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Apparel Prices 1914–1993 and the Hulten/Bruegel Paradox

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2.1 Introduction

So much evidence has been produced over the years demonstrating an upward bias in the Consumer Price Index (CPI) and National Income and Product Account (NIPA) deflators, especially for consumer and producer durable goods of relatively recent invention, that it requires a sharp adjustment in one's mind-set to contemplate the opposite: that for major consumption components over long intervals, the CPI may have incorporated a significant *downward* bias. Yet the Hulten-Bruegel paradox as interpreted here makes a convincing logical case that at some point in the past there *must have been* a downward bias in the CPI for several major components. This chapter demonstrates that one of these components is apparel, one of the three "necessities" (along with food and shelter), and a companion paper (Gordon and VanGoethem 2007) reaches the same conclusion for rental shelter. Both are unique in covering most of the twentieth century; 1914 to 1993 in this chapter on apparel and 1914 to 2003 in the companion paper on shelter.

Viewed as a contribution to the price index literature, this chapter joins others that have explored differences in hedonic and matched-model (MM)

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indexes developed from the same data. Several previous studies have found that computer prices tend to be reduced upon the introduction of new models, leading hedonic price indexes to exhibit more rapid rates of price decline than matched-model indexes from the same data.[1] The matching process appears to exclude price declines when new computer models are introduced. There has long been a suspicion in the apparel price literature that price *increases* occur with changes in models or styles and are missed by the matched-model procedures of the CPI, and this chapter is perhaps the first study to demonstrate this systematic difference between hedonic and matched-model indexes from a uniform data set for apparel over a long historical period of time.[2] A striking corollary of the results is that quality change in apparel over the long period 1914 to 1993 has been negligible, in the sense that the new hedonic index tracks raw unadjusted price change relatively closely, while changes in the implied index of average quality are relatively minor.

This chapter represents the fulfillment of a long-standing goal to extract from the Sears catalog a new history of apparel prices over the entire history between the beginning of the CPI in 1914 and the final year of the Sears catalog in 1993 (the catalog itself began in 1893, two decades after the Montgomery Ward catalog's initiation in 1872).[3] Initially the goal of this project was to duplicate the CPI matched-model methodology with catalog data and compare CPI apparel subcomponents with the corresponding Sears matched-model indexes. Subsequently it became apparent that the same Sears data could be used to develop hedonic price indexes for at least one product—womens' dresses—where an ample number of data observations are available in the catalogs. The resulting differences in the hedonic and matched-model indexes for womens' dresses provide convincing evidence that the matched-model technique misses a significant portion of price increases that occur when styles and models change.

2.1.1 The Hulten-Bruegel Paradox

Numerous economists have speculated about the implications for estimates of long-term economic growth of bias in official price indexes. In an

1. Among studies that examine differences between matched-model and hedonic indexes for personal computers and/or software are Berndt, Griliches, and Rappaport (1995); Berndt and Rappaport (2003); Doms, Aizcorbe, and Corrado (2003); and Triplett (2004).

2. For history buffs, the time period of this study, dictated solely by the starting date of the CPI and the termination date of the Sears catalog, echoes dates signifying the start and end of the most terrible events of the twentieth century. In the words of Eric Hobsbawm (1994, 3), the interval 1914 to 1991 marks the "short twentieth century" bookmarked by the start of World War I and the final collapse of the Soviet Union.

3. Sears catalog data for 1893 to 1914 were previously analyzed by Rees (1961b), as discussed further following. A history of the Sears Roebuck and other mail-order catalogs and further references can be found in Gordon (1990, 419–23).

important and influential example, Nordhaus (1997) speculated that when plausible rates of upward price index bias are extrapolated backwards for two centuries, the increase in real wages from 1800 to 1992 (which in the official data is by a factor of 13 to 18) might have been by a factor of 40 with a low estimate of price index bias (0.5 percent per year) or by a factor of 190 with a higher estimate of bias (1.4 percent per year).

Nordhaus' conference discussant, Charles Hulten, pointed out the implausibility of this thought experiment; the high bias estimate implies (in my own numerical example that makes Hulten's point with different numbers than his) that median household income in the year 1800 was $143 in 1992 prices, or $0.39 per day: enough to buy a mere 1.3 pounds of potatoes per day for the household, with nothing left over for shelter, clothing, or anything else.[4]

But why stop there? The "Hulten paradox" should be renamed the "Bruegel paradox," after the landmark painter Pieter Bruegel the Elder (1525–1569). Even if we assume that the then-unavailable official estimates would register no increase in the real wage from 1569 to 1800, when we extrapolate Nordhaus' high bias estimate back to the last year of Bruegel's life, we find the implication that the real wage should have increased from 1569 to 1992 by a factor of 5,482, making median *annual* household income in the earlier year equal to $5.59, enough to buy exactly 0.8 ounces of potatoes per day, with nothing left over for food or shelter.[5] Yet the happy burghers in Bruegel paintings often look overfed, content, well-clothed, and with solid-looking houses in the background.

2.1.2 The Application to Apparel

In setting a research agenda to look for the possibility of negative CPI bias, one looks first to the three traditional consumer necessities—food, apparel, and shelter—these are the "big three" items of consumer expenditure and have a sufficient weight to "matter" in arriving at an eventual resolution of the Hulten/Bruegel paradox. While there might be some long-term bias in the CPI for food, I have sidelined that category to the back burner for lack of an obvious data source that would incorporate developments over time in the increased degree of processing of food (canned food, frozen food, delis in the supermarket, etc.) Instead, the research payoff looks more promising for the remaining two necessities, apparel and shelter, for two reasons. First,

4. The 1992 current-dollar median household income was $30,786 and the 1992 price of a pound of white potatoes was $0.31 (U.S. Bureau of the Census 1994, tables 707 and 763, respectively). Extrapolating backwards a growth rate of real wages of 2.8 percent per year yields a ratio of real wages in 1992 divided by the year 1800 of 216 ($30,786/216 = $142.50).

5. The factor of 5,482 equals the factor of 216 implied by the high-bias estimate (a bias of 1.4 percent per year added to the official growth rate of real wages of 1.4 percent per year), multiplied by an additional factor of 25.3 to take account of a 1.4 percent bias in the 231 years from 1569 to 1800.

there is prima-facie evidence, reviewed following for apparel (and equally true for structures) that raw (non-quality-adjusted) price data for a given type of apparel sold in mail-order catalogs increase far more over the 1914 to 1993 period than the CPI. Second, apparel is one of the three main areas where critics have suggested that the CPI may incorporate a downward bias (the others being housing and autos, see Wynne and Sigalla [1994, 10–11]).

Among the reasons suggested for the downward bias in apparel is the strong seasonal pattern in clothing styles and prices, leading to possible inaccuracy in linking prices for old styles sold at low closeout prices with new styles sold at high initial prices. In suggesting that "style" goods are a source of the bias problem, Wynne-Sigalla cite the difference between the 1967 to 1987 CPI inflation rate of 6.0 percent for infants' and toddlers' apparel with those for men's and boys' apparel (3.4 percent) and women's and girls' apparel (2.9 percent). A much more comprehensive study of "style" and "fashion" goods is provided by Pashigian and coauthors (Pashigian 1988; Pashigian and Bowen 1991; Pashigian, Bowen, and Gould 1995) and indicates that seasonal fluctuations in the prices of women's apparel are greater than for men's apparel, and that prices of women's apparel start high because of uncertainty by retailers about what styles will be popular and prices later decline as "sales" are necessary to clear out inventories of unpopular merchandise. Without extreme care in linking old styles last year to new styles this year, any price index based on linking is subject to major errors.

2.1.3 Plan of the Chapter

Our review of the evidence begins with comparisons over the long 1914 to 1993 period between changes in the CPI and in raw price changes for selected items from the Sears catalog; the much faster increase in the Sears prices could be reconciled by a rapid quality change, by an atypical rate of Sears increase relative to economy-wide apparel prices, or by a downward bias in the CPI. To address the representativeness of Sears catalog prices, we then turn to a consideration of advantages and disadvantages of the catalog as a data source.

The rest of the chapter develops the matched-model (MM) for numerous apparel product categories and the hedonic index for womens' dresses. The MM indexes are based on more than 10,000 data observations, and the hedonic index on roughly 6,500 observations. The discussion of the MM indexes and a comparison with the CPI is followed by a detailed presentation of the hedonic results. The case for a downward bias in the CPI rests primarily on the hedonic regression study of women's dresses, which exhibits a much faster rate of price increase than either the Sears MM index for women's dresses or the CPI for womens' dresses. The negligible rate of quality improvement for women's dresses is extrapolated to other types of apparel to reach the general conclusion of downward bias in the CPI not just for women's dresses but for all apparel.

2.2 Further Motivation for a Study of Apparel Prices

Between 1914 and 1993 the CPI implies that apparel prices on average rose by a factor of 7.6 (an average annual growth rate of 2.6 percent per annum). However, a quick glance at any Sears catalog in the era prior to World War I reveals prices that seem much too low relative to 1993 to be consistent with the CPI. In 1914 cotton percale house dresses, trimmed with braid and ruffles, could be purchased for $0.98 and a taffeta silk jacket for $6.75. Men's all-wool pants were $1.35, an all-wool suit was $4.50, and an all-wool overcoat was $7.00.

The impression that the catalog prices have increased far more than the 1993/1914 price ratio of 7.6 for the CPI can be quantified. Taking the median dresses (ranked from most to least expensive) sold by Sears in 1993 and the median sold in 1914, the 1993/1914 price ratio is 32.7. For the two most expensive dresses in each year the ratio is 27.4, while for the two least expensive dresses the ratio is 59.5. It might seem easy to dismiss this discrepancy between the CPI increase and the median increase in catalog dress prices by arguing that quality has increased commensurately, but in fact an inspection of the photos and specifications in the catalogs suggests that, if anything, quality was higher in the earlier era, with higher quality fabrics (silk, cashmere) and more decorative elements (ruffles, braids, etc.).

Experts at the Bureau of Labor Statistics (BLS) have long suspected that the CPI for apparel, at least prior to 1988, might incorporate a downward bias.[6] Both the CPI and Sears MM indexes may understate the true rate of quality-adjusted price increase. If our hedonic regression results consistently display a faster rate of price increase than the MM indexes from the same catalog data, then this would support the view based on the raw (quality-unadjusted) comparisons previously cited that the CPI may understate secular inflation in apparel prices, thus helping to explain the Hulten/Bruegel paradox.

2.2.1 Other Aspects of This Research

Part of the goal of this research is to determine if for important product groups like apparel and shelter that there is any case to be made for a downward bias in the CPI over any significant period of time. Another goal is simpler and more direct, to create a complementary study of price changes to that of Rees (1961b), who carried out detailed studies of apparel prices from catalogs as well as for other products (e.g., shelter prices from newspaper advertisements). Rees covered the period 1890 to 1914; that is, the years between the establishment of the Wholesale Price Index (WPI) and of

6. Further discussion of possible bias in the CPI for apparel is contained in Armknecht and Weyback (1989) and Liegey (1993). Recent experiments with hedonic price indexes for apparel are described in Liegey (1994).

the CPI. The coverage in this chapter of apparel prices for the period after 1914 complements the study by Rees and sheds new light on his results, since his study was based entirely on matched-model methodology and did not make any use of hedonic regression techniques.

The research in this chapter is based on much more evidence on MM indexes than on hedonic indexes. Matched-model indexes have been created for most types of apparel covered by the CPI over the entire period 1914 to 1993. Our hedonic study is of necessity limited to women's dresses, because of inadequate sample sizes for other types of apparel.

2.2.2 Advantages and Disadvantages of Catalog Price Data

In my past work on price measurement (Gordon 1990), an important preliminary step has been to discuss advantages and disadvantages of using mail-order catalogs as a supplementary source of price index numbers to be compared with official price indexes like the CPI. This comparison of advantages and disadvantages needs to be put in perspective by two sets of factors. First, for many durable goods examined in my book (Gordon 1990), price indexes based on *Consumer Reports* were so clearly superior in the extent of industry coverage and attention to the collection of true transaction prices that, whenever available, *Consumer Reports* indexes were used in preference to catalog indexes. For this study of apparel, the first consideration is irrelevant, since *Consumer Reports* has never compiled ratings, quality evaluations, or prices of apparel. Second, the emphasis in this chapter is more on differences in methodology to extract alternative matched model versus hedonic indexes from the same data than it is on differences in implied price changes between catalog indexes and the official CPI. Thus, differences in the validity of catalogs versus the official CPI are less important. Nevertheless, it is worthwhile to review the advantages and disadvantages of catalog data, especially for this study of apparel that goes back to 1914.

2.2.3 Advantages of Catalog Price Data

Among the most important advantages of catalog price indexes are the following:

1. Most important, specifications and illustrations published in catalogs allow closer control for changes in quality than in the official price indexes. The continuity of item codes from one catalog to the next is often helpful in following a particular item, and there is usually a long list of specifications that can be checked to insure that the models being compared are absolutely identical. In the CPI exact specifications are not available and accessible over any kind of long historical period. The consistency of specification listings in catalogs also makes them preferable to newspaper advertisements as a data source.

