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AN APPLICATION OF THE HEDONIC APPROACH TO CLOTHING IN THE CONSUMER PRICE INDEX (CPI)

Paper submitted by Statistics Canada[1]

I. Introduction[2]

1. One of the most important requirements for producing a meaningful index of pure price change for a commodity is that the items being priced are of constant quality over time. Due to changing fashion trends and seasons, however, most clothing articles can be found in the marketplace for only a very brief period of time, typically a matter of months. This means that direct price comparability for these items is not a realistic assumption. When an item being priced vanishes from the marketplace the objective is to choose a replacement item that is of comparable quality. Failing this, a minimum requirement is to choose a very similar item and accurately quantify the quality difference. This information can then be used for quality adjustment, which serves to maintain continuity in the index. Given the very dynamic nature of the clothing market, the role of quality adjustment is paramount in the construction of a meaningful price index.

2. Attaching a dollar value to the quality difference between two similar garments is often a very difficult task, if not impossible. Clothing garments are extremely heterogeneous, and changes in quality characteristics are often difficult to distinguish from changes in fashion. With the current approach to quality adjustment in the CPI, the basis for quality adjustment is on the recommendation of the field representatives, who carry out all of the pricing

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[1] Prepared by Mr. Terri Markle, Prices Division, Statistics Canada. Any views in this paper are those of the author and do not necessarily represent the opinions of Prices Division or Statistics Canada.

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activities for the CPI. The current study was initiated a few months ago to explore the feasibility of using an alternative method, called the hedonic approach, for making these quality adjustments.

3. Both the U.S. and Sweden have adopted the hedonic approach for quality adjustment in the production of their clothing price indexes, and both countries are satisfied that this method represents an improvement over previous methods. Our objective is to learn from their experiences and to select from their procedures and methodologies, adapting them to the Canadian context. In broader terms, the ultimate goal is to evaluate our options for producing quality adjustments that are more objective, consistent, and accurate than the current ones.

4. The present document contains a summary of the work that has been carried out to date, even though no final empirical results are yet available. A brief discussion about how clothing items are actually selected for pricing in the CPI, and how these items are substituted once they vanish from the marketplace, will be given first. Each phase of the current study will then be described, in turn, with particular reference to Men's Dress Shirts. The paper will conclude with some general observations.

II. Background

5. In the context of the Canadian CPI, items are selected for pricing according to a predetermined set of specifications. (See Appendix A, which includes the CPI specification for pricing Men's Dress Shirts.) In general, the specifications describe an item that is neither up-market nor down-market[1], whose price movement is presumably representative of the class as a whole. Within the guidelines of these specifications, it is the responsibility of the field representative to select a particular item in a particular outlet to be priced on a monthly basis. Their objective then becomes to select an item that is representative of what most consumers buy, namely the volume seller, thereby increasing the probability that the article will be around for a while, and hence won't have to be substituted for some time. In the case of clothing, items tend to be substituted more frequently than in any other commodity category in the CPI.[2]

6. When an original item being priced is no longer sold in a particular outlet, the field representative must select a replacement. A basic requirement is that the replacement item be selected at the same outlet as the original item. They will follow the guidelines of the CPI pricing specifications when choosing the substitute. Each time a substitution is made, the field representative must complete a special form called a Quality Price Change Report (QPCR). This form requires that information be recorded on the old item as well as its replacement. A recommendation from the field representative as to how the observed quality difference between the two items should be quantified is also required. Essentially, they are asked to specify three dollar values: 1) the observed price difference, based on regular prices, between the new and the former selection; 2) the estimated quality difference of the new selection as compared to the former selection; and 3) the recommended pure price change for the CPI (which is found as a residual). This is the basis for all quality adjustments in clothing. Because the field representatives do not have explicit information about quality

characteristics and their values, this approach is not deemed to be very precise. Some potential sources of error include: subjectivity on the part of field representatives, who lack an explicit procedure (e.g. formula) for estimating quality difference; lack of consistency in appraising quality change from one instance to the next, or across field representatives; the undue influence of sales people, who have a tendency to justify observed price increases as being attributable to quality improvements.

