

**FIBER PRICE DYNAMICS:
FROM MILL THROUGH RETAIL**

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Abstract

What is the relationship between changes in raw cotton prices and retail prices for cotton products? The paper provides a statistical examination of cotton-related prices at three different points in the manufacturing/retail pipeline. The results of simple linear regression models suggest that the relationship between mill-delivered prices and yarn prices, and between yarn prices and retail prices for apparel products is weak. One explanation for the finding is the idea that the apparel market is strongly driven by consumer demand and that changes in key input prices, while statistically significant, are of minor importance when compared to other market factors.

Introduction and Background

Cotton surged to record price levels in the United States in early 1995 at the same time the retail apparel industry was experiencing its second straight year of declining retail prices. How did the higher cotton prices affect the prices at retail for cotton products? Was there significant upward pressure on prices from the mill level through retail as a result of record prices for raw cotton? More generally, what is the relationship between changes in raw cotton prices and retail prices for cotton products? This paper examines cotton-related prices at three different points in the manufacturing/retail pipeline.

Analysis and Findings

Monthly data for three different types of prices covering the period January 1990 through October 1995 were examined for this analysis:

- mill-delivered prices for cotton, (1)
- yarn prices for 10 singles, 100% cotton open-end yarn (2) and
- average retail prices for men's and women's denim jeans and men's undershirts. (3)

The focus on the retail price for denim jeans is for two reasons. First, the cotton content in denim jeans is among the highest of all cotton apparel products. This allows for a more direct analysis of the relationship between the raw material and the final product. Secondly, the denim market in the United States has an extremely low level of import penetration compared to other types of apparel. This

suggests that changes in the retail price for denim jeans in the United States should be less susceptible to changes in foreign markets and, in theory, more directly related to price changes in the U.S. market. The market for men's undershirts is also characterized by low import penetration and a high cotton content in retail products. Analyzing prices for men's undershirts also allows for a comparison with the findings for denim apparel products.

The variables in the analysis will be referred to as MILLPRICE (percentage change in mill-delivered prices), YARNPRICE (percentage change in yarn prices), MJPRICE (percentage change in the average retail price of men's denim jeans), WJPRICE (percentage change in the average retail price for women's denim jeans) and MUPRICE (the percentage change in the average retail price for men's undershirts). Data analysis was performed with Quattro Pro for Windows.®

The nominal monthly average price data were converted to real prices using the CPI for apparel commodities (less footwear), the seasonally adjusted CPI for textiles and home furnishings and the Producer Price Index for apparel. (4)

A correlation analysis was performed to test the relationships between the MILLPRICE and YARNPRICE variables. Several analyses were conducted with lagged specifications for the YARNPRICE variable. The strongest correlation (.18) was produced when YARNPRICE was lagged for a period of five months. A linear regression analysis with the lagged variable YARNPRICE as the dependent variable and MILLPRICE as the independent variable yielded a model with an R^2 of .03 and a T statistic for the MILLPRICE variable that was not significant at the 95% confidence level. The model statistics are presented in Table 1.

Correlations were also examined for the variables MJPRICE, WJPRICE, MUPRICE and YARNPRICE. Lag effects were tested for the retail prices when correlated with YARNPRICE. The strongest correlations occurred when MJPRICE was lagged five months and WJPRICE was lagged two months. The correlation between YARNPRICE and MUPRICE was strongest when MUPRICE was lagged for a period of four months.

Linear regression models were constructed using each of the retail prices as dependent variables and YARNPRICE as the independent variable. The results of the models are reported in Table 2. For all three models, R^2 values were less than 0.1, suggesting that less than ten percent of the variation in retail prices for men's and women's denim jeans and men's undershirts can be explained by changes in yarn prices. In each of the models, the T statistic for the variable YARNPRICE was statistically significant at the 95% confidence level.

Discussion

Assuming that price increases in mill-delivered cotton were completely passed through the manufacturing/retail pipeline, we would expect to see a 1.7 percent change in retail prices. (5) The coefficients for the independent variables in the regression analysis suggest that we would see a 0.2-0.3 percent change in retail prices with a one percent change in yarn prices. The regression analysis for yarn prices shows only a 0.2 percent change in yarn prices with a one percent change in mill-delivered cotton prices. Statistically, the analysis presented here points to a much more complicated model of manufacturing and retail pricing where raw material costs are still likely to play a very small role in explaining the behavior of retail prices.