2. The matched-model methodology used to compare catalog items over time insures that price comparisons are included only for items that are absolutely identical in every dimension reported in the catalog specification. In

contrast, since 1978 the CPI has not been based on published specifications, and even before 1978—the time period most relevant for this study—the CPI made direct comparisons between nonidentical goods if both fell within the same specification description.[7]

3. Related to the first two advantages is the fact that catalog price indexes can in principle be replicated by anyone with access to a library containing historical catalog volumes or microfilms. In contrast, there is no way that CPI indexes at either the lower or upper level can be replicated by anyone except BLS employees. As a practical matter, for historical periods several decades in the past, original source data for the CPI may not be available at all.

4. The selection of products and individual models sold in catalogs responds automatically to the needs of the marketplace. It has always been true that "space to items always has been allotted on the basis of sales" (Hendrickson 1979, 249). This gives catalog price indexes two inherent advantages over the CPI, especially prior to the introduction of the current CPI sampling framework in 1978. First, for products sold in a large number of models or varieties, "it seems reasonable to assume that the number of different detailed varieties in the catalog will be greatest where the volume of sales is greatest, so that we probably weight the major varieties of an item in rough proportion to their importance" (Rees 1961a, 141). There is no such assurance that product indexes are sales weighted across models within a product category in the CPI, at least prior to 1978.

Also, products tend to be introduced into the catalogs soon after they become marketable, in contrast to the CPI, which often has introduced new products many years after they become commercially important. This factor, which is crucial for durable goods like room air conditioners (introduced into the Sears catalog in 1952 but not in the CPI until 1964), is presumably less important for apparel. Prior to 1978 the CPI adhered to fixed specifications over a long period of time, which could lead to a disproportionate weight for obsolete items.[8]

5. Prices printed in the catalogs are actual transaction prices. If retail and wholesale outlets that compete with catalog firms price items at varying discounts, catalog houses must adjust their published prices to remain com-

7. This statement about the CPI comes from Rees (1961a), who states "the BLS makes direct comparisons between nonidentical goods if both fall within the same specification." Triplett (1971, 186, table 6.1) quotes a study showing that for nonfood items in the CPI in April 1966, more than half of all product substitutions were handled by direct comparison of prices of the old and new model, and well under 1 percent were handled by an "explicit size or quality adjustment."

8. As reported by Rees (1961a, 141–2), ". . . it seems probable to us that the selection of specified-in-detail items for the CPI is often at too low a quality level for the index population, probably because the index population moved up to better qualities after the item was specified. In a number of cases we were unable to find any variety of an item in the catalogs . . . whose quality was as low as that specified by the BLS." Rees further reports (142) that rigid adherence to BLS specifications would require excluding a large fraction of the observations that can be collected from the catalogs, in one case reducing the sample by a factor of ten.

petitive (occasionally in the past few decades specialty catalogs for particular products advertising sale prices would be mailed between the issuance of the biannual catalogs—since these interim sale catalogs are not collected by libraries, we cannot use them in this research).

6. Since postage and shipping costs, credit charges, and taxes (except for Federal excise taxes when applicable) are not included in the published catalog prices, the services provided with each item are held constant. In contrast, the CPI may reflect a changing mix of services (e.g., some full-service department stores eliminated free delivery in the 1970s under pressure from discount-store competition). The CPI and catalog indexes can differ due to the inclusion in the CPI of state and local sales taxes.

2.2.4 Disadvantages of Catalog Price Data

The case against catalog price indexes takes two forms. First, there are clear disadvantages of relying on catalogs. Second, criticisms can be offered of the already listed advantages.

1. The most serious problem in the use of catalog prices is the possibility of a systematic difference in the secular growth rates in prices of the same product sold by catalog and noncatalog outlets, due, for instance, to differential growth in the efficiency of catalog operations or changes in pricing policies. Regarding efficiency, for any comparison with the CPI catalog prices include payment for warehouse and distribution services and would have a slower secular rate of increase than prices of retail competitors if the growth of efficiency in the provision of these services by catalog houses had been relatively rapid compared to the services provided by retail stores. It is hard to believe that such a bias could be important, since innovations in warehouse technology are likely to have been adopted by noncatalog competitors, and indeed Wal-Mart has outpaced Sears in warehouse and distribution efficiency over the past several decades.

In fact, it seems to be the catalog merchants who were more efficient than standard retailers in the early decades of the twentieth century and less efficient in the later decades. In my book (Gordon 1990, 422–23), model-by-model price comparisons for consumer appliances between the Sears catalog and *Consumer Reports* indicated that the catalog models tended to be at the lower end of the price range in the early postwar period but drifted toward the middle of the price range over time. Such behavior is consistent with a change in pricing strategy by Sears in the late 1960s and early 1970s ("we're selling last year's goods at next year's prices"). This evidence, if applicable to apparel as well as to consumer appliances, would predict that Sears catalog price indexes for apparel would drift upwards relative to the "true" universe of prices that should be compared with the CPI. Any difference between the representativeness of the Sears data and the CPI is not relevant to our comparison of MM and hedonic indexes for women's dresses, which is based on an identical database from the Sears catalog.

2. Another criticism of the preceding section on advantages of catalog price indexes concerns reproducability, where we need to distinguish two issues. First, an unambiguous advantage of a catalog price index is that *in principle* it can reproduced by anyone with access to the same catalogues. Second, we would not claim that any such reproduction would necessarily yield an identical index, because subjective decisions must inevitably be made in situations where models change without an overlap period, or when only a subset of available information is used in order to economize on research time. The methods used to develop the catalog indexes were, however, designed to minimize subjective decisions, since the actual data collection was carried out by a succession of research assistants.

2.2.5 Weighing the Advantages and Disadvantages

In the goal of finding alternative sources of price data to compare with official price indexes, particularly for earlier decades when the official methodology was not as refined as it is today, catalog price indexes are no panacea. Even if catalog prices are fully corrected for quality change, they may not accurately reflect the unobserved true quality-corrected price index for all suppliers, because of differences between catalog firms and all firms in the growth of efficiency or in the evolution of pricing policies. In comparisons of catalog prices with the CPI for apparel, there is the problem that the selection of models or types of apparel sold through catalogs may be different from those sold by other outlets (e.g., if catalogs typically sell more items that are small or lightweight in order to minimize shipping costs). We might also expect that the product mix sold in catalogs would be more heavily weighted to standard utilitarian items and less heavily to fashion goods. This difference could make the catalog indexes behave differently than the closest comparable CPI strata indexes, although there is no presumption for the direction of the drift.

Further, catalog prices may not adequately control for all types of quality change. Some changes may be introduced without being explicitly acknowledged in the printed catalog descriptions. Indeed, catalog indexes based on the matched-model method are as vulnerable as the CPI to deleting price change that occurs when new models are introduced. Matched-model indexes based on catalog prices or in the CPI may be biased downward if the timing of price increases typically coincides with the introduction of new models (in the apparel case) or biased upward if improvements in performance-price ratios coincides with the introduction of new models (as for computers and other electronic goods).

2.3 The Methodology of the Matched-Model Research

A close analog to this study is the catalog price index for thirty-six clothing items developed by Rees (1961b) for the period 1890 to 1914. Rees' study

differs from the approach taken here, not only that he was comparing with the WPI since the CPI did not yet exist, but also in that he did not attempt to match catalog price indexes with WPI indexes on an item-by-item basis, but rather used catalog prices and expenditure survey weights to construct a completely new index that might be compared with the overall WPI for clothing and for home furnishings. Because Rees made no attempt to compare identical items, his index might differ from the WPI due to a different selection of items and the earlier introduction of new items. In contrast, the drift in the catalog/CPI ratios recorded in this chapter relates to identical items within the limits of feasibility in matching catalog products with CPI strata indexes for apparel.

For any given investment of research resources, there is a trade-off between the number of different catalogs consulted for a given product and the number of separate products that can be included. An initial decision (in Gordon [1990] and carried over to this chapter) was made to limit this study only to Sears, the largest catalog house, and thus to allow time to copy data for additional varieties and products. This procedure is supported by Rees' conclusion (1961a) that the Sears and Ward catalogs gave similar results in his research. Sears' catalog sales in the 1970s were triple Ward's and equal to Ward's sales and the sales of the next three catalogs combined. To allow time to copy prices for more products, prices were copied only from one catalog per year (spring-summer), even though catalogs were published biannually. This decision has the disadvantage that the resulting indexes may understate the degree of short-run flexibility in the catalog prices.

2.3.1 Timing

Because the primary purpose of this study is a comparison of the catalog prices with CPI indexes for the same apparel products and time periods, a decision was required on the choice of time periods for that comparison. The catalog data in this study were collected from the Chicago-area edition of the Sears, Roebuck spring-summer general catalog. According to a Sears official, however, prices are set long in advance of catalog distribution. Since the spring-summer catalog went to press in October of the previous year, and final price decisions were made in October, the most closely comparable CPI indexes would be those for October of the year previous to the date printed on the catalog. However, another interpretation is that the correct BLS index is that of the following spring, contemporaneous with the period during which the catalog prices are in effect, because aspects of Sears' pricing strategy were forward-looking. For instance, in some past periods, Sears purchased futures in goods like cotton and rubber to cover anticipated sales in the following six months. They also owned parts of corporations supplying them with products and arranged to buy forward at a price established for conditions of the following six months.

While in some early stages of the research on the 1990 book, BLS prices in

year $t-1$ were compared with prices in the spring-summer catalog for year t, in the end, both were compared in year t. It might have been preferable to use monthly BLS indexes for, say, September or October of the year prior to the date on the catalog, but monthly data for BLS commodity indexes were not as complete as for annual data. This choice to adopt contemporaneous pricing is made partly because it is probably more accurate and also to simplify the presentation of the results. Slight inaccuracies may be introduced on the timing of major cyclical movements in prices, such as those in the Great Depression, but there is unlikely to be any effect on the measured rate of change of the Sears/CPI ratios over periods of a decade or more.

2.4 Matched-Model Catalog Indexes for Apparel, 1914 to 1993

Which products are chosen for study? For the apparel matched-model (MM) indexes the approach is straightforward. Historical CPI strata indexes are available for broad groupings (e.g., "women's separates and sportswear"). We turned to the Sears catalog and selected virtually every category of apparel that corresponded to each CPI stratum description. Table 2.1 lists the thirty-nine separate apparel categories for which Sears catalog matched-model indexes were constructed, the average number of annual price comparisons carried out for each category, and the CPI strata with which groups of categories were compared. The table is divided into three sections, corresponding to the three intervals of the 1914 to 1993 period for which research was carried out at separate stages.

2.4.1 Method of Comparison

Price comparisons for each pair of years are facilitated by Sears' policy of carrying several models in each product category. Changes in specifications usually affect only a subset of models in any one year, so for almost every product at least a few identical models are available for a price comparison between a pair of years. Because model changes occur at irregular intervals, the number of price comparisons of identical models for any given product may be on the order of seven for a series of years and then collapse to two or three in a year of substantial model changes. Price changes for models that are discontinued, newly introduced, or subject to quality change are imputed to the price changes of models that remain completely unchanged in a given comparison of prices in years t and $t-1$. In the subsequent comparison of prices in $t+1$ and $t+2$, a different set of models is covered, perhaps including one or more models newly introduced in year $t+1$ and excluded in the previous comparison of t with $t+1$.

Thus, each pair of years is treated separately and the list of models is allowed to change annually. This approach allows much more frequent model changes than in the CPI as it was constructed prior to 1978, when CPI field agents were required to find prices for models according to a detailed

Table 2.1 **Sears products and corresponding CPI products**

Sears product	Years excluded	CPI products	Comparisons per year
		A Apparel 1914–1947	
Women's apparel		Women's and girl's apparel	26.0
Coats	—	Wool apparel	1.7
Skirts	—		1.3
Dresses	—	Rayon and silk apparel	1.2
Slips	1926–1947		1.6
Panties	—		0.8
Hosiery	—		1.0
Pajamas	1914–1929		1.0
Dresses	—	Cotton apparel	0.9
Housedresses	—		1.5
Nightgowns	—		0.6
Unionsuits	—		1.6
Hosiery	—		1.0
Bloomers	1927–1947		0.4
Slips	—		0.6
Hats, wool	—	Other apparel	1.9
Gloves	—		1.8
Girdles	—		1.6
Brassieres	—		1.8
Rubbers	—	Footwear	1.8
Street shoes	—		1.9
Men's apparel		Men's and boy's apparel	26.1
Suits	—	Wool apparel	2.0
Trousers	—		1.8
Sweaters	1914–1922		1.4
Overcoats	1931–1946		0.5
Socks	—	Rayon apparel	0.9
Overcoats	—	Cotton apparel	1.7
Overalls	1946–1947		1.6
Shirts, work	—		0.9
Shirts, business	—		1.0
Pajamas	1946–1947		1.6
Unionsuits	—		2.1
Socks	—		1.0
Hats, wool	—	Other apparel	2.1
Neckties	—		1.8
Rubbers	—	Footwear	1.9
Street shoes	—		1.9
Work shoes	—		1.9
		B Apparel (1947–1964)	
Women's apparel	—	Women's apparel	99.4
Bathrobes	1947–1948, 1963–1964	Underwear, nightwear, hosiery, and accessories	3.9
Brassieres	—		19.8
Camisoles	1947–1949, 1950–1952, 1963–1965		2

Table 2.1 (continued)

