Paris, September 2007

# Fashion and Consumer price index

Dominique Guédès[1]

Abstract:
Clothing market knows a fast renewal of his product offer. That implies both many replacements for products in CPI sample and the importance of quality adjustments in this area. However this sector is also marked by a specific phenomenon: fashion.
Is fashion a quality in CPI point of view? As an objective and deciding element of price determination, fashion is clearly an element of quality. On the contrary to more concrete qualitative characteristics, fashion is variable over time. A dress in fashion today will be out of fashion in one year, and perhaps will come back into fashion in 5 years. But, if we want to make an index with constant quality and if this quality is variable over time for an unchanged product, then it is necessary to make quality adjustments even without replacement of product. Thus, fashion is potentially cause of bias if its treatment is dissymmetrical between increase of "fashion quality" cancelled at the time of the replacements and loss of "fashion quality" not taken into account in the course of time for a product followed without interruption.
This paper tries to explore these problems in the French context starting from concrete examples and presents the pragmatic solution adopted for the treatment of quality for clothing for the French CPI.

Keyword: consumer price index; quality adjustment; clothing; fashion


Résumé : Mode et indice des prix.
L'habillement est un secteur marqué par un renouvellement rapide de l'offre. Cela implique de nombreux remplacements de produits de l'échantillon IPC et l'importance des ajustements de qualité dans ce secteur. Toutefois ce secteur est aussi marqué par un phénomène spécifique : la mode.
La mode est-elle une qualité au sens de l'IPC ?
Considérée comme un élément objectif et déterminant dans la fixation du prix d'un produit, la mode est clairement un élément de la qualité du produit.
Mais la mode, contrairement à des caractéristiques qualitatives plus concrètes, est une chose variable dans le temps. Une robe à la mode aujourd'hui sera démodée dans un an et, peut-être de nouveau à la mode dans 5 ans. Or, si l'on veut faire un indice à qualité constante et si cette qualité est variable dans le temps pour un produit inchangé, alors il convient de faire des ajustements de qualité même sans remplacement de produit.
La mode est donc potentiellement source de biais si son traitement est dissymétrique entre le gain de " qualité mode ", annulé lors des remplacements et la perte de qualité au cours du temps pour un produit suivi sans interruption.
Le présent papier essaie d'explorer cette problématique dans le contexte français à partir d'exemples concrets et présente la solution pragmatique adoptée pour le traitement de la qualité de l'habillement pour l'IPC français.

The sector of clothing was one of the first, historically, to be included in consumer price index. With food and housing, it is one of the basic needs for the population targeted by CPI, whatever its definition. It is part of the minimum cover of any CPI. Because of this apparent banality, clothing is seldom a subject of new studies. However it is a large sector (5% of the weight of the IPC in France) and its specific features leads to important problems of which we can quote the strong seasonality and the important turnover of the products. This paper focuses on the treatment of quality.

1. Why be interested in clothing?

To be convinced that the sector of clothing poses true problems, both theoretical and very practical, it is enough to explore the databases of Eurostat. In fact, the comparison of the prices indices for clothing produced by European countries shows strongly divergent evolutions (see graph 1).

**Graph 1 : Clothing price indices for some european contries**
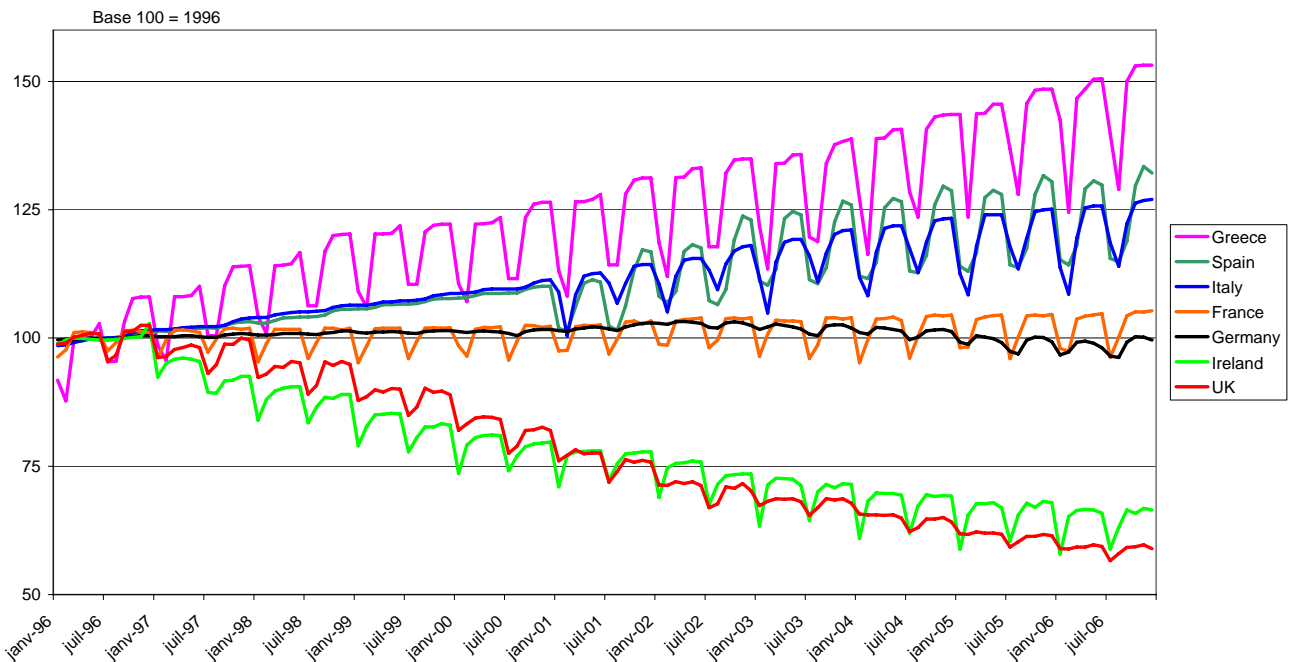


The European market of this sector is greatly integrated, strongly dominated mainly by the same producers and the same distributors. Admittedly, European integration did not erase all the differences of the general level of inflation among countries. Even if we consider, not the price indices for clothing but the difference between these indices and the general indices, significant divergences remain (see graph 2).

