets/functions. What before was an ambiguous verification of the rule now is the possible no-exclusion of a wrong hypothesis or expectation.

At a conceptual level there is an intrinsic component of positive test inside the classic hypothesis testing method that doesn't provide an adjustment of the mean, but only a confirmation of a disconfirmation of the hypothesis. In fact, we focus our test on the expectation similarly to how the PTS focus the test on the hypothesized rule.

Figure 35: The cases of the model and the positive test strategy
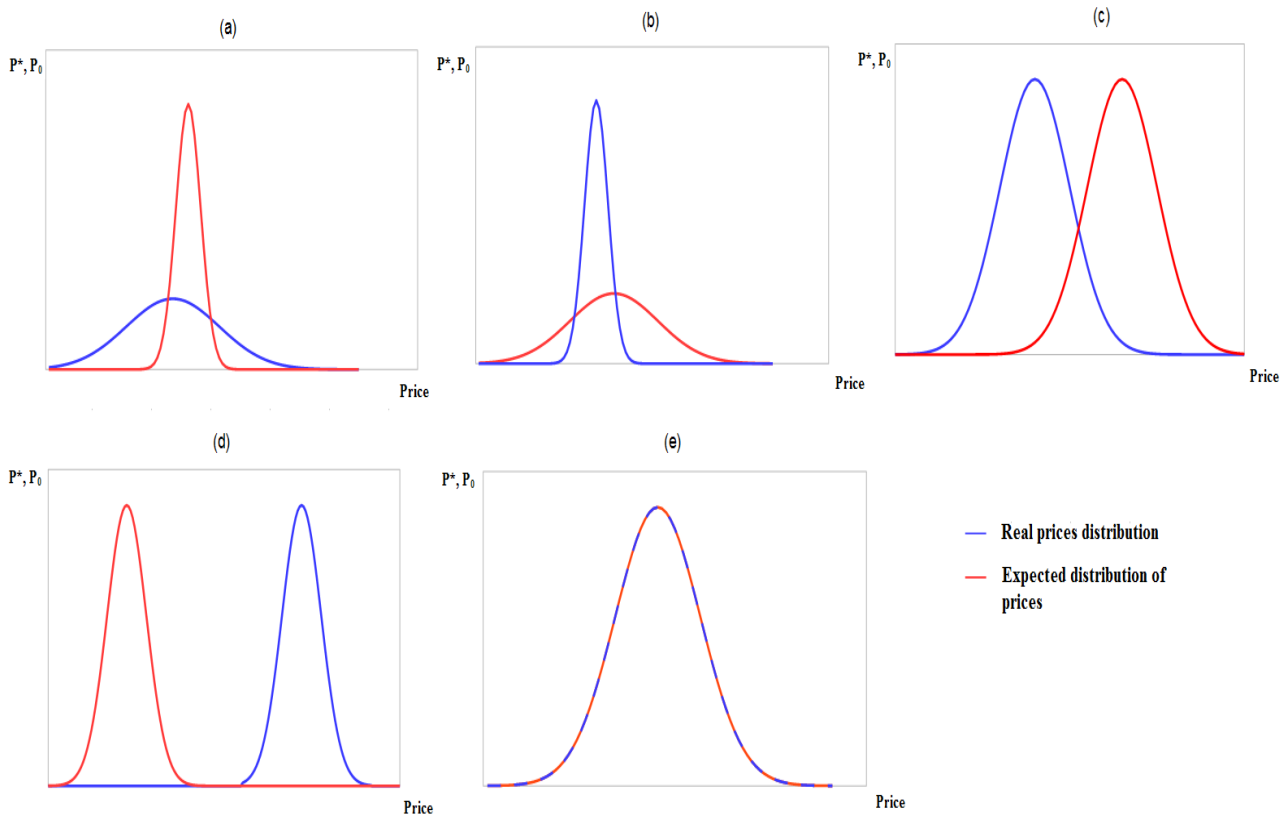
Source: personal elaboration

6.2.5 Critics and limitations

Even if this model seems to explain well what happened during the euro changeover it has different limits, that could prevent it to be a valid explanation of 2002's perceptions.

First of all, it's unlikely that a consumer changes his mind if he tests a price that is greater of his expectation, indeed it's probable that it further increases the starting consumer's beliefs. At the same time, it's not unrealistic that the consumer discards his expectation if he understands that he knows nothing about the distribution of the prices, and then our assumption still retains some truth.

It's hard to believe that a consumer will get to know the real prices level once he debunked his expectation. An alternative possibility is that the average consumer, after the disconfirmation of his hypothesis, proceeds to a gradual decrease in his expectation until the moment he confirms it. However, it's chosen to assume that the consumer gets to know the real price level for three reasons:

- The consumer that sees debunked his expectation could give more credibility to the official estimates;

- If the consumer wants to perform his own estimation gathering a simple sample, the expected value of the sample mean would be presumably equal to the official indices estimates;

- This approach provides more cautious estimates of the phenomenon respect any other one else.