Sears product	Years excluded	CPI products	Comparisons per year
Hosiery	—		13.2
Panties	—		29.9
Slips	1947–1948		9.5
Jackets	1947–1948	Coats and jackets	4.4
Jeans	1953–1954	Separates and sportswear	5.3
Pants	—		5.9
Skirts	1947–1949		2.4
Dresses	1948–1949, 1960–1961, 1963–1964	Dresses	3.1
Men's apparel		Men's apparel	146.8
Bathrobes	1960–1961	Furnishings and special clothing	2.3
Belts	—		5.8
Coveralls	—		3.7
Pajamas	1947–1948		3.4
Shorts	1947–1955		1.4
Socks	1964–1965		16.5
Swimming trunks	1947–1948, 1949–1950, 1953–1955		2.4
Undershirt	—		10.6
Underwear	1947–1948		20.1
Jeans	1947–1948	Dungarees, jeans, and trousers	10.3
Pants	—		12.4
Dress shirts	—	Shirts	11.1
Shirts	—		13.4
Blazers	1962–1963	Suits, sport coats, coats, and jackets	1.8
Jackets	—		10.7
Rainwear	—		12.6
Suits	1947–1948, 1962–1964		8.1

Sears products	CPI products	Comparison per year
	C Apparel 1965–1993	
Women's apparel	Women's apparel	57.9
Bathrobes	Underwear, nightwear, hosiery, and accessories	3.3
Bras		9.3
Camisoles		2.4
Hosiery		7.7
Panties		9.3
Slips		6.1
Jackets	Coats and jackets	4.7
Jeans	Separates and sportswear	4.4
Pants		4.1

(*continued*)

Table 2.1 (continued)

Sears products	CPI products	Comparison per year
Skirts		3.4
Dresses	Dresses	3.3
Men's apparel	Men's apparel	93.3
Bathrobes	Furnishings and special clothing	3.1
Belts		4.8
Coveralls		5.2
Pajamas		5
Jumpsuits		3.2
Shorts		3.1
Socks		8.3
Swimming trunks		2.4
Undershirts		8.1
Underwear		10.8
Jeans	Dungarees, jeans, and trousers	7.5
Pants		5.7
Dress shirts	Shirts	4.4
Shirts		7.8
Blazers	Suits, sport coats, coats, and jackets	3.7
Jackets		6.8
Rainwear		4.5

Note: Dashed cells in panels A and B indicate that no years were excluded.

description that might well have become obsolete. Extra models can be included that appear and disappear between major CPI revisions. Ideally, this approach should lead to the inclusion of more models per product than in the CPI.

The matched-model indexes were developed by comparing all identical models in every pair of adjacent years. For a comparison to be made, the adjacent-year observations had to have the same serial number (subject to the following qualifications), the photo or drawing depicting the model must have been identical, and the description of the model must have been identical. Identical catalog numbers do not always ensure that two models are identical, just as dissimilar catalog numbers do not necessarily signify differences between models. Therefore the determining criterion for the direct comparison of models relied heavily on the match of product descriptions. Nevertheless, the model numbers are very useful for quickly spotting models that are likely to be identical or for spotting changes in characteristics in the set of models available for two adjacent years.

Figure 2.1 presents a schematic diagram of the method of matching models for the important example of women's dresses. This method was carried out not only for women's dresses but for all apparel types in developing all the indexes reported in tables 2.2 through 2.7. The criteria for matching are very tight and the resulting MM price indexes are surely representative of apparel "models" that have almost exactly the same quality. The defect of the

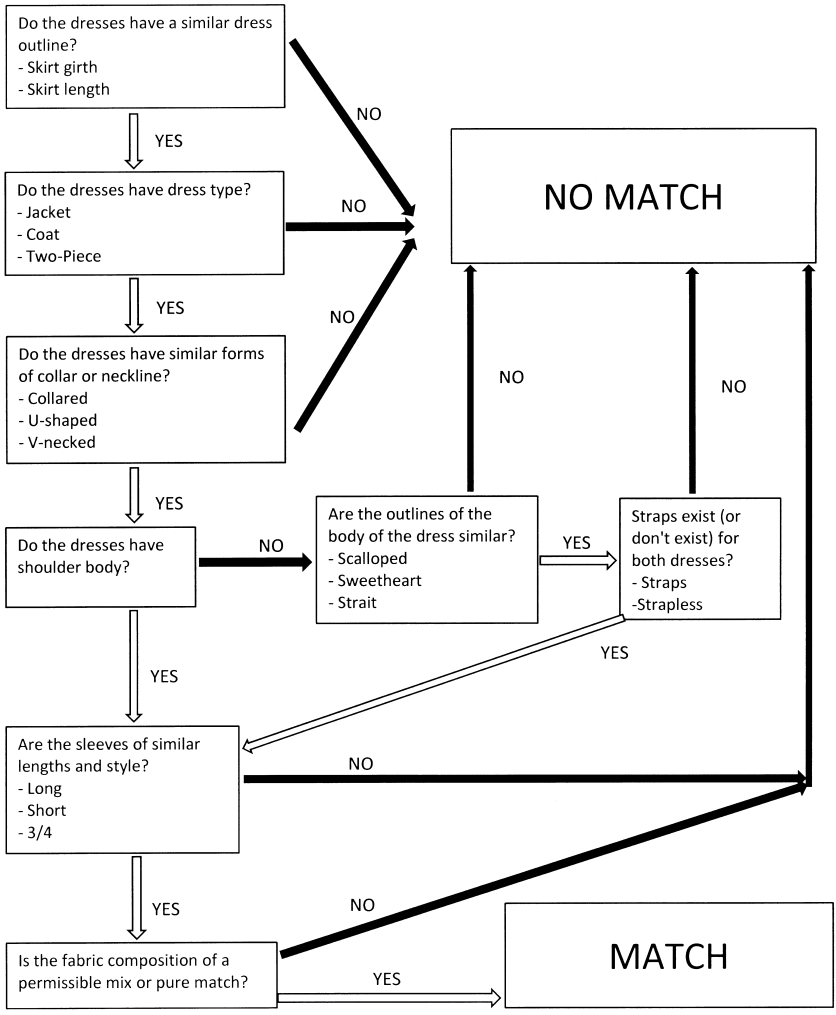

Fig. 2.1 Matched-model flowchart

MM method is that these tight criteria often exclude models that change in minor ways but for which prices increase much more than for the models that are matched. The irony of the MM method is that it can control completely for changes in quality without providing an accurate measure of changes in price, a phenomenon that only becomes evident when comparing the MM indexes with hedonic indexes for the same products.

The lowest-level observation for the catalog matched-model price indexes is the log change in price between two adjacent years for a given model that has been determined by the process previously described to have remained identical across the two years. Then these price changes are aggregated. Log

price changes (e.g., for an identical dress in two adjacent years) are aggregated into log product price changes for a product category (e.g., "women's dresses") by applying an equal weight to each model in any given pair of adjacent years. The absence of model-by-model sales data necessitates the use of equal weights for each model of a given product. Some response to market sales is incorporated to the extent that the mix of models that Sears carries for a given product responds to the relative volume of sales.

Product price changes are aggregated into subgroup price indexes, where the subgroup refers to the lowest level of aggregation available in the CPI. Equal weights are applied to each product in forming subgroup price indexes. Then subgroup price indexes are aggregated into groups and totals, using the appropriate CPI weights for each subgroup. The indexes created in this chapter have the advantage that they are open to public inspection and can be reproduced by anyone with access to a library that holds back issues of the Sears catalog. As stated previously, the catalog indexes are subject to the same problem as any MM index, including those compiled by BLS. Any price change that occurs upon the introduction of a new model is deleted. If manufacturers typically postpone price increases during the life of a model for the occasion of a new model introduction, then deletion causes the exclusion of major price changes and leads to a downward secular bias in price indexes. If, on the other hand, quality improvements in new models tend to be introduced with no change in price, the deletion technique causes the exclusion of reductions in "true price" and leads to an upward secular bias. We learn subsequently in the comparisons of the hedonic and MM indexes for women's dresses that the former phenomenon dominates and causes a significant downward bias. As we will point out in discussing the hedonic index for women's dresses, a striking aspect of the MM indexes is that they are based on *so few observations.* In contrast, for many pairs of years the hedonic sample size is more than 300, or more than 150 observations per year for just a single product. This reflects the tightness of the matching criterion used in developing the MM indexes; that is, how hard it is to find exactly the same item in the catalogs for two successive years.

The new MM price indexes for apparel cover thirty-nine types of women's, men's, girls', and boys' apparel over part or all of the period 1914 to 1993, covering the years from the beginning of the CPI in 1914 to the date when Sears discontinued publication of its general catalog in 1993. Details on the types of apparel are shown separately for 1914 to 1947, 1947 to 1965, and 1965 to 1993 in table 2.1. The sum of matched-model comparisons in these tables is 10,385, an average of fifty-two per year during 1914 to 1947 (for a total of 1,719), an average of 146 per year during 1947 to 1965 (for a total of 4,432), and 151 per year during 1965 to 1993 (for a total of 4,234).

2.4.2 Matched-Model Results, 1914 to 1993

Separate catalog MM price indexes and comparisons with the CPI are displayed in tables 2.2 and 2.3 for women's and men's apparel; the

Table 2.2 **Matched-model apparel price indexes (1958 = 100), 1914–1993 (Women's Apparel)**

Year	Sears	CPI	Sears/CPI	Observations
1914	75.8	38.3	1.98	27
1915	79.0	39.0	2.02	30
1916	116.1	42.9	2.70	28
1917	133.7	51.4	2.60	28
1918	167.3	69.7	2.40	30
1919	214.9	92.3	2.33	31
1920	283.0	109.9	2.58	30
1921	179.4	84.7	2.12	28
1922	152.0	68.8	2.21	27
1923	140.9	69.2	2.04	28
1924	137.6	68.3	2.01	23
1925	134.4	67.1	2.00	31
1926	129.9	66.1	1.97	31
1927	121.9	64.6	1.89	29
1928	116.1	63.7	1.82	31
1929	109.3	63.0	1.73	28
1930	109.1	61.7	1.77	30
1931	101.5	56.0	1.81	27
1932	82.7	49.7	1.66	30
1933	79.2	47.9	1.66	28
1934	93.9	52.5	1.79	28
1935	74.9	53.0	1.41	26
1936	77.5	53.7	1.44	25
1937	77.2	56.2	1.37	26
1938	75.6	55.9	1.35	24
1939	75.8	55.2	1.37	23
1940	80.8	55.5	1.46	26
1941	83.0	58.1	1.43	27
1942	95.8	67.1	1.43	24
1943	97.2	66.6	1.46	26
1944	107.5	75.5	1.43	22
1945	108.9	79.6	1.37	26
1946	117.9	85.5	1.38	23
1947	131.9	99.0	1.33	23
1948	126.7	104.9	1.21	57
1949	125.7	99.1	1.27	85
1950	117.3	95.7	1.22	83
1951	126.0	103.1	1.22	95
1952	122.6	101.9	1.20	90
1953	104.8	100.7	1.04	89
1954	107.5	99.8	1.08	114
1955	103.5	99.0	1.05	106
1956	103.8	99.7	1.04	101
1957	100.0	100.2	1.00	109
1958	100.0	100.0	1.00	127
1959	99.1	100.5	0.99	135
1960	99.9	101.0	0.99	118
1961	98.3	101.4	0.97	142

(*continued*)

Table 2.2 (continued)

Year	Sears	CPI	Sears/CPI	Observations
1962	98.5	101.2	0.97	79
1963	95.5	102.0	0.94	101
1964	93.8	102.6	0.91	82
1965	94.9	103.4	0.92	91
1966	95.2	105.5	0.90	100
1967	100.6	110.2	0.91	89
1968	103.2	116.9	0.88	87
1969	106.1	123.2	0.86	88
1970	106.5	127.8	0.83	91
1971	106.7	132.5	0.80	58
1972	107.3	135.6	0.79	58
1973	110.4	140.2	0.79	46
1974	119.3	148.7	0.80	47
1975	124.4	152.3	0.82	47
1976	116.3	156.6	0.74	48
1977	125.0	161.3	0.77	42
1978	131.2	164.6	0.80	61
1979	139.9	167.5	0.84	43
1980	145.1	170.4	0.85	44
1981	155.7	172.6	0.90	50
1982	169.5	174.4	0.97	39
1983	179.8	177.7	1.01	48
1984	187.5	180.1	1.04	59
1985	195.1	186.9	1.04	72
1986	193.5	185.3	1.04	77
1987	195.8	196.8	1.00	32
1988	199.0	204.6	0.97	32
1990	180.6	218.1	0.83	37
1991	172.3	226.4	0.76	34
1992	185.2	230.8	0.80	44
1993	187.2	235.4	0.80	

comparison for each is with the total CPI apparel index before 1935, since the CPI began to break out separate aggregates for women's and men's apparel only in that year. Tables 2.4 and 2.5 exhibit results in the same format for girls' and boys' apparel for the much shorter period 1978 to 1993. Table 2.6 provides the most important results of the research—the comparison of the catalog MM and CPI indexes for all apparel—and table 2.7 breaks out the Sears/CPI ratios separately for women's, men's, and all apparel. Graphical displays of the results are also presented, with figures 2.2 and 2.3 corresponding to tables 2.2 and 2.3; figure 2.4 corresponding to table 2.6, and figure 2.5 corresponding to table 2.7.

