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Abstract:

Economists widely regard new products as a net source of upward bias in the US Consumer Price Index (CPI) relative to a true cost of living index. This view is based upon the logic that new products must gain acceptance in the marketplace by offering better values to consumers than the products they displace. In the CPI, however, the problem of evolving sets of items available for purchase is particularly pronounced in the areas of apparel and automotive vehicles. In these important cases failing to account for price changes when new products replace old ones leads to a *downward* bias. Real price rises, rather than price declines, often accompany turnover in populations of clothing items and automobiles because manufacturers tend to time price increases to coincide with the introduction of updated styles or models.

The recent debate on the accuracy of the CPI has focused attention on the upward bias from failing to credit consumers' gains from better or cheaper new products. This is undeniably an important problem, but downward biases from overlooking price increases accompanying new or changing product lines also merit attention. Equally noteworthy are BLS's procedural improvements that should enable the CPI to reflect most price change coinciding with the appearance of new product models or designs.

New Ways of Handling Quality Change in the U.S. Consumer Price Index

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One of the most difficult problems in measuring price change is that the set of items available for purchase varies over time. Economists widely regard new products as a net source of upward bias in the US Consumer Price Index (CPI) relative to a true cost of living index. This view is based upon the logic that new products must gain acceptance in the marketplace by offering better values to consumers than the products they displace.

In the CPI, the problem of evolving sets of items available for purchase is particularly pronounced in the areas of apparel and automotive vehicles. In these important cases, however, failing to account for price changes when new products replace old ones leads to a *downward* bias. Real price rises, rather than price declines, often accompany turnover in populations of clothing items and automobiles because manufacturers tend to time price increases to coincide with the introduction of updated styles or models. Manufacturers do this for many reasons. Higher prices for the new line or model, together with discounted prices for the discontinued product, help to clear out inventories of the old items. Also, in an inflationary environment, manufacturers may delay price increases until their product line turns over to avoid menu costs. Consumers may have less resistance to price increases that accompany product introductions because they have difficulty assessing the value of the quality changes. Finally, novelty itself may be valued by consumers. That is, the mere fact that a garment is the latest style, or an automobile is the latest model year, may increase its desirability. When consumers' preferences are unstable in away that systematically favors new products, the logic that those products which succeed are revealed preferred, is misleading. For example, no-iron polyester shirts were viewed as an improvement on cotton when they first appeared, but a few years later many consumers regarded the substitution back to the more comfortable cotton as another quality improvement (Triplett, 1988, p. 68).

The recent debate on the accuracy of the CPI has focused attention on the upward bias from failing to credit consumers' gains from better or cheaper new products. This is undeniably an important problem, but downward biases from overlooking price increases accompanying new or changing product lines also merit attention. Equally noteworthy is BLS's success in developing improved procedures that should enable the CPI to reflect most price change coinciding with the appearance of new product models or designs.

I. CPI Procedures for Repricing and Item Substitution

After the Bureau of Labor Statistics (BLS) selects a sample of outlets (stores), it selects a sample of unique items in the sampled outlets and records detailed specification information for each of these unique items. Then each period BLS field economists locate those unique items based on their specification descriptions and record their current prices. Collecting prices for exactly the same item as in the previous period is known as *repricing*. Repricing ensures that comparisons of current to earlier prices hold quality constant.

Sometimes repricing is impossible because the outlet no longer sells the sampled item. In this case, BLS selects a new item for pricing—ideally, the most similar item in the same outlet. BLS refers to the replacement of discontinued items with currently available items as *substitutions.* How BLS measures price change for a substitution depends on whether the replacement item is of comparable quality to the original item.

When a substitution occurs, a BLS commodity analyst decides whether the replacement item is equivalent in quality to the discontinued item by comparing the items' specifications. If the commodity analyst finds that the quality differences are negligible, BLS simply compares the price of the replacement item to the discontinued item's price from the previous period. This is known as a *comparable substitution*. Alternatively, the commodity analyst may have information (such as production cost data) that can serve as a basis for estimating the value of the difference in quality between the discontinued and replacement items. By netting out the portion of the price difference between the two items that is attributable to quality variation, the analyst creates a comparable substitution whose price change is useable in the CPI.