**Graph 2 : gap between clothing price index and total CPI for some european contries**
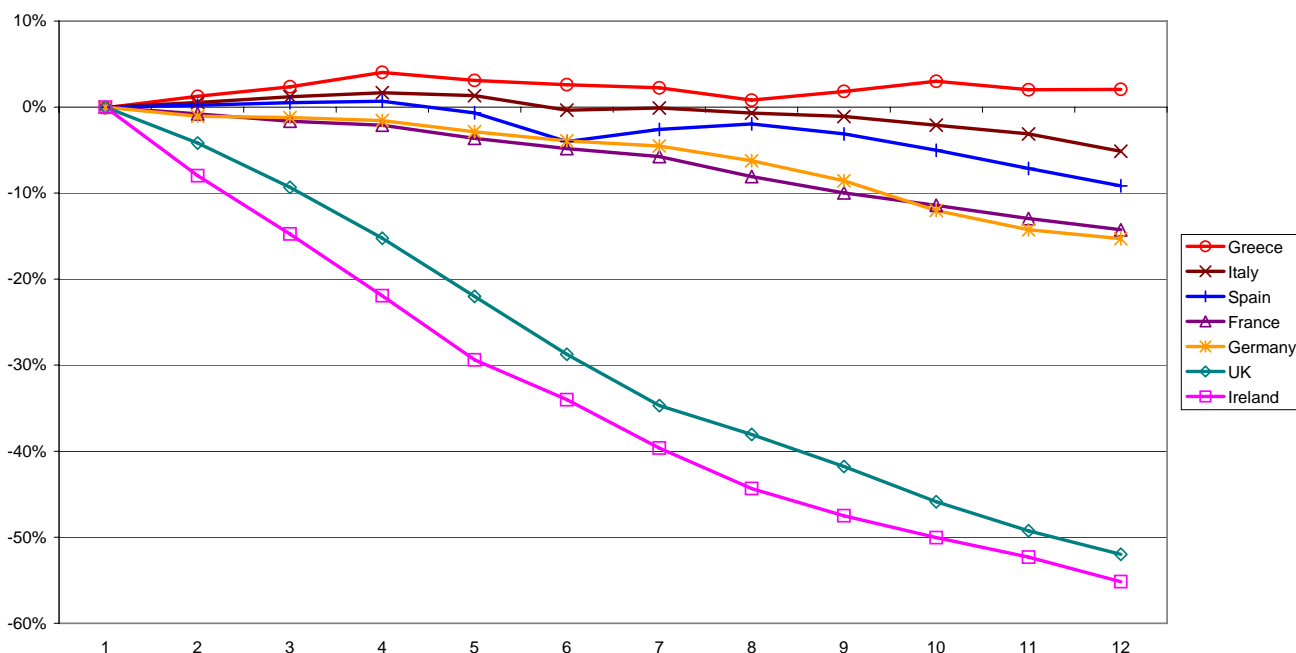


Beyond the local characteristics (importance of sales…), no economic argument justifies a long-term divergence of the trend of the prices between Germany and Italy or between France and the United Kingdom. However, over 10 years, the index of clothing in Italy increases hardly less quickly than the Italian total index (- 5%), the German and French indices records a differential of about -15% and the British index plunges to -52%!

To explain such a divergence it is necessary to understand how prices evolve in this sector and in particular on which occasions the price changes are recorded. Our indices, by construction, take into account various types of change of price: price changes observed on followed item but also price changes during replacements of products, accompanied by a quality adjustment or not, and finally virtual price changes related to imputation for missing observations. In table 1, we report a summary for the whole of year 2006 of price changes recorded in the price index in France. For each sector these changes of price are distributed according to their type.

Table 1: distribution of price changes in CPI computation according to the situation of the product.

|  | Normal observation | Bargain price (in and out) | Replacements | With adjustment | Without adjustment | Non observation |
|---|---|---|---|---|---|---|
| Clothing | 6 % | 37 % | 35 % | 24 % | 11 % | 21 % |
| Durables | 37 % | 11 % | 29 % | 28 % | 1 % | 23 % |
| Other Industrial products | 56 % | 13 % | 15 % | 10 % | 6 % | 16 % |
| Food | 61 % | 16 % | 6 % | 2 % | 4 % | 17 % |
| Services | 64 % | 3 % | 15 % | 7 % | 8 % | 19 % |
| Total | 48 % | 17 % | 17 % | 11 % | 6 % | 18 % |

The sector of clothing is clearly different from the other sectors. First of all an important proportion of the changes of price occurs during sales or promotions: 37% against 17% on average. Behind promotions, replacements, and absences of observations create most of price change. Finally, only 6% of the price changes happen between two successive observations of the same item at normal prices, situation that in the other sectors (except the durable goods) represents more than half of price changes.

Some examples of trajectories of price represented in graph 3, illustrate well the typical situation of clothing: a great stability punctuated by sale periods and replacements with modifications of price (these trajectories are real observation of winter skirts).