III. Selection of CPI clothing items for the pilot study

7. In selecting the specific clothing items to use in this study, consideration was given to five prominent factors. The first was the sample size; in order to preserve degrees of freedom in our hedonic equations it was important that we start out with as many observations, or QPCRs, as possible. The QPCRs being considered were those in effect in May, 1995. This was the earliest possible date we could choose, as it was the month in which it was decided to start retaining all of the QPCRs. A high frequency of substitutions, subsequent to May 1995, was a second requirement. The conjecture here was that in order to gauge how well the hedonic method of adjustment works relative to the traditional method, given our very short time frame, we would need many observations upon which to base our conclusions. A third requirement was that the items selected should correspond to price series that were most prone to error.[3] Fourthly, we wanted a range of complexity to gain the most out of the experience. Finally, we wanted to select some of the more important items, with relatively large expenditure shares.

8. The five items that were ultimately selected were: Men’s Dress Shirts, Men’s Suits, Men’s Sportscoats, Men’s Casual Slacks, and Women’s Winter Sweaters. Because the most extensive work has been done on Men’s Dress Shirts, the phases that will be described next will be with reference to this item.

IV. Itemizing the quality characteristics

9. A small team of economists and commodity experts met to discuss each of the items selected for the study in turn, and to determine all of their characteristics that pertain to quality.[4]

10. We began by reviewing each characteristic specified by the Bureau of Labor Statistics (BLS) for corresponding commodity categories. For example, to define the important quality characteristics for Men’s Dress Shirts we referred to the BLS category “men’s shirts”, which is similar, but quite a bit broader than our men’s dress shirt category. Many of the BLS quality characteristics were not relevant in our context, mainly because of the narrow specifications we use to select items for pricing. For example, two of the characteristics deemed most important by the BLS for men’s shirts were: type of shirt (e.g. dress shirt, sport shirt, pullover, tank top, work shirt), and sleeve length (e.g. long, short, sleeveless). Our specification requires strictly dress shirts with long sleeves. Next, a list of quality characteristics for each commodity was supplied independently by our senior clothing commodity officer. The two sources of information were then consolidated to produce characteristic lists for each item. One such list is exhibited in Appendix B for Men’s Dress Shirts.

11. Our objective was to create lists that were as comprehensive as possible to facilitate the data capture of characteristic values. What we were attempting to do was to anticipate any and all pieces of information about the quality of the items in question that could potentially appear on the QPCRs. However, the fairly loose format of the QPCR forms meant there was no guarantee that information on certain characteristics would be consistently reported just because we included them on our list.

V. Creating the data from QPCRs

12. After the team's consensus was reached on which characteristics to capture, we began to codify information from the QPCRs that were in effect in May, 1995. It was also necessary to capture the same information about the items substituted subsequent to May, 1995. In the case of Men's Dress Shirts, there were 73 shirts priced in May, 1995, and 29 substitutions that followed, up to the end of June, 1996.

13. A spreadsheet was created for each commodity selection, having a column designated for each of the characteristics decided upon in the previous section. The biggest problem encountered was missing data. A very limited number of these missing values were imputed, but only when it followed from comparisons with other very similar observations. Overall, imputation did not help very much. The second biggest problem had to do with inconsistent values being recorded for a given characteristic. In the case of Men's Dress Shirts, for example, the only two data values we were anticipating for fabric were Broadcloth and Oxford Cloth, since all dress shirts are either one or the other. In our dataset, however, the following variations were found: Broadcloth, Oxford Cloth, good grade, medium grade, plain weave, soft hand, and no description of fabric at all.

14. Both of the major problems just described could be avoided by standardizing the information requirements on our QPCR forms, as has been done in the U.S. and Sweden. In these countries, all characteristics for each of their Apparel categories are explicitly stated on checklists. Every time a substitution is made the relevant checklist is completed by the field representative. Using this standard format, the information on all quality characteristics of substitutes is routinely collected. This also makes it a very simple matter to capture the data electronically.

VI. Establishing the methodology

15. Prior to establishing what methodology to adopt, a review of the methodologies used in the U.S. and Sweden was conducted. Part of the review required that we become aware of what commonalities the two methodologies share as well as where they differ. Highlights are given in Table 1.