Noncomparable substitutions occur when the commodity analyst determines that a replacement item differs in quality from its predecessor but cannot directly estimate the value of the quality difference. In these cases, the difference between the old item's price in last period and the replacement item's price in the current period serves as an estimate of the value of the quality difference after netting out the effect of price change between the two periods. BLS imputes the price change effect either from an index containing either all similar items or from a specially selected set of similar items from the same geographic area.[1] These procedures are equivalent to chaining an index for the market basket containing the replacement item with an index for the market basket containing the original item, with an intermediate link based on a market basket containing neither item.

Noncomparable substitutions reduce the effective sample size for the CPI. In addition, Reinsdorf (1994) points out that repeated chaining of a price index can make the index take on the character of a geometric random walk. This type of time series has undesirable long run properties, including an exploding variance, mean and coefficient of variation.[2] However, the most serious problem with noncomparable substitutions is that they can cause bias when items undergoing design changes have different price behavior from items that can be repriced.

To avoid this problem, BLS has reduced the frequency of noncomparable substitutions and improved its price change imputation procedures. Procedures that diminish the need for noncomparable substitutions have been most important in the apparel indexes, while the improved imputation method was originally developed for the new car indexes. We will therefore discuss how BLS decreased noncomparable substitutions in the context of the apparel indexes, and then discuss the new method of price change imputation in the auto indexes.

II. Reducing Noncomparable Substitution Rates: the Case of Apparel Indexes

A. Difficulties in Measuring Price Change for Apparel

Table 1 shows that noncomparable substitutions in the CPI fell from around 2 percent of all collected prices in 1983 to about 1.1 percent in 1995. The primary cause of this fall was a decline from 10.2 percent to 2.6 percent in noncomparable substitution rates in the apparel and upkeep components of the CPI.

Many types of apparel are subject to seasonal cycles that make price change measurement difficult. Apparel retailers typically begin a selling season with a broad selection of items at high "regular" prices because they cannot predict which fashions will be popular; see Pashigian (1988) and Lazear (1986). Inventories of the most popular items may sell out early in the selling season. Other items turn out to be less marketable and must be marked down in order to sell. Consequently, as the selling season progresses, mark downs grow larger and more common. Eventually a new selling season begins and heavily discounted "clearance sale" items give way to new fashions with high "regular" prices. Many of these items are also destined to sell for less than their initial asking price.

Rising price levels for clothing tend to take the form of higher prices at the start of selling seasons. Once an item's selling season has begun, its price tends to be constant or falling, even in times of high inflation. Thus, imputing price changes for new fashions from price changes for continuously available apparel items is likely to cause downward bias. Unfortunately, however, changes in styles and fashions often make matching garments that appear at the start of a new selling season with identical garments from the corresponding selling season of the previous year impossible. Consequently, until a few years ago, new fashions frequently entered the CPI as noncomparable substitutions whose price changes were imputed from samples consisting primarily of repriced items.

During the early Eighties, efforts to avoid comparing prices of different quality items resulted in price change imputation for about 60 percent of apparel substitutions. Armknecht and Weyback (1989, p. 113-114) observe that these imputations reduced the growth rate of the apparel commodities index from 12.4 percent to 1.4 percent in 1984, and that over the nine year period ending in December 1986 the index for apparel commodities increased by only 25.5% while the all-items CPI increased by 77.9%. Since industry sources indicated that apparel inflation rates were higher than the CPI implied, BLS began work on improving the CPI apparel indexes. Research on the use of hedonic regressions for apparel indexation was a major component of this effort.[3]

B. Hedonic Regressions for Apparel

Hedonic regressions for apparel commodities estimate the average effect on price of garment characteristics such as fiber content, style, type of designer and type of outlet. Their functional form is:

$$\log P = \beta_0 + \sum_{n=1}^{N} \beta_n X_n + \varepsilon.$$

Here β_n is the expected effect of the n^{th} characteristic on the natural logarithm of the item's price. In most cases X_n is dichotomous, but in some cases it measures a continuous quantity such as percentage wool. For example, the hedonic regression model for women's dresses provides estimates of the effect on price of 19 characteristics such as style (daytime or formal), number of pieces (one or two), fiber content, brand label category (local store or national), size range, type of lining (bodice or full), and type of outlet (full service or discount).

