U.S. Clothing Expenditures: A Closer Look

The purpose of this paper is to improve understanding of U.S. clothing expenditures, assuming that consumers adjust their clothing expenditures to their long-run desired levels. Clothing expenditures is modeled as a function of income and price, using the cointegration technique to examine the co-movement relationship among variables. It was found that a co-movement relationship exists among clothing expenditure, own price and disposable income. The demand for clothing is both income- and price-inelastic in the long- and short-run.

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Introduction

Many empirical studies have been conducted to explore the nature of demand for U.S. clothing. In general, demand for clothing seems to be income inelastic. The price elasticity may be sensitive (Bryant & Wang, 1990; Mokhtari, 1992) or may not be so at all (Norum, 1990). When examining long- and short-run income and price elasticity of clothing expenditures, Mokhtari (1992) reported a unitary long-run own price elasticity, and found the short-run price elasticity to be almost twice that magnitude over the years of 1929-1987. The findings seem to contradict the prediction of economic theory that elasticity is greater I the long run than in the short run; thus raising questions about price elasticity.

The purpose of this study is to improve understanding of U.S. clothing expenditures, assuming that consumers adjust their clothing expenditures to their long-run desired levels. The research question is whether the long-run income and price elasticity of clothing expenditures are greater than those in the short run, as economic theory would predict.

Literature Review

The following review mainly focuses on time series studies, which assume that consumers adjust their clothing expenditures to their long-run desired levels. Table 1 summarizes income and price elasticity of those studies.

Houthakker and Taylor (1970, pp. 17-18) conducted a study based on a stock adjustment model and found that the immediate effect of an increase in total expenditure was an increase in the stock of clothing. However, the higher stock level tended to decrease the quantity of purchases in subsequent periods. This implies that consumers adjust their clothing stock gradually. They also reported a short-run total expenditure elasticity of .65 and an own price elasticity of -.93.

Bryant and Wang (1990) worked on stock adjustment model under permanent income framework and derived equations for empirical estimation. According to quarterly data of clothing expenditure from 1955-1984, they found the short-run elasticity of permanent income to be .69. They also reported a short-run price elasticity of –1.08.

Table 1
Summary of Income and Price Elasticity of Clothing Expenditures (Time Series Studies)

	Income Elasticity		Price Elasticity	
Elasticity	Short-run	Long-run	Short-run	Long-run
Houthakker & Taylor (1970)	.65		-.93	
Bryant & Wang (1990)	.69		-1.08	
Norum (1990)	.97		-.19	
Mokhtari (1992)	.48	.51	-1.96	-1.01

Norum (1990) directly applied Bryant and Wang's (1990) methodology to annual data. After adjusting for depression and war years, Norum (1990) found short-run income elasticity to be .97 over the years of 1929-1987. She also found price elasticity to be inelastic (-.19).

Mokhtari (1992) extended Norum's (1990) study and applied an Error-Correction Model and cointegration technique to study the relationship between U. S. clothing expenditures and the relevant determinants over the years of 1929-1987. He assumed that consumers make short-run proportional adjustments in clothing expenditures based on past consumption disequilibrium. He proposed that per capita clothing expenditure (LnC_t) is a function of per capita disposable income (LnY_t), ratio of relative Apparel and Upkeep price index to Consumer Price Index ($Ln(PC_t/P_t)$), ratio of elderly to general population ($Ln(POP65_tROP_t)$), and departure of the economy from full employment (U_t). Mokhtari's (1992) clothing demand model is as follows: (coefficients of logarithm represent long-run elasticities)

$$LnC_t = 1.9 + 0.51LnY_t - 1.01Ln(PC_t/P_t) - 5.11Ln(POP65_t/POP_t) - 0.01U_t + e_t \quad (M1)$$

where the adjusted R^2=.930. After confirming that long-run equilibrium error series, e,, is stationary, he added a one-period lag equilibrium error term (Ec_{t-1}) to form the Error-Correction Model (ECM). The estimated ECM is:

$$\Delta LnC_t = -0.01 + 0.48\Delta LnY_t - 1.96\Delta Ln(PC_t/P_t) + 8.60\Delta Ln(POP65_t/POP_t) - 0.006\Delta U_t - 0.16EC_{t-1} \quad (M2)$$

and the adjusted R^2=.783. Those coefficients, except the one for EC_{t-1} are interpreted as short-run elasticities. Based on empirical results, Mokhtari (1992) concluded that the long-run price elasticity was unitary and the short-run price elasticity was almost doubled. The findings that price elasticity is greater in the long run than in the short run seem to contradict what the economic theory predicts.

