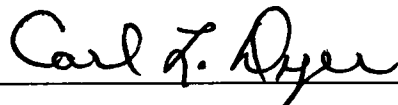


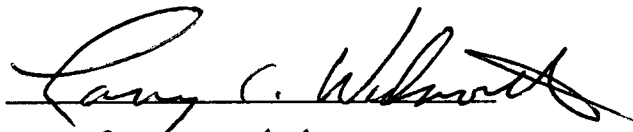
To the Graduate Council:

I am submitting herewith a dissertation written by Jae Kyung Hong entitled "Effects and Elasticities of Import Demand, Domestic Output and Factors of Production for U.S. Textiles and Apparel." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.



Carl L. Dyer, Major Professor

We have read this dissertation
and recommend its acceptance:



Accepted for the Council:



Associate Vice Chancellor
and Dean of The Graduate School

EFFECTS AND ELASTICITIES OF IMPORT DEMAND, DOMESTIC OUTPUT AND
FACTORS OF PRODUCTION FOR U.S. TEXTILES AND APPAREL

A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville

Jae Kyung Hong

December, 1993

DEDICATION

This dissertation is dedicated to

my father (홍성수),

my mother (박중수),

my late father-in-law (안명규), and

my mother-in-law (나명복);

and especially, my mother's 70th birthday.

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I am grateful to all of my family, especially my parents for their unfailing love, encouragement and support. I wish to extend my deep gratitude to my wife, Sung Eui, for her faith, sacrifice and support. I give my best wishes to my daughter, Su Mi, and my second baby who will be born in December 1993.

ABSTRACT

The general purpose of this study was to develop and examine models to better understand the impacts of textile and apparel imports upon the determinants of textile and apparel import demand, upon the U.S. domestic textile and apparel production levels and upon the principle factors of the production in the U.S. domestic textile and apparel industries. A more specific objective was to estimate the elasticities of U.S. import demand for textiles and apparel, of U.S. domestic output of textiles and apparel, and of selected major production resources for U.S. domestic textile and apparel industries. The three types of models estimated for textiles and apparel were import demand models, output models and input demand models.

The data used in this study were monthly time series for the time period from January 1970 to September 1991. Most of the data were taken primarily from published secondary data, and some were collected from unpublished data provided by the United States Government agencies.

The level of imports demanded was hypothesized to be related to import price, domestic price, disposable personal income, and level of imports in previous time periods. The level of domestic output was supposed to be relate to level of total employment, capital utilization rate, domestic price, inventories, capacity and the level of imports. The each level of five selected factors (total employment, labor utilization rate, capital utilization rate, capital stock and

inventories) of production was expressed as a function of each level of five selected factors of production, level of total products, ratio of factor prices, and time trend.

The estimated results were reasonable, statistically significant and economically meaningful for the most part. Therefore, the estimated elasticities in this study can help to better understand the effects of textile and apparel imports on the American consumer, producer, worker, industry and to some degree the United States economy.

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CHAPTER I

INTRODUCTION

1. Statement of the Problems

Imported textile and apparel items have become increasingly popular at the United States marketplace in recent years. Within the past decade these imports from low-wage, developing countries have increased drastically in many textile and apparel categories. Today, textile and apparel imports compete with items produced in the United States that are very similar in fiber content and style. For example, imported apparels are present in virtually all categories and price lines, including those carrying expensive, prestigious brand names.

According to the Textile Hi-Lights (1993), more imported items are sold in the U.S. markets than comparable domestic apparels. It is estimated that 61.3% of the apparel in the U.S. marketplace is now imported. Table 1.1 shows the import penetration percentage of U.S. textile and apparel markets.

At one time, textile and apparel imports were considered to be desirable items that were too expensive to produce efficiently in the United States. However, textile and apparel imports from foreign countries have long been a source of frustration for American textile and apparel producers. Recently, their concern has mounted as import levels have sky-rocketed. A serious problem confronting the nation is its ever-increasing trade deficit, with the textile and apparel trade playing a significant role in this unbalance. According to the

Table 1.1. Import Penetration Percentage of U.S. Textile and Apparel Markets

Year	Textiles (SME)		Apparel (SME)		Import Penetration	
	U.S. Market	Imports	U.S. Market	Imports	Textiles	Apparel
1973	24,759	4,285	13,006	3,607	17.3%	27.7%
1974	23,607	3,688	12,417	3,123	15.6%	25.1%
1975	22,603	3,199	12,006	2,801	14.2%	23.3%
1976	24,450	4,169	12,947	3,610	17.1%	27.9%
1977	25,376	4,160	13,415	3,570	16.4%	26.6%
1978	25,948	4,799	13,560	4,144	18.5%	30.6%
1979	25,524	3,879	13,146	3,334	15.2%	25.4%
1980	24,262	4,084	12,746	3,548	16.8%	27.8%
1981	24,136	4,828	12,882	4,160	20.0%	32.3%
1982	23,664	4,962	13,077	4,232	21.0%	32.4%
1983	25,648	6,442	13,716	5,178	25.1%	37.8%
1984	27,209	8,543	14,500	6,655	31.4%	45.9%
1985	27,780	9,282	14,771	7,165	33.4%	48.5%
1986	29,421	11,246	15,801	8,797	38.2%	55.7%
1987	30,193	11,500	16,069	9,019	38.1%	56.1%
1988	29,709	10,714	15,808	8,400	36.1%	53.1%
1989	31,179	12,112	16,825	9,507	38.8%	56.5%
1990	29,988	12,164	15,939	9,465	40.6%	59.4%
1991	30,018	12,771	16,286	9,986	42.5%	61.3%
1992	32,840	14,528	17,784	11,420	44.2%	64.2%

Source: ATMI, based on data from the National Cotton Council and the U.S. Department of Commerce. Data are in millions of square meter equivalents (SME).

statistical figures released by the U.S. Department of Commerce (1993), the United States recorded its 37th consecutive annual textile and apparel trade deficit. In 1992 this deficit reached \$31.3 billion, 18.8% higher than in 1991. The textile and apparel imports have increased from about \$4.3 billion in 1974 to approximately \$41.2 billion in 1992. It is estimated that these imports increased almost 958 percent within 20 years. During the same period the combined textile and apparel trade deficit has grown from about \$2.1 billion in 1974 to almost \$31.3 billion in 1992; that is, the trade deficit has increased 1,490 percent for 20 years. The U.S. textile and apparel trade is tabulated in Table 1.2.

Generally speaking, the growth of textile and apparel imports in the United States is related to the lower wholesale prices of textile and apparel products in developing countries such as Hong Kong, Taiwan, Thailand, and China, where lower labor costs make them much more price competitive than products made in the United States. Average hourly wages in the U.S. textile and apparel industries in 1984 were listed at \$8.60 as compared to \$1.65 in Hong Kong, \$1.64 in Taiwan, \$0.56 in Thailand, and \$0.16 in China (Norum and Clark, 1989). These low wages and resulting low prices have brought about high import penetration because approximately one-third of cost of the U.S. produced textiles and apparels consists of wages and salaries. Therefore, rapid increases in the levels of textile and apparel imports have had an adverse impact on the domestic textile and apparel industries. For example, textile and apparel

Table 1.2. U.S. Textile and Apparel Trade

Year	Textiles & Apparel		
	Imports	Exports	Trade Balance
1974	4,269	2,195	-2074
1975	4,162	2,028	-2134
1976	5,726	2,480	-3246
1977	6,432	2,567	-3865
1978	8,508	2,902	-5606
1979	8,690	4,120	-4570
1980	9,525	4,834	-4691
1981	11,258	4,851	-6407
1982	11,703	3,737	-7966
1983	13,752	3,168	-10584
1984	19,387	3,169	-16218
1985	21,330	3,121	-18209
1986	24,705	3,469	-21236
1987	28,885	4,089	-24796
1988	29,624	5,227	-24397
1989	32,442	5,984	-26458
1990	33,708	7,415	-26293
1991	35,038	8,697	-26341
1992	41,165	9,849	-31316

Source: U.S. Department of Commerce, FT-135, FT-140, SITC Classification 65 & 84. Data are in millions of dollars.

industries experienced a 10% unemployment rate in 1992 as compared to an 8.2% annual average unemployment rate for all manufacturing industries (Employment and Earnings, 1993).

Today, Asian textile and apparel manufacturers are establishing production facilities in Caribbean countries such as Haiti, Jamaica, Dominican Republic and Costa Rica. These Caribbean Basin Initiative countries enjoy duty-free and quota-free access to the United States markets.

Domestic textile and apparel manufacturers and labor unions have helped enact three major steps to counteract the problems mentioned above. First, all textile and apparel products are required by law to be labeled conspicuously as to the country of origin. This has made American-made products more easily identifiable since they were not previously required to carry such a label prior to December 1984.

Second, "Made in U.S.A." and "Buy American" campaigns promoting domestically-made merchandise have been developed. These campaigns, directed at retailers as well as consumers, are some of the advertising campaigns in the apparel industry.

Third, U.S. textile and apparel industry leaders have fought for tariffs, quotas, and other measures to protect the domestic sector from the influence of imports. Thus, intense pressure has been put on legislators to take restrictive action against imports. Economists, on the other hand, suggest that trade barriers should be minimized because they believe that free trade benefits the

consumer. Many economic experts believe that lower income Americans in particular benefit from the availability of low-cost imported products. There is no easy answer to the issue of limiting imports; it is a complex matter which involves not only economic considerations but also many global political and social concerns. The United States is concerned both with maintaining political goodwill as well as an altruistic stance in assisting developing countries - along with the maintenance of its own domestic industries.

In conclusion, this research focused upon the problems enumerated above. This study attempted to investigate the effects of textile and apparel imports on the American consumer, producer, worker, industry and to some degree the U.S. economy.

2. Purpose of the Study

The general purpose of this study was to develop and evaluate models to better understand the impacts of textile and apparel imports upon the determinants of textile and apparel import demand, upon the principle factors of the production and upon production levels in the United States domestic textile and apparel industries. A more specific purpose was to estimate the elasticities of U.S. import demand for textiles and apparel, of U.S. output of textiles and apparel, and of selected production resources for domestic U.S. textile and apparel industries. The three types of models estimated for textiles and apparel were: (1) import demand models, (2) output models, and (3) input demand

models. The first model estimated the direct price elasticity of import demand, cross price elasticity of import demand, and income elasticity of import demand. The second model estimated the total employment elasticity of domestic output, capital utilization rate elasticity of domestic output, direct price elasticity of domestic output, inventory elasticity of domestic output, capacity elasticity of domestic output, and import elasticity of domestic output. Finally, the third model evaluated the input elasticities of several major production factors in the United States domestic textile and apparel industries. These production factors include: (1) total employment, (2) labor utilization rate, (3) capital utilization rate, (4) capital stock, and (5) inventories.

In this study, attempts were made to provide valuable insights and to obtain reasonable and significant parameters of the models that were briefly introduced above. Such information is needed, and hopefully some progress can be made herein.

3. Hypotheses

The following hypotheses were established in relation to the import demand models, output models, and input demand models.

H1: The level of textile imports is related to textile import price, producer price of domestic textiles, disposable personal income, and level of textile imports in previous time period(s).

H1a: The level of textile imports is related to textile import price, producer price of domestic textiles, disposable personal income, and level of textile imports in time periods $t-1$ and $t-6$.

H1b: The level of textile imports is negatively related to textile import price, positively to domestic textile price, positively to disposable personal income, positively to level of textile imports in time period $t-1$, and negatively to the level of textile imports in time period $t-6$.

H2: The level of apparel imports is related to apparel import price, domestic apparel price, disposable personal income, and level of apparel imports in previous time period(s).

H2a: The level of apparel imports is related to apparel import price, domestic apparel price, disposable personal income, and level of apparel imports in time periods $t-1$ and $t-6$.

H2b: The level of apparel imports is negatively related to apparel import price, positively to domestic apparel price, positively to disposable personal income, positively to level of apparel imports in time period $t-1$, and negatively to the level of textile imports in time period $t-6$.

H3: The level of domestic textile output is related to level of total textile employment, capital utilization rate, domestic price of textiles, textile inventories, capacity, and the level of textile imports.

H3a: The level of domestic textile output is related to textile employment, weekly average spindle hours, ratio of domestic textile price in time period t to

domestic textile price in time period $t-1$, ratio of textile inventories in time period t to textile inventories in time period $t-1$, capacity, and level of textile imports in time period t and time period $t-3$.

H3b: The level of domestic textile output is positively related to textile employment, positively to weekly average spindle hours, positively to the ratio of domestic textile price in time period t to domestic textile price in time period $t-1$, negatively to the ratio of textile inventories in time period t to textile inventories in time period $t-1$, positively to capacity, and negatively to the level of textile imports in time period t and time period $t-3$.

H4: The level of domestic apparel output is related to level of total apparel employment, capital utilization rate, domestic price of apparel, apparel inventories, capacity, and the level of apparel imports.

H4a: The level of domestic apparel output is related to apparel employment, weekly average spindle hours, ratio of domestic apparel price in time period t to domestic apparel price in time period $t-1$, ratio of apparel inventories in time period t to apparel inventories in time period $t-1$, capacity, and level of apparel imports in time period t and time period $t-3$.

H4b: The level of domestic apparel output is positively related to apparel employment, positively to weekly average spindle hours, positively to the ratio of domestic apparel price in time period t to domestic apparel price in time period $t-1$, negatively to the ratio of apparel inventories in time period t to apparel

inventories in time period $t-1$, positively to capacity, and negatively to the level of apparel imports in time period t and time period $t-3$.

H5: The level of total textile employment is a function of level of total textile employment, labor utilization rate, capital utilization rate, level of capital stock, level of textile inventories, level of total textile mill products, ratio of factor prices, and time trend.

H5a: The level of total textile employment is a function of level of total textile employment in time period $t-1$, average weekly hours of textile production workers in time period $t-1$, weekly average spindle hours in time period $t-1$, hours per active spindle in time period $t-1$, textile inventories in time period $t-1$, total textile mill products, ratio of factor prices, and time trend.

H5b: The level of total textile employment is a function of level of total textile employment in time period $t-3$, average weekly hours of textile production workers in time period $t-3$, weekly average spindle hours in time period $t-3$, hours per active spindle in time period $t-3$, textile inventories in time period $t-3$, total textile mill products, ratio of factor prices, and time trend.

H6: The labor utilization rate for textile production workers is a function of level of total textile employment, labor utilization rate, capital utilization rate, level of capital stock, level of textile inventories, level of total textile mill products, ratio of factor prices, and time trend.

H6a: The labor utilization rate for textile production workers is a function of level of total textile employment in time period $t-1$, average weekly hours of

textile production workers in time period t-1, weekly average spindle hours in time period t-1, hours per active spindle in time period t-1, textile inventories in time period t-1, total textile mill products, ratio of factor prices, and time trend.

H6b: The labor utilization rate for textile production workers is a function of level of total textile employment in time period t-3, average weekly hours of textile production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, textile inventories in time period t-3, total textile mill products, ratio of factor prices, and time trend.

H7: The capital utilization rate for textiles is a function of level of total textile employment, labor utilization rate, capital utilization rate, level of capital stock, level of textile inventories, level of total textile mill products, ratio of factor prices, and time trend.

H7a: The capital utilization rate for textiles is a function of level of total textile employment in time period t-1, average weekly hours of textile production workers in time period t-1, weekly average spindle hours in time period t-1, hours per active spindle in time period t-1, textile inventories in time period t-1, total textile mill products, ratio of factor prices, and time trend.

H7b: The capital utilization rate for textiles is a function of level of total textile employment in time period t-3, average weekly hours of textile production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, textile inventories in time period t-3, total textile mill products, ratio of factor prices, and time trend.

H8: The level of capital stock for textiles is a function of level of total textile employment, labor utilization rate, capital utilization rate, level of capital stock, level of textile inventories, level of total textile mill products, ratio of factor prices, and time trend.

H8a: The level of capital stock for textiles is a function of level of total textile employment in time period $t-1$, average weekly hours of textile production workers in time period $t-1$, weekly average spindle hours in time period $t-1$, hours per active spindle in time period $t-1$, textile inventories in time period $t-1$, total textile mill products, ratio of factor prices, and time trend.

H8b: The level of capital stock for textiles is a function of level of total textile employment in time period $t-3$, average weekly hours of textile production workers in time period $t-3$, weekly average spindle hours in time period $t-3$, hours per active spindle in time period $t-3$, textile inventories in time period $t-3$, total textile mill products, ratio of factor prices, and time trend.

H9: The level of textile inventories is a function of level of total textile employment, labor utilization rate, capital utilization rate, level of capital stock, level of textile inventories, level of total textile mill products, ratio of factor prices, and time trend.

H9a: The level of textile inventories is a function of level of total textile employment in time period $t-1$, average weekly hours of textile production workers in time period $t-1$, weekly average spindle hours in time period $t-1$,

hours per active spindle in time period t-1, textile inventories in time period t-1, total textile mill products, ratio of factor prices, and time trend.

H9b: The level of textile inventories is a function of level of total textile employment in time period t-3, average weekly hours of textile production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, textile inventories in time period t-3, total textile mill products, ratio of factor prices, and time trend.