Estimating hedonic adjustment coefficients is a challenging and demanding process. First, commodity analysts must select a sample and review the data for completeness, consistency and accuracy. Next, the commodity analysts must resolve econometric difficulties associated with model specification, adequacy and performance. For example, Shepler (1994) notes that,

> "Applying hedonic regression to women's apparel [is] especially problematic since perceived fashionability can be as much a determinant of price as measurable characteristics such as clothing fibers. Since difficulty also exists in separating out the effects of the [price determining] variables, multicollinearity frequently occurs. Misspecification resulting in biased estimates is another potential problem. There is also uncertainty as to the stability of the parameter estimates due to the dynamics of the apparel marketplace."

To date, CPI apparel analysts have developed more than 30 hedonic regression models for women's, men's, girls', and boys' apparel, as well as footwear, and jewelry. This research has improved the apparel indexes in three major ways. First, as commodity analysts have learned more about how quality characteristics affect apparel pricing, they have been able to make substitution comparability decisions more accurately and more confidently. This is quite important because most apparel commodities display some seasonal marketing pattern, and changes in styles often make finding the same item that was priced in the previous fall/winter or spring/summer selling season impossible.

Second, BLS has revised the apparel data collection forms (known as "checklists") to help its field economists find substitute items that match the major price-determining characteristics of original items that have become unavailable. This increases the chance of the BLS field economist choosing a comparable substitute. Hedonic coefficient estimates and statistical significance measures have played an important role in identifying the major price-determining characteristics for each type of apparel.

Lastly, since January 1991, BLS has used hedonic regression coefficients for direct quality adjustments of apparel item prices. When major price-determining characteristics do not match, commodity analysts attempt to use parameter estimates from hedonic models to adjust for quality differences between original and substitute items. Such adjustments have further reduced reliance upon noncomparable substitutions. The appendix provides an example of a hedonic quality adjustment.

C. Other Improvements to the Apparel Indexes

Procedural changes unrelated to hedonic regression have also played crucial roles in improving the apparel indexes. The first of these was a change in the timing of substitutions for seasonal apparel items that made more of these substitutions comparable and improved the representativeness of the apparel samples (Sullivan, 1988, pp.10-14.) In particular, in 1987 BLS designated many classes of apparel items as seasonal and prohibited substitution away from items in those classes when they are out of season. Now, when a seasonal item disappears after its selling season has ended, BLS waits until it is back in season before substituting to a different item.[4]

The aim of the remaining changes in the apparel indexes was not avoiding noncomparable substitutions but rather improving their execution. The first of these changes was the introduction in 1990 of an eight month overlap pricing period when a new sample of apparel outlets replaces an obsolete sample. BLS instituted this extended overlap pricing period because after the 1987 CPI revision a pattern emerged of flat or falling apparel indexes in cities with new outlet samples. This pattern occurred even at the start of selling seasons—when cities without new samples had large jumps in apparel prices—because changes from sale to regular prices were under-represented in the rotation cities (Armknecht, 1989, p. 2). The eight month lag permits the new sample to begin reflecting such changes before it enters the CPI.

Second, in January 1991 BLS modified its treatment of sale prices in noncomparable substitutions. Since 1978, BLS had returned the price of an apparel item that was on sale before disappearing to its pre-sale level before linking in a noncomparable substitute (which was also required to be at a non-sale price.) Returning the sale price to its regular level before linking prevented downward bias from falsely attributing the difference between the old item's sale price and new item's regular price to the higher quality of the new item. In January 1991 BLS began returning sale prices to regular prices that were adjusted for trend and seasonal time series components.

Finally, in December 1992 BLS began phasing out this treatment of sale prices in noncomparable substitutions. Rather than returning sale prices to adjusted regular prices before a noncomparable substitution, BLS now uses the price change imputation method that is discussed in Section III below.

D. Results of the Apparel Index Improvements

In the early 1980's BLS classified only about 40 percent of the substitutions in the CPI apparel samples as comparable.[5] Figure 1 shows that this pattern persisted until 1987. Then, between 1988 and 1990 the proportion of substitutions deemed comparable rose to around 65 percent due, in part, to help from hedonic regression results in designing data collection forms and in making comparability decisions. In 1991, BLS began to make quality adjustments based on hedonic regression results and apparel comparability ratios climbed again, reaching 85 percent.

Table 2 displays the annual rates of changes of the all-items, all-commodities and apparel commodities indexes from 1980 to 1994. The gaps between the growth rates of the all-items and all-commodities indexes on the one hand and the growth rate of the apparel commodities index on the other hand seem implausibly large prior to 1987. Since then, however, the apparel commodities index has diverged much less from the broader indexes.