Table 2.8 summarizes the results by providing growth rates of the Sears catalog indexes, corresponding CPI, and the Sears/CPI ratios for four

Table 2.3 **Matched-model apparel price indexes (1958 = 100), 1914–1993 (Men's Apparel)**

Year	Sears	CPI	Sears/CPI	Observations
1914	58.27338129	32.2519084	1.81	28
1915	58.27338129	33.01526718	1.77	27
1916	69.78417266	36.25954198	1.92	26
1917	78.89688249	43.51145038	1.81	29
1918	102.3980815	58.77862595	1.74	26
1919	128.2973621	78.05343511	1.64	25
1920	152.9976019	92.9389313	1.65	23
1921	113.4292566	71.5648855	1.58	21
1922	109.8321343	58.20610687	1.89	26
1923	99.28057554	58.39694656	1.70	28
1924	102.1582734	57.82442748	1.77	27
1925	98.32134293	56.67938931	1.73	28
1926	94.48441247	55.72519084	1.70	26
1927	89.6882494	54.58015267	1.64	25
1928	96.16306954	53.81679389	1.79	22
1929	94.48441247	53.24427481	1.77	27
1930	96.882494	52.09923664	1.86	30
1931	88.96882494	47.32824427	1.88	27
1932	69.78417266	41.98473282	1.66	29
1933	67.14628297	40.45801527	1.66	30
1934	78.65707434	44.46564885	1.77	30
1935	56.59472422	44.84732824	1.26	27
1936	58.7529976	45.41984733	1.29	27
1937	59.95203837	47.90076336	1.25	28
1938	56.11510791	47.70992366	1.18	28
1939	56.59472422	46.75572519	1.21	29
1940	65.94724221	47.70992366	1.38	29
1941	61.39088729	50	1.23	26
1942	70.50359712	58.20610687	1.21	22
1943	74.34052758	61.06870229	1.22	25
1944	75.29976019	63.93129771	1.18	24
1945	75.29976019	66.60305344	1.13	21
1946	78.41726619	75.57251908	1.04	22
1947	103.5971223	89.69465649	1.15	52
1948	100.2398082	94.65648855	1.06	95
1949	99.28057554	91.98473282	1.08	95
1950	96.16306954	91.60305344	1.05	118
1951	106.7146283	99.04580153	1.08	126
1952	103.3573141	99.61832061	1.04	121
1953	102.6378897	98.85496183	1.04	132
1954	102.6378897	98.28244275	1.04	130
1955	97.60191847	97.13740458	1.00	131
1956	98.56115108	98.85496183	1.00	141
1957	98.32134293	100.3816794	0.98	137
1958	100	100	1.00	138
1959	103.5971223	99.80916031	1.04	133
1960	105.2757794	101.7175573	1.03	141
1961	105.9952038	102.8625954	1.03	127
1962	108.1534772	103.4351145	1.05	121
1963	108.6330935	104.7709924	1.04	128

(*continued*)

Table 2.3 (continued)

Year	Sears	CPI	Sears/CPI	Observations
1964	108.8729017	106.2977099	1.02	126
1965	107.6738609	107.4427481	1.00	135
1966	110.0719424	110.3053435	1.00	177
1967	116.7865707	114.5038168	1.02	152
1968	123.501199	120.8015267	1.02	118
1969	131.8944844	128.6259542	1.03	128
1970	135.0119904	133.9694656	1.01	118
1971	139.8081535	137.7862595	1.01	102
1972	144.1247002	139.5038168	1.03	90
1973	153.4772182	144.6564885	1.06	77
1974	168.5851319	156.1068702	1.08	73
1975	191.6067146	162.7862595	1.18	69
1976	188.0095923	168.3206107	1.12	82
1977	208.8729017	176.1450382	1.19	88
1978	215.58753	179.9618321	1.20	92
1979	221.3429257	182.6335878	1.21	78
1980	239.8081535	190.8396947	1.26	86
1981	263.0695444	201.1450382	1.31	86
1982	289.4484412	208.9694656	1.39	82
1983	302.8776978	214.1221374	1.41	62
1984	317.0263789	218.129771	1.45	91
1985	326.1390887	224.6183206	1.45	110
1986	322.7817746	227.2900763	1.42	106
1987	315.3477218	235.8778626	1.34	51
1988	322.3021583	245.610687	1.31	60
1990	341.0071942	262.9770992	1.30	70
1991	341.0071942	271.3740458	1.26	63
1992	372.6618705	275.9541985	1.35	72
1993	367.3860911	277.480916	1.32	

Table 2.4 **Matched-model apparel price indexes (1980 = 100), 1978–1993 (Girl's Apparel)**

Year	Sears	CPI	Sears/CPI	Observations
1978	88.8	95.3	0.93	21
1979	95.9	96.6	0.99	22
1980	100.0	100.0	1.00	24
1981	107.5	103.6	1.04	18
1982	116.5	103.6	1.12	18
1983	129.4	104.6	1.24	19
1984	134.3	104.6	1.28	21
1985	141.8	107.6	1.32	22
1986	145.2	106.4	1.37	21
1987	141.2	112.2	1.26	12
1988	151.7	117.4	1.29	6
1990	126.7	125.9	1.01	14
1991	139.0	133.3	1.04	16
1992	153.2	138.0	1.11	15
1993	157.9	137.5	1.15	

Table 2.5 **Matched-model apparel price indexes (1980 = 100), 1978–1993 (Boy's Apparel)**

Year	Sears	CPI	Sears/CPI	Observations
1978	87.1	90.1	0.97	29
1979	95.2	94.2	1.01	30
1980	100.0	100.0	1.00	27
1981	106.8	105.0	1.02	29
1982	116.8	108.1	1.08	25
1983	120.1	112.0	1.07	19
1984	121.5	113.9	1.07	29
1985	123.3	116.7	1.06	28
1986	125.1	117.1	1.07	27
1987	127.0	115.7	1.10	8
1988	127.8	119.2	1.07	2
1990	128.3	121.4	1.06	20
1991	131.8	125.4	1.05	17
1992	140.9	129.0	1.09	19
1993	138.5	131.0	1.06	

Table 2.6 **Matched-model apparel price indexes (1958 = 100), 1914–1993 (All Apparel)**

Year	Sears	CPI	Sears/CPI	Observations
1914	66.5	30.6	2.17	55
1915	68.0	31.2	2.18	57
1916	90.9	34.3	2.65	54
1917	103.8	41.2	2.52	57
1918	132.0	55.7	2.37	56
1919	167.6	73.8	2.27	56
1920	212.0	87.9	2.41	53
1921	143.6	67.7	2.12	49
1922	129.5	55.1	2.35	53
1923	118.5	55.3	2.14	56
1924	118.7	54.7	2.17	50
1925	104.5	53.6	1.95	59
1926	110.9	52.9	2.10	57
1927	104.5	51.6	2.03	54
1928	105.6	51.0	2.07	53
1929	101.8	50.5	2.02	55
1930	102.9	49.4	2.09	60
1931	95.1	44.9	2.12	54
1932	76.2	39.9	1.91	59
1933	72.9	38.4	1.90	58
1934	86.0	42.1	2.04	58
1935	65.3	42.5	1.54	53
1936	67.6	42.9	1.58	52
1937	68.0	44.9	1.51	54
1938	65.3	44.7	1.46	52
1939	65.5	44.2	1.48	52
1940	73.1	44.5	1.64	55
1941	71.3	46.6	1.53	53

(*continued*)

Table 2.6 (continued)

Year	Sears	CPI	Sears/CPI	Observations
1942	82.2	54.5	1.51	46
1943	85.1	56.8	1.50	51
1944	90.2	60.9	1.48	46
1945	90.7	64.0	1.42	47
1946	96.4	70.1	1.37	45
1947	116.9	95.0	1.23	75
1948	112.4	100.7	1.12	152
1949	111.6	95.9	1.16	180
1950	106.2	94.2	1.13	201
1951	116.4	101.7	1.14	221
1952	112.7	100.9	1.12	211
1953	104.0	100.0	1.04	221
1954	105.3	99.1	1.06	244
1955	100.5	98.3	1.02	237
1956	100.9	99.3	1.02	242
1957	98.9	100.2	0.99	246
1958	100.0	100.0	1.00	265
1959	101.1	100.2	1.01	268
1960	102.9	101.1	1.02	259
1961	103.5	101.7	1.02	269
1962	104.7	101.9	1.03	200
1963	103.6	103.0	1.01	229
1964	103.1	103.7	0.99	208
1965	103.1	104.5	0.99	226
1966	104.4	106.3	0.98	277
1967	110.5	110.6	1.00	241
1968	115.5	116.9	0.99	205
1969	121.6	123.7	0.98	216
1970	123.5	128.8	0.96	209
1971	126.2	132.7	0.95	160
1972	128.9	135.3	0.95	148
1973	135.1	139.9	0.97	123
1974	147.6	150.1	0.98	120
1975	162.5	155.7	1.04	116
1976	156.7	160.1	0.98	130
1977	156.7	166.6	0.94	130
1978	162.7	170.5	0.95	153
1979	171.8	175.3	0.98	121
1980	181.8	185.5	0.98	130
1981	196.9	192.6	1.02	136
1982	215.3	195.7	1.10	121
1983	227.6	199.8	1.14	110
1984	236.4	202.6	1.17	150
1985	247.6	208.2	1.19	182
1986	246.5	208.9	1.18	183
1987	244.5	218.6	1.12	83
1988	250.7	228.2	1.10	92
1990	237.8	244.9	0.97	107
1991	249.5	254.2	0.98	97
1992	266.7	259.7	1.03	116
1993	268.4	263.1	1.02	

Note: n.a. = not available.

Table 2.7 Comparison of Sears/CPI ratio (1958 = 1.0)

Year	Women's Apparel	Men's Apparel	All Apparel
1914	1.98	1.81	2.17
1915	2.02	1.77	2.18
1916	2.70	1.92	2.65
1917	2.60	1.81	2.52
1918	2.40	1.74	2.37
1919	2.33	1.64	2.27
1920	2.58	1.65	2.41
1921	2.12	1.58	2.12
1922	2.21	1.89	2.35
1923	2.04	1.70	2.14
1924	2.01	1.77	2.17
1925	2.00	1.73	1.95
1926	1.97	1.70	2.10
1927	1.89	1.64	2.03
1928	1.82	1.79	2.07
1929	1.73	1.77	2.02
1930	1.77	1.86	2.09
1931	1.81	1.88	2.12
1932	1.66	1.66	1.91
1933	1.66	1.66	1.90
1934	1.79	1.77	2.04
1935	1.41	1.26	1.54
1936	1.44	1.29	1.58
1937	1.37	1.25	1.51
1938	1.35	1.18	1.46
1939	1.37	1.21	1.48
1940	1.46	1.38	1.64
1941	1.43	1.23	1.53
1942	1.43	1.21	1.51
1943	1.46	1.22	1.50
1944	1.43	1.18	1.48
1945	1.37	1.13	1.42
1946	1.38	1.04	1.37
1947	1.33	1.15	1.23
1948	1.21	1.06	1.12
1949	1.27	1.08	1.16
1950	1.22	1.05	1.13
1951	1.22	1.08	1.14
1952	1.20	1.04	1.12
1953	1.04	1.04	1.04
1954	1.08	1.04	1.06
1955	1.05	1.00	1.02
1956	1.04	1.00	1.02
1957	1.00	0.98	0.99
1958	1.00	1.00	1.00
1959	0.99	1.04	1.01
1960	0.99	1.03	1.02
1961	0.97	1.03	1.02
1962	0.97	1.05	1.03
1963	0.94	1.04	1.01
1964	0.91	1.02	0.99
1965	0.92	1.00	0.99

(*continued*)

Table 2.7 (continued)

Year	Women's apparel	Men's apparel	All apparel
1966	0.90	1.00	0.98
1967	0.91	1.02	1.00
1968	0.88	1.02	0.99
1969	0.86	1.03	0.98
1970	0.83	1.01	0.96
1971	0.80	1.01	0.95
1972	0.79	1.03	0.95
1973	0.79	1.06	0.97
1974	0.80	1.08	0.98
1975	0.82	1.18	1.04
1976	0.74	1.12	0.98
1977	0.77	1.19	0.94
1978	0.80	1.20	0.95
1979	0.84	1.21	0.98
1980	0.85	1.26	0.98
1981	0.90	1.31	1.02
1982	0.97	1.39	1.10
1983	1.01	1.41	1.14
1984	1.04	1.45	1.17
1985	1.04	1.45	1.19
1986	1.04	1.42	1.18
1987	1.00	1.34	1.12
1988	0.97	1.31	1.10
1990	0.83	1.30	0.97
1991	0.76	1.26	0.98
1992	0.80	1.35	1.03
1993	0.80	1.32	1.02

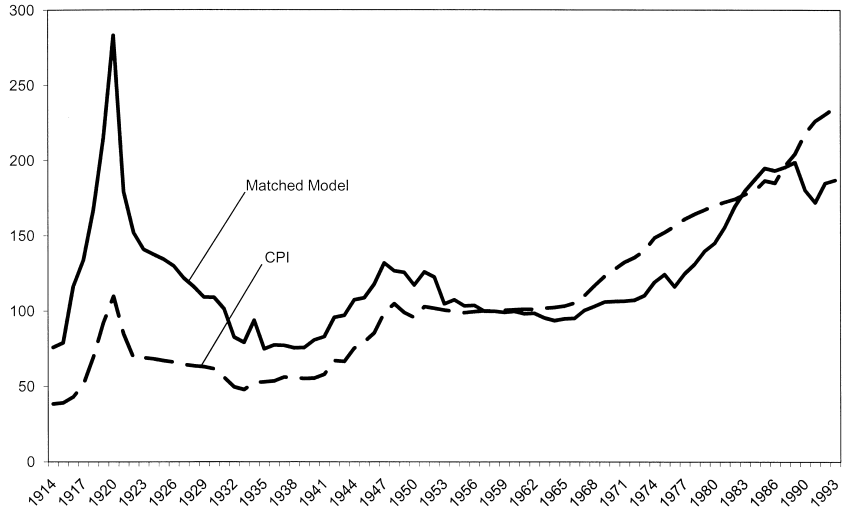

Fig. 2.2 Sears matched-model index vs. CPI for women's apparel (1958 = 100), 1914–1993