It's hard that a consumer performing a proper analysis doesn't notice that the expectation is systematically higher than the prices tested, especially true when we have a series of tests and less important when we are talking of only one or two tests. It highlights also the lack of some scale of the credibility of the beliefs. Indeed, in the model, we have that the consumer accepts or rejects the hypothesis, but would be logic thinking that the consumer trusts more his hypothesis when accepted with a price close to the belief than when accepted by a price far from it.

It is possible that a consumer may exclude some price outside of his range of acceptance recognizing it as an outsider. That would be the classic confirmation bias in his broader definition, but is not a problem since if it'd be true, the model will explain in a great manner the perceived inflation.

One of the more important assumptions of the model is that it provides a clear and defined expectation by the consumer, with a certain variance and mean, in addition to a rigid confidence level. It is unlikely that the consumer has a so clear idea of his expectations, and even if he has, it's highly probable that such variables change depending on the current situation. Moreover, the distributions of the prices and the expectations could be better summarized by a distribution different than the normal one, with different results in terms of probability of acceptance and expected impact on the consumers' perceptions.

Another great problem comes by the impossibility to verify the phenomenon, indeed an experiment that would try to confirm it should consider separately the expectation of the price increase and the confirmation of it, and this would be troublesome since it's hard to distinguish which case the consumer is talking when it is asked what are his opinion about the prices. Indeed

we don't know if the Isae data caught the first or later one, and in both cases, we would lack the other one to build up a verification experiment.

Despite these limits, the model still have, theoretically, some level of capability to explain a possible presence of the confirmation bias in the abnormal increased of perceived prices after the euro changeover, since explanatory of a verification method that could have turned the expectations of the consumers in concrete beliefs, or at least strengthened the phenomenon of the high perceived inflation together with the others factors.

7. CONCLUSIONS

In this work, we have presented the problem of the high inflation perception after the euro changeover. We have seen that the official data were not able to explain the perceptions as may do the non-official ones, that reported higher rates. But we have seen also that both the first and, a lot more, the second have different limits as statistical instrument. After, we reported the studies about the impact of the rounding up effects, that together with the official data give us a relative safety about the stability of prices at the time of the changeover.

Given that, we went on illustrating the data about the perceptions index and treating the literature about the possible psychological reasons that could affect the consumers' perceptions. Among them, the subjectivity of the inflation suffered, the tendency to overestimate the importance of the frequently purchased product, the effect of the loss aversion and of the high-value changes, as well as the media influence. Eventually finding that no one of them could be considered for sure the principal cause of the abnormal perceptions.

In the last part of the work, we proposed the confirmation bias as another factor that can be added to the list of the reasons why the consumers had wrong perceptions. We explained that the consumers might expect an increase of the inflation rate thanks to the others factors listed above and some grade of denying of the official data by the politic environment, and that, as cause of it, a sort of confirmation bias could have taken place.

Then, we built up our model using the hypothesis test framework, for which the consumers accept their expectation if they see a price near to it, and accept the official data to be true once they draw a price far from the expectation. We went on with the analysis of the different variables and their effect on the perceptions. Of particular interest the sample size. We found that also high samples size don't always help to prevent the bias, and in the case of relatively low expectation, a high sample size gets a worse impact. Explaining why also the high degree consumers, that may have performed a deeper analysis, have perceived an high inflation.

In the end, our model showed that the ambiguity confirmation, deriving from the prices close to the consumers' ideas, could have stretched the time the consumers took to absorb a wrong starting expectation, explaining why they believed it for such long period.

Like the other possible reasons our model doesn't definitively confirm that is the confirmation bias the origin of the discrepancy between the real data and the perceptions. Since the confirmation bias itself, needs the presence of other factors. In fact, also in the case where the effect of the bias explains the perceptions of 2002, the starting expectation would remain unanswered. Eventually,

probably there was no a unique reason that caused the phenomenon, but different factors that reinforced each other and the confirmation bias could be one of them.

8. REFERENCES

Badarinza, C. and M. Buchmann (2009), "Inflation Perceptions and Expectations in the Euro Area. The Role of News", ECB Working Paper 1088

Banca d'Italia (2012) "I bilanci delle famiglie italiane nell'anno 2010", Supplemento al Bollettino Statistico - Indagini campionarie, 17, 6.

Bates, J. M., & Gabor, A. (1986), "Price perception in creeping inflation: Report on an enquiry", Journal ofEconomic Psychology, 7, 291–314.

Behrend, H. (1977), "Research into inflation and conceptions of earnings", Journal of Occupational Psychology, 50, 169–176.

Del Giovane P. and Sabbatini R. (2005), "The Introduction of the Euro and the Divergence Between Officially Measured and Perceived Inflation: The Case of Italy", Paper presented at the OECD Seminar "Inflation Measures: Too High - Too Low - Internationally Comparable?", Paris, June.