The effect of hedonic quality adjustments can be gauged by comparing indexes calculated with hedonically adjusted prices to indexes that do not incorporate such adjustments. Liegey (1994) compares price indexes calculated without hedonic quality adjustments to published indexes for seven types of apparel from June to December, 1991. Three of the indexes omitting the hedonic quality adjustments are higher than their official counterpart, three are lower, and in one case hedonic adjustments have no net effect. Yet, when all seven indexes are aggregated into an index for apparel as a whole, hedonic adjustments raise apparel's measured inflation rate by 0.2 percent. This occurs because the hedonically adjusted indexes for the items with the lowest comparability ratios grow much more quickly than their unadjusted counterparts. In particular, women's dresses rise 0.8 percent more with hedonic quality adjustment, and women's suits rise by an additional 3.2 percent over the six month period.

III. Using a Representative Sample to Impute a Price Change: The Case of Autos

Despite BLS's progress in reducing the number of noncomparable substitutions, product replacements and modifications sometimes bring prices into CPI samples that cannot be compared with an earlier price. Simply omitting such prices from CPI calculations is the solution that comes immediately to mind, but doing this may cause bias. Dropping a redesigned product from the index is equivalent to imputing its price change by an average price change of the remaining products in the index. Most of those products are likely to be unaltered, and prices of unaltered products often behave differently from prices of redesigned products.

In the motor vehicle industry, regular product redesigns are an institution as each year manufacturers introduce new car and truck models. When comparing prices from different model years, BLS must account for design changes that affect vehicle performance and efficiency. In addition, BLS treats changes in mandated safety and pollution requirements as changes in quality.

Since the early 1960s, BLS has estimated the value of vehicle quality changes by marking up manufacturers' estimates of the production costs of those changes to the retail level. Although BLS adjusts more than half of all new model year car and truck prices for quality changes in this way, manufacturers are often unable to provide production cost data for extensive changes between model years. For example, when a rear-wheel drive car becomes front-wheel drive, assessing the production cost of the design changes with any degree of precision may be impossible. When BLS cannot directly estimate a "pure" price change for a new model year vehicle that excludes the effects of quality changes, it must impute a price change based on the behavior of other vehicles' prices.

Before October 1989, when BLS had to impute a price change for a new vehicle model, it used an index that included all other vehicles in the sample from the same geographic area. This meant that the price change between a discontinued model and a dissimilar new model was imputed from a sample consisting predominately of vehicles from a single model year. Using the entire sample for price change imputation is appropriate when introductions of new versions of the product are unrelated to price change, and BLS continues to use this method for most food items and all services. For automobiles, however, a significant relationship exists between price change and the introduction of the new models. Within a model year prices tend to be constant—or even to decline near the end of the year—while between model years prices typically increase. Imputing price change for new model years based largely on price changes for continuing models is, therefore, inappropriate.

Table 3 illustrates the effect of restricting the sample used for price change imputation to directly comparable and quality-adjusted substitutions. When the model year does not change, prices of new cars in Chicago decline, on average, by 0.2 to 0.7 percent per month. On the other hand, prices for new model years average 0.2 to 5.8 percent higher than prices of the previous model year in the previous month, even after factoring out quality differences. Consequently, using a subsample containing only model changeovers to impute the price change of any noncomparable new model raises the January 1995 index from 100.18 to 100.85.

Stewart (1988, p. 12) reports similar patterns at the national level. He finds that for monthly collection periods ending between March 1987and February 1988, car models undergoing repricing had, on average, no price change. In contrast, after adjusting for quality differences, models that entered the index as comparable substitutions cost an average of 3 percent more than their counterparts had cost in the previous month. In cities that have bi-monthly collection periods for car prices, Stewart finds that the average price change between visits was -0.2 percent for repriced models and 2.8 percent for directly comparable or quality-adjusted substitutions. Over the twelve month period ending February 1988, a new car index that just used comparable substitutions to impute price change for noncomparable substitutions rose 2.76%, compared to 2.42% for the published index.

In October 1989 these results led BLS to adopt *class mean imputation* for estimating price changes for new automotive models of dissimilar quality.[6] Now, when BLS lacks information needed for direct quality adjustment of a new automobile model, it uses the average price change of directly comparable and quality-adjusted model changeovers to impute a price change. Price changes for cars and trucks *within* a model year are no longer used to impute price changes *between* model years.