H10: The level of total apparel employment is a function of level of total apparel employment, labor utilization rate, capital utilization rate, level of capital stock, level of apparel inventories, level of total apparel products, ratio of factor prices, and time trend.

H10a: The level of total apparel employment is a function of level of total apparel employment in time period t-1, average weekly hours of apparel production workers in time period t-1, weekly average spindle hours in time period t-1, hours per active spindle in time period t-1, apparel inventories in time period t-1, total apparel products, ratio of factor prices, and time trend.

H10b: The level of total apparel employment is a function of level of total apparel employment in time period t-3, average weekly hours of apparel production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, apparel inventories in time period t-3, total apparel products, ratio of factor prices, and time trend.

H11: The labor utilization rate for apparel production workers is a function of level of total apparel employment, labor utilization rate, capital utilization rate, level of capital stock, level of apparel inventories, level of total apparel products, ratio of factor prices, and time trend.

H11a: The labor utilization rate for apparel production workers is a function of level of total apparel employment in time period $t-1$, average weekly hours of apparel production workers in time period $t-1$, weekly average spindle hours in time period $t-1$, hours per active spindle in time period $t-1$, apparel inventories in time period $t-1$, total apparel products, ratio of factor prices, and time trend.

H11b: The labor utilization rate for apparel production workers is a function of level of total apparel employment in time period $t-3$, average weekly hours of apparel production workers in time period $t-3$, weekly average spindle hours in time period $t-3$, hours per active spindle in time period $t-3$, apparel inventories in time period $t-3$, total apparel products, ratio of factor prices, and time trend.

H12: The capital utilization rate for apparel is a function of level of total apparel employment, labor utilization rate, capital utilization rate, level of capital stock, level of apparel inventories, level of total apparel products, ratio of factor prices, and time trend.

H12a: The capital utilization rate for apparel is a function of level of total apparel employment in time period $t-1$, average weekly hours of apparel

production workers in time period t-1, weekly average spindle hours in time period t-1, hours per active spindle in time period t-1, apparel inventories in time period t-1, total apparel products, ratio of factor prices, and time trend.

H12b: The capital utilization rate for apparel is a function of level of total apparel employment in time period t-3, average weekly hours of apparel production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, apparel inventories in time period t-3, total apparel products, ratio of factor prices, and time trend.

H13: The level of capital stock for apparel is a function of level of total apparel employment, labor utilization rate, capital utilization rate, level of capital stock, level of apparel inventories, level of total apparel products, ratio of factor prices, and time trend.

H13a: The level of capital stock for apparel is a function of level of total apparel employment in time period t-1, average weekly hours of apparel production workers in time period t-1, weekly average spindle hours in time period t-1, hours per active spindle in time period t-1, apparel inventories in time period t-1, total apparel products, ratio of factor prices, and time trend.

H13b: The level of capital stock for apparel is a function of level of total apparel employment in time period t-3, average weekly hours of apparel production workers in time period t-3, weekly average spindle hours in time period t-3, hours per active spindle in time period t-3, apparel inventories in time period t-3, total apparel products, ratio of factor prices, and time trend.

H14: The level of apparel inventories is a function of level of total apparel employment, labor utilization rate, capital utilization rate, level of capital stock, level of apparel inventories, level of total apparel products, ratio of factor prices, and time trend.

H14a: The level of apparel inventories is a function of level of total apparel employment in time period $t-1$, average weekly hours of apparel production workers in time period $t-1$, weekly average spindle hours in time period $t-1$, hours per active spindle in time period $t-1$, apparel inventories in time period $t-1$, total apparel products, ratio of factor prices, and time trend.

H14b: The level of apparel inventories is a function of level of total apparel employment in time period $t-3$, average weekly hours of apparel production workers in time period $t-3$, weekly average spindle hours in time period $t-3$, hours per active spindle in time period $t-3$, apparel inventories in time period $t-3$, total apparel products, ratio of factor prices, and time trend.

CHAPTER II

REVIEW OF LITERATURE

1. U.S. Protection and Trade for Textiles and Apparel

The textile and apparel industries have taken measures to secure protection from imports since the late 1950s. For instance, the textile industry has repeatedly returned to the government to request additional trade assistance for protection every two or three years. The textile industry was virtually the lone petitioner in the 1960s; by the mid-1970s, it was textiles and steel; by the late 1970s, it was textiles, steel, televisions, and footwear; and by 1985, more than sixty separate industry groups had filed at least one petition in two or more years between 1975 and 1985 (Coleman & Yoffie, 1990). In fact, it happened that most of the increase in demand for protection occurred during the Reagan administration. On September 28, 1988, President Reagan vetoed a bill that would restrict imports of textiles, apparel, and shoes, stating that bill "would have disastrous effects on the U.S. economy" and "impose needless costs on American consumers, threaten jobs in our export industries, jeopardize our overseas farm sales and undermine our efforts to obtain a more open trading system for U.S. exports." (Hume, 1988). On October 4, 1988, the U.S. House of Representative failed to override the President veto (Langley, 1988).

The first major restraint as a means of settling a trade dispute was the agreement that limited Japanese textile exports to the United States in 1936.

Japanese exports of cotton textiles had risen sharply from 1.22 million square yards in 1929 to 7.29 million square yards in 1936. By the end of 1937, Japanese exports were estimated to be almost 150 million square yards. At this point American textile producers sought a quick means by which to stem the surge of Japanese exports. Negotiations between representatives of producers from both countries, which were concluded in late 1936, resulted in a "gentlemen's agreement" between the two national industries and apparently had the consent of both governments. It set yearly limits of 155 million square yards of cotton textile product exports in 1937 and 100 million square yards in 1938. In late 1938 the agreement was renewed for two more years, allowing for 100 million square yards per year in 1939 and 1940. Separate quota agreements were also conducted on cotton rugs, velveteens and corduroys, and cotton hosiery (Jones, 1989). In 1957, the United States and Japan negotiated a Voluntary Export Restraints (VER) agreement. The VER limited textiles exports for a period of five years, pursuant to the Agriculture Act of 1956, in which Congress granted the Eisenhower administration power to negotiate agreements restricting textile product imports into the United States. As a result of this agreement and Japan's voluntary cut-backs on cotton textile exports to the United States, major changes occurred in U.S. suppliers of cotton textiles. Between 1958-1960, the developing countries of Portugal, Spain, and Egypt emerged as new exporters, and Hong Kong became the largest new exporter. As the United States marketplace experienced rapidly increasing cotton textile

imports from developing countries, requests by domestic producers for a more comprehensive textile trade restriction policy increased (Preusse, 1991).

However, tariffs or quotas on imports would have been contrary to U.S. efforts to liberalize international trade and inconsistent with the General Agreement on Tariffs and Trade (GATT), which was created in 1947. The GATT was designed to promote a continuing reduction of trade barriers and to guarantee the openness of the international trading system. The basic GATT rules are as follows: GATT (1) prohibits discrimination among contracting parties; (2) eliminates quantitative restrictions except under special circumstances; (3) prohibits other non-tariff forms of trade restrictions, such as discriminatory internal regulations; and (4) mandates that tariffs, applied on a nondiscriminatory basis, should function as the principal means of regulating international trade and should be gradually eliminated through successive negotiating rounds.

In the mid-1950s, textiles and apparel industries were the largest employers (more than two million workers) in the manufacturing sector in the United States. Although textiles was more capital-intensive than apparel, both industries could be classified as labor-intensive in the 1950s with relatively low barriers to entry. Capital requirements were low compared to industries like steel, automobiles and consumer electrics; and technology, raw materials, and equipment were readily available. Under these conditions, a single bilateral agreement between the United and Japan would quickly attract new entrants.

With low barriers to entry, non-Japanese exporters could easily penetrate the U.S. marketplaces, making it difficult to protect the U.S. markets effectively. For that reason, imports should increase, the profitability of U.S. manufacturers should remain low, and the request for protection should increase. In fact, the 1957 VER failed to protect the U.S. domestic producers. Asian exports of cotton manufacturers passed over the U.S. protection boundary. The combination of increasing imports and profits well below the manufacturing average led both textile and apparel industries to step up their demand for protection. Hence, not only was the demand for protection higher, but also the government became increasingly willing to support it.

The proposal by the Kennedy administration to extend textile restrictions in 1961 was so-called the Short-Term Arrangement on Cotton Textiles (STA). This agreement authorized the contracting countries to enter into bilateral agreements when textile imports caused or threatened to cause market disruption in the importing country. The STA was replaced by the Long-Term Arrangement on Cotton Textiles (LTA), which was in effect for five years. In addition to allowing the negotiation of bilateral restraint agreements, the LTA permitted the limitation of imports from countries with which it was not possible to negotiate a comprehensive bilateral agreement. Both the STA and LTA were originally enacted as temporary measures to protect importing countries. But, the LTA was broadened in 1974 to include other textiles under the Arrangement Regarding International Trade in Textiles, the so-called Multifiber Arrangement (MFA). The

MFA was considered to be essentially permanent and allowed for annual growth of 6% in restricted trade (Murray, Schmidt & Walter, 1978).

As new exporters continued to enter the U.S. market in the 1960s, import penetration continued to increase from 6% of the cotton market in 1960 to 12% in 1969. Because the LTA only covered trade in cotton textiles, many exporters more significantly changed to unrestrained fabrics (wool, man-made fibers, and blends) to avoid the LTA. Although importing countries could negotiate limitations on man-made fiber on bilateral basis outside the LTA framework, imports rose rapidly both in quantity and in value. For instance, man-made fiber imports rose from 213 million square yard equivalents (SYE) in 1962 to 1,453 million SYE in 1968. Imports of wool products rose from 141 to 210 million SYE in the same period. A similar rapid rise took place in apparel imports. Eventually, it was necessary to expand the LTA to include these fibers. This pressure led to the negotiations of a multifiber agreement, the MFA.

The consequence of greater government willingness to supply protection and the increasing demands for trade barriers was the Multifiber Arrangement (MFA) of 1974. The MFA was a framework of Voluntary Export Restraints (VER) regulating textile and apparel exports of most developing countries entering nearly all major industrial markets. The main objective of the MFA was bilaterally negotiated quotas in narrowly defined product categories. The 1974 MFA was extended three times, and subsequent renewals of the MFA in 1977, 1981, and 1986 were transformed into one of the most powerful protection

measures of the postwar era. The MFA covered products made of man-made fibers, wool, silk, and vegetable fibers, as well as cotton. More than half of all textile fibers, textiles and apparel imported from developing countries by industrial nations was subject to MFA quotas (Erzan, Goto & Holmes, 1990). In reality, the MFA was one of the most comprehensive and discriminatory deformations in the international trading system. The MFA discriminated against developing countries' most important manufactures and contradicted the spirit of the GATT (Erzan and Holmes, 1990).

During the years of MFA I (1974-1977) and MFA II (1978-1981), the system seemed to work tolerably well, at least from the perspective of domestic industries. Imports grew by an average annual rate of one percent under MFA I and 4.8 percent under MFA II. However, during the period of MFA III (1982-1986), the system did not appear to restrain imports. Imports grew at an average annual rate of over 15 percent, and import growth far exceeded the growth of the U.S. markets. As a result, textile and apparel import penetration climbed dramatically from 1980 to 1986. The sharp increase in imports caused severe economic dislocation. Employment in the textile and apparel industries declined by 238,000 workers between 1981 and 1985. The surge in imports exposed several weaknesses in the system of textile restraints under the MFA. The major weakness from a protectionist perspective was the absence of limits on aggregate import growth (Greenwald & Hoing, 1987).

With the signing of MFA IV in 1986, and the start of the Uruguay Round, the question of the impact of the MFA on developing country exporters had been raised; that is, the MFA restraints had been ineffective. Since the MFA agreement with an individual country did not always limit exports from all textile and apparel product categories, a country restricted in some categories could simply shift to selling more of the unrestrained product categories. Low fulfillment levels of quotas on individual categories for many countries suggested that the MFA had not been a binding constraint. Furthermore, it was argued that the restriction of major exporters had merely diverted demand toward smaller exporting countries (such as Indonesia, Malaysia, Pakistan, Philippines, Bangladesh and Sri Lanka), thus failing to inhibit the growth of aggregate U.S. imports from these countries (Dean, 1990).

Several studies, however, argued that the MFA had prevented developing countries exports to the industrial nations. Wolf (1983) contented that developing countries' share of textile exports to North America and Western Europe had remained constant for two decades, while their share of apparel exports peaked in 1976 and had fallen thereafter. Cline (1987) emphasized that despite the lack of comprehensive coverage of the MFA, the U.S. textile imports had grown at an average rate below the target 6%, and its apparel imports have averaged only 1% above the target since the early 1970s.

However, despite the increasing number of protection measures and the growing restrictiveness, the textile and apparel industries' low barriers to entry

had made it impossible to stem imports. The restrictions simply failed to halt the decline in U.S. textile and apparel employment or improve the competitive position of textile and apparel producers. Today, Japanese and East Asian producers have increasingly moved up-market into middle-range goods, while Association of South East Asian Nations (ASEAN) countries and other less-developed nations have taken over the lower end of the market. The U.S. manufacturers that have not found higher-fashion, higher-price-market niches, have been increasingly forced to exit. The result is that the U.S. textile and apparel industries have run a trade deficit over 30 years (Textile-High Lights, 1993). Actually, the bilateral trade deficit between the United States and Japan had long been a serious issue for the U.S. administration and a major cause for overall trade problem. That same concern was being raised with respect to the Asian Newly Industrializing Countries (NICs): Hong Kong, Singapore, South Korea, and Taiwan. For example, the basis of U.S. concern was seen in the trade unbalance. In 1986 the U.S. ran a \$30.8 billion trade deficit with the four NICs - \$6.5 billion with Hong Kong, \$1.5 billion with Singapore, \$7.1 billion with South Korea, and a surprising \$15.7 billion with Taiwan. This amounted to 18.1 percent of the total U.S. trade deficit of \$169.8 billion. While the trade deficit with Japan at \$58 billion was greater than the sum of the four countries, the NICs' contribution was still substantial and worrisome (Krause, 1987).

Generally speaking, the U.S. textile and apparel industries have experienced rising levels of import penetration and trade deficit and increasing

the demand for protection since the late 1950s. But, after more than 30 years of extraordinary protection, the cost of textile and apparel protection falls mainly on consumers. The 1987 study by Cline estimated that the consumer cost of import quotas and tariffs on textiles and apparel for 1986 was \$20.344 billion. These consumer costs resulted from a higher price for imports (21.9 percent higher for textiles and 34.6 percent higher for apparel), a higher price for domestic products (3.1 percent higher for textiles and 18.9 percent higher for apparel), and a smaller quantity of imports (29.8 percent lower for textiles and 56.7 percent lower for apparel). The total cost of \$20.344 billion could be translated into a cost of \$238 per year for every American household. Only a fraction of this amount was recouped by American workers and industries. The quotas and tariffs also affect domestic businesses that buy textiles and apparel as intermediate products. For example, textile quotas could hurt the domestic auto industry by increasing the cost of automobile interiors. Apparel quotas also increase costs of the retail apparel market. The result is higher retail prices for buyers of apparel and fewer jobs in the retail sector.

Because protection raises the price of each category of imported and domestic textile and apparel products, producer prices of imported textiles and apparel have been higher than they would have been, and prices of domestic substitutes have also been higher. The increases attributable to protection were 3.1 percent for textile and 18.9 percent for apparel in 1986. Cline(1987) also calculated the ratio of the consumer cost of protection to the value of jobs saved

in the textile and apparel industries. The consumer cost was 3.8 times the value of jobs saved for textiles and 4.1 times the value of jobs saved for apparel. An implication of this result was that consumers should be able to compensate the textile and apparel workers under the free trade system rather than the protective system. Thus, import restrictions were a very expensive way of avoiding unemployment in textile and apparel industries. In fact, employment has declined in the U.S. textile and apparel industries in spite of quotas and tariffs. Declining employment in the U.S. textile and apparel industries is part of a broader pattern of decline textile and apparel employment, and the trend is likely to continue regardless of what happens to the quotas and tariffs. Even though textile and apparel employment has declined, the national unemployment rate had declined from 9.5 percent in 1982 to less than 6 percent in 1988.

In the aggregate, it is time to change the direction of textile and apparel trade policy because the costs of quotas and tariffs are so large relative to worker benefits. Textile and apparel trade should return to compliance with the GATT rules, and import restraints should be determined by economic considerations rather than political forces.

2. Consumers' Views toward Imported Apparel

The United States, along with most other developed countries, has experienced in recent years a major influx of imported textile and apparel products. Most of these imports have come from the Third World countries

where labor is plentiful and cheap. Because of the minimal capital requirements and the labor-intensive nature of the textile and apparel industries, it is usually one of the first manufacturing enterprises to be established in developing country. Textile and apparel products, then, become the major export commodities for economic development of the Third World countries.

The increasing flow of textile and apparel imports into the United States marketplace over the years has injured domestic textile and apparel producers. One method used by domestic American producers to counter the large influx of imports was with a labelling program that was initiated in the early 1980s. Labels stating "Made in U.S.A." are now more widely used by domestic producers, and consumers have been coached by media promotions to look for these labels in the textile and apparel items they purchase as symbols of quality. In the U.S. marketplace, consumers of apparel have indicated their opinion by purchasing either imported or domestic products.