Table 1. Highlights of the U.S. and Swedish Approaches to Hedonic Adjustment for Apparel Price Indexes

Features	Sweden	U.S.
Types of variables in model	Only dummy variables are included. There are four separate classes of dummy variables relating to: 1) outlet; 2) origin; 3) physical properties; and 4) time (since the model is based on a time series of observations).	All variables representing fibre content are continuous; all others are dummy variables.
Number of variables for physical characteristics	Typically, less than seven variables would represent physical characteristics.	Some models may have as many as 20 variables.
Range in size of sample	Each month there are about 80-90 observations for each "item group" (4-5 varieties in 20-25 outlets). Regressions are based on 12 months of data. With forced substitution this yields sample sizes in the range of 120-420 varieties.	The BLS tends to have upwards of 200 observations for a particular item group. Sometimes the number of observations even exceeds 1000 (e.g. women's dresses).
Total number of models	There are seven nested models from which 28 hedonic models are estimated.	There are 28 models corresponding to classes of apparel for which price indexes are published
Use of checklists	Checklists have been used since 1990/91.	The BLS has used checklists per se since 1978. However, checklists following a hierarchy of specifications determined by hedonic modeling have been used since 1987 (four years prior to adopting the hedonic approach).
Most important variables	Brand is viewed as most important. When choosing substitutes the single most important constraint is to preserve the brand whenever possible.	A potentially different set of variables are identified as being most important for each clothing item. These are the variables listed on "Tier 1" of the checklist. All substitutions must strive to preserve these "Tier 1" characteristics.

Table 1. Highlights of the U.S. and Swedish Approaches to Hedonic Adjustment for Apparel Price Indexes (concluded)

Features	Sweden	U.S.
Classification of brands	All brands that appear in CPI data (about 1600) are classified into six status classes by the staff of the largest fashion magazine in Sweden. Varieties with unknown brands are classified by manufacturing country.	Brands are classified into four groups by the field representatives. These groupings, in declining order of prestige are referred to as: “exclusive”, “national/regional”, “private label” and “miscellaneous”.
Functional form	All models are semi-log.	All models are semi-log.
Price data	Regular prices are used rather than transaction prices. Empirical analysis on 1991/92 data has been conducted using transaction prices, and has shown that the regression parameters tend to be very similar.	Regular prices are used rather than transaction prices. A recent study by Shepler (1995) explored the possibility of using transaction prices, but concluded that there was not enough evidence to support their use in practice.
CPI sampling methodology	The Business Register serves as the sampling frame of outlets, which is stratified into three strata for clothing items: department stores, super markets, and specialty shops. A rotated sample of 60 outlets is selected with probability proportional to size (pps) each year. For a given item group, the price collectors choose 4-5 varieties of each item group in each outlet, which are supposed to differ with respect to at least one important property (e.g. brand, country of origin, style, etc.).	As with the Swedish approach the price sample is selected scientifically, using a pps procedure.
Frequency of updates	Once a year.	Ideally once a year, but not less than once every five years
How many months of data are used in the model?	Twelve, and three (rather than 12) time dummies appear in the model to pick up price variation due to the passage of time.	Two, since many items are only priced every other month. However, no time dummies are included.

16. There are many subtile differences between the two methodologies. However, the one key difference that required us to choose between the two approaches was the treatment of the fibre content variables, since there is a difference in the underlying philosophies. Norberg (1995) states on page 6:

> "A continuous relation between price level and fibre content, when the latter varies from 0 to 100, is not realistic to assume."

17. He rationalizes, for example, that once there is any wool present in a garment (e.g. a suit) that automatically makes it more expensive. Furthermore, he argues that a 100% wool suit could actually be less desirable than a wool suit containing a small percentage of synthetic fibre, as the latter would tend not to wrinkle as much. This argument does not seem to be that convincing. Furthermore, even if it were, our clothing pricing specifications tend to be so narrow that substitution items typically contain the same fibres as the items they are replacing, only the proportions are different. For instance, in the case of dress shirts, all of the shirts in our dataset contained cotton fibre, but some had as little as 35% while others were 100% cotton. In many instances the only difference in shirt substitutions (that were recorded) were small variations in their percentages of cotton fibre. Using the Swedish model, quality adjustments would only be possible when a new fibre is introduced with a substitution, not when there is a change in the percentage of a fibre that was already there. Therefore we chose the BLS's approach and decided to represent fibre content variables as continuous.