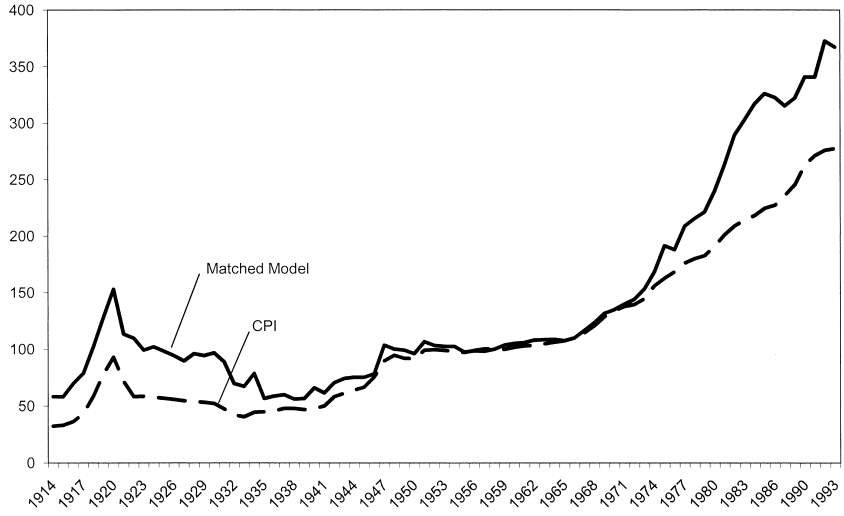

Fig. 2.3 Sears matched-model index vs. CPI for men's apparel (1958 = 100), 1914–1993

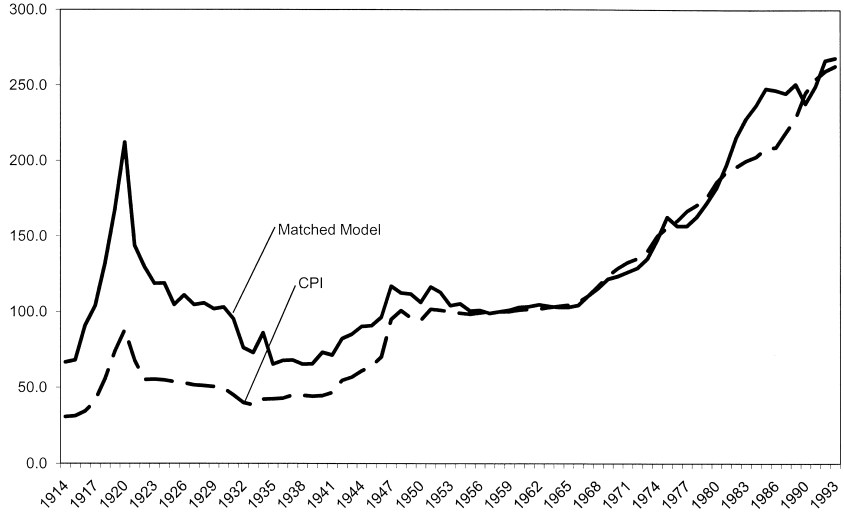

Fig. 2.4 Sears matched-model index vs. CPI for all apparel (1958 = 100), 1914–1993

selected subperiods of the 1914 to 1993 interval and for the entire interval as well.

As shown in table 2.8, for women's apparel the 1914 to 1947 annual growth rate of the Sears matched-model index is 1.68 percent per year, considerably slower than the CPI increase of 2.87 percent per year, implying growth rate of the Sears/CPI ratio of –1.19 percent per year. The difference is similar for

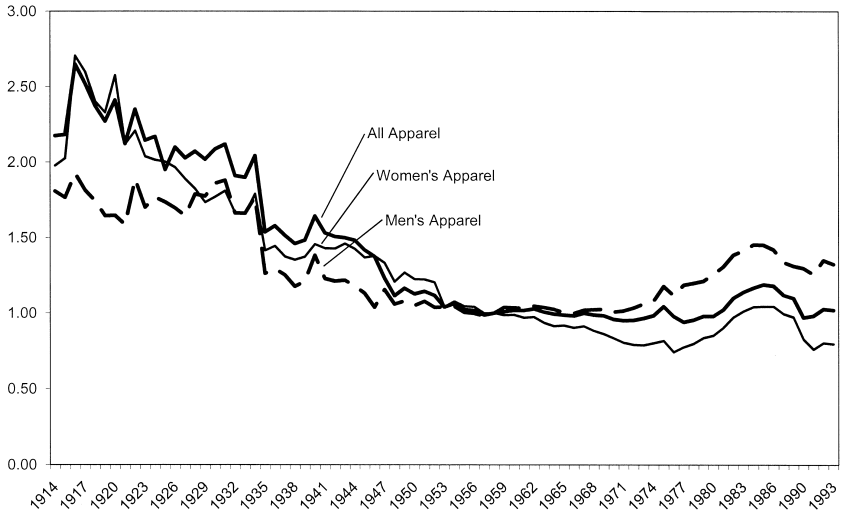

Fig. 2.5 Ratio of Sears matched-model index to CPI for women's, men's and all apparel (1958 = 100), 1914–1993

men's apparel, 1.74 percent per year for Sears versus 3.10 percent for the CPI, implying a growth rate of the Sears/CPI ratio of –1.36 percent per year.

A striking aspect of the results is that much of the decline in the Sears/CPI ratio occurs during a single pair of years, 1934 to 1935; this is particularly evident in figure 2.5, which plots the Sears/CPI ratios. The most obvious explanation would be a major mistake in transcribing the Sears prices, so we have double-checked and triple-checked the 1934 to 1935 comparisons. Here are some sample prices for this pair of years for particular clothing items classified as identical by our matched-model procedure.

	1934	*1935*
Men's suits	13.50	11.95
Men's union suits	0.79	0.59
Men's work socks	0.17	0.12
Men's wool pants	4.85	4.45
Men's "Chieftan" overalls	0.88	0.77
Women's silk slips	1.98	1.69
Women's cotton hosiery	0.33	0.25
Women's washfast house dresses	0.95	0.49
Women's rayon gloves	0.98	0.59
Women's rayon pajamas	1.00	0.59

It is possible that Sears changed its pricing policy relative to the rest of the marketplace in 1935, but it is also possible that the CPI missed a shift in the availability of discount outlets during the Great Depression—perhaps an early example of "outlet substitution bias."

Table 2.8 **Growth rates of Sears matched-model (MM) indexes compared with the CPI, alternative intervals, 1914–1993**

	1914–1947	1947–1965	1965–1978	1978–1993	1914–1993
Women's apparel					
Sears MM	1.68	–1.83	2.49	2.37	1.15
CPI	2.87	0.24	3.57	2.39	2.30
Sears/CPI	–1.19	–2.07	–1.08	–0.02	–1.15
Men's apparel					
Sears MM	1.74	0.21	5.34	3.55	2.33
CPI	3.10	1.00	3.97	2.89	2.72
Sears/CPI	–1.36	–0.79	1.37	0.67	–0.39
All apparel					
Sears MM	1.71	–0.70	3.51	3.34	1.77
CPI	3.43	0.53	3.77	2.89	2.72
Sears/CPI	–1.72	–1.22	–0.25	0.44	–0.95

When we look more broadly at the full 1914 to 1993, we notice several interesting patterns. First, there is a consistent downward drift in the Sears/CPI ratio for women's apparel in all periods but the last, 1978 to 1993. Second, there is a distinct turnaround in the drift of the Sears/CPI ratio for men's apparel from negative over 1914 to 1965 to positive during 1965 to 1993, with a small overall negative drift over the entire period. Third, there is a consistent tendency for the inflation rate in women's apparel to be a smaller positive rate or larger negative rate than for men's apparel, and this difference is more pronounced for the Sears indexes than for the CPI. This finding is consistent with the view that matched-model indexes "link out" more quality change for women's apparel, which are subject to more frequent changes in styles. Averaging together women's and men's apparel for 1914 to 1993 with girls' and boys' apparel for 1978 to 1993, the Sears indexes increase less than the CPI during 1914 to 1978 and by more during 1978 to 1993, and the overall drift in the Sears/CPI ratio for the entire period is roughly –1.0 percent per year. Note in the bottom line of table 2.8 that the Sears/CPI drift shifts progressively from a large negative rate of –1.72 percent per year in 1914 to 1947, to smaller negative rates in 1947 to 1965 and 1965 to 1978, and finally to a positive drift in the final period 1978 to 1993. This is consistent with the hypothesis that in the early years Sears was an innovative low-price market leader, analogous to today's Wal-Mart, but gradually over the years lost its competitive edge and found its relative price position rising from the bottom toward the middle or upper-middle.

2.5 Hedonic Price Indexes for Women's Dresses

This section discusses the application of hedonic regression techniques to apparel. In this study we have chosen to do an intensive investigation of

a single type of apparel, women's dresses, because the available data allows much larger sample sizes in the regressions than for any other apparel product. The choice of variables is limited to those provided in the catalogs, which differ from year to year. Women's dresses are complex products and many of their features are visible only in photos (e.g., decorative items, pockets, belts, etc.). Thus, the large data set used in this hedonic regression study was custom-built by several research assistants who examined the photos as well as the detailed specifications as published in the catalog to assign values to the quality characteristics entered into the regressions.[9]

2.5.1 Determination of Explanatory Variables and Their Mean Values

The list of variables is displayed in table 2.9. Of these, the most important is weight, which proxies the quality of fabric, amount of fabric, complexity of construction, presence of linings, and so forth, and would be expected to have a positive coefficient. In addition, several dummy variables are included to indicate the presence or absence of higher-quality "organic" fabrics, knit or woven fabrics, and other quality characteristics that should raise price and thus have a positive coefficient in the regressions, including the presence of lace, sequins, embroidery, belt, jacket, bow, tie, zipper, and the need for dry cleaning. There is also a dummy variable for imported dresses (when they are identified as such in the catalog), and no presumption whether the coefficient should be positive or negative.

The hedonic regression study for women's dresses is carried out for sixty of the seventy-nine possible pairs of adjacent years between 1914 and 1993. The exceptions are the years of rapid inflation during World War I and its aftermath (1915 to 1920 are excluded), the years of World War II price controls (1942 to 1945 are excluded), and the years when the catalog for unknown reasons temporarily suspended publication of weight data for each item (1929 to 1933). For a subset of fifteen of the included years table 2.10 displays the number of observations in that particular year, the average weight, and the percentage of dresses having the various quality attributes designated by the zero, one dummy variables.

The sample sizes for the hedonic study of women's dresses are much larger than the sample on which the matched-model indexes for dresses is based (only 0.9 matches during 1914 to 1947 and only 3.3 matches during 1965 to 1993). The number of observations shown in table 2.9 are as high as 183 per year for 1936 and as low as forty-two per year for 1980. The number of observations diminishes markedly after 1988, and for this reason the hedonic study terminates in 1988 rather than 1993.

Table 2.10 exhibits the mean values of price and weight through 1993 and of the other explanatory variables through 1988. The mean price jumps

9. I am particularly grateful to Jayun Kim for her understanding of the nuances of women's dresses and acknowledge that she designed the final form of the hedonic project, including the choice of the quality characteristics and their description.

Table 2.9 **Characteristics of hedonic index dresses**

Variable name	Coding	Description
LN weight	LN WT	The weight of a dress (in ounces), indicates the amount of fabric utilized to construct the dress and is a proxy for its overall quality.
Organic	ORG	Organic fabrics include wool, silk, linen, and cotton derivatives such as velvet. These type of fabrics are considered high grade material and contributes to the perceived quality of apparel.
Imported	IMP	Apparel that were imported from a foreign country and advertised as such, could add or subtract from perceived quality.
Lace/Sequins/ Embroidery	LSE	Manufacturing cost for items of apparel with either lace, sequins, or embroideries tend to be priced higher than those without these qualities.
Belt	BLT	Presence of a belt.
Two-Piece	2-PC	Two-piece dresses require more fabric as well as sewing to produce.
Dry Clean	DRY	Indicates whether or not the apparel required dry cleaning or any other special care for laundering.
Jacket	JCK	Indicates the inclusion of a jacket or blazer, generally of heavier fabric and higher quality than the top of a two-piece dress (see "2PC" above).
Bow/Tie	BOW/TIE	Items of apparel with either a bow or a tie were considered to have extra trimmings and contributed to its cost.
KNIT or woven	KWV	Indicates that the fabric was knit or woven.
Zipper	ZIP	Indicates presence of a zipper.

around from year to year but on average in 1993 was 13.3 times the average in 1914 ($63.52 versus $4.75). Recall that the ratio for the median price was 32.7, indicating that the mean of the 1914 distribution was skewed upward by relatively expensive dresses. The mean value of weight was by coincidence almost exactly the same in 1914 and 1993 at about 1.5 pounds, but there were "long waves" in the behavior of the mean weight. During the entire 1928 to 1948 period, weight was at 3.0 pounds or higher, and weight fell to as low as 0.9 pounds in 1983 to 1984. A ten-year moving average of the mean weight from the hedonic sample is displayed in figure 2.6. To the extent that weight is the most important explanatory variable and contributes positively to quality, then there was no appreciable change in quality between 1914 and 1993, and substantial fluctuations in quality in the intervening years.