**Graph 3 : Some price trajectories (dot lines show replacements)**
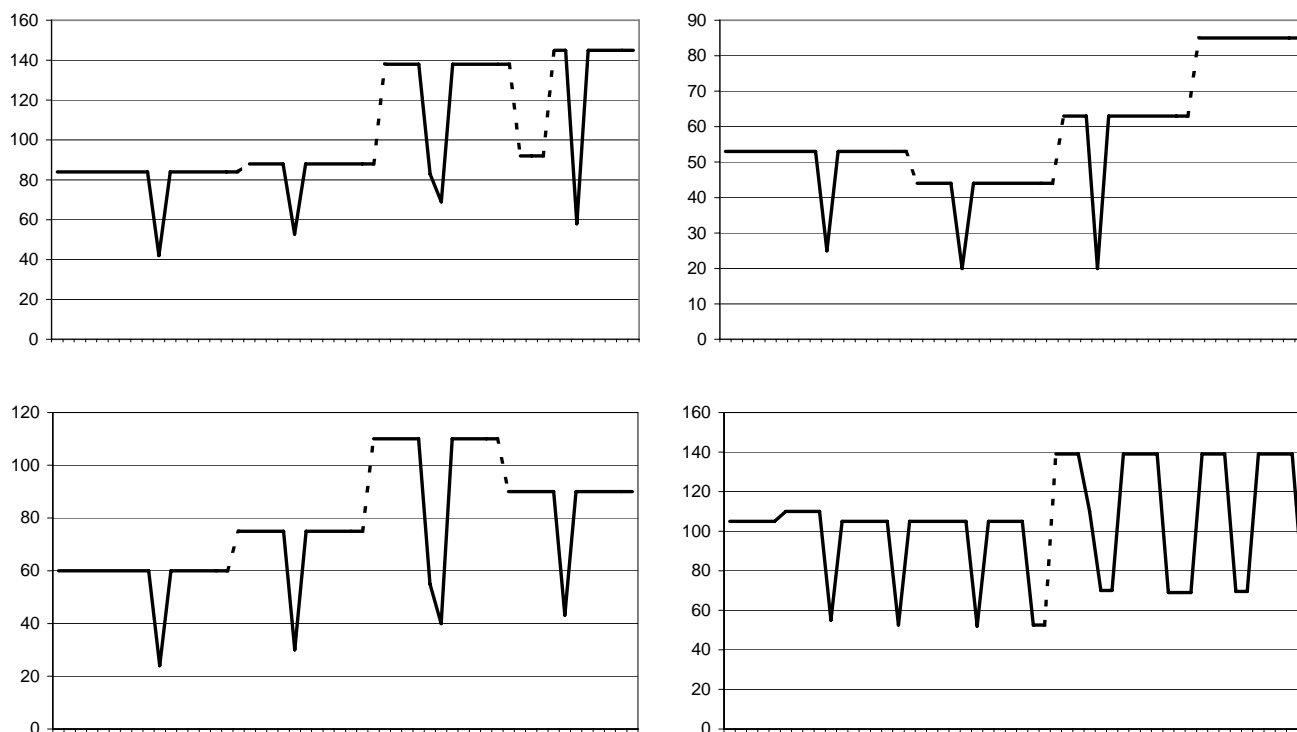


The importance of promotions and sales reflects well the reality of the clothing market and does not induce too many problems (taking into account these commercial practices is recommended by the international handbook of consumer price indices and by the European regulation). On the other hand the importance of replacements and absences of observation, on the whole 56% of the price changes, is alarming. Indeed, in both cases, the price change taken into account in the index calculation is greatly artificial depending on the methods adopted for the quality adjustment and the imputation of missing prices.

Then, regarding graph 1, the question is what is the reality and what is methodological artefact in the evolution of the price indices for clothing sector? We can however distinguish replacements and nonobservances. Indeed, the imputation for missing prices are in general provisional and the return at an observed price allows an exact calculation. Thus, the impact on the calculation of the index of this kind of imputation is momentary and noncumulative. On the other hand, the quality adjustments made with replacements are definitively integrated in the calculation of the index, for the month given but also for the future. Their effects are thus permanent and cumulative and thus much more important for the total evolution of the index.

To confirm the importance of the quality adjustments on the index, we can observe at the level of elementary products, the difference between the index with all adjustments and imputations and the average price really observed (thus without adjustments). For some products a systematic divergence appears as on the example describe in graph 4 for winter skirts. In this case, the divergence grows mainly at the autumn, period of collections renewal during which most of the replacements is carried out.