Unusual price change behavior when a product is replaced by a new version occurs in many industries besides automobiles. Section II notes, for example, that the apparel industry tends to time price increases to coincide with the shipment of garments for a new selling season. BLS therefore began phasing in class mean imputation for most commodities other than food in December 1992. Price changes for most noncomparable commodity substitutions are now imputed from the average price change of directly comparable and quality-adjusted substitutions in the same geographic area.

IV. Conclusion

Flux in the set of products found in the marketplace poses a challenging problem in the production of price indexes. Simply linking new products into the index entails risks of bias (and elevated variance) that are easy to overlook. When new products represent superior values or embody important technological advances this bias will be upward,[7] but downward biases may also be common. In particular, manufacturers often time real price increases to coincide with product redesigns or the introduction of new models. Such behavior is particularly evident in industries that have regular cycles of product line renewal, such as apparel and autos.

In recent years the BLS has implemented new approaches for handling changes in item characteristics that make the CPI much less prone to miss price increases obscured by simultaneous changes in product attributes. First, noncomparable substitutions occur less often than they once did. This is true for many types of items, but apparel, where the problems were most serious, has experienced the greatest improvement. Improved substitute selection procedures and changes in the timing of apparel substitutions have both helped to increase success rates in finding comparable substitutes. In addition, BLS now uses hedonic regression coefficients to adjust prices of substitute apparel items to correct for differences in quality. In many cases, such adjustments make price comparisons possible in situations that would once have required price change imputation.

Second, when noncomparable substitutions involve a type of item whose price change may be related to the introduction of a new product version, BLS now imputes the price change for a new or redesigned item using a more representative subsample containing items that have also undergone changes. This improvement provides an interesting illustration of the importance of considering sample selection effects in designing statistical estimators.

BLS is continuing research on improved procedures for bringing new items and outlets into the apparel indexes. One area of investigation is the role of outlet quality differences in outlet price differentials, and the extent to which these price differentials should be reflected in the CPI when one outlet replaces another during sample rotation.[8] BLS is also exploring the use of panel data for some apparel commodities whose cross-sectional samples are too small to yield usable results. Ordinary least squares (OLS) generally cannot be used for estimation with such data because the assumption of independent errors is violated. Instead, an estimation method that allows for the presence of error components must be used to avoid misleading statistical inference.[9] Some success in obtaining quality adjustment factors for product characteristics has already been achieved.

APPENDIX

Quality Adjustment for an Apparel Item Substitution Using Hedonic Regression

The price for an apparel item leaving the sample can be quality-adjusted based on the difference in item characteristics for both old and new items. Parameter estimates developed in an hedonic regression model for women's coats and jackets are used to adjust price. The following example illustrates this procedure under the assumption that only the fiber content for the new item is different.

Item	Old Item Description	New Item Description
Design	Trenchcoat	Trenchcoat
Fiber	All Wool	All Cotton
Length	Mid-Calf	Mid-Calf
Lining	Full Lining	Full Lining

Price Information:

Old Item's Price = $63.00

New Item's Price = $40.00

Proportional Price Effect for All Wool Characteristic = 0.47896929

Proportional Price Effect for All Cotton Characteristic = 0.10039884

Hedonic Quality Adjustment Procedure:

1. Determine All Wool Value to Price (0.47896929)*(63.00) = 30.18
2. Determine All Cotton Value to Price (0.10039884)*(63.00) = 6.33
3. Determine the Quality Adjustment Amount (-30.18) + (6.33) = -23.85
4. Determine Quality Adjusted Price (-23.85) + (63.00) = 39.15

The New Price Change With Quality Adjustment:

$$\text{Quality Adjusted Price Change} = \left(\frac{\text{New Item Price}}{\text{Quality Adjusted Price of Old Item}} - 1 \right) * 100 = 2.2\ \%$$

Notes

1. The US CPI is a weighted average of 9,108 basic item-area indexes covering 44 geographic areas and 207 groupings of goods and services called item strata. BLS occasionally uses prices from more than one area to get an adequate sample size for purposes of imputation.

2. Valliant and Miller (1989) simulate the deleterious long run effects of chaining on the index's variance. They also provide a formula that minimizes the mean square error of a long run index. This formula comes close to simply treating all substitutions as comparable.