VII. Preparing the Data for Modeling (Men's Dress Shirts)

18. For Men's Dress Shirts, after excluding the variables captured for error checking purposes, we were left with the characteristics shown in Table 2, which were categorized loosely into three groups.[5] (All observations were considered in categorizing the characteristics, including the 73 items being priced in May 1995 as well as the 29 observations representing substitutions made after May 1995.)

Table 2. Categorization of Quality Characteristics for Men's Dress Shirts.

Very Important	**Important but Problematic (i.e. not enough variation, too many missing values, or too many unusual occurrences)**	**Marginally Important**
Outlet	Country of Origin	City
Brand	Fabric	Manufacturer[b]
% Cotton/Polyester	Thread Count	Sleeve Length
	Yoke	Fabric Design
	Seam	Opening Style
	Breast Pocket	Sleeve Style
		Body Style
		Button-down Collar
		Number of Buttons
		Number of Buttons on Cuff

19. The first column contains three very important price-determining variables for which values were (almost) always recorded, and reasonable, on the QPCRs. The second column contains six additional variables that are likely to have some bearing on the price of a shirt. However, for reasons outlined below, they are bound to be of limited use for modeling purposes. As with the variables in the second column, the variables in the final column have values that exhibit either too little variation or too much variation, and are missing a large proportion of the time. However, these variables are viewed as having marginal importance from a subject matter point of view, relative to the variables in the first two columns.

20. Once the data was refined within an Excel spreadsheet, the next step was to read it into SAS and transform the variables into a suitable format for regression analysis. The most challenging and time consuming part of making the variable transformations was to develop suitable classifications of brands and outlets. Our approach was similar to that of the BLS. Three groups of outlets were distinguished: "high", "medium", and "low". The assumption was that an outlet assigned to the "high" category would tend to have a high level of service, and probably a good location, inducing higher markups on its merchandise. Outlets classified to the "medium" and "low" groups would be associated with relatively lower levels of service, and possibly worse locations, allowing markups to be lower. Each outlet name encountered in the dataset was assigned to one of these three groups. Brands were also subdivided into three groups: "national/regional" which represents nationally (or regionally) advertised brands (e.g. Arrow); "store" which represents brand labels that are sold exclusively in particular stores (e.g. Moores); and "miscellaneous", which included the remaining brand names that did not fall into the previous two categories, and hence had no particular significance.

21. As there were only two types of fibre, cotton and polyester, encountered in our data, and since they were represented as continuous variables, no transformations of their values were required. The only minor

requirement that had to be checked was that the total fibre content summed to 100 percent in all cases.

22. The first variable in the second column is Thread Count, which is presumably an important quality determinant, as it relates to the density of the fabric. Its value, however, was not reported on the QPCRs, however, about one third of the time. Furthermore, due to the very difficult procedure used by field representatives to count threads, the precision of the estimate, when recorded, may be associated with a large amount of measurement error. The Country of Origin was always recorded, however, there was too little variation. An overwhelming majority of shirts in the sample was made in Canada. Fabric descriptions were too varied, and often missing, as already mentioned Section 5. Whenever a value for Yoke was entered, which was less than half of the time, it was a double yoke. Since the only reasonable imputation for the remaining observations is a double yoke (since it is mentioned as a quality requirement in the pricing specifications) this variable has no variation, and is therefore of no use. Similarly, the Seam and Breast Pocket variables had many missing values. When present, their values were too inconsistent to classify them into meaningful groups.