**Graph 4 : winter skirts**

Base 100, april 2003
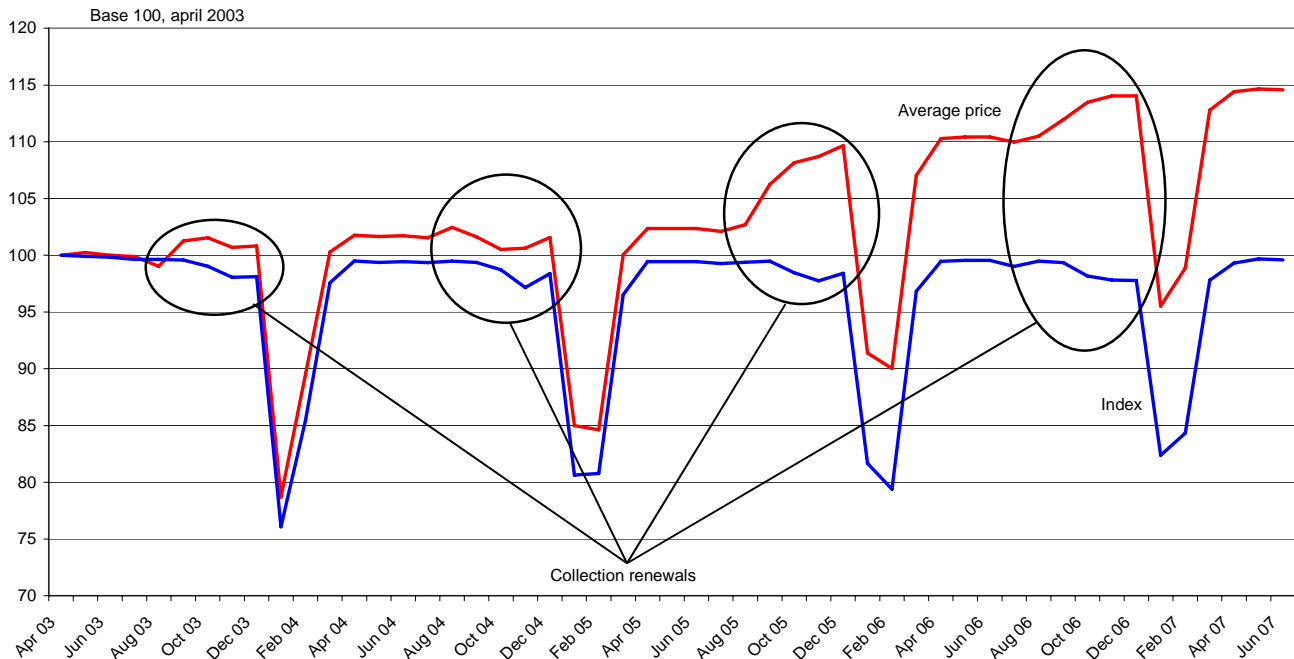


This example comes from the French index. The methods of adjustments used in France, in particular in clothing, are mainly the direct comparison and of the methods of imputation ("bridged overlap"), completed by some use of hedonic methods.

Reflections are carried out within the European Union for the harmonization of quality adjustment methods. That led us to re-examine our methods. In the case of clothing, it appears clearly that the method of imputation is not satisfactory. It indeed supposes an identity of behavior of the prices during the replacements and of the normal follow-up of the product. In this sector, except period of sales, the prices do not change at normal period of the life of the product, while at the same time the replacements are the occasions for changing prices. The choice of an alternative method, pushed us to look further into the concept of quality in clothing.

2. Quality in clothing

The importance of the replacements in the sector of clothing makes essential to perfectly control the problems of quality adjustment for these products. The question is, in fact, to understand well what defines the quality for these products.

According to the international handbook: "the evaluation of the quality change is essentially an estimate of the additional amount that a consumer is willing to pay for the new characteristics possessed by the new quality" (CPI manual, chapter 1, 2004).

A purely technical approach, sticking to the manufacturing process, the quality of raw material etc, is undoubtedly useful to estimate a production cost but shows very quickly some limitations for the consumer prices.

Hedonic regressions on some examples make it possible to establish certain important characteristics in the real price determination (and so to the price that consumers are ready to pay):
- the brand: important for many kind of product, the brand is a fundamental element in clothing sector
- the type of outlet
- appearance: the cut, the color, accessories (pockets, type of closing, girdles…)
- some technical features: type of fabric, presence of technical fiber (spandex…)

The brand, the type of outlet and the technical features are rather traditional in a hedonic model like those developed for technological products. The third category is more specific and less dependent to

an observable physical quality (solidity, heat-storage capacity…) that with the taste of the public. It gathers in fact all the aspects related to fashion[2].

For certain clothing products, the hedonic models seem well adapted and provide reliable predictive values. For this reason, we have used in France for a few years, a hedonic approach for the adjustments of qualities during the replacements for the shirts men long sleeves.

The model used is updated every year. With this update, we see certain instability, not only of the parameters of the regression but even of the variables regarded as significant. This instability relates mainly to fashion characteristics.

The hedonic models used in other sectors also know evolutions. The technological products, for which technical progress is strong, see the factors determining the price evolve quickly. However in their cases, the movement is generally an univocal fall and is accompanied by the appearance of innovations (for the numerical cameras the "price" per megapixel decreases regularly with the appearance of increasingly powerful models). In the case of clothing, instability is more heterogeneous. Some characteristics become more important, others less, all that without being related to a technological development or the appearance ex-nihilo of an innovation but on the changes of fashion from one season to another.

Let us take again the example of winter skirts for women for whom we previously saw the importance of the replacement periods. Data for this product are taken from CPI raw data source from July 2003 to June 2007 (approximately 480 products were followed). We have for each month and each observation the observed price but also information such as the brand, the outlet type, the length, the shape, the color, the type of closing… Over the period the offer evolved little in term of brand or type of outlet. On the other hand the length and the shape knew strong evolutions as table 2 shows it (the color, opened variable, as too many possible answers to be usable).

Table 2: temporal evolution of the offer for the skirts of winter.

|  | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|
| Shape |  |  |  |  |  |
| - Straight | 65 % | 61 % | 51 % | 36 % | 32 % |
| - Flared | 27 % | 30 % | 39 % | 51 % | 54 % |
| - Others | 8 % | 9 % | 10 % | 13 % | 13 % |
| Length |  |  |  |  |  |
| - Long | 25 % | 22 % | 16 % | 17 % | 15 % |
| - Medium | 33 % | 35 % | 38 % | 43 % | 45 % |
| - Short | 42 % | 43 % | 46 % | 40 % | 40 % |

For each quarter an hedonic model is built in order to explain the price with available variables (these models are multiplicative). Are retained in the model: the brand, the type of outlet, the shape, the length, the presence of a lining and the indicator of promotion (bargain prices or sales).

