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Kang, Shin II

INFORMATION AND ITS EFFECTS ON LOCATION AND SCALE: AN APPLICATION TO THE TEXTILE INDUSTRY

The Ohio State University

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INFORMATION AND ITS EFFECTS ON LOCATION AND SCALE:
AN APPLICATION TO THE TEXTILE INDUSTRY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of the Ohio State University

By
Shin Il Kang

* * * * *

The Ohio State University
1986

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To my Parents
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Chapter I

INTRODUCTION

Fluctuating market demand for a product may have a variety of effects on the organization of production in an industry. It may alter optimal firm size because of the differential abilities of firms of various sizes to respond to changes in consumer demand. Furthermore, it may alter the optimal location of the industry. If consumer preferences change quickly, it may be important for an industry to relocate closer to the consumption market, since long delivery lags increase the probability of style obsolescence. This process may affect both the internal location of an industry and the likelihood of import penetration.

The textile industry is a good choice for exploring these propositions empirically. This industry has two major components, mill products and apparel. The second is much more vulnerable to fluctuations in fashion, or the demand for variety. It is expected that the apparel industry will be comprised of smaller firms in general, and will be located closer to the information centers, the Northeast or Northcentral regions of the U.S.. These propositions should apply as well to the international shift in the locus of production in the last decade or two. Developing countries have penetrated the U.S. with nonfashion goods because of long delivery
lags, while developed countries have penetrated the U.S. with fashion goods because of the similar consumer information structures.

Again the textile industry has two major components, textile mill\(^1\) products and apparel, the second of which is more vulnerable to fluctuations in fashions. In 1977, the textile mill industry shipped 76.3\% of its products to intermediate markets and 20\% of its products to the apparel industry.\(^2\) If intermediate markets, such as the automobile, agriculture, and furniture market, etc., are less affected by style than the apparel industry, it is evident that the textile mills industry is in general much less subject to fluctuations in style than the apparel industry, since the former supplies most of its products to intermediate markets. An analysis of stock price data below supports this empirical conjecture.

A simple comparison of the industrial organization of the two sectors is consistent with the fluctuating demand hypotheses. The apparel sector, which faces more rapidly changing demand conditions, is comprised of small family owned firms. Over sixty-six per cent of the 4-digit industries in this sector have an eight firm concentration ratio (CR8) of 40 or less. Most industries in the textile sector, in contrast, fall between 40 and 70. Generally, they are competitive industries; however, the textile mills industry is less obviously so than the apparel industry.

---

1. The term "mill" as used here refers to the several types of manufacturing establishments as defined by the Bureau of the Census.
Historically, both industries have shifted to the South. The shift of the textile mills industry to the South, however, has been more rapid and complete. Regional differences in factor costs have been a major reason of relocation. As will be developed at length below, both industries shifted to the South to take advantage of low fuel costs, weak unionism, and a large supply of low skilled workers. The reason for the differential speeds of adjustment will be a major focus of analysis below.

Information factors, including uncertain fashion shifts, may play a major role in the industry structure of each sector and in determining location of the industry. The first proposition raised is that firm size is partly determined by the trade-off between the risks the firm faces under fashion uncertainty and mass production. Mass production techniques (large batches of standardized goods) achieve lower per unit costs as the batch becomes larger, but are very risky under uncertainty because, among other things, they commonly involve long-term commitments to organizations that are highly specialized. Losses may be large if the plan proves to be wrong because highly specialized techniques are expensive to convert. Therefore, uncertain market demand resulting from changes in the consumer information structure may change the optimal firm size and lead to less usage of capital intensive methods compared to a certain world. It is expected that the apparel industry will tend to have small firms and the textile mills industry will tend to have medium-sized firms.
Similarly, information and uncertainty considerations may affect locational decisions. The apparel industry, which is sensitive to fashion, is located near fashion markets, usually large urban cities, in part because large urban cities, such as New York, are style setting centers. The concentration in large urban cities allows manufacturers to be in touch with ideas from other firms and consumers. In order to make a fast adjustment to a short life cycle of style, manufacturers try to provide quick delivery on special orders. Otherwise, the style may pass out and replaced by another. It is expected that in the presence of fashion uncertainty, the apparel industry will be located closer to the consumer information market to deliver goods instantaneously, and that the textile mill industry that produces items for which access to style centers are less important, may locate away from the fashion center.

We apply the above two propositions to the international shift in the locus of production of the textile industry. The textile industry is a good area for studying various types of products, such as standardized and customized products. Although nondurable goods industries usually produce standardized products and carry few unfilled orders (See Table 1), the same is not true of the textile industry. Large textile firms use capital more intensively than labor and produce standardized products, while small textile firms use relatively more labor and produce customized products (Ol(66)). The textile industry in developing countries is often a "mature" industry. The textile industry in developing countries produce standardized products while
the textile industry in developed countries produces customized products.

Small-sized producers in developed countries adjust efficiently to market randomness by producing made-to-order products for export to developed countries having similar consumer information structures. This provides a way to minimize the risks of producers in developed countries.