Dickerson (1982) found that nearly 48% of the consumers said they carefully noticed whether apparel goods they bought were produced in the U.S. or another country and approximately 25% said they sometimes noticed. The majority (64%) perceived imported apparel as not being of equal quality to that produced in the United States. A majority said it was important or somewhat important to them that apparel which they bought had been produced in the U.S. However, many did not give concise answers as to why they did or did not buy imported apparel. Perhaps many consumers did not have a clear picture in their

own minds as to the specifics of why they prefer or dislike imported apparel. This result indicated that many consumers may be indifferent to whether apparel products were imported or domestically produced.

McLean, Roper and Smothers (1986) conducted a study of consumer perceptions of imported apparel, specially blouses. This study was composed of two groups of female consumers. Group I consisted of students, and Group II was composed of elderly members of women's clubs. The women in Group II expressed a stronger preference for American-made blouses than did the students in Group I. This might indicate that American-made products have less appeal for younger consumers than for old consumers. However, this study indicated that whether a blouse was produced in the United States or in a foreign country apparently had little influence on purchase considerations by both groups.

Atkins and Jenkins (1988) examined the attitudes and practices of retail buyers of imported ladies' sportswear. Buyers of ladies' sportswear indicated that they did not notice whether or not they bought items produced in the U.S. or in other countries. Of the buyer respondents, 75% reported they always noticed, 17% sometimes noticed. These buyers appeared to be much more aware of buying imports than the consumers studied by Dickerson (1982). The buyers were about equally divided in their opinion on whether imported apparel actually hurt the domestic apparel industry, with 48% indicating it did and 45% giving the opposite opinion. The most important reason for thinking imports hurt the domestic industry was "better quality for price overseas." Quality of imported

apparel compared to items produced in the United States was rated "better" by 35% of buyers and "equal" by 38%. On the other hand only 10% of the consumers in Dickerson's study (1982) perceived imported apparel as being higher quality than apparel produced in the U.S. These findings suggested that the foreign apparel producers had endeavored to satisfy consumer wants and demands at competitive prices, and apparel imports had become more fashion-oriented and better in quality during the previous decade.

Bereron and Carver (1988) sought to determine whether students had specific preferences for apparel produced domestically. Of the respondents, 29% reported reading country of manufacture labels as compared to 46% indicating that they never read it. This result indicated that country of manufacture was considered as the least important factor by most of the respondents (71%). In this study, only 8% perceived U.S. apparels as being of better quality. Thus, the majority of respondents did not perceive any clear differences. This meant that the ability of foreign firms to satisfy consumer wants and demands at competitive prices is given as the reason for increasing apparel imports. Participants in this study also indicated that concern for the industry would influence their buying habits. About 76% of the students felt that imports threaten domestic industries and would consider purchasing domestic apparels for patriotic reasons (i.e., to help sustain the domestic industry).

Dardis, Spivak and Shih (1985) examined price and quality differences between domestic and imported apparel. In their study, statistical analysis was

used to determine whether price and quality were significantly different between national and private brands or domestic and imported brands. The major findings of this study showed that significant price differences existed between domestic and imported brands in the pre-sale period, and no major quality differences existed between domestic and imported shirts. The results of this study also indicated that brand and store types significantly influenced price during the pre-sale period, but there were no major differences between national and private brands. It was also interesting to note that the mean price of imported men's shirts was 11% less than domestic shirts while the sale price of the imported shirts was 4% less than the sale price of domestic shirts. In general, these results suggested that brand and store types, origin, and time of purchase had an important effect upon prices paid by consumers.

In putting these several studies together, we can observe the following conclusions. A majority of the consumers were aware of the penetration of imported apparel into the U.S. markets, perceived correctly that a trade deficit existed in the this commodity area, and also knew that there was a comparative wage advantage for importing countries. Similarly, a majority of the consumers saw imported apparel as damaging to the United States industry and expressed concern over this. A majority also favored passing stronger laws to limit imported apparel. The consumers' views that laws should further restrict imports were related to concerns for the U.S. industry rather than to perceptions of unbalance of trade status.

A majority of the consumers also indicated that their purchases of apparel were influenced by their concern for the domestic industry and that they considered it important that items they bought had been produced in the U.S. These views were contrary to the theory of comparative advantage, which suggests that consumers benefit from buying goods produced where they can be made least expensively. The economists may very well say that the consumers' views of loyalty and preference for the U.S. goods may be not be in the consumers' best interest. There is also a chance that consumers' views expressed in the studies show that consumers were actually less concerned than they indicated they were because they thought they should answer in a manner favorable to domestically produced textiles and apparel.

Although the U.S. consumers preferred domestically produced apparel, a majority of the consumers had obviously encouraged the influx of imported apparel products by buying them. It is possible that the consumers' actual buying patterns are not consistent with the preference the majority expressed for the U.S. products.

Actually, consumers did not have a definite preference for apparel made domestically over imported apparels. Most consumers did not read country of manufacture labels before a purchase, they did not consider country of manufacture a significant factor in the buying of apparel, and they did not perceive a difference between domestic goods and imports. Also, most did not prefer to buy domestically produced apparels for any particular reason.

On the bright side, consumer buying habits seemed to be characterized by neutrality. Consumers were no more predisposed to buy imports than they were to buy domestically produced apparels. It should encourage producers that consumers had a positive view of the quality of domestically produced apparel, while they remained neutral toward imports. Furthermore, consumers were aware of the trade deficit in textile and apparel, felt that it was harmful to the domestic industries, and, most importantly, would consider buying more domestically produced apparel in order to help the U.S. industry.

3. Effects of "Made in U.S.A." and "Buy American" Campaigns

A number of producers are now promoting their goods as American-made. Two examples of this strategy are Plymouth's "Born in America" and Miller's "Made the American Way" campaigns. Perhaps the most extensive effort has been the "Made in U.S.A." campaign, sponsored by the Crafted With Pride in the U.S.A. Council. The purpose of this campaign is to convince consumers to look for and purchase apparel "Made in U.S.A."

According to the Knitting Times (1988), a study to measure certification mark awareness conducted by R.H. Bruskin Associates found 52% of the adult American population reported seeing the "Made in U.S.A." label. The Good Housekeeping Institute's Consumer Research Department interviewed 500 women about the quality of American-made apparel. Most these women considered "Made in U.S.A." apparel to be of better quality than apparel imported

from the Far East. Based on these results, it appears that the "Made in U.S.A." campaign has had an effect on consumer attitudes. Little is known, however, about its impact on consumer's buying patterns.

Ettenson, Wagner and Gaeth (1988) conducted a conjoint analysis study which assessed consumer decision-making before and after the introduction of the "Made in U.S.A." campaign. In this study, while the majority of participants seemed to have positive attitudes toward domestically produced goods, country of origin had little effect on participants' decision-making. Another important finding was that the "Made in U.S.A." television promotion had little effect on the decision strategies of most of the participants.

Tolbert, Sternquist and Davis (1988) investigated how apparel buyers viewed the "Buy American" campaign. The results indicated that "Buy American" campaign, in general, had not greatly influenced apparel buyers to purchase domestically produced goods and that most buyers were not supportive of the campaign. Two additional interesting findings that emerged from this study were: (1) high-salary earners were less likely to begin promoting the "Buy American" campaign than were low-salary earners, and (2) older buyers were more favorable toward promoting the "Buy American" campaign than were younger buyers. These findings suggested that older buyers may have a stronger sense of patriotism toward domestically produced products. In addition, it is likely that older buyers still associate imported products with poor quality.

In summing up these studies, the following conclusions emerged.

American producers could bring about change of consumers' buying patterns by capitalizing on the consumers' perception of domestic apparel as high quality, their desire to have a healthy domestic textile and apparel industries, and their apparent willingness to contribute toward that purpose by the purchase of more domestically produced apparels. Consumer education by means of the most effective media is a very important tool that producers will want to use in order to let consumers know how much their support is needed. An appeal to patriotism should be considered, but producers will also have to remain committed to satisfying the consumer's primary needs for quality, fit and style of apparel.

4. Previous Import Demand Studies

Economist have paid a great deal attention to the theoretical and practical implications of import demand elasticities because of their importance in trade theory. Only a relatively small portion of the relevant studies will be reviewed in this section. The empirical models regarding the estimation of input demand elasticities typically relate the quantity of imports to importing country's level of real income, to the price of imports, and to the price of domestic import substitutes. Ball and Mavwah (1962) sought to estimate import demand functions for the United States, based on quarterly data, 1948-58. Total imports were divided into six groups - crude foodstuffs, crude materials, semi-

manufactures, manufactured foodstuffs, manufactures, and service. The basic analysis used was that variations in import demand were to be explained by variations in output or income and import prices relative to domestic prices. The single equation least squares method was used to obtain estimates of coefficients. The regression results showed that manufactured goods had the largest elasticity followed by manufactured foods and semi-manufactures, and about 50 percent of the United States imports fell into the elastic range with respect to relative prices. This study suggested that the United States imports were elastic with respect to both relative prices and to output, and relative prices were a significant determinant for the volume of imports of the United States.

Krein (1967) attempted to estimate the elasticity of substitution and import demand elasticities for several industrial countries, including the United States. The elasticities of substitution in international trade were computed for three groups of manufactures: chemicals (SITC 5), machinery and transport equipment (SITC 7), and other manufactures (SITC 6 and 8). Two interesting findings were: (1) the cross elasticity of demand in international trade was 2.6 times higher for SITC groups 6 and 8 (consumer goods) than for SITC groups 5 and 7, and (2) the elasticity of import demand for SITC groups 6 and 8 was 2.6 times that for SITC groups 5 and 7.

Houthakker and Magee (1969) estimated the demand elasticities with respect to price and income for both exports and imports of several developed countries. They used ordinary least-squares along with double logarithmic

equations. They also estimated the elasticities for the United States by country of origin or destination, and by commodity class. Their analyses followed the general lines of earlier works by Ball and Mavwah (1962) and Kreinin (1967). The result indicated that the long-run elasticities of income and price were low for crude foods and crude materials, while finished manufactures had high income and price elasticities. Their conclusions were: (1) the U.S. income elasticity of demand for total imports was about the same as that of other developed countries, but that the other countries' income elasticity of demand for the U.S. exports was abnormally low, and (2) the U.S. income elasticity of demand for imported finished manufactures was exceptionally high, in contrast to the demand of other countries for the United States finished manufactures.

Khan (1975) estimated import demand functions for aggregate imports and for nine commodity classes of imports for Venezuela. The results indicated that the price elasticities were significant at the 5 percent level, and ranged from -0.765 for machinery imports to -5.890 for furniture except for construction materials, tobacco and beverages. Thus, the relative prices and real income were adequate to explain a large proportion of the variation in Venezuelan imports. The weighted average elasticities of price and income were greater than those elasticities obtained from directly calculating the equation for aggregate imports. However, the calculated price elasticity suggested that the weighted average price elasticity had an upward bias.

Rousslang and Parker (1984) examined a method for estimating cross-price elasticities of import demand combining data on values of imports and domestic shipments with own-price import demand elasticities. The cross-price elasticities of import demand show how changes in the relative prices of imports from one country will affect demand for domestic output and for imports from other countries, and predict how tariff changes in one country will affect imports from different countries. Their study was particularly attempted to determine how U.S. tariff changes affected domestic output and imports.

The most common functional forms for import and export demand are either linear or log-linear formulations. Since economists have not provided any standards for selecting the appropriate function form, the question of selection then becomes an empirical problem. Khan and Ross (1977) attempted to decide empirically the appropriate form of the aggregate import demand equation for three major industrial countries - the United States, Canada and Japan. The results concluded that the log-linear functional form for the import demand equation is better than the linear form. Since the field of international trade relationships was primarily interested in estimating price and income elasticities, these elasticities could be directly calculated from the regression equation. Therefore, the log-linear form was convenient and made ease of interpretation.

Generally speaking, the use of a linear formulation for an aggregate import demand equation means a decreasing price elasticity of import demand and an income elasticity tending towards unity, on the other side, the use of a

log-linear functional form implies constant elasticities with respect to price and income. Theoretically this may be considered too restrictive.

Boylan, Cuddy and O'Muircheartaigh (1980) also tried to choose empirically the appropriate formulation of the aggregate import demand function, and to estimate a generalized import demand function for the three small European countries, Ireland, Denmark and Belgium. They found that the log-linear functional form was appropriate form for import demand equation. This study confirmed and generalized the earlier work of Khan and Ross (1977).

Burgess (1974) insisted that imports were not final goods which were separable from all other commodities in the utility function for consumer. The author felt that additional measures should be considered in combination with capital and labor in the import demand functions because imports consisted of intermediate goods. The study concluded that technology was not separable between inputs and outputs. The detailed empirical elasticities of substitution suggested that labor and capital were substitutes, labor and imports were substitutes, and capital and imports were complements. Thus, a change of output toward more consumption goods and less investment goods would raise the demand for labor services and lower the demand for both capital services and imports at given prices.

One of the primary reasons for studying estimates of U.S. import demand functions disaggregated by commodity groups and supplying countries is the importance to the formulation of trade policies of quantitative information on

income and price elasticities for trade volume. Kwack (1972) developed a quarterly model of the U.S. imports and exports and estimated the income and price elasticities for imports and exports disaggregated by types of commodity on the basis of the Standard International Trade Classification (SITC). The results indicated that import demand in the United States for foreign goods was explained in terms of real U.S. disposable income or output and relative U.S. wholesale prices, and export demand in the United States by foreign importers was dependent upon real income, relative U.S. export prices and U.S. government grants and loans. This study concluded that differences in elasticities between groups of commodities were substantial. For example, the income and price elasticities of the U.S. import demand for manufactured goods were higher than those for raw material and mineral goods. The income elasticity was higher for the U.S. import demand for foreign manufactured goods than for foreign import demand for the U.S. manufactured goods. The U.S. import demand was more elastic with respect to real income and relative prices than foreign demand for the U.S. exports.

Price and Thornblade (1972) presented a portion of estimations of import demand functions for the United States with respect to eleven developed countries and 26 product classes of manufactured goods at the 3-digit SITC level of aggregation. They concluded that price elasticities for import demand in several categories of steel were significant and large, and relative price for

manufactured imports did not demonstrate significant power in explaining import demand.

Krein (1973) examined the import demand elasticities for the U.S. estimated from import data disaggregated by commodity. This Study also presented the estimates for import demand elasticities of five European countries and five other OECD countries. In the Price and Thornblade (1972) study, they disaggregated U.S. imports only by commodity and not by country of origin. On the other hand, this study estimated the import demand elasticities disaggregated by supplied countries other than the United States. In this study, the independent variables were lagged one quarter behind the dependent variable, and the author tried to determine whether domestic demand pressure had an adverse influence on a country's manufactured exports, independent of price effects.

Yadav (1975) estimated empirically the import demand function at a relatively disaggregated level using quarter data, and tested the time-lagged adjustment. The study found that the relatively simple demand function could explain a considerable proportion of the variations in the Canadian volume of imports, and adjustment between actual and long-run import demand occurred in the first quarter, but on the other hand the adjustment was recorded by the end of the fourth quarter.

Khan (1974) presented estimates of aggregate import and export demand functions for 15 developing countries, and determined whether changes in prices

of trade and nontraded goods influenced on the trade flows of these countries. The results indicated that price elasticities of imports and exports were high, but income elasticities for both imports and exports were relatively low. The autocorrelation coefficient was more significant in the imports equations than in the export equations. This result confirmed that restrictions of individual country were more important in the determination of imports than of exports. It also appeared that the use of a static equilibrium model on an annual basis for industrial countries was justified by the equilibrium estimates.

Goldstein, Khan and Officer (1980) formulated a general import demand function with respect to import prices, tradable goods, and nontradable goods. This function was examined using price indices of tradable and nontradable goods to ascertain whether the price of nontradable goods was relevant empirically in the determination of the demand for imports. The major finding suggested that the price of nontradable goods was not a significant determinant of the demand for imports in most developed countries. Therefore, the price of tradable goods (using as the domestic price variable) was appropriate to estimate the relative price elasticity of the import demand.

CHAPTER III

RESEARCH METHOD AND DATA

1. Conceptual Theory

This section is a review of the theory of demand for imports, output, and factors of production. In the first stage we explain the theory of import demand model. In the second stage the theory of output model is described. Finally in the third stage the theory of input demand model is illustrated.

Import Demand Model

The import demand theory is derived from a consumer demand function. In general, economists assume that the quantity of a good demanded during a particular period depends upon four major variables: (1) the price of the good itself, (2) the prices of related goods, (3) the incomes of the consumers, and (4) the tastes of the consumers.

As we would expect, consumers are willing to buy more of a good the lower the price of the good, when the other variables are held constant. If the price of a good rises, consumers tend to change from that good to now relatively cheaper goods. On the contrary, if the price of a good falls, consumers tend to buy more of that good and less of other goods that are now relatively more expensive. Therefore, there is negative relationship between the quantity demanded of a good and the price of a good.