For our regressions we took as reference the modes whose share increases in the course of time.

The results show two things well. The first of all is a strong and stable contribution of the brands, type of outlet and indicator of promotion (graph 5 shows the coefficients attached to the type of brands).

---

[2] Brand can also be an element of fashion, nevertheless experience shows that its cycle of life is much longer than for the characteristics of appearance. That's why we do not include brand in what we indicate by characteristics of fashion here.

**Graph 5 : Evolution of regression parameters for brand classes**

Reference : class 4

Brand class 3

Brand class 2

Brand class 1
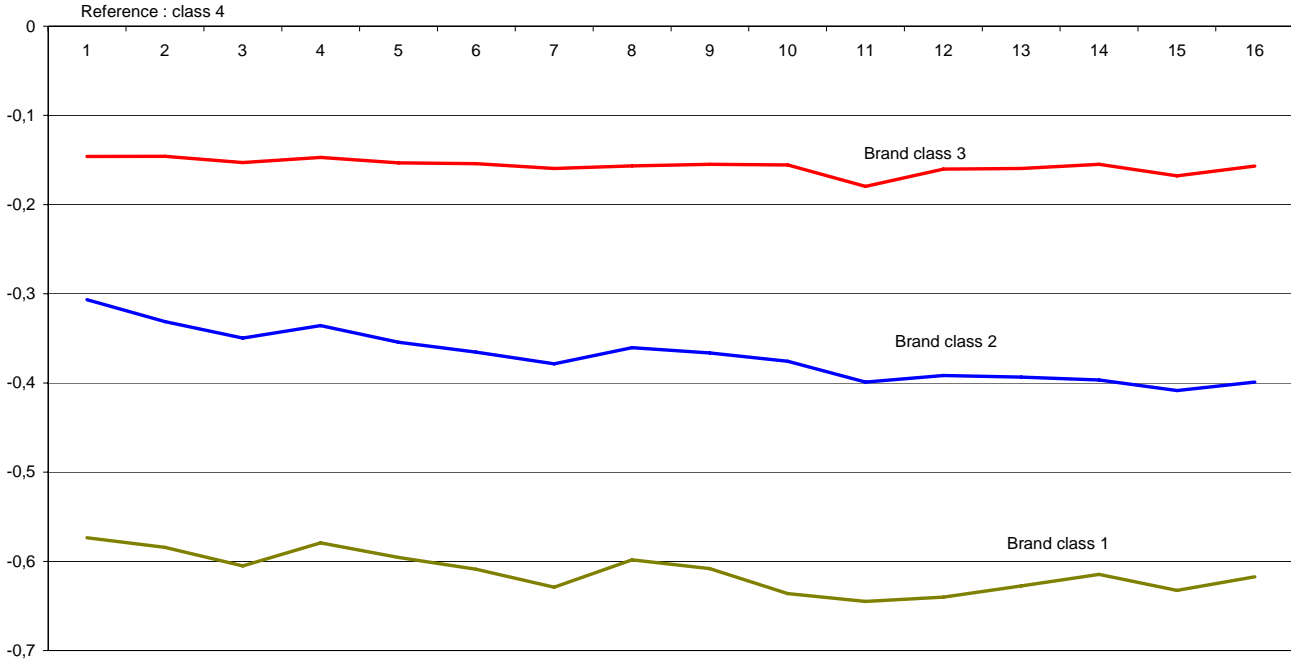
The second is a weaker but significant contribution of the characteristics of appearance (of fashion). Those are much less stable and their evolution went in the same direction than the offer: a fall of market share is linked to a fall of relative price. That reflects well the fashion phenomenon: an obsolete product sees simultaneously its prices and its volumes of sales decrease, whereas the product in fashion knows a rise in price and in market share. Graph 6 shows the downward trend of the coefficients for two features of skirts: straight shape and long skirt whose shares are falling in the same period as shown in table 1.

**Graph 6 : Evolution of regression parameters for fashion caracteristics**

Long (versus "medium-sized")

Straight (versus "flared")
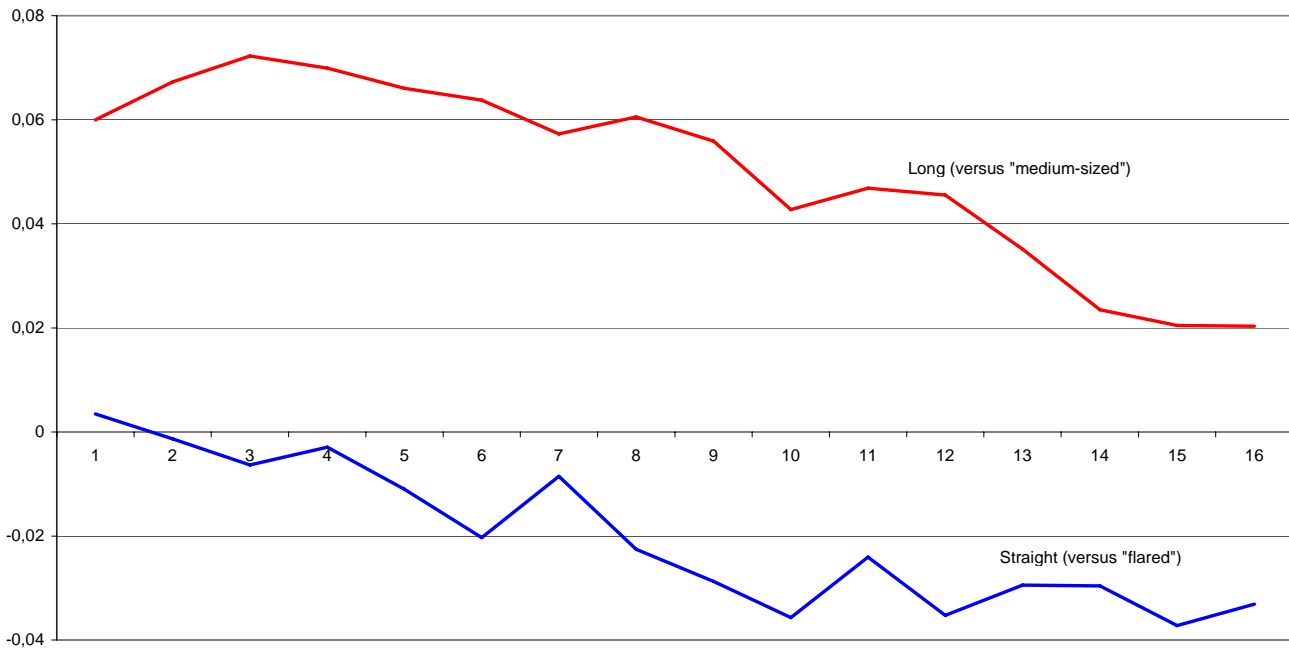
The characteristic "long skirt" is interesting because the coefficient is positive, which seems normal because a long skirt incorporates more raw materials and undoubtedly requires more work. However the overcost of a long skirt compared to an average length skirt passes from 18% at the beginning of period to only 5% in 2007. At the same time, the market share of this type of skirt passes from 25% to 15%. The objective differences in manufacturing cost (physical quality) can thus affect the fixing of the final selling price but are subordinated to the effects of fashion and, in this example, are occulted by the disaffection of the public for such or such characteristic.