23. The final column contains variables that have presumably a very marginal effect on the price of a shirt, relative to those in the other two columns. One may then logically ask why we decided to capture the values for these variables in the first place. Part of the answer is that we did not have a true picture as to the variation of our sample with respect to some of these variables until the data capture phase was complete. For example, in the case of Country of Origin we did not realize that 74 per cent of the shirts in our sample were made in Canada. More importantly, we wanted to err on the side of having too much information, rather than not enough. Therefore, we decided to capture any information, no matter how marginal. Moreover, some variables, such as City, which will not be used directly in the estimation of a hedonic function, may be useful in a subsequent analysis of the reporting problems that emerge in the various Regional Offices.

VIII. Estimation of the Hedonic Model (Men’s Dress Shirts)

24. Although the final hedonic function for Men’s Dress Shirts has not yet been established, a fair amount of preliminary work has been carried out, which will now be described.

25. The linear version of the model being estimated is of the form:

$$P = b_0 + \sum_{i=1}^{k} b_i x_i + e$$

where the dependent variable, *P*, is the regular price of a shirt (before discounting), the x_i’s are the various quality characteristics (of which there are *k*) that are included in the model, and the b_i’s are the parameter values for these characteristics.

26. Although the final model estimated will be semi-log, the analysis that follows is based on the linear model, which has simpler arithmetic, since the parameter estimates can be interpreted as dollar values. For a dummy

variable, the parameter estimate represents the price discount or premium implied by the given characteristic being present. For the only continuous variable in the model, the cotton content of the shirt, the parameter estimate represents the increase in price implied by each percentage increase in the cotton content of a shirt.

27. The semi-log model has slightly more difficult arithmetic, but is more realistic, since it is highly unlikely that retailers charge the same dollar markup on the cheapest and the most expensive shirts. For a dummy variable, the parameter estimate represents the percentage discount or premium implied by the given characteristic being present. For the cotton content of the shirt, the coefficient value represents the percentage increase in price implied by each percentage increase in the cotton content of a shirt.

28. Before performing any regression analysis there should be some attempt to specify an *a priori* model. This can be done very informally by hypothesizing, from product knowledge, about the relative importance of the various quality characteristics and their expected influence on the price. In other words, we should have some clear expectations regarding which x_i's should be present in the model. The *a priori* expectations regarding Men's Dress Shirts were presented, rather informally, in the preceding section. We should also have *a priori* expectations about the signs and magnitudes of the parameters being estimated (b_i's). Then, once results are generated they can be evaluated to see how well they conform with initial expectations. We should be very surprised in the case of Men's Dress Shirts, for example, if the cotton fibre content variable turned out to have a parameter with a negative sign, or if the parameter representing a prestige brand label did not turn out to be higher than the one representing unknown brands.

29. Two experimental models will now be presented in Tables 3 and 4 for purposes of illustration only. The first model is a simple linear regression containing the variable cotton, which is a continuous variable representing the percentage content of cotton in a shirt. It ranges in value between 35 and 100 percent.

Table 3. Experimental Model 1

Dependent Variable: Regular Price

Variable	Parameter Estimate	Standard Error	T statistic for H_0 :b=0
Constant	-8.921456	3.58224019	-2.490
Cotton	0.800989	0.06211433	12.895
R^2=0.7008; **Adj R^2**=0.6966; **Prob>F**=.0001; **n**=73			

30. While this model is far too simplistic to provide an adequate specification, it is of interest as it shows that a very large proportion (70%) of the variation in the price of men's dress shirts can be explained by the percentage content of cotton alone! If this model were to be used in quality adjustment we would assess the quality difference at 80 cents for a unit change in the percentage content of cotton, resulting from substitution.

However, in the case that the cotton fibre content did not change with substitution, this equation would not help us in making a quality adjustment.

31. In the second model, three additional variables have been added. N-R Brand is a dummy variable indicating a national/regional brand, so the intercept relates to all other brands, including store brands as well as miscellaneous brands. Two dummy variables associated with the "high" and "low" groups of outlets also appear in this model, namely Outlet-High and Outlet-Low, so the intercept corresponds to "medium" outlets.