For the other quality variables as summarized in table 2.10, a surprise is the lack of consistent trends. In the early years (1914 to 1930) Sears sold numerous elaborate dresses made of silk and/or velvet, and this shows up in the relatively high value of the "Organic" variable in table 2.10. Similarly,

Table 2.10 **Percentage of dresses with various quality attributes**

Year	Observations per year	Price	Weight	ORG	IMP	LSE	BLT	2-PC	DRY	JCK	BOW/TIE	KWV	ZIP
1914	60	4.0	18.8	15.0	1.7	73.3	23.3	5.0	0.0	1.7	51.7	1.7	0.0
1921	77	8.0	25.7	18.2	0.0	37.7	20.8	2.6	0.0	1.3	61.0	0.0	0.0
1926	71	8.3	26.0	46.5	4.2	33.8	11.3	11.3	0.0	0.0	80.3	1.4	0.0
1936	183	3.0	18.9	0.5	5.5	31.7	28.4	79.8	0.0	23.0	33.3	13.1	0.0
1941	148	3.1	20.0	2.0	0.0	23.0	6.8	16.9	23.0	18.9	14.9	32.4	11.5
1946	96	4.9	21.6	0.0	0.0	18.8	13.5	39.6	67.7	0.0	6.3	57.3	19.8
1950	157	6.1	23.6	0.6	0.0	10.8	21.0	8.9	66.9	10.2	4.5	61.1	31.8
1955	155	7.0	22.1	0.0	0.6	8.4	12.3	6.5	43.9	9.7	18.7	37.4	26.0
1960	150	9.5	17.9	5.3	6.0	21.3	10.7	5.3	60.7	6.7	10.7	43.3	0.0
1965	149	10.2	16.2	2.7	0.0	5.4	0.0	22.8	58.4	8.1	4.7	84.6	0.0
1970	97	13.9	21.7	1.0	1.0	6.2	13.4	9.3	53.6	8.2	12.4	97.9	0.0
1975	78	18.8	19.1	0.0	0.0	14.1	14.1	9.0	2.6	17.9	1.3	94.9	0.0
1980	42	20.8	14.8	2.4	0.0	0.0	21.4	14.3	0.0	19.0	7.1	90.5	0.0
1985	100	42.7	14.6	6.0	3.0	15.0	45.0	16.0	16.0	9.0	10.0	78.0	0.0
1988	80	49.5	30.0	6.3	7.5	28.8	47.5	15.0	16.3	10.0	7.5	15.0	0.0
1993	n.a.	63.5	22.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Note: n.a. = not available.

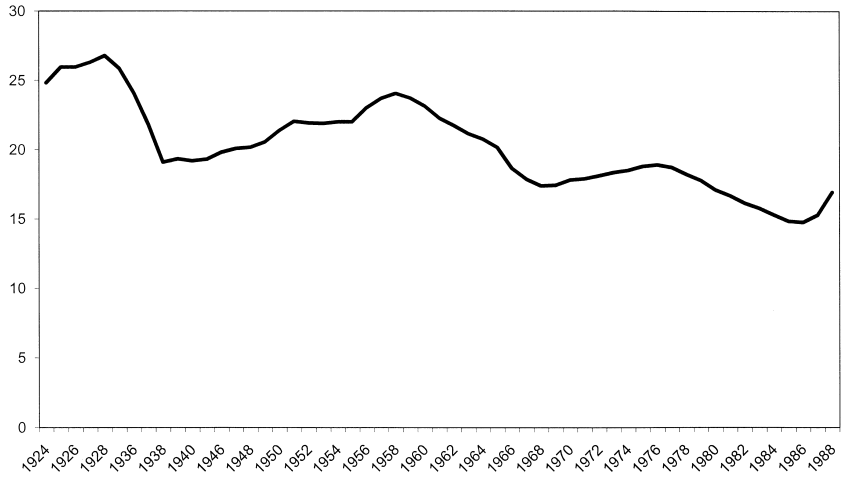

Fig. 2.6 Ten-year backward moving average of the weight of dresses in the hedonic sample, 1914–1988

through 1940 there were relatively large values for the "LSE" (lace, sequins, embroidery) variable. The mix of dresses then shifts in the postwar period to a very large fraction of knit and/or woven ("KWV"). A peculiar aspect of table 2.9 is that the "DRY" (dry cleaning) variable was at a high value between the late 1940s and mid-1970s and then dropped off to almost nothing. This could indicate a change in the catalog policy of explicitly listing the need for dry cleaning.

2.5.2 Hedonic Regression Results

There is always a trade-off between two extremes in running hedonic price regressions on a long time-series of data. One extreme would be to run separate regressions on every pair of years. This has the advantage of allowing the regression coefficients on characteristics like weight to shift as market and production conditions change, and the disadvantage that it minimizes sample size. The opposite extreme would be to run a single regression on all the data for all the years. This has the advantage of maximizing sample size and the disadvantage that it forces coefficients on characteristics to remain the same over a sample period of seventy-nine years.

In the case of apparel, there is the additional consideration that fabrics changed over time—silk disappeared and synthetics appeared, and so an approach that allowed for changing coefficients seemed essential. There were sufficient data to base the estimated coefficients on each successive pair of years, an abundance of data that allowed us to escape the many compromises required in a previous study of mainframe computers (Gordon 1989, 1990). Looking at the regression coefficients as displayed in table 2.11, those on

Table 2.11 Coefficients from hedonic regressions of women's dresses

Years	YEAR	LN WT	ORG	IMP	LSE	BLT	2-PC	DRY	JCK	BOW/ TIE	KWV	ZIP	Adjusted R^2	SEE	OBS
1914–1921	0.553**	0.444	1.259**	0.066	0.397**	0.060	–0.168	n.a.	–0.057	0.198*	0.296	n.a.	0.70	0.44	137
1921–1922	–0.490**	0.436*	1.182**	0.020	0.312**	–0.205*	0.102	n.a.	–0.315	0.039	–0.361	n.a.	0.69	0.42	168
1922–1923	0.178**	0.351	1.119**	0.116	0.227**	–0.021	–0.071	n.a.	0.001	0.127	0.100	n.a.	0.74	0.37	151
1923–1924	0.183**	0.651**	0.899**	0.221**	–0.011	0.013	0.103	n.a.	0.231	0.067	–0.082	n.a.	0.68	0.31	133
1924–1925	–0.117	1.060**	0.915**	0.286**	0.030	0.058	0.379*	n.a.	–0.032	0.003	–0.032	n.a.	0.57	0.40	163
1925–1926	0.071	0.616*	0.957**	0.276*	0.088	0.140	0.447**	n.a.	–0.223	–0.121	0.112	n.a.	0.59	0.44	161
1926–1927	–0.177*	0.355*	0.941**	–0.263	0.149	0.068	0.411**	n.a.	n.a.	0.096	0.235	n.a.	0.57	0.38	153
1927–1928	–0.168**	0.545**	0.963**	0.145	0.123	0.102	0.357**	n.a.	0.182	n.a.	0.247	0.228**	0.58	0.40	178
1928–1934	0.209*	1.116**	0.679**	–0.030	0.172*	0.167**	0.275*	n.a.	n.a.	–0.383*	0.261	0.188**	0.70	0.46	192
1934–1935	–0.301**	1.118**	0.490**	0.034	0.188**	0.238**	–0.003	n.a.	–0.075	0.235**	0.026	0.137	0.67	0.40	228
1935–1936	0.219**	1.294**	0.489**	n.a.	0.031	0.027	0.092	0.055	0.004	0.206**	0.186**	0.084	0.70	0.34	316
1936–1937	–0.022	1.481**	–0.036	n.a.	–0.018	0.096	–0.029	–0.040	0.034	0.142**	0.185**	0.386	0.76	0.30	329
1937–1938	0.093**	1.612**	–0.415*	n.a.	–0.077	–0.184*	–0.002	–0.058	0.089	0.105**	0.148**	0.233**	0.79	0.27	299
1938–1939	–0.127*	1.570**	0.103	n.a.	–0.057	0.062	–0.065	–0.004	0.060	0.123*	0.100	0.154**	0.65	0.39	336
1939–1940	0.059	1.471**	0.230*	n.a.	0.148**	–0.006	0.123*	n.a.	0.084	0.062	0.140**	0.111*	0.69	0.37	335
1940–1941	–0.173**	1.635**	0.052	n.a.	0.248**	–0.042	0.100*	0.033	0.089	0.002	0.145**	0.095*	0.83	0.28	300
1941–1946	0.354**	1.600**	0.117	n.a.	0.132**	0.029	0.041	0.041	0.088	0.081	0.239**	0.160**	0.82	0.29	244
1946–1947	0.337**	1.015**	n.a.	n.a.	0.066	0.174**	0.028	0.134*	n.a.	0.189*	0.261**	0.253**	0.70	0.26	174
1947–1948	0.199**	1.104**	0.887**	n.a.	0.161**	0.050	0.154**	0.128*	0.251**	0.009	0.182**	0.137**	0.80	0.22	202
1948–1949	–0.081**	0.912**	0.892**	n.a.	0.029	–0.025	0.155**	0.203**	0.179**	–0.061	0.184**	0.062	0.81	0.20	289
1949–1950	–0.310**	0.974**	0.731**	n.a.	0.045	0.062	0.077	0.144**	0.108*	–0.060	0.154**	0.000	0.71	0.23	323
1950–1951	0.106**	1.094**	0.730**	n.a.	0.119**	0.083*	0.001	0.111	0.090	0.054	0.071*	–0.023	0.67	0.26	292
1951–1952	0.098**	0.669**	0.759**	n.a.	0.168**	0.000	0.027	0.334**	0.150**	0.110	0.063	–0.029	0.64	0.28	276
1952–1953	–0.036	0.498**	0.638**	n.a.	0.159**	–0.020	0.135	0.372**	0.189**	0.166**	–0.006	–0.135**	0.59	0.30	286
1953–1954	0.101**	0.540**	0.421*	n.a.	0.106	–0.027	0.137*	0.337**	0.037	0.150**	–0.062	–0.174**	0.51	0.30	286
1954–1955	–0.021	0.625**	0.487*	0.094	0.118*	–0.029	–0.049	0.222**	–0.008	0.096*	–0.025	–0.184**	0.46	0.28	296
1955–1956	–0.253**	0.765**	0.787**	0.169	0.221**	0.027	0.017	0.325**	0.086	0.029	0.040	0.028	0.63	0.28	332
1956–1957	0.218**	0.786**	0.902**	n.a.	0.321**	–0.144**	0.043	0.365**	0.099*	–0.015	0.039	0.063	0.70	0.29	367
1957–1958	0.103**	0.760**	0.792**	n.a.	0.253**	–0.140**	–0.020	0.340**	0.143*	0.070	0.024	0.037	0.68	0.30	342