These evolutions in the coefficients of regression show contradictory evolutions of "hedonic qualities" of various models. We take two models of skirts, of the same type of brands, bought in the same type of stores, one straight and long, the other flared and average length, and we notice reversed evolutions of quality, drops for the first and raises for the second (graph 7). That leads finally to an inversion of the hierarchy. Skirt 1, according to the model hedonic of the initial period, was of better quality than skirt 2 (i.e. the public is ready to buy it at a higher price). But at the final period, it is the skirt 2, which is judged of better quality. It should be noticed that this inversion is accompanied by a similar evolution of the market shares (better is "quality", better is the market share).

**Graph 7 : estimated prices for two types of skirt**



The problem highlighted here is the non-homothetic evolution of the quality of the products. For the majority of the products, in particular technological, the hedonic models used to approach the quality of the products evolves in time. However, even if quality changes, the relative hierarchy of the models remains generally constant.

In the case of clothing the question is that to make during a replacement? The theory says to us that one must make an adjustment of quality. Let us observe what happens.

We follow a skirt of the type 1 from the beginning of period. The product is kept in the CPI sample as long as it is possible, then, as it is less and less available, at some point the product disappears and we have to replace it by a skirt of the type 2. As our instructions for collector is to follow the initial product as long as it is possible, the replacement will undoubtedly intervene late, at a date when the skirt of the type 2 is judged of better quality. An adjustment of quality at the time of replacement thus will decrease the index. If, for example, a real increase in price happens at the time of the passage from one model to another, quality adjustment will cancel it at least partially.

Quite the reverse, if model 1 disappears prematurely in the store where we follow it, the quality adjustment can be inversed, leading this time at an increase in the value of the index after replacement. In both cases that is coherent with the will to maintain quality constant during the

replacement. However, a broader view shows us that the quality of the skirt of model 2 at the end of the period is identical to that of the skirt of model 1 at the beginning of period. Over long period, the adjustment is not justified.

This is clearly a problem arising from the evolution of quality over time. The price index is defined to be "with constant quality". In practice it is considered that if we follow the same product over time, this property is automatically obtained. Only when a replacement is observed we assume that quality can change and leads to a quality adjustment. The skirts example shows a very different story, with no constant quality during the normal live of the product. In the absolute, the calculation of an index "with constant quality" would thus imply to carry out adjustments of quality permanently, even if exactly the same product was observed two periods in a row. Thus, paradoxically, the traditional and rigorous application of adjustments of quality only at the time of replacements can introduce bias into the calculation of the index.

Let us try to picture a typical situation that can resume what we can meet when we follow-up clothing product for CPI, in order to better understand this possible bias. We take again the price trajectories followed by products, illustrated in graph 3, and confirmed by statistics show in table 1. It is seen that the prices are very stable apart from the episodes of promotions (the sales are easily identifiable) and of the replacements.