Firms in developing countries have a comparative disadvantage in producing fashion goods. Truly high fashions may be expensive enough to warrant air delivery but for the vast bulk of apparel shipments ocean shipping is the only economical delivery system. Delivery lags contribute to their low import penetration into U.S. markets. Large firms in developing countries have linked their production to the needs and fast changing demand of stores and customers thousands of miles away by producing made-to-order consumer goods through overseas subcontracting with developed countries (Keesing(1983)). The role of subcontracting may be one of the contributing factors for developing countries to increase penetration of developed countries' markets. In 1979, the export flow share of clothing between developed countries dominates the export flow share of clothing between developed countries and developing countries (44.1%) (See Table 2). However, the export share of the latter has recently grown rapidly.

Firms in developed countries understand the consumer information structure of developed countries better than that of developing
countries because they have similar consumer information structures. We expect that U.S. firms facing higher proportions of import share from developed countries may be firms which produce more stylish (or fashionable) products than other firms.

The plan of this study is the following. Our first objective is to examine the empirical relationship between information and location and the relationship between information and firm size. We apply the same propositions to explain the international shift in the locus of production. Second, we survey a substantial amount of literature concerning these issues in Chapter 2. Third, we explain the equilibrium distribution of the textile industry between locations and firm size when fashion uncertainty exists in Chapter 3. Furthermore, the firm size is explained under a variety of consumer preferences in Chapter 3. Fourth, we discuss the stylized facts about the textile industry in Chapter 4. Fifth, we explore the above propositions empirically as they apply to the textile industry, and apply two propositions to international shifts in the locus of production in the last decade or two in Chapter 5. Finally, Chapter 6 provides a summary and states our conclusion.
### TABLE 1

**MANUFACTURER SHIPMENTS, NEW ORDERS AND INVENTORIES IN 1971**

[unit: $\text{M}$]

<table>
<thead>
<tr>
<th></th>
<th>New Orders</th>
<th>Unfilled Orders (End of Years)</th>
<th>Inventory Total</th>
<th>A/B</th>
</tr>
</thead>
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<tr>
<td><strong>Shipments Monthly Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Manufacturing Industries</td>
<td>110,843</td>
<td>112,451</td>
<td>191,845</td>
<td>180,116</td>
</tr>
<tr>
<td>Durable Goods Industries</td>
<td>58,010</td>
<td>59,562</td>
<td>183,296</td>
<td>114,860</td>
</tr>
<tr>
<td>Nondurable Goods Industries</td>
<td>52,832</td>
<td>52,889</td>
<td>8,547</td>
<td>65,256</td>
</tr>
<tr>
<td>Apparel and Home Goods</td>
<td>5,406.33</td>
<td>5,432.75</td>
<td>2,774</td>
<td>10,621</td>
</tr>
</tbody>
</table>

Note (*)

1. Only available data are a combination of apparel and home goods.
2. Textile mill data are not available separately in new orders and unfilled orders.

Source: Department of Commerce, Bureau of the Census

### TABLE 2

**PERCENTAGE OF MAJOR EXPORT COUNTRIES FLOWS**

<table>
<thead>
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<th></th>
<th>Fibers 1963</th>
<th>Textiles 1963</th>
<th>Clothing 1963</th>
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<tr>
<td>IND TO IND (%)</td>
<td>16.4</td>
<td>49.4</td>
<td>53.4</td>
</tr>
<tr>
<td>IND TO DEVELOP (%)</td>
<td>5.4</td>
<td>18.9</td>
<td>12.2</td>
</tr>
<tr>
<td>DEVELOP IND (%)</td>
<td>24.4</td>
<td>7.5</td>
<td>9.5</td>
</tr>
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</table>

Source: GATT '1983 OECD REPORT' (2300-M21) pp 45
Chapter II

LITERATURE REVIEW

The focus of this literature deals with firm size and the choice of location under frequent changes in the consumer information structure. For the most part, the old literature implicitly understands the above issues but does not develop them rigorously.

The literature on the theory of firm is enormous. The social organization that we call a firm performs risk bearing (42), coordination (5, 12, 16, 48, 19), and supervision (13, 37, 40, 22, 66, 114). Lucas (47), Williamson (116), Beckman (13), Oi (66), and Calvo (16) analyze equilibrium firm size with a common characteristic, namely each firm has only one entrepreneur. His functions are risk bearing in an uncertain world, monitoring of labor forces, and coordination of production. All decisions must ultimately be coordinated by a single decision making unit which could be an owner-operator and (or) a chief executive. Variations in the size of given units of coordinating ability could generate different equilibrium firm sizes in the same industry. Chandler (19) shows that the fundamental shift toward managers, who carry out administrative coordination and allocation, exerted a large influence in determining firm size.
Oi (1983) mentions that a dispersion of entrepreneur abilities generates an equilibrium size distribution of firms and that the product mix varies with the firm in such a way that customized goods are produced in small batches which are not suited to capital intensive production. Small firms are better able to provide the flexible, adaptable organizations that meet the shifting demands for customized, labor intensive products. Carlton (14) mentions that firms have an incentive to integrate to insure a supply of input to satisfy their high probability demand, because the free market cannot be relied upon to achieve the socially desirable allocation of risk and production. He further notes, however, that firms are less likely to integrate when they form a small part of total demand for the input since they would lose the risk pooling economies of large markets as they integrate.