Next we look at the changes in income. Holding the other variables constant, an increase in income can cause the amount of a commodity demanded either to increase or to decrease. If an increase in income causes quantity demanded to increase, we refer to such a commodity as a normal good. Namely, income and quantity demanded vary directly. However, when an increase in income reduces the quantity demanded, this type of commodity is referred to as an inferior good.

Commodities may be related in demand in either of two ways: as substitutes or complements. If two goods are substitutes, an increase in the price of one good will increase the quantity demanded of the other good. Conversely, a decrease in the price of a substitute good will decrease the quantity demanded of the other good. If two goods are complements, an increase in the price of complementary good will decrease the quantity demanded of the other good, the price of the other good held constant.

A change in tastes or preferences can change the quantity demanded of a commodity, the other variables held constant. Clearly, taste changes could either increase or decrease the quantity demanded of a commodity. Given the difficulty of measuring tastes, economists usually assume that this variable is constant during the period of analysis.

The consumer demand function during a particular time period is generally specified as:

$$Q_{i,t} = f(P_{i,t}, P_{j,t}, Y_t, K) \quad (3.1)$$

where,

$Q_{i,t}$ = quantity demanded of good i in period t ,

$P_{i,t}$ = price of good i in period t ,

$P_{j,t}$ = price of related good j in period t ,

Y_t = consumers' incomes in period t ,

K = taste patterns of consumers, and

t = subscript denoting time period.

As discussed previously, the quantity demanded of good i will vary indirectly with the price of good i , whereas the quantity demanded of good i will vary directly with the price of related good j . The quantity demanded of good i will vary directly with the consumer income. However, the quantity demanded of good i will vary directly or indirectly with the taste patterns of consumers. If the taste patterns of consumers are positive, the quantity demanded of good i will vary directly with these variables. If the taste patterns of consumers are negative, the quantity demanded of good i will vary indirectly with these variables. But, we generally consider the taste variable to be constant.

Output Model

The output theory is derived from a disequilibrium domestic output equation presented by Pelzman and Martin (1981). In this equation, Pelzman and Martin presume that the domestic output during a particular period depends upon seven variables: (1) average hourly earnings of production workers, (2) rental price of capital, (3) relative price of imports (the ratio of the import price

to the domestic price), (4) real disposable income, (5) domestic price, (6) inventories, and (7) quantity of imports. Therefore, the domestic output function is as follows:

$$Q_{i,t} = f\{W_t, R_t, (PM_j/PD_i)_t, Y_t, (PD_{i,t}/PD_{i,t-1}), (I_{i,t}/I_{i,t-1}), M_{j,t-n}\} \quad (3.2)$$

where,

$Q_{i,t}$ = domestic production of commodity i in period t,

W_t = average hourly earnings of production workers in period t,

R_t = rental price of capital in period t,

$(PM_j/PD_i)_t$ = ratio of the import price of related commodity j to the domestic price of commodity i in period t,

Y_t = real disposable income in period t,

$(PD_{i,t}/PD_{i,t-1})$ = ratio of domestic price of commodity i in period t to domestic price of commodity i in period t-1,

$(I_{i,t}/I_{i,t-1})$ = ratio of inventory of commodity i in period t to inventory of commodity i in period t-1,

$M_{j,t-n}$ = quantity of imports demanded of related commodity j in period t-n,

t = subscript denoting time period, and

n = length of the time lag.

All things considered, the level of domestic production of commodity i will vary directly with the levels of the ratio of the import price to the domestic price, real disposable income, and ratio of domestic price to time-lagged domestic price while the level of domestic production of commodity i will vary indirectly with the levels of the average hourly earnings of production workers, rental price of

capital, and ratio of inventory in commodity i to time-lagged inventory in commodity i. Finally, the level of domestic production of commodity i will vary directly or indirectly with the level of time-lagged quantity of imports demanded of related commodity j. If imports of related commodity j serve to displace domestic production of commodity i, the level of domestic production of commodity i will vary indirectly with the level of time-lagged quantity of imports demanded of related commodity j. Conversely, if both domestic production of commodity i and imports of related commodity j are growing in response to an increase in demand for the commodity i, the level of domestic production of commodity i will vary directly with the level of time-lagged quantity of imports demanded of related commodity j.

However, we revise some variables to estimate the effect of textile and apparel imports on competing domestic products in this study. The revised domestic output function is as follows:

$$Q_t = f\{LE_t, CU_t, (P_t/P_{t-1}), (I_t/I_{t-1}), CP_t, M_{t-n}\} \quad (3.3)$$

where,

Q_t = domestic output in time period t,

LE_t = level of employment in time period t,

CU_t = capital utilization rate in time period t,

P_t/P_{t-1} = ratio of domestic price of output in time period t to domestic price of output in time period t-1,

I_t/I_{t-1} = ratio of product inventory in time period t to product inventory in time period t-1,

CP_t = capacity in time period $t-1$,

M_{t-n} = quantity of import demanded in time period $t-n$,

t = subscript denoting time period, and

n = length of the time lag.

As we would expect, the level of output will vary directly with the level of employment, capital utilization rate, ratio of domestic price to time-lagged domestic price, and capacity. On the contrary, the level of output will vary indirectly with the levels of ratio of product inventory to time-lagged product inventory, and time-lagged quantity of imports demanded.

Input Demand Model

The input demand theory is derived from input demand function presented by Nadiri and Rosen (1973). Actually, this input demand function is from the familiar Cobb-Douglas production function. The Nadiri and Rosen input demand function is as follows:

$$Y_{i,t} = f\{S_t (W/C)_t, T, Y_{1,t-1}, Y_{2,t-1}, Y_{3,t-1}, Y_{4,t-1}, Y_{5,t-1}, Y_{6,t-1}\} \quad (3.4)$$

$$i = 1, 2, 3, 4, 5, 6;$$

where,

$Y_{i,t}$ = level of input i in period t ,

S_t = total shipments in period t ,

$(W/C)_t$ = ratio of average hourly wage for production workers to rental price of capital in period t ,

T = time trend,

$Y_{1,t-1}$ = stock of production workers in period $t-1$,

$Y_{2,t-1}$ = average weekly hours of production workers in period t-1,

$Y_{3,t-1}$ = capital stock in period t-1,

$Y_{4,t-1}$ = capital utilization in period t-1,

$Y_{5,t-1}$ = inventories in period t-1,

$Y_{6,t-1}$ = stock of non-production workers in period t-1, and

t = subscript denoting time period.

As in the Nadiri and Rosen study, the level of each input variable will vary directly with the level of total shipments, whereas the level of each input variable will vary indirectly with the level of ratio of average hourly wage for production workers to rental price of capital. The level of each input variable will vary directly or indirectly with the levels of time-lagged input variables. On the whole, Nadiri and Rosen conclude that the signs of relative change in each input variable depend on the types of variable and industry characteristics involved.

However, we modify some variables to estimate the effects of output change on inputs in the textile and apparel industry. The modified input demand function is as follows:

$$Y_{i,t} = f(Q_t, RP_t, TR, Y_{1,t-n}, Y_{2,t-n}, Y_{3,t-n}, Y_{4,t-n}, Y_{5,t-n}) \quad (3.5)$$

$$i = 1, 2, 3, 4, 5;$$

where,

$Y_{i,t}$ = level of input i in period t,

Q_t = output in period t,

RP_t = ratio of factor prices in period t ,

TR = time trend,

$Y_{1,t-n}$ = level of employment in period $t-n$,

$Y_{2,t-n}$ = labor utilization rate in period $t-n$,

$Y_{3,t-n}$ = capital utilization rate in period $t-n$,

$Y_{4,t-n}$ = capital stock in period $t-n$,

$Y_{5,t-n}$ = inventories in period $t-n$,

t = subscript denoting time period, and

n = length of the time lag.

As might be expected, the level of each input will vary directly with the level of output while the level of each input will vary indirectly with the ratio of factor prices. The level of each input will vary directly or indirectly with the levels of time-lagged inputs. In general, the direction of change is not clear in all cases; that is, existing theory does not dictate all relationships.

2. Data and Sources of Data

As is usual in most economic studies, the ideal data were unavailable and various compromises had to be made. The data used in this study were monthly time series for the period from January 1970 to September 1991. Most series were taken directly from published sources, and some were collected from unpublished data provided by U.S. Government agencies.

Quantity of Imports

The quantity of textile imports are reported in the Textile Hi-Lights Monthly Supplements. The monthly supplements are published by the American Textile Manufacturers Institute (ATMI). The data are reported in square meter equivalents after January 1989, and thus U.S. Department of Commerce conversion factors were used to convert units to square meter equivalents (SME). To obtain the quantity of textile imports, we need to set up the following equation:

$$\text{Quantity of Textile Imports} = \text{Total Textile and Apparel Imports (SME)} - \text{Cotton Apparel (SME)} - \text{Man-Made Apparel (SME)} - \text{Wool Apparel (SME)}.$$

The quantity of apparel imports were calculated by totaling the cotton apparel, man-made apparel and wool apparel imports.

Import Values

The values of textiles and apparel for general imports were reported in the U.S. General Imports and Imports for Consumption (Report FT135). Table 1 in the Report FT135 contains the value of schedule A groupings of commodities, and the commodities are classified by using the Standard International Trade Classification (SITC) code. SITC code No. 65 is used for textiles and No. 84 for apparel. No. 65 includes textile yarns, fabrics, made-up articles and related products, and No. 84 contains wearing apparel and accessories, and articles made of fur. The Report FT135 has been discontinued with the issue containing data for December 1987; therefore, U.S. General Imports of Cotton, Wool, Man-Made

Fiber, and Vegetable Fiber (Except Cotton) and Silk Blend Textiles (Report TQ2496) was used for the period 1988 to September 1991. The Report TQ2496 covers the quantity and value of cotton, wool, man-made fiber, and silk manufactures (yarn, fabric, apparel and finished goods) imported into the United States. Data are usually shown for current month. The Report FT135 and Report TQ2496 are published by the U.S. Department of Commerce.

Producer Price of Domestic Textiles

The selected textile mill products index (1982=100) in the special commodity groupings was used for the producer price index. The special commodity groupings are tabulated in the Supplement to Producer Price Indexes. The selected textile mill products commodity does not exist prior to 1976; therefore, the textile products (excluding hard and bast fiber products) category is used for the period 1970 to 1975. This category (1967=100) is multiplied by a conversion factor to revise the index to a 1982 year base. The data was published by U.S. Department of Labor.

Disposable Personal Income

Disposable personal income (DPI) is personal income less personal taxes and nontax payments. Personal taxes include income, estate and gift, and personal property taxes. Nontaxes include tuitions and fees paid to schools and hospitals, fines and penalties, and donations. DPI is the income available to consumers for spending or saving.

This variable is tabulated under the general business indicators-personal income heading in the Business Statistics. The data was reported by the U.S. Department of Commerce, Bureau of Economic Analysis.

Consumer Price of the Domestic Apparel

The Apparel and Upkeep category (1982-1984=100) in the consumer price index was used for the domestic price of apparel. The consumer price index is released in the CPI Detailed Report. This report is a monthly report on consumer price movements and is published by the Bureau of Labor Statistics in the U.S. Department of Labor.

Domestic Output

The Industrial Production Index (1987=100) was used for domestic output. The textile mill products index was used for domestic textile output, and the apparel products index represented domestic apparel output. This data was reported on the Federal Reserve Bulletin and was collected by Board of Governors of the Federal Reserve System.

Average Weekly Labor Hours of Workers

This variable was reported in the Supplement to Employment and Earnings, and it stands for the labor utilization rate of production workers by the U.S. textile and apparel industry. This supplement was provided by the Bureau of Labor Statistics under the U.S. Department of Labor.

Weekly Average Spindle Hours

This variable was used as a proxy variable for capital utilization rate and was collected by using the Textile Hi-Lights. The Textile Hi-Lights was prepared and published quarterly by the ATMI Economic Information Division.

Total Inventories

These variables were collected from the Current Industrial Reports (M3-1): Manufacturers' Shipments, Inventories, and Orders. The total inventories of textile mill products were represented for textile inventories, and the total inventories of home goods and apparel were used for apparel inventories. The Current Industrial Reports are published by the U.S. Department of Commerce, Bureau of the Census.

Capacity

The capacity data were collected by using the Federal Reserve Bulletin. This variable was tabulated under the output, capacity, and capacity utilization heading in the Financial and Business Statistics. The bulletin is issued monthly under the direction of the Board of Governors of the Federal Reserve System.

Employment

This variable was reported in the Supplement to Employment and Earnings. The total employees of textile mill products were used for textile employment, and the total employees of apparel and other textile products represented apparel employment. The Supplement is published by the U.S. Department of Labor, Bureau of Labor Statistics.

Hours per Active Spindle

This variable was used as a proxy variable for capital stock and was collected from the Textile Hi-Lights. The Textile Hi-Lights is published by the American Textile Manufacturers Institute (ATMI), but this data was originally provided by the U.S. Department of Commerce, Bureau of the Census.

Average Hourly Earnings

These variables were used as proxy variables for wages of textile and apparel production workers. The average hourly earnings for textile and apparel industry are provided by the U.S. Department of Labor, Bureau of Labor Statistics.

High-Grade Municipal Bonds Rate

This variable was used as a proxy variable to assess the cost of capital. The high-grade municipal bonds rate is tabulated under the Interest Rates and Bond Yields heading in the Economic Indicators. The Economic Indicators is prepared for the Joint Economic Committee and is published by the Council of Economic Advisers. However, this data was extracted from the Standard & Poor's.

3. Data Analysis

The estimating procedure used in this study is Ordinary Least Squares (OLS) in the Statistical Analysis System (SAS). The OLS procedure is suitable to estimating the coefficients for the selected regression models. The results of log

linear regression models are presented in the Chapter IV. The results of semi-log linear and inverse semi-log linear regression models are presented in the Appendix.

CHAPTER IV

EMPIRICAL MODELS AND ESTIMATED RESULTS

1. Import Demand Models

According to the economic theory, the import price is negatively related to the quantity of imports demanded, and the income and domestic price are positively related to the quantity demanded for imports. An increase in import price results in a decrease in the quantity demanded for imports, whereas a rise in income results in an increase in the quantity of imports demanded. The positive relation between income and demand for imported products indicates that imported products are generally regarded as normal goods. However, if an increase in income could result in a decrease in the quantity demanded of imports, the imported products could be called inferior goods.

In this study, imported products are usually considered substitutes for domestic products but not perfect substitutes. Given this assumption, a decrease in the import price will increase the quantity of imports demanded but decrease the demand for competing domestic products. Consequently, the domestic price will decrease. On the other hand, if an increase in the price of domestic products results in a decrease in the quantity demanded of imports, the imported and domestic products are complements, but that possibility is not interesting in this study.

Textiles

We deal with two log linear equations of import demand models for textiles in this section. The first equation made an attempt to evaluate the separate effects of import and domestic textile prices on the quantity of imports demanded. The second equation tried to estimate the effect of the price ratio (ratio of the textile import price to the domestic textile price) on the quantity of textile imports demanded.

The first log linear equation of import demand model for textiles is generally specified as:

$$\begin{aligned} \log \text{IMQ}_t = & \beta_0 + \beta_1 \log \text{PIM}_t + \beta_2 \log \text{PUS}_t + \beta_3 \log Y_t \\ & + \beta_4 \log \text{IMQ}_{t-n} + u_t \end{aligned} \quad (4.1)$$

where,

IMQ_t = quantity of textile imports expressed in square meter equivalents (SME) in period t ,

PIM_t = textile import price expressed as dollar/SME in period t ,

PUS_t = producer price index of the domestic textiles in period t ,

Y_t = disposable personal income in period t ,

IMQ_{t-n} = quantity of textile imports in period $t-n$,

u_t = an error term in period t ,

t = subscript denoting time period, and

n = length of the time lag.

The expected sign pattern of the coefficients is assumed to be:

$$\beta_1 < 0; \beta_2 > 0; \beta_3 > 0; \beta_4 > 0.$$

The estimated parameters of the import demand equations for textiles were:

$$\begin{aligned} \log \text{IMQ}_t = & 1.4108 - 0.5509 \log \text{PIM}_t + 0.4586 \log \text{PUS}_t + 0.2022 \log Y_t \\ & (0.0001) \quad (0.0283) \quad (0.0359) \\ & + 0.5973 \log \text{IMQ}_{t-1} \quad (4.2) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.9179$$

$$\begin{aligned} \log \text{IMQ}_t = & 2.2165 - 1.0618 \log \text{PIM}_t + 1.0918 \log \text{PUS}_t + 0.2686 \log Y_t \\ & (0.0001) \quad (0.0001) \quad (0.0374) \\ & + 0.2637 \log \text{IMQ}_{t-6} \quad (4.3) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.8722$$

where the set of figures in parentheses are the significance levels.