In diagram 8, we follow a product (skirt, dress, trousers…), whose design's renewals lead to periodical and regular replacements. We simplify the life cycle of the products by eliminating the sales periods. In this case, the changes of price happen mainly during the replacements. Therefore, in our simplified model we consider stable prices except during the replacements, which are the occasion of rise in price (first part of the diagram). In addition we suppose a decreasing quality in the course of the time, which goes up during the replacements. This evolution reflects the situation resulting from the instructions given to the price collectors: during a replacement, to choose "a well sold" article. The item is thus quite representative at the time it enters into the CPI sample, it has a good market share (it is in fashion). Gradually it becomes out of fashion, so its quality is reduced and its market shares decrease. Finally, it disappears and has to be replaced by another item with new design…(this is summarized in the second part of diagram).
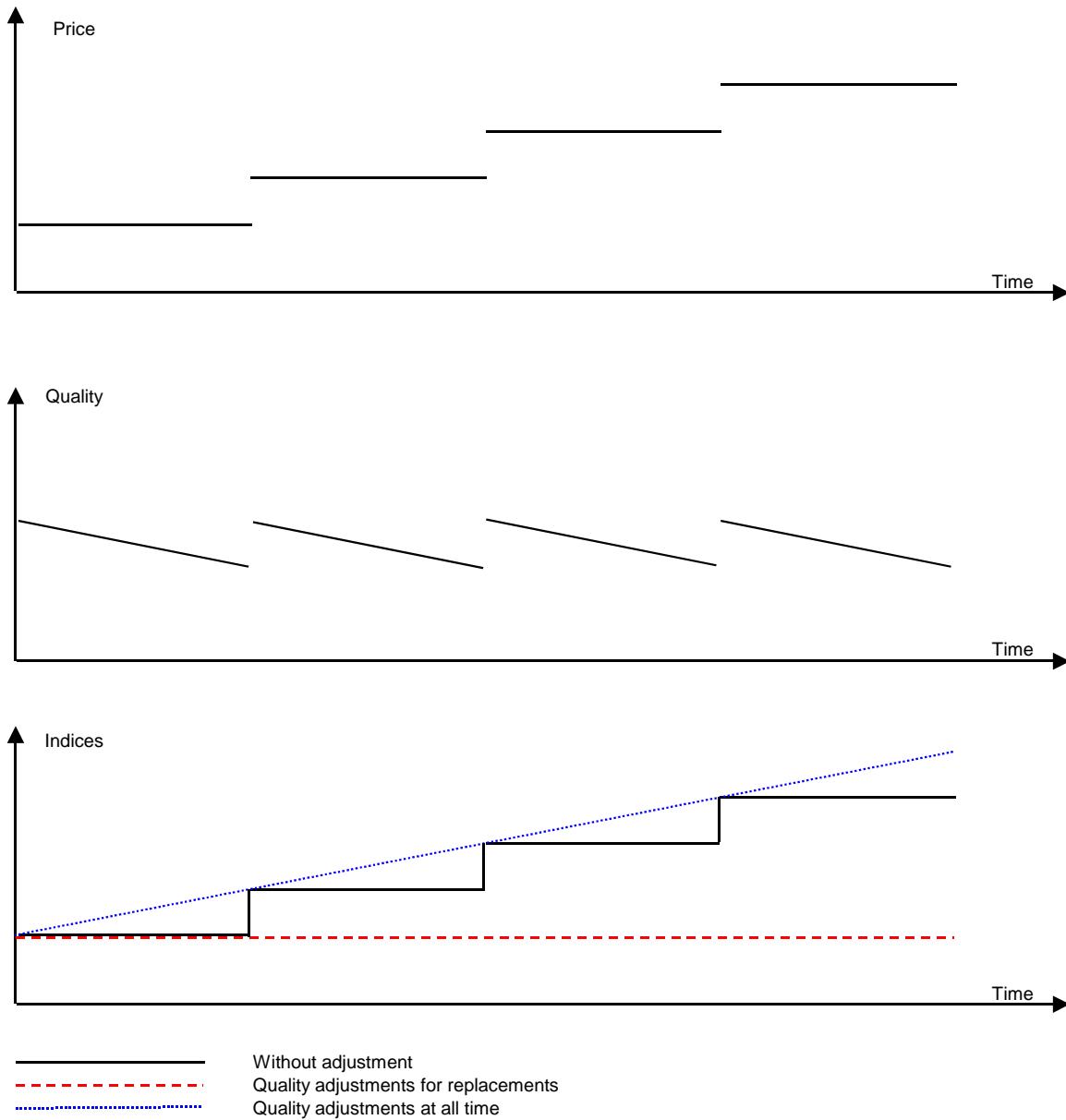
In this situation, three different indices can be calculated.
- an index without any adjustment of quality
- an index with adjustment of quality during the replacements
- an index with adjustment of quality uninterrupted (even in normal period of follow-up).

In this simulation the adjustments of quality are regarded as exact, corresponding to real quality. In practice the results depend greatly on method used. It is however remarkable here that, for traditional way of quality adjustment only when replacements occur (curve red), the hedonic method (if the model is relevant and that it estimates accurately the real quality) and the imputation method end with same result: a constant index.

On the contrary, the method of direct comparison during the replacement (not of adjustment of quality) gives an index growing close to the index with continuous quality adjustment (what is completely logical with the shape of the quality curve with a constant trend).

**Graph 8: Price index for a product with changing quality**
**Fashion sensitive cloth**



| | |
|---|---|
| ———————— | Without adjustment |
| – – – – – – – – | Quality adjustments for replacements |
| ·············· | Quality adjustments at all time |

3. New practices for the calculation of the clothing price index in France

At the beginning of year 2007, we introduced a new set of procedures for computation of the price indices for clothing products. For the replacements we defined two types of characteristics. The first gathers the type of outlet, the type of brands (list provided by our experts) and the technical features (as define above) i.e. all variables whose influences on the price are stable. The second type gathers the characteristics of fashion. The instructions for replacement of disappeared product are to privilege a substitute respecting the same variables of first type (priority variables). On the contrary, one should not seek to preserve the characteristics of fashion (type 2), but to take a product in fashion at the time of the replacement. Thus a red dress will be replaced by blue if the fashion passed from the red to blue.
If the replacement respects the stability of the priority criteria of choice (brand, stores and technical features), the index will be calculated by using the direct comparison of the prices. The two items are not of the same quality at the time of replacement, but the new one at this time is of the same quality

than the old one when this one entered the CPI sample. So the constant quality of sample product is not exact at short term but is assured at long term.

If replacement cannot be made with a substitute with the same characteristics of first type, a quality adjustment is applied for index computation.

These instructions had for first effect of notably increase the number of replacements without adjustment of quality to the detriment of those with adjustment, outcome with an inversion of their share in the whole of the replacements (see graph 9).