Table 4. Experimental Model 2

Dependent Variable: Regular Price

Variable	Parameter Estimate	Standard Error	T statistic for H_0 :b=0
Constant	2.546342	4.21515808	0.604
Cotton	0.485540	0.07221471	6.724
N-R Brand	7.112582	2.23980172	3.176
Outlet- High	16.706974	3.40377585	4.908
Outlet-Low	-5.124550	2.69712976	-1.900
R^2=0.8239; **Adj R^2**=0.8135; **Prob>F**=.0001; **n**=73			

32. This model shows even higher values of R^2. The parameters all have reasonable standard errors, and, except for the constant term, all are significant (at least at the 10% level of significance), which is a very desirable result. We also notice that the parameter estimate for cotton has been moderated considerably due to the inclusion of the brand and outlet variables.

33. If this model were to be used in quality adjustment we would assess a unit change in the percentage of cotton fibre resulting from substitution at 49 cents. However, if the brand changed upon substitution from a store brand or a miscellaneous brand to a national/regional brand the quality difference would be assessed at $7.11. The outlet variables included in this model would not be used in quality adjustment directly, but are present in the model simply to improve its specification.

34. Although this second model has parameters whose magnitudes and signs conform with our *a priori* expectations it is far from obvious that this is the best model that can be delivered. A broader coverage of characteristics would be one possible improvement. A model that includes two of the three brand categories may be possible, for example, given a more thorough review of the brand classification established. Some other important variables that are missing from the model could perhaps be made workable if reviewed more thoroughly by the commodity experts. Furthermore, these models are experimental as several more formal diagnostic checks remain to be done (e.g. detection of outliers, tests for specification error, checks for multicollinearity, check for normality of price).

IX. Analyzing Substitutions: Comparison of Traditional and Hedonic Approach (Men's Dress Shirts)

35. As alluded to above, the practical value of the model in terms of its usefulness for making quality adjustments must be considered when selecting the final model specification. Therefore, every attempt must be made to become familiar with the nature of the substitutions that are occurring so that it is known which variables tend to be changing most frequently when substitutions are made. The main point that should be noted here is that in order to make a hedonic quality adjustment, given a change in a particular characteristic, the model must contain that particular characteristic.

36. Upon examination of the data for Men's Dress Shirts it is apparent that, of the 29 substitutions that occurred, 15 of them involved a change in the percentage content of cotton. Of these 15, six of them involved a change in the brand as well. Three others also involved a brand change. This means that a total of 18 substitutions, representing 62 percent, involved a change in fibre content, brand, or both. Other variables that changed with some frequency were: Country (6 times), Fabric (twice), Thread Count (10 times), Buttons (4 times), Breast Pocket (6 times), Colours (19 times).

37. Table 5 compares, for each of the 29 substitutions, the actual CPI quality adjustments with those that might be expected with the hedonic approach. Experimental Model 2 was used to produce the hedonic quality adjustments shown in the last column.[7] The actual CPI quality adjustments are shown in the second-last column.

Table 5. Comparison of Traditional and Hedonic Quality Adjustments for Men's Dress Shirts

1	S to M	0	3.08	1.50	0.00
2	-	5	0.00	0.00	2.43
3	-	-25	-8.02	-8.02	-12.14
4	-	-25	-5.00	-5.00	-12.14
5	-	-5	3.25	1.00	-2.43
6	-	5	0.00	0.00	2.43
7	N/R to S	5	0.00	0.00	-4.68
8	M to N/R	0	0.00	0.00	7.11
9	-	0	18.69	15.00	0.00
10	-	5	0.00	0.00	2.43
11	N/R to S	0	-12.51	0.00	-7.11
12	-	-40	-4.99	-4.99	-19.42
13	-	0	0.00	0.00	0.00
14	-	0	0.00	0.00	0.00
15	-	0	-1.00	-1.00	0.00
16	-	0	3.05	0.00	0.00
17	N/R to S	35	25.00	21.00	9.88
18	-	0	0.00	0.00	0.00
19	-	0	-15.00	-15.00	0.00
20	-	0	5.00	4.00	0.00
21	N/R to S	35	0.00	0.00	9.88
22	-	15	15.00	12.00	7.28
23	-	-5	3.00	0.00	-2.43
24	S to N/R	0	1.00	2.00	0.00
25	S to N/R	0	10.00	5.00	0.00
26	-	15	0.00	0.00	7.28
27	M to S	0	-7.22	-7.22	0.00
28	-	25	10.00	8.00	12.14
29	-	40	5.00	3.00	19.42

38. One striking difference between the two approaches to quality adjustment is that the CPI quality adjustment is always judged to be in the same direction as the price change observed. Furthermore, its magnitude never exceeds the value of total price change. In contrast, these rules do not apply to the hedonic adjustment. An increase in price can occur simultaneously with a deterioration in quality (and vice-versa) with the hedonic approach.