The signs of the estimated parameters were as expected. All estimated coefficients in the equations were significantly different from zero at the 0.05 level or stronger. The own-price elasticity of textile import demand changed from -0.5509 to -1.0618, and was negative; in other words, the absolute value of the percentage change in the quantity demanded for textile imports becomes greater than the absolute value of the percentage change in import price as the time lag becomes longer. These results suggest that the own-price elasticity changes from inelastic demand to elastic demand, and the quantity of imports demanded becomes more sensitive to import price change as the time lag is lengthened. The cross-price elasticities of textile import demand were 0.4586 and 1.0918, and had positive signs. These consequences show that the imported

and domestic products may be considered to be substitutes. The income elasticities of textile import demand were 0.2022 and 0.2686, and were positive. These results indicate that the imported textile products are deemed to be normal goods. The estimated parameter for the lagged textile imports changed from 0.5973 to 0.2637. This outcome suggests that the effect of lagged imports decreases as the time lag is longer.

The second log linear equation of import demand model for textiles is generally specified as:

$$\log \text{IMQ}_t = \beta_0 + \beta_1 \log(\text{PIM}/\text{PUS})_t + \beta_2 \log Y_t + \beta_3 \log \text{IMQ}_{t-n} + u_t \quad (4.4)$$

where,

IMQ_t = quantity of textile imports expressed in square meter equivalents (SME) in period t ,

$(\text{PIM}/\text{PUS})_t$ = ratio of textile import price to domestic textile price in period t : PIM is textile import price expressed as dollar/SME, and PUS is domestic textile price expressed as producer price index of the domestic textiles,

Y_t = disposable personal income in period t ,

IMQ_{t-n} = quantity of textile imports in period $t-n$,

u_t = an error term in period t ,

t = subscript denoting time period, and

n = length of the time lag.

The expected sign pattern of the coefficients is assumed to be:

$$\beta_1 < 0; \beta_2 > 0; \beta_3 > 0.$$

The ratio of the textile import price to the producer price of the domestic textiles is considered the price ratio. Generally speaking, the price ratio would increase either when import price increases faster or decreases slower than domestic price, or when import price increases while domestic price decreases.

The estimated import demand equations for textiles were:

$$\begin{aligned} \log \text{IMQ}_t = & 1.2692 - 0.5605 \log(\text{PIM/PUS})_t + 0.1544 \log Y_t \\ & (0.0001) \qquad \qquad \qquad (0.0001) \\ & + 0.6013 \log \text{IMQ}_{t-1} \qquad \qquad \qquad (4.5) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.9178$$

$$\begin{aligned} \log \text{IMQ}_t = & 2.2668 - 1.0590 \log(\text{PIM/PUS})_t + 0.2844 \log Y_t \\ & (0.0001) \qquad \qquad \qquad (0.0001) \\ & + 0.2618 \log \text{IMQ}_{t-6} \qquad \qquad \qquad (4.6) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.8722$$

where the set of figures in parentheses are the significance levels.

All coefficients in the equations were significant at the 0.0001 level. The signs of the estimated parameters were as expected. As were shown by the equations, the estimated coefficient of the price ratio changed from -0.5605 to -1.0590, and had a negative sign; namely, the absolute value of the percentage change in the textile import price becomes greater than the absolute value of the percentage change in the domestic textile price as the time lag becomes longer. These results suggest that the effect of price ratio increases as the time lag is longer, and the volume of imports demanded becomes more sensitive to

price change as the time lag is lengthened. The estimated income elasticity of textile import demand increased from 0.1544 to 0.2844 as the time lag was longer. The estimated coefficient for the lagged quantity of textile imports changed from 0.6013 to 0.2618. This indicates that the effect of lagged imports decreases as the time lag is lengthened.

The estimated elasticities of the import demand equations for textiles are tabulated in the Table 4.1.

Apparel

In the apparel part of the study, we try to estimate the effect of price ratio (ratio of the apparel import price to the domestic apparel price) on the quantity of apparel imports demanded.

The log linear equation of import demand model for apparel is generally specified as:

$$\log \text{IMQ}_t = \beta_0 + \beta_1 \log(\text{PIM}/\text{PUS})_t + \beta_2 \log Y_t + \beta_3 \log \text{IMQ}_{t-n} + u_t \quad (4.7)$$

where,

IMQ_t = quantity of apparel imports expressed in square meter equivalents (SME) in period t ,

$(\text{PIM}/\text{PUS})_t$ = ratio of apparel import price to domestic apparel price in period t : PIM is apparel import price expressed as dollar/SME, and PUS is domestic apparel price expressed as consumer price index of the domestic apparel,

Y_t = disposable personal income in period t ,

IMQ_{t-n} = quantity of apparel imports in period $t-n$,

u_t = an error term,

Table 4.1. Estimated Elasticities of Import Demand Equations for Textiles

Independent Variables	Dependent Variables			
	$\log \text{IMQ}_t$	$\log \text{IMQ}_t$	$\log \text{IMQ}_t$	$\log \text{IMQ}_t$
Constant	1.4108 (0.0001)	2.2165 (0.0001)	1.2692 (0.0001)	2.2688 (0.0001)
$\log \text{PIM}_t$	-0.5509 (0.0001)	-1.0618 (0.0001)		
$\log \text{PUS}_t$	0.4586 (0.0283)	1.0918 (0.0001)		
$\log(\text{PIM}/\text{PUS})_t$			-0.5605 (0.0001)	-1.0590 (0.0001)
$\log Y_t$	0.2022 (0.0359)	0.2686 (0.0374)	0.1544 (0.0001)	0.2844 (0.0001)
$\log \text{IMQ}_{t-1}$	0.5973 (0.0001)		0.6013 (0.0001)	
$\log \text{IMQ}_{t-6}$		0.2637 (0.0001)		0.2618 (0.0001)

The set of figures in parentheses are the significance levels.

IMQ = quantity of textile imports

PIM = textile import price

PUS = domestic textile price

PIM/PUS = ratio of textile import price to domestic textile price

Y = disposable personal income

t = subscript denoting time period, and

n = length of the time lag.

The expected sign pattern of the parameters is assumed as:

$$\beta_1 < 0; \beta_2 > 0; \beta_3 > 0.$$

The ratio of the apparel import price to the consumer price of the domestic apparel is considered the price ratio.

The estimated import demand equations for apparel were:

$$\begin{aligned} \log \text{IMQ}_t = & 1.2262 - 0.1834 \log(\text{PIM/PUS})_t + 0.3727 \log Y_t \\ & (0.0001) \qquad \qquad \qquad (0.0001) \\ & + 0.6206 \log \text{IMQ}_{t-1} \qquad \qquad \qquad (4.8) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.9231$$

$$\begin{aligned} \log \text{IMQ}_t = & 3.1031 - 0.2255 \log(\text{PIM/PUS})_t + 0.6513 \log Y_t \\ & (0.0004) \qquad \qquad \qquad (0.0001) \\ & + 0.2875 \log \text{IMQ}_{t-6} \qquad \qquad \qquad (4.9) \\ & (0.0001) \end{aligned}$$

$$R^2 = 0.8803$$

where the set of figures in parentheses are the significance levels.

All parameter estimates in the equations were statistically significant at high levels. The signs of the estimated parameters were as anticipated. The estimated coefficients for the price ratio (-0.1834 and -0.2255) had negative signs and were in the inelastic range; that is, the absolute value of the percentage change in the apparel import price is less than the absolute value of the percentage change in the domestic apparel price. These results indicate that

the quantity of apparel imports demanded is not strongly responsive to price change which is somewhat surprising. Such low price ratio elasticities for apparel import demand may be caused by the distorting effects of the non-tariff barriers (primarily quotas) imposed on apparel imports, particularly if quota limits are filled. The estimated income elasticities of apparel import demand were 0.3727 and 0.6513, and had positive signs. These results indicate that the imported apparel products are considered to be normal goods, and the income elasticity of apparel import demand increases as the time lag is lengthened. A decrease in the parameter estimates for the lagged quantity of apparel imports resulted in decreasing in the effect of lagged imports as the time lag was longer.

The calculated elasticities of the import demand equations for apparel are shown in Table 4.2.

2. Output Models

In this section, the impact of an increase in imports on domestic production is assessed. In order to estimate the response of domestic producers to increased imports, domestic output equations are estimated.

Textiles

The log linear form of output equation for textiles is generally specified as:

$$\begin{aligned} \log \text{TMP}_t = & \beta_0 + \beta_1 \log \text{TE}_t + \beta_2 \log \text{WAS}_t + \beta_3 \log (\text{PUS}_t / \text{PUS}_{t-1}) \\ & + \beta_4 \log (I_t / I_{t-1}) + \beta_5 \log \text{CP}_t + \beta_6 \log \text{IMQ}_{t-n} + u_t \end{aligned} \quad (4.10)$$

Table 4.2. Calculated Elasticities of Import Demand Equations for Apparel

Independent Variables	Dependent Variables	
	$\log \text{IMQ}_t$	$\log \text{IMQ}_t$
Constant	1.2262 (0.0019)	3.1031 (0.0001)
$\log(\text{PIM}/\text{PUS})_t$	-0.1834 (0.0001)	-0.2255 (0.0004)
$\log Y_t$	0.3727 (0.0001)	0.6513 (0.0001)
$\log \text{IMQ}_{t-1}$	0.6206 (0.0001)	
$\log \text{IMQ}_{t-6}$		0.2875 (0.0001)

The set of figures in parentheses are the significance levels.

IMQ = quantity of apparel imports

PIM/PUS = ratio of apparel import price to domestic apparel price

Y = disposable personal income

where,

TMP_t = domestic textile output in period t ,

TE_t = textile employment in period t ,

WAS_t = weekly average spindle hours in period t ,

PUS_t = producer price index of the domestic textiles in period t ,

I_t = textile inventories in period t ,

CP_t = capacity in period t ,

IMQ_{t-n} = quantity of textile imports in period $t-n$,

u_t = an error term in period t ,

t = subscript denoting time period, and

n = length of the time lag.

The expected signs of the coefficients are:

$$\beta_1, \beta_2, \beta_3, \beta_5 > 0; \beta_4 < 0; \beta_6 > 0 \text{ or } \beta_6 < 0.$$

According to production theory, the domestic textile output will increase as textile employment, weekly average spindle hours, and capacity increase, respectively. It is assumed above that β_1 , β_2 , and β_5 are positive. The positive sign for β_3 indicates that a rise in domestic price causes an increase in domestic production. The negative sign for β_4 suggests that an increase in inventories will induce a decrease domestic output. The sign for β_6 has more than one meaning. If imports serve to replace domestic production, then $\beta_6 < 0$.

However, if both imports and domestic production are augmenting a response to a general growth in domestic demand, then $\beta_6 > 0$. In either case, the import

elasticity of output would provide an estimate of the direct impact of increased imports on domestic production.

The estimated parameters of output equations for textiles were:

$$\begin{aligned} \log \text{TMP}_t = & - 3.6937 + 0.7861 \log \text{TE}_t + 0.2028 \log \text{WAS}_t \\ & (0.0001) \quad (0.0001) \\ & + 3.0534 \log (\text{PUS}_t / \text{PUS}_{t-1}) - 0.1714 \log (\text{I}_t / \text{I}_{t-1}) \\ & (0.0001) \quad (0.0001) \\ & + 0.9370 \log \text{CP}_t - 0.0485 \log \text{IMQ}_t \end{aligned} \quad (4.11)$$

$$R^2 = 0.8479$$

$$\begin{aligned} \log \text{TMP}_t = & - 3.2292 + 0.6517 \log \text{TE}_t + 0.2054 \log \text{WAS}_t \\ & (0.0001) \quad (0.0001) \\ & + 3.0001 \log (\text{PUS}_t / \text{PUS}_{t-1}) - 0.1814 \log (\text{I}_t / \text{I}_{t-1}) \\ & (0.0001) \quad (0.0001) \\ & + 0.9323 \log \text{CP}_t - 0.0387 \log \text{IMQ}_{t-3} \end{aligned} \quad (4.12)$$

$$R^2 = 0.8422$$

where the levels of significance are shown in parentheses.

The import elasticities of output (-0.0485 and -0.0387) had negative signs and were statistically significant. If it is given that imports serve to replace domestic production, then an increase in textile imports leads to decreasing domestic output. But, the impact of imports on domestic textile production was quite small because the import elasticities of output were very small. The estimated parameters for the inventory change (-0.1714 and -0.1814) were negative and were significant at the 0.0001 level. The estimated coefficients for

the change in domestic textile price (3.0534 and 3.0001) were positive and were statistically significant. These results indicate that the textile output is very responsive to changes in the producer price of domestic textiles. The parameter estimates for the textile employment (0.7861 and 0.6517) were of the correct sign and were statistically significant. Likewise, the estimated coefficients for the weekly average spindle hours (0.2028 and 0.2054) were significant and had positive signs, and the estimated parameters on the capacity variables (0.9370 and 0.9323) were statistically very significant and had the correct signs.

On the whole, the estimated coefficients for the textile output equations are significant at the acceptable level and of the correct sign as anticipated. The estimated elasticities of output demand equations for textiles are tabulated in the Table 4.3.

Apparel

The log linear equation for the apparel output model is generally specified as:

$$\begin{aligned} \log AP_t = & \beta_0 + \beta_1 \log AE_t + \beta_2 \log WAS_t + \beta_3 \log (PUS_t / PUS_{t-1}) \\ & + \beta_4 \log (I_t / I_{t-1}) + \beta_5 \log CP_t + \beta_6 \log IMQ_{t-n} + u_t \end{aligned} \quad (4.13)$$

where,

AP_t = domestic apparel output in period t ,

AE_t = apparel employment in period t ,

WAS_t = weekly average spindle hours in period t ,

PUS_t = consumer price index of the domestic apparel in period t ,

Table 4.3. Estimated Elasticities of Output Equations for Textiles

Independent Variables	Dependent Variables	
	$\log \text{TMP}_t$	$\log \text{TMP}_t$
Constant	-3.6937 (0.0001)	-3.2292 (0.0001)
$\log \text{TE}_t$	0.7861 (0.0001)	0.6517 (0.0001)
$\log \text{WAS}_t$	0.2028 (0.0001)	0.2054 (0.0001)
$\log(\text{PUS}_t/\text{PUS}_{t-1})$	3.0534 (0.0001)	3.0001 (0.0001)
$\log(\text{I}_t/\text{I}_{t-1})$	-0.1714 (0.0001)	-0.1814 (0.0001)
$\log \text{CP}_t$	0.9370 (0.0001)	0.9323 (0.0001)
$\log \text{IMQ}_t$	-0.0485 (0.0001)	
$\log \text{IMQ}_{t-3}$		-0.0387 (0.0001)

The set of figures in parentheses are the significance levels.

TMP = textile output

TE = textile employment

WAS = weekly average spindle hours

PUS = domestic textile price

I = textile inventories

CP = capacity

IMQ = quantity of textile imports

I_t = apparel inventories in period t ,

CP_t = capacity in period t ,

IMQ_{t-n} = quantity of apparel imports in period $t-n$,

u_t = an error term in period t ,

t = subscript denoting time period, and

n = length of the time lag.

The expected signs of the parameters are:

$$\beta_1, \beta_2, \beta_3, \beta_5 > 0; \beta_4 < 0; \beta_6 > 0 \text{ or } \beta_6 < 0.$$

The expected signs follow the same views as in the previous sections on textiles.

The estimated coefficients for the apparel output equations were:

$$\begin{aligned} \log AP_t = & -11.7280 + 0.9925 \log AE_t + 0.2684 \log WAS_t \\ & (0.0001) \quad (0.0001) \\ & + 2.5335 \log(PUS_t/PUS_{t-1}) - 0.7571 \log(I_t/I_{t-1}) \\ & (0.0001) \quad (0.0001) \\ & + 2.6028 \log CP_t - 0.0688 \log IMQ_t \\ & (0.0001) \quad (0.0001) \end{aligned} \quad (4.14)$$

$$R^2 = 0.8350$$

$$\begin{aligned} \log AP_t = & -11.0711 + 0.8386 \log AE_t + 0.2674 \log WAS_t \\ & (0.0001) \quad (0.0001) \\ & + 2.4982 \log(PUS_t/PUS_{t-1}) - 0.7515 \log(I_t/I_{t-1}) \\ & (0.0001) \quad (0.0001) \\ & + 2.5625 \log CP_t - 0.0513 \log IMQ_{t-3} \\ & (0.0001) \quad (0.0001) \end{aligned} \quad (4.15)$$

$$R^2 = 0.8214$$

where the probability values are shown in parentheses.

The estimated coefficients for the price change (2.5335 and 2.4982) had positive signs and were significant at the 0.0001 level. These consequences suggest that the apparel output is very sensitive to changing the consumer price of domestic apparel. The estimated parameters for the change in inventory (-0.7571 and -0.7515) had negative signs and were statistically significant. The import elasticities of output (-0.0688 and -0.0513) were negative and were statistically significant. These results show that apparel imports serve to replace domestic products. Thus, increasing imports induces a decrease in domestic output. However, the magnitude of import elasticity in each equation is given the fact that the impact of imports on domestic apparel production is quite small. The parameter estimates on the capacity variables (2.6028 and 2.5625) were statistically very significant and of the correct sign. In the same way, the estimated coefficients for the apparel employment (0.9925 and 0.8386) were significant and had positive signs, and the estimated parameters for the weekly average spindle hours (0.2684 and 0.2674) were of the correct sign and were statistically significant.

By and large, the parameter estimates in the apparel output equations are statistically significant at 0.0001 level, and have the correct signs as expected. The calculated elasticities of output demand equations for apparel are shown in the Table 4.4.