**Graph 9: Share of direct comparaison amongst all replacements in clothing sector**
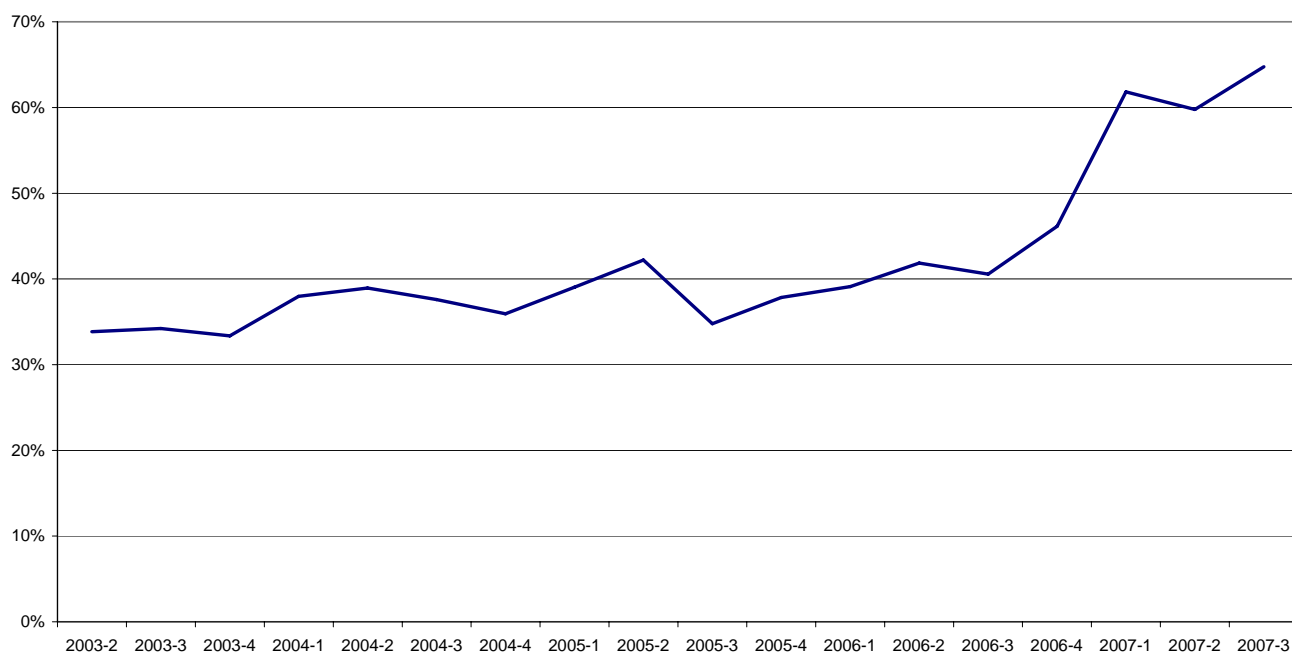


The second effect was to impact positively the index evolution of the sector. It is still early to have a global vision of this effect, the instructions being applied only since the beginning of the year. However it is possible to compare year-to-year evolution of the first 8 months index of 2007 to the same result of previous years. The table 3 shows an increase of about 0.4 % for the beginning of this year compared to the same period in 2006 and 2005.

Table 3: Year to year evolution for January-August average

| Year | Evolution |
|------|-----------|
| 2007 | 0.42 % |
| 2006 | 0.02 % |
| 2005 | -0.01% |
| 2004 | -0.13 % |
| 2003 | -0.87 % |

Conclusion

In the construction of the price indices, the theoretical and absolute fixity of the basket of products followed in the sample is not possible. To be able to carry out replacements while restoring a virtual fixity of the CPI sample, the concept of quality was created. It is this quality what will be maintained constant at the time of product replacements in order to insure continuity in the computation of the index. This constancy can be insured directly (by finding replacing products of strictly the same quality than disappeared ones) or by an adjustment at the replacing time in computation to restore it. Many efforts were spent as well in theory as in practice around the maintenance of quality during the replacements.

The study of the clothing sector makes it possible however to highlight the instability of what we defines as the quality of a product (any objective features that can change the price people are ready to pay to have the product). Indeed the elaborated econometric models at various periods to explain the prices of certain products show, beyond certain parameters having a stable influence, a category of parameters important for price determination but whose influence varies in the short run. These variables are mainly variables of appearance attached to the phenomenon of fashion. Moreover these variations are not homothetic and lead to modifications in the absolute hierarchy of the various models available for a given product. The appreciation of the difference of quality between two products thus goes variable in time at the point to be able to be reversed. However the fashion has also a consequence on the offer of products. The products in fashion are not only expensive but also more numerous. On average a replacement will occur between an old product (out of fashion) towards a new in fashion one. That corresponds to an improvement of "quality" at the time of the replacement. However this systematic increase in quality related to fashion at the time of replacements is to be put in parallel with the fall of this quality in the course of time when the product is available and followed for CPI. A traditional approach with adjustments of quality only at the time of replacements thus leads to a dissymmetrical and skewed treatment.

The solution adopted in France consists in distinguishing two types of variables: those whose influence on the price is stable, and those relating to fashion whose influence is more fickle. The variables of the first type are treated classically: they are maintained constant during the replacement, if not we need to make a quality adjustment. The variables on the second type, quite the reverse, should not be maintained constant but follow the state of the offer (collector chooses a replacing product in fashion) and are not subject to quality adjustment. This method makes it possible on the long term to maintain constant "fashion" quality of the products and justifies the absence of adjustment on these same criterias even if they have, at every moment, an influence on the prices.