1958–1959	0.186**	0.829**	0.672**	n.a.	0.153**	0.017	0.001	0.305**	0.197**	0.038	–0.050	n.a.	0.67	0.30	345
1959–1960	0.096**	0.849**	0.623**	0.074	0.181**	0.039	0.008	0.255**	0.105	0.016	–0.047	n.a.	0.72	0.29	333
1960–1961	0.092*	0.846**	0.494**	0.167*	0.156**	0.215**	0.025	0.285**	0.027	0.134*	–0.037	n.a.	0.78	0.27	253
1961–1962	0.066	0.840**	0.560**	0.271*	0.056	0.215**	–0.118	0.412**	0.115	0.049	–0.008	n.a.	0.73	0.30	217
1962–1963	0.007	0.625**	0.488**	0.312*	0.109*	0.299**	–0.125	0.584**	0.160	0.249*	0.040	n.a.	0.68	0.33	237
1963–1964	0.023	0.629**	0.381**	–0.180	0.170**	0.266**	–0.036	0.532**	0.107	0.190	0.082*	n.a.	0.7	0.32	290
1964–1965	0.020	0.635**	0.437**	–0.386	0.219**	0.241**	0.062	0.474**	0.043	0.162	0.135**	n.a.	0.74	0.29	316
1965–1966	0.043	0.467**	0.416**	n.a.	0.294**	0.345*	0.166**	0.524**	0.148*	0.194*	0.107*	n.a.	0.67	0.30	308
1966–1967	0.068	0.430**	n.a.	n.a.	0.268**	0.266*	0.122*	0.380**	0.156*	0.117	0.052	n.a.	0.62	0.30	288
1967–1968	–0.024	0.738**	n.a.	n.a.	0.123**	0.142	–0.040	0.170**	0.044	0.116	0.129*	n.a.	0.69	0.27	273
1968–1969	0.066*	0.849**	0.623*	n.a.	0.080*	0.070	–0.062	0.130**	0.046	0.137	0.158	n.a.	0.78	0.25	258
1969–1970	0.007	0.865**	0.602*	–0.239	0.043	0.007	–0.001	0.083*	0.033	0.050	0.117	n.a.	0.8	0.22	211
1970–1971	0.162**	0.703**	0.462	n.a.	–0.112	0.096	0.029	0.131**	0.247**	0.100	0.121	n.a.	0.71	0.23	197
1971–1972	–0.019	0.721**	n.a.	n.a.	–0.016	0.171*	0.014	0.194**	0.317**	0.138	0.061	n.a.	0.63	0.26	200
1972–1973	0.230**	0.621**	n.a.	n.a.	0.069	0.081	0.056	0.330**	0.139	0.126	0.046	n.a.	0.62	0.26	201
1973–1974	0.093**	0.486**	n.a.	n.a.	0.071	0.045	0.180**	0.313**	0.221**	0.206*	0.038	n.a.	0.6	0.23	192
1974–1975	0.063	0.443**	n.a.	n.a.	0.074	0.025	0.142*	0.157	0.216**	0.208	–0.107	n.a.	0.56	0.23	169
1975–1976	–0.027	0.420**	n.a.	n.a.	0.117*	0.050	0.133*	–0.054	0.071	0.224**	–0.101	n.a.	0.51	0.22	166
1976–1977	0.023	0.314**	n.a.	n.a.	0.155**	0.157**	0.128*		0.179**	0.280**	0.139	n.a.	0.53	0.22	155
1977–1978	0.093*	0.192*	n.a.	n.a.	0.145	0.149*	0.171*	0.549**	0.305**	0.367**	–0.098	n.a.	0.44	0.25	138
1978–1979	0.272**	0.186*	–0.109	n.a.	0.206*	0.099	0.127	0.500**	0.202*	0.121	–0.067	n.a.	0.47	0.24	116
1979–1980	–0.187**	0.085	0.027	n.a.	0.260*	0.147**	0.087	0.468*	0.181**	0.125	0.155*	n.a.	0.48	0.19	87
1980–1981	0.110**	0.087	n.a.	n.a.	0.068	0.114**	0.079		0.174**	0.231**	0.362**	n.a.	0.57	0.16	83
1981–1982	0.095**	0.232**	0.660**	n.a.	0.117*	0.076*	0.150*	0.306	0.177**	0.129*	0.037	n.a.	0.51	0.20	115
1982–1983	0.299**	–0.225*	0.262	0.187	–0.024	–0.172**	0.092	–0.673**	0.132	–0.010	0.006	n.a.	0.32	0.35	170
1983–1984	–0.006	–0.054	0.611**	0.788**	–0.077	–0.097	0.094	–0.467**	0.090	0.063	0.164	n.a.	0.18	0.40	204
1984–1985	0.160**	0.557**	0.006	0.137	0.136*	0.046	0.092*	0.427**	–0.014	0.067	–0.063	n.a.	0.64	0.23	208
1985–1986	0.023	0.497**	–0.086	0.266**	0.195**	0.041	0.146**	0.472**	0.056	0.018	–0.047	n.a.	0.67	0.21	169
1986–1987	–0.154**	0.387**	0.045	0.176*	0.084	0.000	0.079	0.464**	–0.017	0.054	0.030	n.a.	0.71	0.19	150
1987–1988	0.014	0.411**	0.168*	0.049	0.137**	0.009	–0.041	0.354**	0.030	–0.001	0.077	n.a.	0.69	0.18	161

Note: n.a. = not available.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

weight are almost always highly significant, with an average estimated elasticity of 0.71. The weight elasticity is much higher in the 1928 to 1948 period (1.0 or above) and lower at the beginning and end. Several of the other quality variables are highly significant with the expected positive coefficient and a plausible magnitude of coefficients, particularly the "organic fabric" variable, as well as the "LSE" (lace, sequins, embroidery) and "DRY" (dry cleaning) variables.

The implied hedonic price index for women's dresses is compared with the CPI for women's dresses and the Sears MM index for women's dresses. These are displayed in table 2.12 and in figures 2.7 and 2.8, along with the median price and the implicit hedonic quality index (i.e., median price divided by the hedonic price index). Table 2.13 summarizes the growth rates of these five indexes for women's dresses over key intervals. Except for the negligible difference during 1914 to 1947, the huge positive differences between the annual growth rates of the hedonic and MM indexes for women's dresses from absolutely the same data set are remarkable. The introduction of this chapter provided a context for the "Hulten-Bruegel" paradox based on long-term annual rates of bias of 0.5 or 1.5 percent. Here we have a long-term difference in the Sears hedonic versus MM index of 2.90 percent per year.

An important aspect of these results is that the Sears/MM difference in growth rates is so much larger in the postwar era than between 1914 and 1947. While this is a puzzle, it may be related to the very different quality of dresses sold by Sears in the early part of the sample period—silk and velvet during 1914 to 1930, compared to pedestrian working-class dresses in the later parts of the sample (e.g., 1975 to 1993). A paradox that is not resolved by this chapter is the hedonic/MM difference increases in annual growth rates in the later years of the postwar era just when Sears is becoming more "pedestrian" and "less fashionable."

2.5.3 A Closer Look at Particular Pairs of Years

Are any generalizations possible about the periods when the Sears hedonic price increased so much more than the Sears MM index? To answer this question, a closer look was taken at three pairs of adjacent years with the greatest difference in growth rates between the two price indexes; as shown in the first three columns of table 2.14, these were 1972 to 1973, 1978 to 1979, and 1982 to 1983. The fourth column looks at the five-year interval (1978 to 1983) that had the greatest discrepancy. For contrast, three other pairs of years were chosen with only negligible differences between the growth rates of the two indexes; these pairs (1960 to 1961, 1966 to 1967, and 1977 to 1978) are displayed in the three right-hand columns of table 2.14.

The first three lines of table 2.14 records the annual growth rates of the two price indexes in each pair of years. The greatest difference was in 1982 to 1983, with a 30 percent increase in the hedonic index versus zero for the MM index. The next greatest difference was in 1978 to 1979, with respective

Table 2.12 Comparison of price indices for women's dresses

Year	Sears median price	CPI	Sears matched-model index	Sears hedonic price index	Sears implicit quality index
1914	45.34	43.87	84.16	44.71	101.42
1915	n.a.	44.74	87.68	*48.38*	n.a.
1916	n.a.	49.13	129.03	*52.36*	n.a.
1917	n.a.	59.07	148.53	*56.67*	n.a.
1918	n.a.	79.83	186.22	*61.32*	n.a.
1919	n.a.	105.86	239.00	*66.37*	n.a.
1920	n.a.	126.04	314.81	*71.82*	n.a.
1921	90.01	97.09	199.56	77.72	115.81
1922	67.90	78.96	169.06	47.62	142.60
1923	84.85	79.25	156.74	56.89	149.14
1924	86.42	78.37	153.08	68.32	126.50
1925	94.16	76.91	149.41	60.77	154.94
1926	92.82	75.74	144.43	65.25	142.26
1927	37.04	73.99	135.48	54.66	67.76
1928	88.44	73.11	129.03	46.21	191.39
1929	n.a.	72.23	121.55	*47.85*	n.a.
1930	n.a.	70.77	121.26	*49.54*	n.a.
1931	n.a.	64.34	112.76	*51.29*	n.a.
1932	n.a.	57.02	91.94	*53.11*	n.a.
1933	n.a.	54.98	88.12	*54.99*	n.a.
1934	42.42	60.24	104.40	56.95	74.49
1935	33.33	60.53	83.28	42.15	79.09
1936	33.56	60.74	86.07	52.47	63.96
1937	33.11	62.58	85.78	51.32	64.51
1938	38.16	61.35	84.02	56.33	67.75
1939	40.97	61.55	84.16	49.61	82.58
1940	35.02	61.55	89.88	52.62	66.54
1941	34.90	63.60	92.23	44.26	78.86
1942	n.a.	76.48	106.45	*47.51*	n.a.
1943	n.a.	79.75	108.06	*51.00*	n.a.
1944	n.a.	87.32	119.50	*54.74*	n.a.
1945	n.a.	92.02	120.97	*58.75*	n.a.
1946	55.56	93.87	130.94	63.07	88.09
1947	73.51	107.16	150.88	88.34	83.22
1948	87.43	115.95	146.63	107.79	81.11
1949	87.65	99.80	148.24	99.40	88.18
1950	68.91	90.18	128.30	72.91	94.52
1951	79.24	96.93	122.58	81.06	97.75
1952	78.34	97.03	120.82	89.40	87.62
1953	74.64	97.14	117.45	86.24	86.54
1954	83.73	97.34	111.73	95.41	87.76
1955	79.12	97.96	107.48	93.43	84.69
1956	89.67	98.77	119.79	72.54	123.62
1957	103.48	99.39	107.04	90.21	114.71
1958	100.00	100.00	100.00	100.00	100.00
1959	101.46	102.45	94.72	120.44	84.24
1960	106.29	102.86	90.47	132.58	80.17

(*continued*)

Table 2.12 (continued)

Year	Sears median price	CPI	Sears matched-model index	Sears hedonic price index	Sears implicit quality index
1961	109.43	103.07	98.68	145.35	75.28
1962	112.68	103.48	78.89	155.27	72.57
1963	116.27	104.29	78.15	156.36	74.36
1964	128.84	106.34	82.70	160.00	80.53
1965	114.48	108.18	87.98	163.23	70.13
1966	123.01	113.50	87.98	170.40	72.19
1967	133.22	123.31	94.87	182.39	73.04
1968	130.86	137.83	95.75	178.07	73.49
1969	143.55	151.33	81.23	190.22	75.46
1970	156.57	159.51	103.81	191.55	81.73
1971	141.86	157.26	103.81	225.24	62.98
1972	145.68	160.33	103.81	221.00	65.92
1973	176.54	167.48	106.45	278.15	63.47
1974	206.06	173.62	111.44	305.26	67.50
1975	211.22	177.71	115.69	325.11	64.97
1976	203.70	184.05	121.70	316.45	64.37
1977	220.99	190.80	127.86	323.81	68.25
1978	210.21	195.30	140.18	355.37	59.15
1979	288.33	202.25	146.63	466.46	61.81
1980	233.33	202.25	146.63	386.90	60.31
1981	252.08	202.45	146.63	431.89	58.37
1982	307.63	196.93	147.95	474.93	64.77
1983	409.99	203.68	147.95	640.45	64.02
1984	410.89	213.09	157.18	636.62	64.54
1985	478.79	217.38	174.19	747.08	64.09
1986	549.61	214.72	174.19	764.46	71.89
1987	498.32	238.45	145.60	655.35	76.04
1988	555.56	252.56	147.07	664.59	83.59
1989	n.a.	252.54	148.53	n.a.	n.a.
1990	n.a.	263.68	148.53	n.a.	n.a.
1991	n.a.	273.75	169.21	n.a.	n.a.
1992	n.a.	273.2	169.21	n.a.	n.a.
1993	n.a.	278.35	150.88	n.a.	n.a.

Note: Italics indicate that the Sears hedonic price index is interpolated for these years. n.a. = not available.

increases of 27.2 and 4.5 percent. We note from table 2.11 that the hedonic regressions for 1978 to 1979 and 1982 to 1983 were based on 116 and 170 observations, respectively, whereas the MM indexes are based on only four observations in each year-pair. Even this small number of comparisons overstates the representativeness of the MM index, since in 1978 and 1979 the "two" models in each year are actually a single dress, with the two models differing only as to whether they are available in half-sizes (with a slightly higher price).