3. Descriptions of the hedonic index research for apparel appear in Armknecht (1984), Liegey, (1993) and Liegey (1994).

4. The procedures adopted in 1987 required waiting until the second month of the selling season to substitute to a new version of a seasonal item. The purpose was to allow time for a complete selection of new fashions to arrive in the stores. In 1992 BLS began permitting substitutions during the first month of selling seasons because new fashions now arrive more quickly once selling seasons start.

5. See Armknecht and Weyback's (1989) Table 1 and Callahan (1984).

6. Kalton and Kasprzyk (1986) discuss class mean imputation. For additional information about BLS's use of class mean imputation see, "Improvements in CPI Procedures," *CPI Detailed Report* (Bureau of Labor Statistics, August 1992, pp.3-4).

7. For example, Reinsdorf (1993) discusses the example of entry by lower-priced outlets, while Griliches and Cockburn (1994) discuss the linking in of lower-priced generic pharmaceuticals.

8. Popkin (1993, p. 256) suggests that BLS should undertake such research.

9. See Hsiao (1986) or Baltagi (1995). Moulton (1986) shows that error components can also arise in cross-sectional regressions involving grouped data and that they can easily cause large biases in OLS standard errors.

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Table 1

Comparable, Noncomparable, and Quality-Adjusted Subtitutions As a Percentage of Prices Collected[a]

Category	Year	Comparable	Noncomparable	Direct quality adjustment	Total
All	1995	2.01	1.09	0.43	3.53
	1983[b]	1.56	1.97	0.32	3.85
Food & beverages	1995	0.79	0.82	0.03	1.64
	1983	0.52	1.29	0.00	1.81
Housing	1995	2.02	1.27	0.12	3.41
	1983	2.21	1.89	0.15	4.25
Apparel & upkeep	1995	9.03	2.57	1.73	13.32
	1983	7.15	10.15	0.03	17.34
Transportation	1995	3.69	1.10	1.87	6.66
	1983	3.13	1.41	2.18	6.72
Medical Care	1995	0.62	0.94	0.73	2.29
	1983	0.65	0.94	0.64	2.22
Entertainment	1995	2.96	1.61	0.37	4.94
	1983	1.92	2.51	0.18	4.61
Other goods & services	1995	1.25	0.86	0.27	2.38
	1983	1.44	1.69	0.17	3.30

a. Residential rent, homeowners' equivalent rent, used cars, health insurance, and magazines, periodicals, and books are excluded.

b. The 1983 substitution percentages come from Armknect & Weyback (1989), *Journal of Official Statistics* 5 (2), Table 1 p.110.

Table 2

Growth Rates of Annual Average Indexes for Apparel Commodities, All Commodities, and All Items

1980-1995[a]

Years Compared	Apparel Commodities	All Commodities	All Items
1980-81	3.9	8.4	10.3
1981-82	1.9	4.1	6.2
1982-83	1.9	2.9	3.2
1983-84	1.3	3.4	4.3
1984-85	2.5	2.1	3.6
1985-86	0.2	-0.9	1.9
1986-87	4.5	3.2	3.6
1987-88	4.4	3.5	4.1
1988-89	2.6	4.7	4.8
1989-90	4.5	5.2	5.4
1990-91	3.6	3.1	4.2
1991-92	2.4	2.0	3.0
1992-93	1.2	1.9	3.0
1993-94	-0.5	1.7	2.6
10/94-10/95	-0.7	1.7	2.8

a. Growth rate for 1994-5 is based on index changes from October, 1994 to October, 1995.