Table 4.4. Calculated Elasticities of Output Equations for Apparel

Independent Variables	Dependent Variables	
	$\log AP_t$	$\log AP_t$
Constant	-11.7280 (0.0001)	-11.0711 (0.0001)
$\log AE_t$	0.9925 (0.0001)	0.8386 (0.0001)
$\log WAS_t$	0.2684 (0.0001)	0.2674 (0.0001)
$\log(PUS_t/PUS_{t-1})$	2.5335 (0.0001)	2.4982 (0.0001)
$\log(I_t/I_{t-1})$	-0.7571 (0.0001)	-0.7515 (0.0001)
$\log CP_t$	2.6028 (0.0001)	2.5625 (0.0001)
$\log IMQ_t$	-0.0688 (0.0001)	
$\log IMQ_{t-3}$		-0.0513 (0.0001)

The set of figures in parentheses are the significance levels.

AP = apparel output

AE = apparel employment

WAS = weekly average spindle hours

PUS = domestic apparel price

I = apparel inventories

CP = capacity

IMQ = quantity of apparel imports

3. Input Demand Models

This section involves the estimation of the effects of output changes on five input variables (employment, average weekly labor hours, weekly average spindle hours, hours per active spindle and inventories). In order to estimate the output elasticity of each input variable, we consider a one-month lag input demand model and a three-month lag input demand model. The former model implies that five input variables of each input demand equation are lagged one month, and the latter model implies that five input variables of each input demand equation are lagged three months.

Textiles

The log linear equation of input demand model for textiles is generally specified as:

$$\begin{aligned}\log A_{k,t} = & \beta_{k0} + \beta_{k1} \log A_{1,t-n} + \beta_{k2} \log A_{2,t-n} + \beta_{k3} \log A_{3,t-n} \\ & + \beta_{k4} \log A_{4,t-n} + \beta_{k5} \log A_{5,t-n} + \beta_{k6} \log \text{TMP}_t \\ & + \beta_{k7} \log \text{RFP}_t + \beta_{k8} \log \text{TR}_t + u_t\end{aligned}\tag{4.16}$$

$k=1, 2, 3, 4, 5;$

where,

$A_{k,t}$ = level of input variable k in period t ,

$A_{1,t-n}$ = textile employment in period $t-n$,

$A_{2,t-n}$ = average weekly hours of textile production workers in period $t-n$,

$A_{3,t-n}$ = weekly average spindle hours in period $t-n$,

$A_{4,t-n}$ = hours per active spindle in period $t-n$,

$A_{5,t-n}$ = textile inventories in period $t-n$,

TMP_t = textile mill products in period t ,

RFP_t = ratio of factor prices in period t ,

TR_t = time trend in period t ,

u_t = an error term in period t ,

t = subscript denoting time period, and

n = length of the time lag.

First, the five log linear equations of one-month lag input demand model for textile were run.

One, the estimated input demand equation for textile employment was:

$$\begin{aligned}\log A_{1,t} = & 0.6873 + 0.9155 \log A_{1,t-1} + 0.0210 \log A_{2,t-1} \\ & (0.0001) \quad (0.2627) \\ & + 0.0050 \log A_{3,t-1} + 0.0051 \log A_{4,t-1} \\ & (0.3369) \quad (0.1388) \\ & - 0.0582 \log A_{5,t-1} + 0.0498 \log TMP_t \\ & (0.0001) \quad (0.0001) \\ & - 0.0059 \log RFP_t + 0.0030 \log TR_t \\ & (0.0493) \quad (0.0071) \end{aligned} \tag{4.17}$$

$$R^2 = 0.9980$$

where the significance levels are shown in parentheses.

Two, the estimated input demand equation for average weekly hours of textile workers was:

$$\begin{aligned}
 \log A_{2,t} = & 3.1124 - 0.1889 \log A_{1,t-1} + 0.4035 \log A_{2,t-1} \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0720 \log A_{3,t-1} + 0.0004 \log A_{4,t-1} \\
 & (0.0001) \quad (0.9622) \\
 & - 0.0921 \log A_{5,t-1} + 0.1476 \log TMP_t \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0245 \log RFP_t - 0.0060 \log TR_t \quad (4.18) \\
 & (0.0026) \quad (0.0435)
 \end{aligned}$$

$$R^2 = 0.7142$$

where the significance levels are shown in parentheses.

Three, the parameter estimates of input demand equation for weekly average spindle hours was:

$$\begin{aligned}
 \log A_{3,t} = & -0.8736 + 0.4924 \log A_{1,t-1} + 0.7753 \log A_{2,t-1} \\
 & (0.0003) \quad (0.0020) \\
 & + 0.3877 \log A_{3,t-1} - 0.0647 \log A_{4,t-1} \\
 & (0.0001) \quad (0.1573) \\
 & - 0.1398 \log A_{5,t-1} + 0.1680 \log TMP_t \\
 & (0.0674) \quad (0.1297) \\
 & - 0.1253 \log RFP_t + 0.0201 \log TR_t \quad (4.19) \\
 & (0.0016) \quad (0.1666)
 \end{aligned}$$

$$R^2 = 0.8354$$

where the significance levels are shown in parentheses.

Four, the estimated coefficients of input demand equation for hours per active spindle was:

$$\begin{aligned}
 \log A_{4,t} = & 2.7736 - 0.6700 \log A_{1,t-1} + 1.0399 \log A_{2,t-1} \\
 & (0.0003) \quad (0.0024) \\
 & + 0.5761 \log A_{3,t-1} - 0.4001 \log A_{4,t-1} \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0376 \log A_{5,t-1} + 0.5097 \log \text{TMP}_t \\
 & (0.7183) \quad (0.0009) \\
 & + 0.1339 \log \text{RFP}_t - 0.0487 \log \text{TR}_t \quad (4.20) \\
 & (0.0133) \quad (0.0148)
 \end{aligned}$$

$$R^2 = 0.3916$$

where the significance levels are shown in parentheses.

Five, the estimated parameters of input demand equation for textile inventories was:

$$\begin{aligned}
 \log A_{5,t} = & -0.5347 - 0.0084 \log A_{1,t-1} + 0.0879 \log A_{2,t-1} \\
 & (0.5812) \quad (0.0022) \\
 & + 0.0119 \log A_{3,t-1} + 0.0065 \log A_{4,t-1} \\
 & (0.1335) \quad (0.2133) \\
 & + 0.9944 \log A_{5,t-1} - 0.0401 \log \text{TMP}_t \\
 & (0.0001) \quad (0.0017) \\
 & - 0.0136 \log \text{RFP}_t + 0.0008 \log \text{TR}_t \quad (4.21) \\
 & (0.0027) \quad (0.6135)
 \end{aligned}$$

$$R^2 = 0.9989$$

where the significance levels are shown in parentheses.

The estimated parameters for output were statistically significant in all equations except that of weekly average spindle hours (A_3). The impact of output was strongest on the hours per active spindle (A_4) followed by average weekly hours of textile production workers (A_2). However, the estimated coefficients for the ratio of factor prices in all equations were significantly different from zero at the 0.05 level and were small except weekly average spindle hours (A_3) and hours per active spindle (A_4). The estimated coefficients on time trend were very small and statistically significant in all but weekly average spindle hours (A_3) and textile inventories (A_5).

All of the own adjustment coefficients were highly significant and with the exception of hours per active spindle (A_4) were positive. A change in textile output was adjusted mostly by textile inventories (A_5) followed by textile employment (A_1). Out of the twenty cross-adjustment coefficients ten were statistically significant at the 0.05 level. However, there was at least one significant cross-adjustment coefficient in each input equation. This suggests that input adjustments are interrelated.

The estimated coefficients of the five one-month lag input demand equations for textiles are shown in the Table 4.5.

Table 4.5. Estimated Coefficients of One-Month Lag Input Demand Equations for Textiles

Independent Variables	$\log A_{1,t}$	$\log A_{2,t}$	$\log A_{3,t}$	$\log A_{4,t}$	$\log A_{5,t}$
Constant	0.6873***	3.1124***	-0.8736	2.7736	-0.5347**
$\log \text{TMP}_t$	0.0498***	0.1476***	0.1680	0.5097***	-0.0401**
$\log \text{RFP}_t$	-0.0059*	0.0245**	-0.1253**	0.1339*	-0.0136**
$\log \text{TR}_t$	0.0030**	-0.0060*	0.0201	-0.0487*	0.0008
$\log A_{1,t-1}$	0.9155***	-0.1889***	0.4924***	-0.6700***	-0.0084
$\log A_{2,t-1}$	0.0210	0.4035***	0.7753**	1.0399**	0.0879**
$\log A_{3,t-1}$	0.0050	0.0720***	0.3877***	0.5761***	0.0119
$\log A_{4,t-1}$	0.0051	0.0004	-0.0647	-0.4001***	0.0065
$\log A_{5,t-1}$	-0.0582***	-0.0921***	-0.1398	0.0376	0.9944***

One asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level, two asterisks denote the 0.01 level, and three asterisks denote the 0.001 level.

A_1 = textile employment

A_2 = average weekly hours of textile production workers

A_3 = weekly average spindle hours

A_4 = hours per active spindle

A_5 = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

Second, the five log linear equations of three-month lag input demand model for textiles were computed.

One, the estimated input demand equation for textile employment was:

$$\begin{aligned}
 \log A_{1,t} = & 2.1294 + 0.7572 \log A_{1,t-3} - 0.0102 \log A_{2,t-3} \\
 & (0.0001) \quad (0.7678) \\
 & + 0.0201 \log A_{3,t-3} - 0.0025 \log A_{4,t-3} \\
 & (0.0468) \quad (0.6968) \\
 & - 0.1574 \log A_{5,t-3} + 0.1650 \log \text{TMP}_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0166 \log \text{RFP}_t + 0.0056 \log \text{TR}_t \quad (4.22) \\
 & (0.0032) \quad (0.0082)
 \end{aligned}$$

$$R^2 = 0.9926$$

where the significance levels are shown in parentheses.

Two, the estimated input demand equation for average weekly hours of textile workers was:

$$\begin{aligned}
 \log A_{2,t} = & 4.3613 - 0.2360 \log A_{1,t-3} + 0.2724 \log A_{2,t-3} \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0450 \log A_{3,t-3} - 0.0017 \log A_{4,t-3} \\
 & (0.0031) \quad (0.8579) \\
 & - 0.1429 \log A_{5,t-3} + 0.1933 \log \text{TMP}_t \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0218 \log \text{RFP}_t - 0.0051 \log \text{TR}_t \quad (4.23) \\
 & (0.0096) \quad (0.1104)
 \end{aligned}$$

$$R^2 = 0.6788$$

where the significance levels are shown in parentheses.

Three, the parameter estimates of input demand equation for weekly average spindle hours was:

$$\begin{aligned}
 \log A_{3,t} = & 3.6126 + 0.1476 \log A_{1,t-3} + 0.6478 \log A_{2,t-3} \\
 & \quad (0.2485) \quad (0.0089) \\
 & + 0.3752 \log A_{3,t-3} - 0.1778 \log A_{4,t-3} \\
 & \quad (0.0001) \quad (0.0002) \\
 & - 0.3854 \log A_{5,t-3} + 0.4339 \log \text{TMP}_t \\
 & \quad (0.0001) \quad (0.0001) \\
 & - 0.1469 \log \text{RFP}_t + 0.0281 \log \text{TR}_t \quad (4.24) \\
 & \quad (0.0003) \quad (0.0629)
 \end{aligned}$$

$$R^2 = 0.8226$$

where the significance levels are shown in parentheses.

Four, the estimated coefficients of input demand equation for hours per active spindle was:

$$\begin{aligned}
 \log A_{4,t} = & 3.3776 + 0.0521 \log A_{1,t-3} + 0.7013 \log A_{2,t-3} \\
 & \quad (0.7353) \quad (0.0188) \\
 & - 0.4714 \log A_{3,t-3} + 0.6074 \log A_{4,t-3} \\
 & \quad (0.0001) \quad (0.0001) \\
 & - 0.2862 \log A_{5,t-3} + 0.4607 \log \text{TMP}_t \\
 & \quad (0.0010) \quad (0.0002) \\
 & - 0.1117 \log \text{RFP}_t + 0.0092 \log \text{TR}_t \quad (4.25) \\
 & \quad (0.0206) \quad (0.6114)
 \end{aligned}$$

$$R^2 = 0.4900$$

where the significance levels are shown in parentheses.

Five, the estimated parameters of input demand equation for textile inventories was:

$$\begin{aligned}
 \log A_{5,t} = & -1.2538 - 0.0390 \log A_{1,t-3} + 0.2479 \log A_{2,t-3} \\
 & \quad (0.1509) \quad (0.0001) \\
 & + 0.0334 \log A_{3,t-3} + 0.0123 \log A_{4,t-3} \\
 & \quad (0.0291) \quad (0.2105) \\
 & + 0.9669 \log A_{5,t-3} - 0.1185 \log \text{TMP}_t \\
 & \quad (0.0001) \quad (0.0001) \\
 & - 0.0395 \log \text{RFP}_t + 0.0053 \log \text{TR}_t \quad (4.26) \\
 & \quad (0.0001) \quad (0.0971)
 \end{aligned}$$

$$R^2 = 0.9960$$

where the significance levels are shown in parentheses.

The estimated coefficients on output were highly significant in all equations. The impact of output was strongest on the hours per active spindle (A_4) followed by weekly average spindle hours (A_3). However, the estimated parameters on the relative factor price variables were small and were all significant at the 0.05 level. The parameter estimates for time trend were very small and with the exception of textile employment (A_1) were statistically insignificant.

All of the own adjustment coefficients were significant at the 0.0001 level and had positive signs. The adjustment to a change in textile output was responded to mostly by textile inventories (A_5) followed by textile employment (A_1). Thirteen of the cross-adjustment coefficients were statistically significant at the 0.05 level. However, there was at least one significant cross-adjustment

coefficient in each input equation. This shows that input adjustments are interrelated.

The estimated coefficients of the five three-month lag input demand equations for textiles are tabulated in the Table 4.6.

Apparel

The log linear equation of input demand model for apparel is generally specified as:

$$\begin{aligned}\log B_{k,t} = & \beta_{k0} + \beta_{k1}\log B_{1,t-n} + \beta_{k2}\log B_{2,t-n} + \beta_{k3}\log B_{3,t-n} \\ & + \beta_{k4}\log B_{4,t-n} + \beta_{k5}\log B_{5,t-n} + \beta_{k6}\log AP_t \\ & + \beta_{k7}\log RFP_t + \beta_{k8}\log TR_t + u_t\end{aligned}\quad (4.27)$$

$k=1, 2, 3, 4, 5;$

where,

$B_{k,t}$ = level of input variable k in period t ,

$B_{1,t-n}$ = apparel employment in period $t-n$,

$B_{2,t-n}$ = average weekly hours of apparel production workers in period $t-n$,

$B_{3,t-n}$ = weekly average spindle hours in period $t-n$,

$B_{4,t-n}$ = hours per active spindle in period $t-n$,

$B_{5,t-n}$ = apparel inventories in period $t-n$,

AP_t = apparel products in period t ,

RFP_t = ratio of factor prices in period t ,

TR_t = time trend in period t ,

u_t = an error term in period t ,

Table 4.6. Estimated Coefficients of Three-Month Lag Input Demand Equations for Textiles

Independent Variables	Dependent Variables				
	$\log A_{1,t}$	$\log A_{2,t}$	$\log A_{3,t}$	$\log A_{4,t}$	$\log A_{5,t}$
Constant	2.1294***	4.3613***	3.6126**	3.3776*	-1.2538***
$\log \text{TMP}_t$	0.1650***	0.1933***	0.4339***	0.4607***	-0.1185***
$\log \text{RFP}_t$	-0.0166**	0.0218**	-0.1469***	-0.1117*	-0.0395***
$\log \text{TR}_t$	0.0056**	-0.0051	0.0281	0.0092	0.0053
$\log A_{1,t-3}$	0.7572***	-0.2360***	0.1476	0.0521	-0.0390
$\log A_{2,t-3}$	-0.0102	0.2724***	0.6478**	0.7013*	0.2479***
$\log A_{3,t-3}$	0.0201*	0.0450**	0.3752***	-0.4714***	0.0334*
$\log A_{4,t-3}$	-0.0025	-0.0017	-0.1778***	0.6074***	0.0123
$\log A_{5,t-3}$	-0.1574***	-0.1429***	-0.3854***	-0.2862**	0.9669***

One asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level, two asterisks denote the 0.01 level, and three asterisks denote the 0.001 level.

A_1 = textile employment

A_2 = average weekly hours of textile production workers

A_3 = weekly average spindle hours

A_4 = hours per active spindle

A_5 = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

t = subscript denoting time period, and

n = length of the time lag.

First, the five log linear equations of one-month lag input demand model for apparel were run.