The remaining lines of table 2.4 stratify the dresses in the hedonic sample

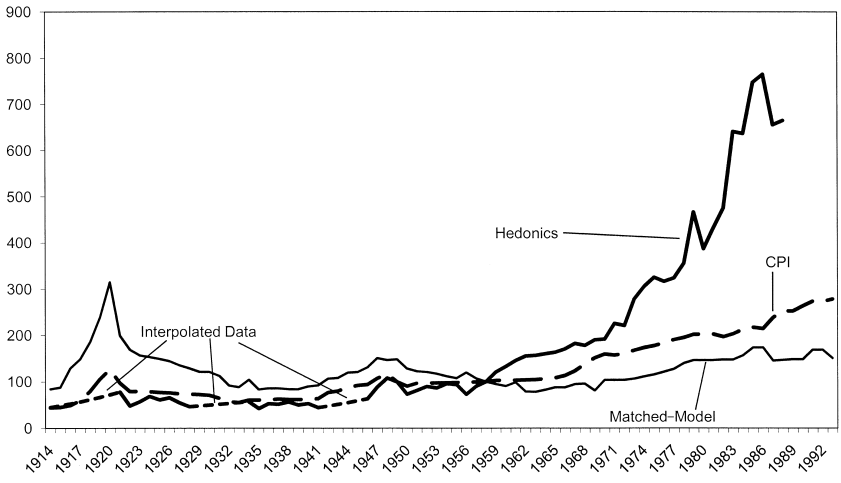

Fig. 2.7 Alternative price indexes for women's dresses: Sears hedonic, Sears MM, and CPI (1958 = 100), 1914–1993

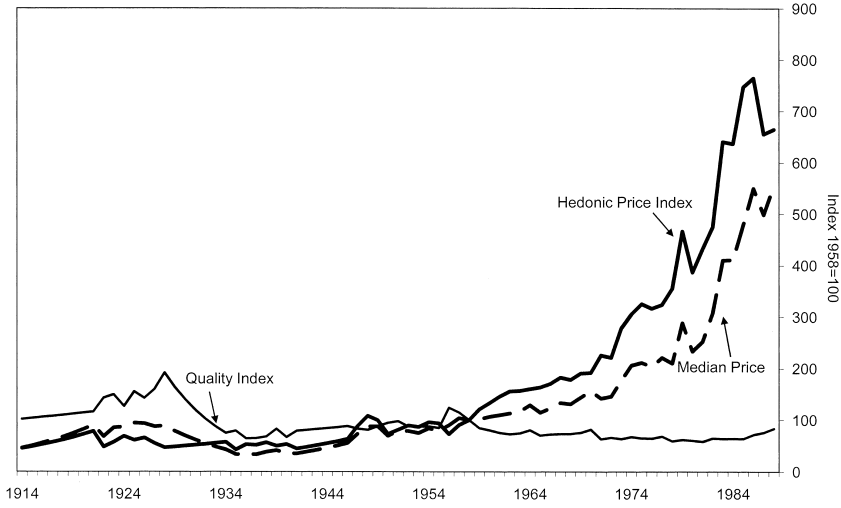

Fig. 2.8 Median price, hedonic, and implicit quality index

in each year by weight. The top section shows raw price change in each weight quartile in each pair of years; this number was obtained by regressing the price on a constant and a dummy variable for the second year in each pair. The second section shows the coefficient on a time dummy in hedonic regressions run separately for each weight quartile. Because the sample sizes were smaller by a factor of four, degrees of freedom were economized by deleting any quality variable (among those listed in table 2.8) that was not

Table 2.13 **Growth rates of Sears matched-model (MM) and hedonic indexes compared with the CPI, the median price, and the implicit quality index, alternative intervals, 1914–1988**

	1914–1947	1947–1965	1965–1978	1978–1988	1914–1988
Sears median price	1.46	2.46	4.67	9.72	3.39
CPI	2.71	0.05	4.54	2.57	2.37
Sears MM index	1.77	–3.00	3.58	0.48	0.75
Sears hedonic index	2.06	3.41	5.98	6.26	3.65
Median price – CPI	–1.25	2.41	0.13	7.15	1.02
CPI – Sears MM index	0.94	3.05	0.96	2.09	1.62
CPI – Sears hedonic index	0.65	–3.36	–1.44	–3.69	–1.28
Sears MM index – Sears hedonic index	–0.29	–6.41	–2.40	–5.78	–2.90
Implicit quality index = Median price – Sears hedonic index	–0.60	–0.95	–1.31	3.46	–0.26

significant in a particular regression at the 10 percent level. The third section subtracts the numbers in each cell in the second section (hedonic price change) from the corresponding cell in the first section (raw price change), resulting in the change in the implicit hedonic quality index. For instance, in the second column for 1978 to 1979, the raw price change is 34 percent, the hedonic price change is 29 percent, and the implicit improvement in quality is 5 percent.

In the first four columns there is a consistent pattern that the lighter dresses (first two weight quartiles) exhibit a substantially faster rate of raw price change and hedonic price change than the two heavier quartiles, especially the heaviest. There was no such difference across the lower two and higher two weight quartiles in the final three columns, showing three pairs of adjacent years when the hedonic and MM price indexes increased by about the same amount. Given the large samples in the hedonic regressions, this result is consistent with the hypothesis that the MM technique, with its sample sizes that of necessity are severely truncated, misses large price increases associated with model changes. Looking at the bottom section of table 2.14, there does not appear to be any significant tendency for lighter dresses to decline in quality relative to the heavier dresses. In several columns, the change in quality across weight quartiles has a zig-zag pattern, alternating between positive and negative.

Several other experiments were run on the data for these pairs of years. Each of the subset of significant quality variables was interacted with the year dummy to look for changes in the coefficients of quality characteristics over time. However, none of these interaction terms was significant at the 10 percent level. The absence of time interaction effects, and the stability of the subset of coefficients that are significant in table 2.11, attests to the

Table 2.14 **Comparison of years when Sears hedonic index grew much faster than Sears MM index with years when the two indexes grew at the same rate, annual growth rates in percent**

	Hedonic >> MM				Hedonic ≈ MM		
	1972–1973	1978–1979	1982–1983	1978–1983	1960–1961	1966–1967	1977–1978
Hedonic price index	23.0	27.2	29.9	11.8	9.2	6.8	9.3
Matched-model price index	2.5	4.5	0.0	–0.6	8.7	7.5	9.2
Hedonic–MM	20.5	22.7	29.9	12.4	0.5	–0.7	0.1
Raw price change	22.0	34.0	20.0	11.8	1.0	9.0	–4.0
First weight quartile	37.0	38.0	34.0	16.9	–1.0	0.0	8.0
Second weight quartile	28.0	40.0	50.0	18.7	9.0	1.0	–12.0
Third weight quartile	16.0	34.0	19.0	10.0	9.0	27.0	–5.0
Fourth weight quartile	9.0	22.0	–24.0	1.1	–3.0	10.0	–8.0
Hedonic price index by weight quartile	24.0	29.0	32.0	11.8	9.0	8.0	10.0
First	32.0	44.0	48.0	14.2	0.0	23.0	10.0
Second	35.0	40.0	53.0	20.1	17.0	7.0	5.0
Third	14.0	13.6	26.0	–1.0	–5.0	26.0	26.0
Fourth	13.0	24.0	–10.0	13.6	14.0	5.0	–1.0
Implicit quality change by weight quartile	–2.0	5.0	–12.0	0.0	–8.0	1.0	–14.0
First	5.0	–6.0	–14.0	2.7	–1.0	–23.0	–2.0
Second	–7.0	0.0	–3.0	–1.4	–8.0	–6.0	–17.0
Third	2.0	20.4	–7.0	11.0	14.0	1.0	–31.0
Fourth	–4.0	–2.0	–14.0	–12.5	–17.0	5.0	–7.0

robustness of the hedonic regression results. Another experiment was to stratify the sample for these years by the DRY variable (0 or 1 depending on the need for dry cleaning), but price changes in this stratification appeared to differ randomly across the DRY = 0 and DRY = 1 subsets of the sample. The last experiment was to identify subsets of dresses with identical quality characteristics across two adjacent years. This amounts to trying to "mimic" the MM technique within the subset of variables available for the hedonic regression, without requiring (as does the MM technique) that the models are absolutely identical. The result is that within these constant-quality subsets, price increases in adjacent-year pairs were mostly higher rather than lower than the basic hedonic time coefficient in those same year-pairs.

As a last step to understand the phenomenon of rapid price increases in the hedonic regressions for these pairs of years, I visited the pair of microfilm machines displaying the 1978 and 1979 Sears catalogs (after years of relying on research assistants to collect the data). I checked the MM models to make sure they were identical, and they were in both the photo, the available colors, and the specifications:

> Fabric: polyester-cotton blend. Tuck-stitching at sides, front placket opening, pointed collar, should yoke in front, yoke and shirring in back, one side-seam pocket, short sleeves, self-tie belt.

This standard dress in standard sizes increased in price from $11.44 to $11.99, and in available half sizes increased from $12.44 to $12.99. These price increases calculated in logs are 4.7 and 4.3 percent, respectively, yielding the 4.5 percent increase in the MM index shown in table 2.14, line 2, for 1978 to 1979.

Then I looked for 1979 dresses that were "closely comparable" to their 1978 counterparts, and it immediately became apparent why the sample sizes in the MM indexes are so small. I found a poly-rayon blend "cap-sleeve" one-piece dress in 1978 that in its photo looked just like a cap-sleeve one-piece dress in 1979. But upon closer inspection of the specifications, they were not identical at all. The 1979 dress was poly-cotton rather than poly-rayon, its weight was thirteen ounces instead of nine ounces, it had no collar instead of a pointed collar, and it had one pocket instead of two (the price increased from $18 to $25). A two-piece dress comparison was more promising, since both the 1978 and 1979 version had a poly-cotton fabric.

Both had a pointed collar, placket opening, and a skirt with a "slightly flared style." However, the 1978 dress had a zipper in back while the 1979 style was "pullover," the 1979 dress had an elastic waistband that was not mentioned in 1978, and the 1978 dress had "attached tabs with D-ring closure" that was not mentioned in 1979. Despite a decline in weight from fifteen to ten ounces, the price went up from $20 to $24. Similarly, a floral print one-piece dress increased in weight from six to seven ounces but increased in price from $19 to $27. Again, they looked similar in photos but upon

closer inspection one had a square neck, the other a "band neckline," one had 3/4 length sleeves, the other elbow-length sleeves, and the 1979 skirt was "three-tiered."

Overall, the mind boggles at the difference between price research on women's dresses and on the many types of durable goods studied in my previous book (Gordon 1990). In durable goods quality improves steadily, if not from year to year then from decade to decade. Engines become more powerful, quieter, and more fuel efficient. Electric and electronic products become more capable at the same time as they become smaller. The difference with women's dresses could not be more profound. The many small changes from year to year in women's dresses that prevent a researcher from "matching a model" do not correspond to our standard notions of "quality." A pocket is moved from the top to the side, a zipper is replaced by buttons or vice versa, a square neck is replaced by a scooped neck. Immersion in the catalogs for a year-pair like 1978 to 1979 leaves the overwhelming impression that the isolated model that was "matched" was actually a freak, and that the large sample of dresses with as many as ten dimensions of quality controlled make the hedonic regression results greatly superior to the MM indexes.

Many types of apparel, from men's suits to work clothes to underwear to children's clothes, exhibit far fewer dimensions of style change than women's dresses. But our overall finding of minimal quality change between 1914 and 1993 should carry over to these apparel products as well, if there is any communality of production techniques used across different types of apparel. One may speculate that an index of the raw price change for the Sears sample of these more homogeneous types of apparel would be closer to the truth than the corresponding MM indexes displayed in tables 2.2 through 2.7.

2.5 Conclusion

This chapter develops new price indexes for apparel based on data from the Sears catalog for the entire period 1914 to 1993, beginning in the first year of the CPI and ending in the last year of the general Sears catalog. The research, which is based on roughly 10,000 exact comparisons for the matched-model (MM) index and another 6,500 observations on the prices and quality characteristics of women's dresses, leads to several conclusions and numerous questions for further research.

The Sears matched-model indexes do not exhibit a consistent negative or positive drift relative to the CPI. For women's apparel the drift is always negative but for men's apparel there is a turnaround, from negative before 1965 to positive thereafter. Both the matched-model indexes and the CPI rise less rapidly for women's apparel than for men's apparel, which would be consistent with the hypothesis that price changes accompanying model changes are more frequent for women's apparel, since models change more frequently.

The hedonic price index for women's dresses increases much faster than the matched-model index from the same data over the entire postwar period, although not in the earlier 1914 to 1947 period. Likewise, the hedonic index also increases faster than the CPI over the entire postwar period but also not during 1914 to 1947 (when the CPI-hedonic difference is a relatively minor 0.65 percent per year). To the extent that the Sears hedonic and matched-model indexes are based on the same data, so that systematic differences between catalog market shares and pricing policies are not relevant, the results provided here offer a nice complement to past research on computer prices, which also found that price changes were contemporaneous with model changes. Just as hedonic price indexes for computers almost always drop faster than matched-model indexes for computers, we have found the opposite relationship for apparel prices, presumably for the same reason.

Despite the large amount of data examined in this chapter, it leaves open the answer to the basic question that motivated the research—what is the overall bias in the CPI for apparel from 1914 to 1993? One answer is a downward bias of 1.28 percent per year, the difference between the CPI and hedonic indexes for women's dresses over the 1914 to 1988 period for which the hedonic index was compiled. As shown in table 2.13, the figure of 1.28 is misleading, since the difference was actually in the opposite direction before 1947, and the 1947 to 1988 difference implies a much higher downward bias of –2.83 percent per year for that period.

In extrapolating this difference from women's dresses sold by Sears to all apparel sold by all retail outlets, two factors suggest scaling down the –2.83 difference for the postwar period to a smaller number, say –1.5 percent. First, as discussed, the market position changed over the years from the lowest-priced vendor to somewhere in the middle. The fact that the catalog was eventually shut down in 1993 suggests the growing importance of lower-priced merchants like Target and Wal-Mart. Second, the underlying diagnosis of the MM-hedonic price difference as being due to frequent style changes would apply less to men's and children's apparel than to women's dresses, suggesting that the CPI may have done a better job in these other categories. However, the annual rate of increase in the CPI for men's apparel over the 1947 to 1993 period was only 0.57 percent per year faster than that for women's apparel, indicating that the style-fashion source of bias for women's versus men's apparel is only a fraction of the overall difference between the CPI for women's dresses and Sears hedonic for women's dresses established in this chapter. Our final conclusion is that the downward bias in the CPI for the postwar period, at least through 1988, is roughly in the range of –1.5 to –2.0 percent, with no evidence of bias in the 1914 to 1947 period.

The implications of this chapter go beyond the limited empirical application of Sears catalog data for women's dresses. Perhaps the most important conclusion of this chapter is one that economizes enormously on future research resources. Quality change in women's dresses over the full 1914 to

1993 period was negligible. If this can be extended to other types of apparel, this creates a radical breakthrough for historical research. However sophisticated the modern CPI in measuring price changes for apparel in the twenty-first century, significant information may be contained in raw price changes of individual apparel products for most of the twentieth century.

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