Dräger, L., Menz J. O. and Fritzsche U. (2011), "Perceived Inflation under Loss Aversion", DEP Discussion Papers, Macroeconomics and Finance Series No. 5/2011, Hamburg.

Ercolani, M. G. and Dutta, J. (2006), "The Euro-changeover and Euro-inflation: Evidence from EuroStat's HICP.", University of Birmingham Department of Economics

Eurispes (2003), "Caro...cibo", Indagine statistica dell'Eurispes sui prezzi dei prodotti alimentari in collaborazione con la coalizione dei consumatori

Frey, D. (1981), "Informationssuche und Informationsbewertung bent Entscheidungen" [Information seeking and information evaluation in decision making], Bern: Huber.

Gadenne V. and Oswald M., (1986), "Entstehung und Veränderung von Bestätigungstendenzen bein Testen von Hypothesen" [Formation and alteration of confirmatory tendencies during the testing of hypotheses], Zeitschrift für Exsperimentelle und Angewandte Psychologie, 33, 360-374.

Georganas, Sotiris, Paul J. Healy, and Nan Li. (2014), "Frequency Bias in Consumers′ Perceptions of Inflation: An Experimental Study", European Economic Review 67: 144–158.

Guido, G. (2002),"Come cambia il marketing con l'euro : nuovi scenari, strategie d'impresa e comportamenti di consumo", F. Angeli, Milano

Insee (2003), "Opinion des ménages sur les prix passés et l'inflation", Note de conjoncture, December

Isae (2002), "L'inflazione effettiva e quella percepita dai consumatori", Quarterly Report, July, pp. 114-120.

Isae (2003), "La conversione approssimata dei prezzi in euro nelle valute nazionali e l'inflazione percepita dai consumatori", Quarterly Report, January, pp. 118-120.

ISTAT (2003), "Rapporto annuale. La situazione del Paese 2002", Roma: 64-79

Jonung, L. (1981) "Perceived and expected rates of inflation in Sweden", The American Economic Review, 71,961–968.

Kahneman, D., and Tversky, A. (1979), "Prospect theory: An analysis of decision under risk", Econometrica 47: 263-291.

Kemp, S. (1999) "An associative theory of estimating past dates and past prices", Psychonomic Bulletin and Review, 6, 41–56.

Klayman, J., and Y. Ha, 1987, "Confirmation, disconfirmation and information in hypothesis testing", Psychological Review 94, 211-228.

Mostacci F. and R. Sabbatini (2001), "Una stima ex-ante dell'impatto del changeover sui prezzi al consumo in Italia", Contributi Istat, 11.

Mostacci F. and R. Sabbatini (2003), "Has the euro caused inflation? The changeover and the consumer price rounding in Italy in 2002", www.istat.it.

Mostacci F. (2004), "Aspetti teorico-pratici per la costruzione di indici dei prezzi al consumo", ISTAT document n. 7/2004

Mostacci. F. and Sabbatini R. (2008), "The Euro, Inflation and Consumers' Perceptions: Lessons from Italy", Berlin: Springer-Verlag: 51-69

Pohl, R. (2004). "Cognitive illusions: A handbook of fallacies and biases in thinking, judgement and memory". East Sussex: Psychology Press

Ranyard, R., Del Missier, F., Bonini, N., Duxberry, D., Summers, B. (2008), "Perceptions and expectations of price changes and inflation: A review and conceptual framework", Journal of Economic Psychology 29: 378–400.

Soroka, S. N. (2006), "Good news and bad news: Asymmetric responses to economic information", The Journal of Politics, 68, 372–385.

Triandafyllidou, A. (2003), "Research Note: The Launch of the Euro in the Italian Media Representations of Political and Economic Integration", European Journal of Communication, 18(2): 255-263.

Wason, P. C.(1960), "On the failure to eliminate hypotheses in a conceptual task", The Quarterly Journal of Experimental Psychology,12:3,129-140

Williamson, M. R., & Wearing, A. J. (1996), "Lay people's cognitive models of the economy", Journal of Economic Psychology, 17, 3–38.

Online resources

Eurostat Database, *Avaibale at:* http://ec.europa.eu/eurostat/data/database

European Commission Directorate-General for Economic and Financial Affairs, Business and Consumer Survey Results, *Avaibale at:* http://ec.europa.eu/economy_finance/db_indicators/surveys/archive_publications/index_en.htm

Marozzi, M. (2002), Un anno di euro Prodi: "Sfida vinta"*, Repubblica.it Avaibale at: http://www.repubblica.it/online/economia/duise/prodi/prodi.html*

Silvio Berlusconi - "La mia battaglia per evitare l'introduzione dell'Euro 2 - 20 12 2003",Youtube video, Posted by: BerlusconiVideo, 24/06/2013 Avaiable at: https://www.youtube.com/watch?v=N6ohOQ9MCDY