One, the estimated input demand equation for apparel employment was:

$$\begin{aligned}\log B_{1,t} = & 0.7984 + 0.8983\log B_{1,t-1} - 0.0255\log B_{2,t-1} \\ & (0.0001) \quad (0.4089) \\ & + 0.0206\log B_{3,t-1} - 0.0088\log B_{4,t-1} \\ & (0.0051) \quad (0.0545) \\ & - 0.0421\log B_{5,t-1} + 0.0716\log AP_t \\ & (0.0001) \quad (0.0001) \\ & - 0.0067\log RFP_t + 0.0010\log TR_t \quad (4.28) \\ & (0.0743) \quad (0.5129)\end{aligned}$$

$$R^2 = 0.9933$$

where the significance levels are shown in parentheses.

Two, the estimated input demand equation for average weekly hours of apparel workers was:

$$\begin{aligned}\log B_{2,t} = & 3.3049 - 0.2162\log B_{1,t-1} + 0.3947\log B_{2,t-1} \\ & (0.0001) \quad (0.0001) \\ & + 0.0453\log B_{3,t-1} + 0.0072\log B_{4,t-1} \\ & (0.0003) \quad (0.3548) \\ & - 0.0424\log B_{5,t-1} + 0.0998\log AP_t \\ & (0.0006) \quad (0.0001) \\ & + 0.0018\log RFP_t - 0.0029\log TR_t \quad (4.29) \\ & (0.7727) \quad (0.2578)\end{aligned}$$

$$R^2 = 0.6676$$

where the significance levels are shown in parentheses.

Three, the estimated parameters of input demand equation for weekly average spindle hours was:

$$\begin{aligned}
 \log B_{3,t} = & -1.1690 + 0.8114 \log B_{1,t-1} + 0.3508 \log B_{2,t-1} \\
 & (0.0001) \quad (0.2441) \\
 & + 0.3042 \log B_{3,t-1} - 0.0352 \log B_{4,t-1} \\
 & (0.0001) \quad (0.4253) \\
 & - 0.3236 \log B_{5,t-1} + 0.6069 \log AP_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0574 \log RFP_t - 0.0008 \log TR_t \quad (4.30) \\
 & (0.1166) \quad (0.9545)
 \end{aligned}$$

$$R^2 = 0.8435$$

where the significance levels are shown in parentheses.

Four, the parameter estimates of input demand equation for hours per active spindle was:

$$\begin{aligned}
 \log B_{4,t} = & 1.9203 - 0.8923 \log B_{1,t-1} + 1.7066 \log B_{2,t-1} \\
 & (0.0003) \quad (0.0001) \\
 & + 0.7460 \log B_{3,t-1} - 0.3817 \log B_{4,t-1} \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0915 \log B_{5,t-1} + 0.1624 \log AP_t \\
 & (0.3568) \quad (0.4184) \\
 & + 0.2079 \log RFP_t - 0.0333 \log TR_t \quad (4.31) \\
 & (0.0001) \quad (0.1171)
 \end{aligned}$$

$$R^2 = 0.3684$$

where the significance levels are shown in parentheses.

Five, the estimated coefficients of input demand equation for apparel inventories was:

$$\begin{aligned} \log B_{5,t} = & -0.7908 + 0.0367 \log B_{1,t-1} + 0.1045 \log B_{2,t-1} \\ & \quad (0.0369) \quad (0.0008) \\ & - 0.0031 \log B_{3,t-1} + 0.0070 \log B_{4,t-1} \\ & \quad (0.6757) \quad (0.1230) \\ & + 0.9778 \log B_{5,t-1} - 0.0788 \log AP_t \\ & \quad (0.0001) \quad (0.0001) \\ & - 0.0112 \log RFP_t - 0.0006 \log TR_t \quad (4.32) \\ & \quad (0.0030) \quad (0.6754) \end{aligned}$$

$$R^2 = 0.9993$$

where the significance levels are shown in parentheses.

The estimated coefficients on output were highly significant in all equations except that of hours per active spindle (B_4). The impact of output was strongest on the weekly average spindle hours (B_3) followed by average weekly hours of apparel production workers (B_2). However, the estimated parameters on the relative factor price variables were small except hours per active spindle (B_4) and with the exception of hours per active spindle (B_4) and apparel inventories (B_5) were all insignificant. The parameter estimates for time trend were very small and were all statistically insignificant.

All of the own adjustment coefficients were significant at the 0.0001 level and had positive signs except hours per active spindle (B_4). The adjustment to a change in apparel output was responded to mostly by apparel inventories (B_5)

followed by apparel employment (B_1). Twelve of the cross-adjustment coefficients were statistically significant at the 0.05 level. However, there was at least one significant cross-adjustment coefficient in each input equation. This shows that input adjustments are interrelated.

The estimated coefficients of the five one-month lag input demand equations for apparel are tabulated in the Table 4.7.

Second, the five log linear equations of three-month lag input demand model for apparel were computed.

One, the estimated input demand equation for apparel employment was:

$$\begin{aligned}
 \log B_{1,t} = & 2.1251 + 0.7756 \log B_{1,t-3} - 0.1131 \log B_{2,t-3} \\
 & \quad (0.0001) \quad (0.0267) \\
 & + 0.0116 \log B_{3,t-3} - 0.0024 \log B_{4,t-3} \\
 & \quad (0.3532) \quad (0.7453) \\
 & - 0.1220 \log B_{5,t-3} + 0.2180 \log AP_t \\
 & \quad (0.0001) \quad (0.0001) \\
 & - 0.0259 \log RFP_t + 0.0020 \log TR_t \quad (4.33) \\
 & \quad (0.0001) \quad (0.4435)
 \end{aligned}$$

$$R^2 = 0.9815$$

where the significance levels are shown in parentheses.

Table 4.7. Estimated Coefficients of One-Month Lag Input Demand Equations for Apparel

Independent Variables	Dependent Variables				
	$\log B_{1,t}$	$\log B_{2,t}$	$\log B_{3,t}$	$\log B_{4,t}$	$\log B_{5,t}$
Constant	0.7984***	3.3049***	-1.1690	1.9203	-0.7908***
$\log AP_t$	0.0716***	0.0998***	0.6069***	0.1624	-0.0788***
$\log RFP_t$	-0.0067	0.0018	-0.0574	0.2079***	-0.0112**
$\log TR_t$	0.0010	-0.0029	-0.0008	-0.0333	-0.0006
$\log B_{1,t-1}$	0.8983***	-0.2162***	0.8114***	-0.8923***	0.0367*
$\log B_{2,t-1}$	-0.0255	0.3947***	0.3508	1.7066***	0.1045***
$\log B_{3,t-1}$	0.0206**	0.0453***	0.3042***	0.7460***	-0.0031
$\log B_{4,t-1}$	-0.0088	0.0072	-0.0352	-0.3817***	0.0070
$\log B_{5,t-1}$	-0.0421***	-0.0424***	-0.3236***	0.0915	0.9778***

One asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level, two asterisks denote the 0.01 level, and three asterisks denote the 0.001 level.

B_1 = apparel employment

B_2 = average weekly hours of apparel production workers

B_3 = weekly average spindle hours

B_4 = hours per active spindle

B_5 = apparel inventories

AP = apparel products

REP = ratio of factor prices

TR = time trend

Two, the estimated input demand equation for average weekly hours of apparel workers was:

$$\begin{aligned}
 \log B_{2,t} = & 3.9653 - 0.2228 \log B_{1,t-3} + 0.3139 \log B_{2,t-3} \\
 & (0.0001) \quad (0.0001) \\
 & + 0.0135 \log B_{3,t-3} + 0.0086 \log B_{4,t-3} \\
 & (0.3047) \quad (0.2793) \\
 & - 0.0626 \log B_{5,t-3} + 0.1221 \log AP_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0022 \log RFP_t - 0.0026 \log TR_t \quad (4.34) \\
 & (0.7356) \quad (0.3321)
 \end{aligned}$$

$$R^2 = 0.6508$$

where the significance levels are shown in parentheses.

Three, the estimated parameters of input demand equation for weekly average spindle hours was:

$$\begin{aligned}
 \log B_{3,t} = & 2.5342 + 0.6024 \log B_{1,t-3} + 0.1183 \log B_{2,t-3} \\
 & (0.0005) \quad (0.7072) \\
 & + 0.2311 \log B_{3,t-3} - 0.1211 \log B_{4,t-3} \\
 & (0.0030) \quad (0.0097) \\
 & - 0.4843 \log B_{5,t-3} + 0.8885 \log AP_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0806 \log RFP_t - 0.0015 \log TR_t \quad (4.35) \\
 & (0.0330) \quad (0.9250)
 \end{aligned}$$

$$R^2 = 0.8249$$

where the significance levels are shown in parentheses.

Four, the parameter estimates of input demand equation for hours per active spindle was:

$$\begin{aligned}
 \log B_{4,t} = & 2.6006 + 0.3914 \log B_{1,t-3} + 0.3734 \log B_{2,t-3} \\
 & (0.0671) \quad (0.3387) \\
 & - 0.5560 \log B_{3,t-3} + 0.6576 \log B_{4,t-3} \\
 & (0.0001) \quad (0.0001) \\
 & - 0.3694 \log B_{5,t-3} + 0.7197 \log AP_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0315 \log RFP_t - 0.0077 \log TR_t \quad (4.36) \\
 & (0.4998) \quad (0.6960)
 \end{aligned}$$

$$R^2 = 0.4695$$

where the significance levels are shown in parentheses.

Five, the estimated coefficients of input demand equation for apparel inventories was:

$$\begin{aligned}
 \log B_{5,t} = & - 2.4848 + 0.0827 \log B_{1,t-3} + 0.3594 \log B_{2,t-3} \\
 & (0.0030) \quad (0.0001) \\
 & + 0.0197 \log B_{3,t-3} + 0.0168 \log B_{4,t-3} \\
 & (0.1129) \quad (0.0253) \\
 & + 0.9442 \log B_{5,t-3} - 0.2002 \log AP_t \\
 & (0.0001) \quad (0.0001) \\
 & - 0.0315 \log RFP_t + 0.0007 \log TR_t \quad (4.37) \\
 & (0.0001) \quad (0.7747)
 \end{aligned}$$

$$R^2 = 0.9982$$

where the significance levels are shown in parentheses.

The estimated parameters for output in all equations were significantly different from zero at the 0.0001 level. The impact of output was strongest on the weekly average spindle hours (B_3) followed by hours per active spindle (B_4). However, the estimated coefficients for the ratio of factor prices were very small and were statistically significant except average weekly hours of apparel workers (B_2) and hours per active spindle (B_4). The estimated coefficients on time trend were extremely small and were all insignificant.

All of the own adjustment coefficients were highly significant and were positive. A change in apparel output was adjusted mostly by apparel inventories (B_5) followed by apparel employment (B_1). Out of the twenty cross-adjustment coefficients twelve were statistically significant at the 0.05 level. However, there was at least one significant cross-adjustment coefficient in each input equation. This suggests that input adjustments are interrelated.

The estimated coefficients of the five three-month lag input demand equations for apparel are shown in the Table 4.8.

Table 4.8. Estimated Coefficients of Three-Month Lag Input Demand Equations for Apparel

Independent Variables	Dependent Variables				
	$\log B_{1,t}$	$\log B_{2,t}$	$\log B_{3,t}$	$\log B_{4,t}$	$\log B_{5,t}$
Constant	2.1251***	3.9653***	2.5342	2.6006	-2.4848***
$\log AP_t$	0.2180***	0.1221***	0.8885***	0.7197***	-0.2002***
$\log RFP_t$	-0.0259***	-0.0022	-0.0806*	-0.0315	-0.0315***
$\log TR_t$	0.0020	-0.0026	-0.0015	-0.0077	0.0007
$\log B_{1,t-3}$	0.7756***	-0.2228***	0.6024***	0.3914	0.0827**
$\log B_{2,t-3}$	-0.1131*	0.3139***	0.1183	0.3734	0.3594***
$\log B_{3,t-3}$	0.0116	0.0135	0.2311**	-0.5560***	0.0197
$\log B_{4,t-3}$	-0.0024	0.0086	-0.1211**	0.6576***	0.0168*
$\log B_{5,t-3}$	-0.1220***	-0.0626***	-0.4843***	-0.3694***	0.9442***

One asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level, two asterisks denote the 0.01 level, and three asterisks denote the 0.001 level.

B_1 = apparel employment

B_2 = average weekly hours of apparel production workers

B_3 = weekly average spindle hours

B_4 = hours per active spindle

B_5 = apparel inventories

AP = apparel products

REP = ratio of factor prices

TR = time trend

CHAPTER V

SUMMARY AND CONCLUSIONS

The objective of this study was to formulate and estimate import demand models, output models and input demand models for factors of production for the textile and apparel sectors of the United States. The import demand theory was derived from a consumer demand function. The method followed the Houthakker and Magee Model which was developed by Houthakker and Magee (1969) and utilized to estimate the demand elasticities with respect to price and income for both exports and imports of several countries. The output theory was derived from a disequilibrium domestic output equation presented by Pelzman and Martin (1981). The input demand models were derived from disequilibrium input demand theory similar to Nadiri and Rosen (1973). Actually, these authors adapted and developed their input demand functions from the familiar Cobb-Douglas production function. The potential of these models lay in analyzing and presenting generalized frameworks for time-series study of imports, production, employment, labor utilization, capital utilization, capital stock and inventory. Each model lent itself to certain economically meaningful conceptual experiments. Specific forms of the general models were specified and estimated from monthly time-series data for the time period from January 1970 to September 1991.

The over-all estimates can be summarized as follows:

(1) The level of textile imports had a negative relation with import price, positive with domestic price, and negative with the price ratio; and the level of apparel imports had a negative relation with the price ratio. The estimated coefficients (-0.5509 to -1.0618 for own-price elasticities and -0.5605 to -1.0590 for price ratio elasticities) of the price variables for textile import demand models indicate that volume of textile imports demanded becomes more sensitive to price changes as the time lag is lengthened. However, the estimated price ratio elasticities (-0.1834 and -0.2255) of apparel import demand models were somewhat small and in the inelastic range, possibly because of probable market distortions due to protection of the apparel industry.

(2) The levels of textile and apparel imports had a positive relation with disposable personal income. This implies that an increase in income would increase the U.S. textile and apparel imports and a decrease in income would cause a decrease in the U.S. textile and apparel imports. The income elasticities (0.2022 to 0.2686 and 0.1544 to 0.2844 for textiles, and 0.3727 to 0.6513 for apparel) of textile and apparel import demand models suggest that normal goods are imported to the United States from most of the exporting countries.

(3) The levels of domestic textile and apparel output had a positive relation with total employment, positive with weekly average spindle hours (a proxy variable for capital utilization rate), and positive with capacity. The estimated elasticity parameters (2.6028 and 2.5625) of the capacity variable for

domestic apparel output were almost three times that (0.9370 and 0.9323) of domestic textile output. This suggests that the level of domestic apparel output may be influenced more by the capacity than the level of the domestic textile output.

(4) The levels of domestic textile and apparel output had a negative relation with the ratio of inventories and positive with the ratio of domestic prices. The estimated elasticity coefficients (3.0534 and 3.0001 for textiles, and 2.5335 and 2.4982 for apparel) for the ratio of domestic prices were larger than that (-0.1714 and -0.1814 for textile, and -0.7571 and -0.7515 for apparel) for the ratio of inventories. This suggests that the levels of domestic output may be more sensitive to price changes than inventory changes.

(5) The levels of domestic textile and apparel output had a negative relation with the level of textile and apparel imports. One interpretation of this is that imports serve to replace domestic production, so an increase in textile and/or apparel imports would lead to decreased domestic output. However, the impact of imports on domestic production was quite small in the short-run because the short-run import elasticities (-0.0485 and -0.0387 for textiles, and -0.0688 and -0.0513 for apparel) of output were very small.

(6) In the one-month lag input demand model for textiles, the impact of output was strongest on the hours per active spindle (a proxy variable for capital stock) followed by average weekly hours of textile production workers (a proxy variable for labor utilization rate of production workers). A change in textile

output was apparently adjusted mostly by textile inventories followed by textile employment. Input adjustments were interrelated because each equation had at least one significant cross-adjustment coefficient.

(7) In the three-month lag input demand model for textiles, the impact of output was strongest on the hours per active spindle followed by average weekly spindle hours (a proxy variable for capital utilization rate). The adjustment to a change in textile output was responded to mostly by textile inventories followed by textile employment. Out of the twenty cross-adjustment coefficients thirteen were statistically significant at the 0.05 level or better. But, each equation had at least one significant cross-adjustment coefficient. This implied that the input adjustments were interrelated.

(8) In the one-month lag input demand model for apparel, the impact of output was strongest on the weekly average spindle hours followed by average weekly hours of apparel production workers. The adjustment to a change in apparel output was responded to mostly by apparel inventories followed by apparel employment. Twelve of the cross-adjustment coefficients were statistically significant at the 0.05 level or stronger. However, in all equations there was at least one significant cross-adjustment, suggesting that input adjustments were interrelated.

(9) In the three-month lag input demand model for apparel, the impact of output was strongest on the weekly average spindle hours followed by hours per active spindle. A change in apparel output was adjusted mostly by apparel

inventories followed by apparel employment and hours per active spindle. There was at least one significant cross-adjustment coefficient in each input equation. Therefore, input adjustments were interrelated as they were in the textile input sectors.