39. Another point worth noting is that whenever there was no observed price difference between the original item and the replacing item no quality difference was found with the traditional approach. This occurred ten times. In six of these cases, however, there was a change in the percentage content of cotton. A hedonic adjustment (based on a model that includes Cotton) therefore gives rise to quality adjustment, and hence price changes that would affect the CPI. It is not at all obvious which approach is more accurate in these cases. However, a likely possibility is that substitute items with identical prices to the items they are replacing may not be examined as thoroughly as those with large price differences.

X. Estimating the analytical indexes

40. Once the final hedonic equation has been estimated for Men's Dress Shirts, the next step will be to construct analytical CPIs from May 1995

forward. The analytical price indexes will be computed in an analogous way to the official series. All data used in the calculations will be identical, except in the case of a substitution. In these instances quality adjustment is required, and therefore the price used in the official CPI will be replaced by a price that was adjusted using the hedonic approach.

XI. Conclusion

41. At this premature stage, we cannot say with certainty whether the hedonic approach will be an improvement for quality adjustment over our current methods.

42. There are at least three handicaps we have relative to the U.S. and Sweden that could compromise the results of this study. The first is the fact that we have relatively small price samples, and possibly too few to carry out a meaningful modeling exercise. On the other hand, the fact that the characteristics of the items in the sample are determined by our very narrow pricing specifications could help to counteract this problem. In other words, we have less variation between items in the sample, therefore we don't have to explain as much variation in the model. This is apparent when we consider the relative homogeneity of the items that would fall into our Men's Dress Shirts category, in comparison to the BLS category for men's shirts. A second potential handicap, which is only temporary, is that we have a very short history of price-characteristic information. QPCRs have only been retained since May 1995. Our resulting hedonic (or analytical) indexes will be very short series indeed. Finally, since checklists were not used to describe characteristics, there is quite a lack of consistency in the information on characteristics. Indeed, often, the required characteristic information was not even recorded on the QPCRs, which raises the issue of imputation, and to what extent it can be used with confidence.

43. Whether or not the study actually provides conclusive results about the superiority of hedonic indexes over our traditional indexes, the value of increased awareness of how our current methods are working should not be understated. Simply attempting hedonic analysis requires a very detailed examination of the data, which in itself is illuminating. Due to tight production deadlines this type of analysis does not occur often enough as part of the production cycle.

44. Even though this study will not be completed for several months some preliminary recommendations can be made. One is that there would be a great value in having checklists. They would enable us to gather the information about the quality characteristics that we deem to be important. Leaving a blank where thread count is called for is a more blatant error than just failing to write it down on a free-format QPCR! A recommendation for the interim would be to offer training in the field that specifically addresses what information is expected on the QPCRs. For example, if information on thread count is a priority then this should be made very explicit in training sessions, and enforced on a regular basis. Another possible improvement that could be made at a very low cost would be to revise the Pricing Specifications so that field representatives could verify more easily whether they have recorded all of the required information on the QPCRs.

Endnotes

1. This is true in reference to the main section of the Pricing Specifications, labeled “Quality Requirement(s)”. A broader range of quality, however, is permitted by including the two additional sections: “Acceptable Added Value Features” and “Acceptable Decreased Value Features”.

2. According to Lowe (1995), over 48% of Clothing articles required substitution over the course of a one year time period, 1994.

3. A recent study by Schultz (1995) indicated that there has been a tendency to overcorrect for quality change in certain categories of clothing, which included men’s dress shirts, and men’s suits.