The results of the analyses suggest that the relationship between mill-delivered prices and yarn prices, and between yarn prices and retail prices for apparel products is weak. This finding may be somewhat surprising--particularly in the case of mill-delivered cotton prices and yarn prices--since raw material costs are approximately 52% of the total manufacturing cost of open-end cotton yarns. (6)

Using mid-point estimates for yarn prices that are quoted in ranges may understate the variability in yarn prices. In the analysis, this can lead to problems with autocorrelation and a low bias in the R² value. A Durbin-Watson test for the models indicated the likelihood of serial correlation. Despite this limitation in the data source, anecdotal evidence supports the interpretation that the observed statistical relationships are consistent with weak relationships observed in practice.

One explanation for the statistically weak relationships observed in this analysis is the idea that the apparel market is so driven by consumer demand that changes in key input prices, while statistically significant, are of minor importance when compared to other market factors. Since the findings of the analysis were similar for both the denim jeans market and the market for men's undershirts, it may also be reasonable to assume that the apparel market in general is driven by consumer demand. Two factors that may be essential for understanding the relatively minor importance of changes in input prices are the competitive retail environment and a shift in consumers' buying behavior. Retail apparel prices have fallen for the last two years. In 1994, the CPI for apparel showed a 0.4 percent drop in retail prices. Prices continued their decline in 1995 with a 1.6 percent drop in the CPI for apparel. With the number of units sold increasing and average prices falling, there has been tremendous pressure on apparel prices at retail, making it difficult for intermediate manufacturers to pass along price increases and for retailers to increase their prices. Consumers in recent years have changed their buying behavior, favoring more apparel purchases at discount and mass merchant stores (Table 3). This shift in purchases away from department and specialty

stores has also contributed to falling average prices at retail.

What does a demand-driven market imply for our understanding of the dynamics of fiber prices? First, it is likely that raw material prices for cotton will still experience variability, primarily as a result of the fundamental supply/demand balance and speculation in the trading of cotton futures. Secondly, intermediate goods manufacturers (i.e., yarns and fabrics) will most likely be unable to pass along price increases in the short run, leaving their profit margins extremely vulnerable to changes in raw material costs. In the long run, these manufacturers will need to decide whether to continue production or shift away from cotton to other types of fibers. In a retail market driven by strong consumer demand for cotton products, this latter option may not be entirely feasible.

References

1. The prices are reported by the USDA. The mill delivered prices used in this analysis are an average of the USDA quotes as calculated by the National Cotton Council.
2. The prices are reported in *Inside Textiles*, published by the Point Publishing Co., Inc. Since prices for yarns are quoted as a range, the midpoint of the range was used as a point estimate for the yarn price in this analysis.
3. Monthly average retail price data are derived from the total unit sales and dollar values sales. The data are reported by the NPD Group in their proprietary monthly database of consumer purchases.
4. The CPI and PPI figures are reported by the Bureau of Labor Statistics, U.S. Department of Labor.
5. The theoretical estimate of a "perfect" 1.7% pass through is obtained by using the following formula:
$$\frac{\text{Dmill-delivered cotton price} \times (\text{cotton weight/unit})}{\text{Dretail price}}$$

The change in retail price is then divided by the average retail price for men's or women's jeans or men's undershirts (The NPD Group) to obtain the percentage change in price. The cotton weight per unit figures are obtained from The NPD group.
6. International Textile Manufacturers Federation. 1995 International Production Cost Comparison, p.15.

Tables

Table 1. Regression Results: Independent Variable=YARNPRICE,
Dependent Variable=MILLPRICE

R ²	.033
Standard Error	.078
P-Value for the T Statistic	150

Table 2. Regression Results: Independent Variable=YARNPRICE,

Dep. Variable=	MJPRICE	WJPRICE	MUPRICE
R ²	.093	.086	.090
Standard Error	.050	.050	.083
P-Value for the T Statistic	.013	.015	.014

Table 3. Change in Apparel Sales by Outlet Type (Dollar Basis)

	1991	1994	Change
Department Stores	24.1%	22.5%	-1.6%
Specialty Stores	19.8%	17.8%	-2.0%
Mass Merchants	19.6%	20.8%	+1.2%
Chains	14.9%	15.4%	+0.5%
Mail Order	5.4%	5.7%	+0.3%
Office Price	5.8%	7.0%	+1.2%
Factory Outlet	3.2%	3.7%	+0.5%