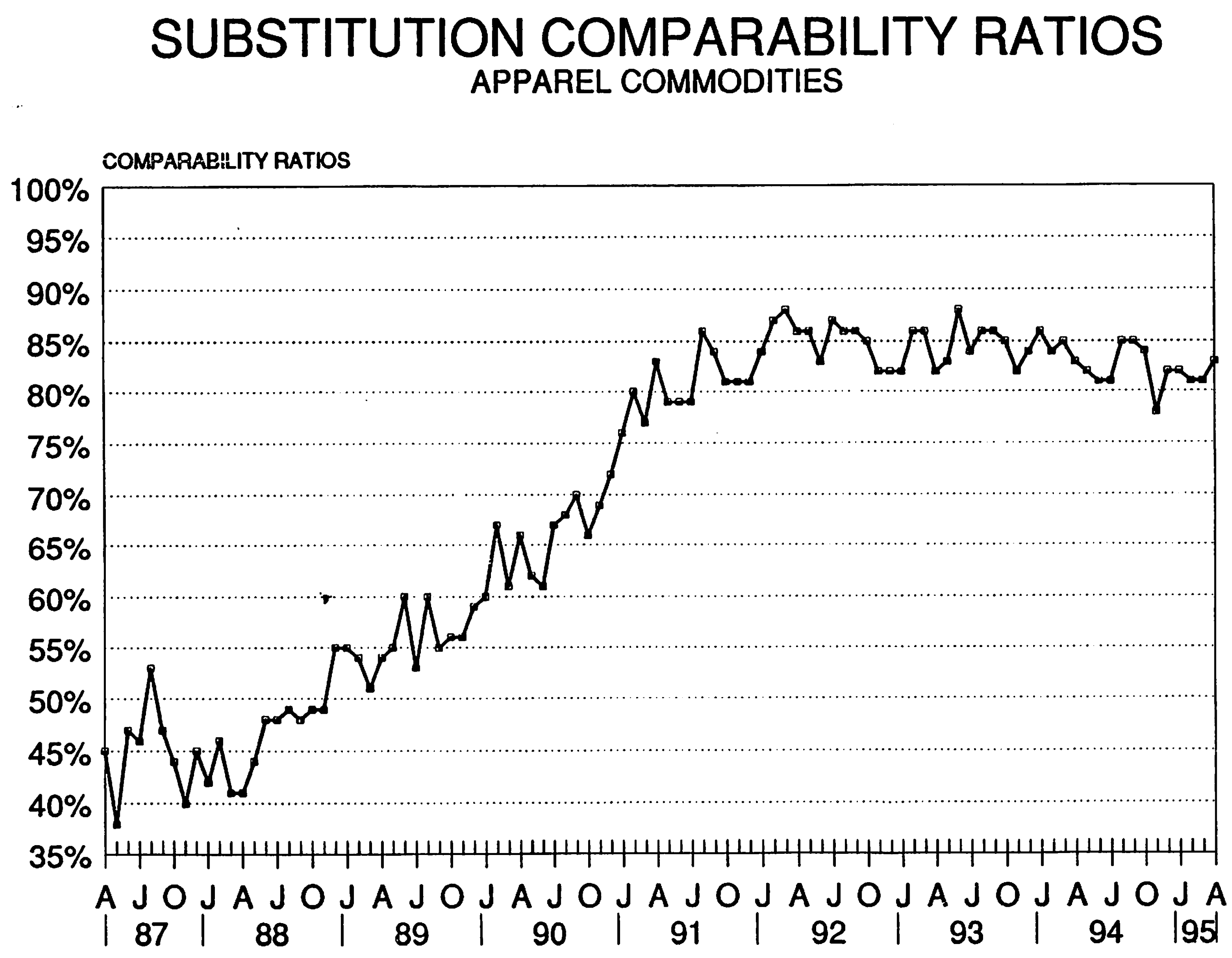
Table 3

Effects of Class Mean Imputation for New Cars in Chicago

September 1994 - January 1995[a]

	Sept 94	Oct 94	Nov 94	Dec 94	Jan 95
Price change w/in the same model year ("Class A")	-0.3%	-0.6%	-0.6%	-0.7%	-0.2%
Price change between model years ("Class B")	0.8%	2.4%	5.8%	1.2%	0.2%
Weighted average price change for Classes A and B	-0.1%	-0.1%	1.1%	-0.5%	-0.2%
Price change for noncomparable model changeovers imputed by old method (i.e., imputed from Classes A and B)	-0.1%	-0.1%	1.1%	-0.5%	-0.2%
Price change for noncomparable model changeovers using *class mean imputation* (i.e., imputed from Class B alone)	+0.8%	+2.4%	+5.8%	1.2%	0.2%
Index, old imputation method, August 1994=100.0	99.858	99.712	100.789	100.335	100.180
Index, class mean imputation method, August 1994=100.0	100.291	100.220	101.366	100.947	100.854

a. Most new car substitutions in the CPI occur between September and January.


SUBSTITUTION COMPARABILITY RATIOS
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COMPARABILITY RATIOS
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FIGURE 1