There are concerns about Mokhtari's (1992) work. The first is why the unemployment rate is hypothesized to share a common trend with per capita clothing expenditure, disposable income, clothing price, and age structure. Similar argument applies to age structure variable. It seems very likely that there exists more than one stable relationship among these five variables. For example, the permanent income hypothesis proposes a long-run relationship between consumption and income. Baneriee et al. (1991, p. 2) pointed out that there are prevailing price-quantity combinations transacted in the market. It would be better to adopt Engle and Granger's (1987) "simple to general" approach. For example, following demand theory, the relationship between clothing expenditure and personal disposable income (or own price) is specified and examined. Then, a third variable, own price (or disposable income) is added should data fail to show a co-movement between the first two variables.

The second concern is that Mokhtari conducted non-stationary tests for each variable using the Dickey-Fuller (DF) t-tests without time trends. He concluded that all five series reach stationary after first differencing because the Dickey-Fuller t-values are less than the critical values. However, the results were misleading in two aspects. First, clothing expenditure, own price, and disposable income series contain time trends. Also, the existence of serial correlation is possible for these variables. Hence, it is appropriate to test each series using the augmented Dickey-Fuller (ADF) t-tests with time trends statistics as ADF test statistics can take care of serial correlation by adding sufficient lag terms (Engle & Granger, 1987, p. 271).

The second reason why the positive DF t-test critical value reported is misleading is that the test is a one-tailed test instead of a two-tailed test. In fact, DF t-values and associated critical values should be negative for stationary series (Fuller 1976, p. 373). In general, the smaller the negative DF t-values, the more likely that the null hypothesis of non-stationary relationships is rejected. The reported first difference DF t-value of the age structure series, $POP65_tROP_t$ is -2.32, which is greater than the critical value -2.9 at the conventional significance level. This implies that age ratio series does not reach stationary after first differencing. Therefore, with the evidence that the first difference age structure series is not stationary, there should exist, at least, another non-stationary series among the above five variables to allow the remainder of equation M1 to reach stationary.

Econometric Model and Data

Engle and Granger's (1987) "simple to general" model specification search is adopted in the empirical study. First, the relationship between clothing expenditure and disposable income is specified and examined. Then, a third variable, own price is added should data fail to show a co-movement between the first two variables. In

addition, Johansen and Juselius' (1990) cointegration test will be used to decide the number of possible cointegration vectors among variables. Although it has been shown that co-integration vector is a consistent estimator of an unknown parameter and the convergence properties of the estimates are superior to those of standard OLS, care has been taken to avoid inefficient and contradictory results when using Engle and Granger's approach to test more than two non-stationary series simultaneously (Hall, 1989).

Data used in the following empirical study were taken from the National Income and Product Accounts and Bureau of Labor Statistics for the years 1929-1993. All nominal variables were converted to real terms, using 198284 as the base year, before taking logarithms and first differences. The log version of real annual per capita clothing expenditure (LnCSE) was obtained by dividing clothing expenditure by the Price Index for Appeal and Upkeep as well as total population. The log of real per capita disposable income (LnDPI) was obtained by dividing personal disposable income by the implicit price deflator and total population. The log of relative price of clothing (LnP) was defined as the ratio of the Consumer Price Index for Apparel and Upkeep to the Consumer Price Index. Note that because both LnCSE and LnP contain a common Apparel and Upkeep price term, a lag relative price term, LnP(=1), will be used during estimation in order to avoid possible bias.

Cointegration Tests Results

Before testing the existence of cointegration among variables, stationarity tests were conducted first. All test results of DF, the first order lag of ADF and t-test statistics of LnCSE, LnDPI, and LnP indicate the presence of time trends for period 1929-1993. Also, three variables reach stationary after first difference.

Johansen's Maximum Likelihood cointegration testing procedure is employed to determine whether there exists co-movement relationship(s) among LnCSE, LnDPI, and LnP. It was found that no cointegration relationship exists between LnCSE and LnDPI, and between LnCSE and LnP over sample period2. This implies that clothing expenditure and income, and clothing expenditure and own price do not share a common trend over the sample periods. A possible explanation for this result is given below.