4. Members of the project team were: Lyne Bolduc, Ted Baldwin, Mark Illing, John Mallon, Terri Markle, Michelle Soucy, and Marion Workman.

5. For a description of these characteristics see Appendix B.

6. Although the Manufacturer is, no doubt, a large price determinant it was not used because it was presumed to be very closely, if not perfectly, correlated with Brand.

7. These values were based on an experimental model and have been included for purposes of illustration only.

Appendix A: CPI Pricing Specifications Men's Dress Shirts

Amendment Notice No. 646, March 1995
332701 Men's Dress Shirt

Description:

Dress shirt. Size range 14-17 regular or shaped fit. Sleeve length 33, 34, and 35. Broadcloth, 65% polyester, 35% cotton fibre (soft hand). Thread count approx. 128x72 per 2.5 cm2. Long sleeves. Single cuffs. Full colour range.

Standard Quantity: 1.00 ***Unit of Measure***: EA

Alternate Unit(s) of Measure: CH

Frequency: Monthly.

Q/PCR Required: A ***SI***: N ***SX***: Y ***GST***: Y

Quality Requirement(s):

Good workmanship. Safety stitched seams. Placket front (may be interlined). Fused collar with stays. Interlined single one button cuffs. Cuffed breast pocket. Double yoke. Six button front. Placket sleeves.

Acceptable Added Value Feature(s):

Patented Mark collar with boomerang stay. Fused cuffs. Two button cuffs. Double cuffs. Seven button front. Dobby weave (tone on tone). Felled seams. 100% cotton.

Acceptable Decreased Value Feature(s):

Lower thread count. Breast pocket not cuffed. Cuffs not interlined. Single yoke. One sleeve length. Limited colour range. Turned back front. Breast pocket turned back and merrowed (possibly not merrowed). Sleeve without placket.

Unacceptable Deviation(s):

Woven stripes, or two seam sleeve construction.

Special Instruction(s):

The item description in section 8 of Q/PCR-A must include: Fabric type and grade; colour range; fit; construction detail. Fabric selected, style and construction must be prided with the highest degree of consistency. When a substitution involves a brand change, a "Comments on Specifications" form requesting H.O. approval must be submitted with the new selection.

Illustrative Manufacturers/Brands:

Arrow, B.V.D., Cluett-Peabody, Mach II, Arrow Mark I, Forsyth, Pierre Cardin, Hathaway

Appendix B: Characteristic List for Men's Dress Shirts

Variable Name	Values to Capture
Price	Enter the price of the item from the computer printout (i.e. ledger).
Self Review	yes, no
Date	Enter both the substitution date and the self-review date (if applicable).
City Code	Record the city code from the QPCR.
Outlet Code	Record the outlet code from the QPCR.
CA #	Record the CA number from the QPCR.
Manufacturer	Enter any information appearing on the QPCR that pertains to the Manufacturer.
Brand/style	Enter all information appearing in this field on the QPCR.
Country of Origin	Record the name of the country where the shirt was made.
Fabric	Broadcloth, Oxford Cloth
Sleeve Length	Record all information appearing on the QPCR.
Cotton (%)	Enter the actual percentage content of cotton fibre, ranging from 0% to100%.
Polyester (%)	Enter the actual percentage content of polyester fibre, ranging from 0% to100%.
Other Fibre (%)	Enter the actual percentage content of all fibres other than cotton and polyester, ranging from 0% to100%.
Fabric Design	solid color, dobby on white, dobby on color, printed stripes, woven stripes (yarn-dyed)
Opening Style	placket, turned back
Sleeve Style	placket, no placket
Body Style	conventional, tapered, full-fit

Appendix B (cont'd)

Variable Name	Values to Capture
Button-down Collar	yes, no
Thread Count	Record all information appearing on the QPCR.
Number of Buttons	Record the actual number of buttons on the opening of the shirt, probably either 6 or 7.
Yoke	double, single
Seam	Capture all information appearing on the QPCR.
Breast Pocket	hemmed, cuffed
Number of Buttons on Cuff	Record the actual number of buttons on the shirt cuff, probably either 1 or 2.
Misc.	Record any and all information appearing on the QPCR that was not specified above.

References

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