In conclusion, the estimated elasticities in this study can help to better understand the impacts of textile and apparel imports upon the determinants of textile and apparel import demand, upon textile and apparel production levels, and upon the major factors of the production in the U.S. domestic textile and apparel industries.

1. Recommendations for Future Study

Future studies should pay attention to the followings:

(1) More attention should be placed upon improved sources and quality of data. Specially, there is great need for better capital utilization rate and capital stock data, particularly for the apparel manufacturing industry.

(2) Textile and apparel categories were each treated as homogeneous product categories in this study, but the textile and apparel categories actually consist of dozens of individual products within each category. Future study should be performed more on specified product data in order to capture differences due to product characteristics.

(3) Better estimation theory for input demand models is needed.

(4) Quotas, VERs and numerous other non-tariff barriers dominate current U.S. Trade policy for textiles and apparel, so some estimates of parameters will be biased.

(5) Tariff equivalents of quotas can be estimated, but data is not readily available, particularly price data.

(6) Some studies could be undertaken using price premiums for major textile and apparel exporters to the U.S. if quota prices are available, but they seldom are.

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APPENDIX

Table A.1. Estimated Coefficients of Semi-Log Linear Equations for Textile Import Demand Model

Independent Variables	Dependent Variables	
	IMQ _t	IMQ _t
Constant	-2610073 (0.0001)	-2435674 (0.0001)
log(PIM/PUS) _t	-93751 (0.0001)	-212343 (0.0001)
logY _t	46802 (0.0001)	74383 (0.0001)
logIMQ _{t-1}	169915 (0.0001)	
logIMQ _{t-6}		96311 (0.0001)

The set of figures in parentheses are the significance levels.

IMQ = quantity of textile imports

PIM/PUS = ratio of textile import price to domestic textile price

Y = disposable personal income

Table A.2. Estimated Coefficients of Inverse Semi-Log Linear Equations for
Textile Import Demand Model

Independent Variables	Dependent Variables	
	$\log \text{IMQ}_t$	$\log \text{IMQ}_t$
Constant	12.2441 (0.0001)	12.6651 (0.0001)
$(\text{PIM/PUS})_t$	-50.1748 (0.0001)	-74.0657 (0.0001)
Y_t	0.0000708 (0.0001)	0.0001 (0.0001)
IMQ_{t-1}	0.0000022 (0.0001)	
IMQ_{t-6}		0.0000013 (0.0001)

The set of figures in parentheses are the significance levels.

IMQ = quantity of textile imports

PIM/PUS = ratio of textile import price to domestic textile price

Y = disposable personal income

Table A.3. Estimated Coefficients of Semi-Log Linear Equations for Apparel
Import Demand Model

Independent Variables	Dependent Variables	
	IMQ _t	IMQ _t
Constant	-3125170 (0.0001)	-2639626 (0.0001)
log(PIM/PUS) _t	-109144 (0.0001)	-114536 (0.0001)
logY _t	105100 (0.0001)	170194 (0.0001)
logIMQ _{t-1}	178006 (0.0001)	
logIMQ _{t-6}		97752 (0.0001)

The set of figures in parentheses are the significance levels.

IMQ = quantity of apparel imports

PIM/PUS = ratio of apparel import price to domestic apparel price

Y = disposable personal income

Table A.4. Estimated Coefficients of Semi-Log Linear Equations for Textile Output Model

Independent Variables	Dependent Variables	
	TMP _t	TMP _t
Constant	-584.5728 (0.0001)	-548.07889 (0.0001)
logTE _t	67.4639 (0.0001)	56.7860 (0.0001)
logWAS _t	15.2405 (0.0001)	15.4907 (0.0001)
log(PUS _t /PUS _{t-1})	238.7435 (0.0001)	235.5867 (0.0001)
log(I _t /I _{t-1})	-15.1963 (0.0001)	-15.9239 (0.0001)
logCP _t	77.5036 (0.0001)	77.0436 (0.0001)
logIMQ _t		-3.6853 (0.0001)
logIMQ _{t-3}		-2.8437 (0.0002)

The set of figures in parentheses are the significance levels.

TMP = textile output

TE = textile employment

WAS = weekly average spindle hours

PUS = domestic textile price

I = textile inventories

CP = capacity

IMQ = quantity of textile imports

Table A.5. Estimated Coefficients of Inverse Semi-Log Linear Equations for Textile Output Model

Independent Variables	Dependent Variables	
	$\log \text{TMP}_t$	$\log \text{TMP}_t$
Constant	-0.4726 (0.3188)	-0.4004 (0.4107)
TE_t	0.0221 (0.0001)	0.0185 (0.0001)
WAS_t	0.0001 (0.0001)	0.0001 (0.0001)
$\text{PUS}_t/\text{PUS}_{t-1}$	3.07112 (0.0001)	3.1506 (0.0001)
I_t/I_{t-1}	-0.0165 (0.0001)	-0.0173 (0.0001)
CP_t	0.0091 (0.0001)	0.0089 (0.0001)
IMQ_t	-0.0003 (0.0001)	
IMQ_{t-3}		-0.0002 (0.0001)

The set of figures in parentheses are the significance levels.

TMP = textile output

TE = textile employment

WAS = weekly average spindle hours

PUS = domestic textile price

I = textile inventories

CP = capacity

IMQ = quantity of textile imports

Table A.6. Estimated Coefficients of Semi-Log Linear Equations for Apparel Output Model

Independent Variables	Dependent Variables	
	AP_t	AP_t
Constant	-1335.9344 (0.0001)	-1279.8687 (0.0001)
$\log AE_t$	83.2913 (0.0001)	70.5308 (0.0001)
$\log WAS_t$	21.8435 (0.0001)	21.7696 (0.0001)
$\log(PUS_t/PUS_{t-1})$	189.3316 (0.0001)	187.0959 (0.0001)
$\log(I_t/I_{t-1})$	-71.4484 (0.0001)	-70.7949 (0.0001)
$\log CP_t$	235.9104 (0.0001)	232.1140 (0.0001)
IMQ_t	-5.6081 (0.0001)	
$\log IMQ_{t-3}$		-4.1241 (0.0001)

The set of figures in parentheses are the significance levels.

AP = apparel output

AE = apparel employment

WAS = weekly average spindle hours

PUS = domestic apparel price

I = apparel inventories

CP = capacity

IMQ = quantity of apparel imports

Table A.7. Estimated Coefficients of Inverse Semi-Log Linear Equations for Apparel Output Model

Independent Variables	Dependent Variables	
	$\log AP_t$	$\log AP_t$
Constant	-1.3134 (0.0022)	-1.3019 (0.0027)
AE_t	0.0209 (0.0001)	0.0185 (0.0001)
WAS_t	0.0001 (0.0001)	0.0001 (0.0001)
PUS_t/PUS_{t-1}	2.4436 (0.0001)	2.4642 (0.0001)
I_t/I_{t-1}	-0.2595 (0.0001)	-0.2712 (0.0001)
CP_t	0.0343 (0.0001)	0.0353 (0.0001)
IMQ_t	-0.0002 (0.0001)	
IMQ_{t-3}		-0.0001 (0.0008)

The set of figures in parentheses are the significance levels.

AP = apparel output

AE = apparel employment

WAS = weekly average spindle hours

PUS = domestic apparel price

I = apparel inventories

CP = capacity

IMQ = quantity of apparel imports

Table A.8. Estimated Coefficients of Semi-Log Linear Equations for One-Month Lag Textile Input Demand Model

Independent Variables	Dependent Variables				
	EMP _t	AWH _t	WAS _t	HAS _t	IV _t
Constant	-3933.2796*	15.6945	-12214.0*	-1211.1444	-48976.0*
logEMP _{t-1}	746.8983*	-7.2523*	955.1497*	-334.0615*	-267.4986
logAWH _{t-1}	10.3084	16.4126*	1252.6983*	513.9115*	1128.8279*
logWAS _{t-1}	-8.9652	2.6647*	552.7359*	300.4817*	-490.1046*
logHAS _{t-1}	7.7766*	0.0692	-81.0450	-206.0504*	241.6809*
logIV _{t-1}	-65.0444*	-3.6210*	-266.4370*	23.1169	6280.1804*
logTMP _t	67.9475*	5.6312*	341.8246	236.6046*	416.0284*
logRFP _t	2.0539	0.9064*	-164.8678*	75.0982*	115.0640
logTR _t	-1.5366	-0.2104	12.1692	-23.4441*	-317.5953*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = textile employment

AWH = average weekly hours of textile production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

Table A.9. Estimated Coefficients of Inverse Semi-Log Linear Equations for One-Month Lag Textile Input Demand Model

Independent Variables	Dependent Variables				
	logEMP _t	logAWH _t	logWAS _t	logHAS _t	logIV _t
Constant	5.8148*	3.2389*	6.1172*	4.5423*	7.9231*
EMP _{t-1}	0.0010*	-0.0003*	0.0000894	-0.0002	-0.0000424
AWH _{t-1}	0.0003	0.0131*	0.0218*	0.0329*	-0.0088*
WAS _{t-1}	0.0000068	0.0000344*	0.0002*	0.0004*	0.0000538*
HAS _{t-1}	0.0000054	0.0000155	-0.0000778	-0.0008*	-0.0000773*
IV _{t-1}	-0.0000006	-0.0000086	0.0000059	-0.0000279	0.0001*
TMP _t	0.0009*	0.0015*	0.0049*	0.0016	0.0029*
RFP _t	-0.0147*	0.0468*	-0.2146*	0.1290	-0.1581*
TR _t	-0.0003*	-0.0003	-0.0015	0.0018	0.0009*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = textile employment

AWH = average weekly hours of textile production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

Table A.10. Estimated Coefficients of Semi-Log Linear Equations for Three-Month Lag Textile Input Demand Model

Independent Variables	Dependent Variables				
	EMP _t	AWH _t	WAS _t	HAS _t	IV _t
Constant	-2814.2570*	65.8679*	-4939.0124*	-1148.0482	-54043.0*
logEMP _{t-3}	622.0862*	-9.3256*	388.1840	66.7433	-442.6052
logAWH _{t-3}	-9.5874	11.1736*	1072.9512*	374.2706*	2292.0983*
logWAS _{t-3}	3.1373	1.7749*	534.0649*	-258.5056*	-370.8209*
logHAS _{t-3}	3.0135	-0.0663	-275.7714*	321.7778*	303.9469*
logIV _{t-3}	-142.4972*	-5.6454*	-664.3083*	-139.3861*	6140.1719*
logTMP _t	155.3698*	7.4246*	775.8323*	205.2813*	805.1460*
logRFP _t	-5.9404	0.8391*	-198.8753*	-55.7039*	-41.7017
logTR _t	0.5656	-0.1730	24.1398	7.1214	-291.1642*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = textile employment

AWH = average weekly hours of textile production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

Table A.11. Estimated Coefficients of Inverse Semi-Log Linear Equations for Three-Month Lag Textile Input Demand Model

Independent Variables	Dependent Variables				
	logEMP _t	logAWH _t	logWAS _t	logHAS _t	logIV _t
Constant	5.9568*	3.4855*	6.5671*	5.1504*	7.6113*
EMP _{t-3}	0.0007*	-0.0004*	-0.0003	-0.0003	0.0002*
AWH _{t-3}	0.0008	0.0100*	0.0213*	0.0254*	-0.0048
WAS _{t-3}	0.0000071	0.0000156	0.0002*	-0.0003*	0.0000629*
HAS _{t-3}	0.0000083	0.0000159	-0.0002*	0.0012*	-0.0000605
IV _{t-3}	-0.0000031	-0.0000110	-0.0000162	-0.0000033	0.0001*
TMP _t	0.0025*	0.0024*	0.0076*	0.0065*	0.0026*
RFP _t	-0.0069	0.0587*	-0.2121*	-0.0785	-0.2364*
TR _t	-0.0008*	-0.0006*	-0.0020*	-0.0019	0.0019*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = textile employment

AWH = average weekly hours of textile production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = textile inventories

TMP = textile mill products

RFP = ratio of factor prices

TR = time trend

Table A.12. Estimated Coefficients of Semi-Log Linear Equations for One-Month Lag Apparel Input Demand Model

Independent Variables	Dependent Variables				
	EMP _t	AWH _t	WAS _t	HAS _t	IV _t
Constant	-6283.0143*	25.7347*	-11902.0*	-1583.7440	-153498.0*
logEMP _{t-1}	1081.0074*	-7.6654*	1361.9957*	-464.1020*	-5532.6104*
logAWH _{t-1}	-24.3856	14.2052*	684.8296	857.3916*	9091.8986*
logWAS _{t-1}	17.9069	1.5405*	476.1170*	390.4094*	67.3212
logHAS _{t-1}	-7.0200	0.2708	-34.2571	-199.5126*	544.9970*
logIV _{t-1}	-52.1265*	-1.5232*	-597.7931*	52.1765	18593.0*
logAP _t	78.3420*	3.5858*	917.9065*	61.8109	-544.2417
logRFP _t	7.7067	0.0367	-23.0213	108.4378*	306.4524
logTR _t	-2.6784	-0.1036	-7.0527	-15.6648	-946.1030*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = apparel employment

AWH = average weekly hours of apparel production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = apparel inventories

AP = apparel products

RFP = ratio of factor prices

TR = time trend

Table A.13. Estimated Coefficients of Inverse Semi-Log Linear Equations for One-Month Lag Apparel Input Demand Model

Independent Variables	Dependent Variables				
	logEMP _t	logAWH _t	logWAS _t	logHAS _t	logIV _t
Constant	6.2181*	3.2254*	5.8137*	4.2237*	8.8132*
EMP _{t-1}	0.0007*	-0.0001*	0.0003	-0.0000575	0.0003*
AWH _{t-1}	-0.0000137	0.0118*	0.0202*	0.0423*	-0.0190*
WAS _{t-1}	0.0000103*	0.0000296*	0.0002*	0.0005*	-0.0000201
HAS _{t-1}	-0.0000132	0.0000119	-0.0000132	-0.0008*	-0.0000607*
IV _{t-1}	-0.0000006	-0.0000038*	-0.0000054	-0.0000102	0.0000434*
AP _t	0.0013*	0.0006*	0.0080*	-0.0006	0.0053*
RFP _t	-0.0273*	-0.0026	-0.0873	0.2298*	-0.1491*
TR _t	-0.0003*	0.0003	-0.0018*	0.0024*	0.0010*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = apparel employment

AWH = average weekly hours of apparel production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = apparel inventories

AP = apparel products

RFP = ratio of factor prices

TR = time trend

Table A.14. Estimated Coefficients of Semi-Log Linear Equations for Three-Month Lag Apparel Input Demand Model

Independent Variables	Dependent Variables				
	EMP _t	AWH _t	WAS _t	HAS _t	IV _t
Constant	-4626.6134*	49.3455*	-5436.0802	-1463.1908	-183535.0*
logEMP _{t-3}	925.9344*	-8.0068*	942.6214*	235.0573*	-4881.1092*
logAWH _{t-3}	-135.5014*	11.3596*	331.1714	180.0633	14151.0*
logWAS _{t-3}	8.9192	0.4996	377.9959*	-299.1110*	547.1917
logHAS _{t-3}	1.2067	0.2973	-193.1774*	346.6559*	740.7795*
logIV _{t-3}	-149.1059*	-2.2111*	-872.7271*	-186.7474*	18007.0*
logAP _t	255.0240*	4.3132*	1384.2130*	351.8109*	1222.1961
logRFP _t	-15.8402*	-0.0943	-63.2468	-16.2816	-68.4078
logTR _t	-1.5494	-0.0905	-7.2730	-2.1578	-886.8778*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = apparel employment

AWH = average weekly hours of apparel production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = apparel inventories

AP = apparel products

RFP = ratio of factor prices

TR = time trend

Table A.15. Estimated Coefficients of Inverse Semi-Log Linear Equations for Three-Month Lag Apparel Input Demand Model

Independent Variables	Dependent Variables				
	logEMP _t	logAWH _t	logWAS _t	logHAS _t	logIV _t
Constant	6.3899*	3.3786*	6.3680*	4.9579*	8.2952*
EMP _{t-3}	0.0005*	-0.0002*	-0.0002	0.0000194	0.0005*
AWH _{t-3}	-0.0007	0.0103*	0.0190*	0.0246*	-0.0127*
WAS _{t-3}	0.0000067	0.0000119	0.0001*	-0.0003*	-0.0000149
HAS _{t-3}	0.0000079	0.0000140	-0.0001	0.0013*	-0.0000313
IV _{t-3}	-0.0000028*	-0.0000042*	-0.0000059	-0.0000118	0.0000409*
AP _t	0.0028*	0.0009*	0.0109*	0.0064*	0.0062*
RFP _t	-0.0406*	-0.0013	-0.0729	0.0363	-0.1924*
TR _t	-0.0005*	0.0001	-0.0028*	-0.0010	0.0013*

An asterisk denotes that the estimated coefficient is significantly different from zero at the 0.05 level.

EMP = apparel employment

AWH = average weekly hours of apparel production workers

WAS = weekly average spindle hours

HAS = hours per active spindle

IV = apparel inventories

AP = apparel products

RFP = ratio of factor prices

TR = time trend

VITA

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