Though, it has been argued that clothing expenditure respond closely to year-to-year changes in current income, the relative share of clothing expenditures with respect to private consumption expenditure (Norum, 1990) or disposable income (Mokhtari, 1992) has steadily declined. There is a growing gap between annual per capita clothing expenditure and disposable income (Mokhtari, 1992, p. 313). Hence, it is not surprising that no evidence of a co-movement relationship between clothing expenditure and income is found.

Although per capita clothing expenditure does not move together with per capita disposable income or with own price, it was found that the three variables seemed to share a common trend over the years 1929-1993. The hypothesis of one cointegration vector existing among three variables cannot be rejected. This result is not surprising and it implies that consumers take both their disposable income and price of clothing together into consideration when adjusting their clothing stock and expenditures.

Discussion

Engle and Granger's (1987) two-step regression approach was employed to estimate ECM. Two dummy variables representing the depression (DEP) and World War II (WAR) periods were included to reflect shocks to the economy. It was found that both long-run and short-run income elasticity might be over-estimated if these shocks were not included. The regression results over the years of 1929-1993 are summarized below. Note that intercepts are not included, t-values are in the parentheses, and *, **, and *** indicate statistical significance at the .1, .05, and.O1 level, respectively.

LnCSE = .6912 L11DPI	-.3785 LnP(-1)	-.0347 DEP	+.0482 WAR	adj R^2 -.9604
(17.853) ***	(5.4994) ***	(.7918)	(1.4744)	DW=.3776
ALnCSE=.5176,Δ LnDPI	+.2890 ΔLnP(-1)	-.0731 DEP	+.0282 WAR	-.2282 EC(-1)
(4.0483) ***	(1.6119)	(3.2431) ***	(1.7082)*	(3.5154) **

where adj R2 = .6197 and DW= 2.0642.

The statements that clothing is a normal good and demand for clothing is income inelastic are supported by the data. As expected, consumers increase their clothing expenditure as their disposable income increases. The estimated income elasticities are .52 and .69 in the short and long run, respectively. These elasticities are greater than those reported by Mokhtari (1992). This may be because Mokhtari did not adjust for extra economic shock, instead he assumed that age structure and unemployment rate share a common trend with expenditure, disposable income and price. Compared to Norum's (1990) estimated short-run income elasticity .97, the one estimated in this study is smaller. A possible reason is that Norum (1990) used aggregate information controlled for population, while this study used per capita information for clothing expenditure, disposable income and price.

It is found that own price has a significant negative impact on clothing expenditure in the long run, but an insignificant effect in the short run. The estimated lagged own price long-run elasticity is significant (-.38), which is greater, in absolute value, in the long run than in the short run. Compared to Mokhtari's (1992) estimated long-run price elasticity of -1.01, the value that is estimated in this study is smaller and inelastic. Similarly, the short-run price elasticity estimated is smaller compared to Mokhtari's finding -1.96, and Bryant and Wang's -1.08.

Clothing expenditures are affected by shocks to the economy in the short run, but not in the long run. For example, the depression had a significant negative impact on clothing expenditures in the short run. Whereas clothing expenditures increased during war periods.

The response to past disequilibrium of clothing expenditures is captured by the coefficient of the error correction term, ECt_1. The estimated coefficients are -.23 over 1929-1993. Compared to Bryant and Wang's (1990) estimated adjustment rate of -.65, Norum's (1990) -.11, and Mokhtari's (1992) -.16, the adjustment rate in this study are in the middle, which implies that clothing may be treated as a semi-durable good.

Conclusion

The purpose of this study is to improve understanding of U.S. clothing expenditures. This is done by modeling clothing expenditure as a function of income and own price, using cointegration technique to investigate possible co-movement relationships among the three variables. The major findings can be summarized as follows. First, no co-movement relationships were found between per capita clothing expenditure and per capita disposable income, or between clothing expenditure and own lag price, in the period 1929-1993. But, as demand theory would predict, clothing expenditure, own price and disposable income share a long-run equilibrium relationship. Second, U.S. clothing expenditures are adjusted to disposable income and own price in the short run and long run. The estimated income and own lagged price elasticity indicate that demand for clothing is both income- and price-inelastic in the long run and short run. Moreover, the long-run elasticity is greater than that for the short run. Income elasticity is greater, in absolute values, than own price elasticity.

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Endnotes

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[2] Both stationary and cointegration test results are available upon request.