Smith (81), Arrow (7), and Stigler (83) suggest some factors, such as diseconomies of scale and market demand, as outweighing effects on the natural growth of social organization and suggest that the firm size depends upon some trade-off between economies of scale and diseconomies of scale.

Robinson (77) and Stigler (84) mention that large firms cannot compete successfully with small firms in conditions in which there is a high degree of uncertainty. Robinson (77) say that "where the important decisions are infrequent, and the necessity for a quick decision is less urgent, the large firm can play its part more efficiently." Schwartzman (87) contributed to understanding the effect of uncertainty on the size of the firm by showing empirically that
uncertainty reduces the size of the firm. As a measure of uncertainty for any industry, he used the ratio of markdown to total sales in the United States between 1953 and 1955. However, his work uses a simple linear regression analysis to establish the negative relationship between uncertainty and concentration without a rigorous model.

Chamberlin (17) characterized demand in a flexible way but product specification is implicit in the form of demand and not explicitly shown. Stiglitz and Dixit (85) assume an explicit form of market demand. They used it to analyze questions such as quantity versus diversity. With scale economies, resources can be saved by producing fewer good and large quantities of each. However this leaves less variety. They show that a greater number of firms with equal size exist in the unconstrained optimum than in market equilibrium.

Location theories of the firm fall into two categories, location in homogeneous space and location in heterogeneous space. In the former, consumers are evenly distributed in space so that demand considerations are an intrinsic part of market area considerations. In the case of heterogeneous space, delivered prices faced by the locator vary continuously over space because outputs and inputs used by the locator have to be transported at a positive price. The pioneering work on the latter part was done by Weber (114), and was extended by Isard (36) who incorporated the substitution principle of economic theory into spacial theory. Moses (62) utilizes the neoclassical theory of production fully integrated with the theory of location.
Weber (114) explains the locational distribution of industry, not merely those connected with an isolated process of production. He introduces agglomerating factors, such as marketing and large-scale production, deglomerating factors such as rental payment, and transportation cost, given the location of material, labor, and the size and place of consumption. He also claimed that various agglomerating factors will become weak as deglomerative factors such as rental payment, and transportation cost increase with the size of agglomeration.

Recent empirical studies since World War II give us an empirical basis for suggesting that the forces such as markets, climate, labor, tax, and external economies (or agglomerative economies) contribute to the disparities in regional growth. An early major studies is that of McLaughlin and Robock (54). Their research is confined to a group of 13 southern states. They point out some forces why plants move to the South. From interviews with 88 plants which recently moved to the South, labor-oriented firms like textile industry were primarily motivated to relocate by the low labor cost and were secondarily influenced by markets. Textile plants went to the northern part of the South to be closer to northeastern markets because of the potential obsolescence of their products. Magee (49) also identifies trends in the location of women's clothing industry within New York, and Chicago. He shows that women's clothing industry tend to be located on the market center of each cities.
Perloff(73) covers labor, climate, and industry mix as factors in regional growth. His analyses of individual industries credit low wage labor availability with attracting textiles and apparel to the South. He suggests that in the apparel industry change in fashion might be a factor in a firm's location choice, but did not show any empirical findings.

Thompson and Mattila(89) examine a few other factors such as taxes, union membership of nonagricultural employment in 1947, and hourly earnings in manufacturing in 1949 to explain the state manufacturing growth. They find that taxes do not seem to have a significant influence. Sobel(82) examines the decentralization of the Rubber-Tire industry from Akron in Ohio. He finds that decentralization has been cited as a consequence of trade union organization. Maher(49) examines wage differentials between union and nonunion plants in dress, and cotton textiles plant. There is found to be no significance to the number or average magnitude of union-nonunion wage rate differentials.

Fuchs(9) estimates, by focusing on manufacturing growth in the period 1929-1954, that one third of all employment shifts between regions were due to resources (including climate) and raw materials, and that another third resulted from abundant low skill, nonunion labor in the South. The remaining third was variously caused by changes in demand or could not be assigned to identifiable influences. Labor's first-place rank is supported by a finding that textiles and apparel contributed heavily to the South's gains and the Northeast's losses. He suggests that market is not the important determinant of
manufacturing location by seeing simple correlation (-0.57) between population density and growth. However, his error in the empirical analysis was to use a narrow concept of the local market, and to use population density as a proxy for manufacturing employment per capita.

Wheat(115) uses data for the 1947-1963 period for the forty-eight contiguous states to measure regional growth patterns and regional influences. The simple correlation (r) between wage and absolute growth in manufacturing employment (+ 0.07) is not only insignificant but positive. A union variable (-0.23) shows a mildly negative value. However, he suggests that the labor variable will display highly significant r's bearing the correct sign when he gets to partial correlations. Finally, he concludes that markets and climate are far ahead as the leading influences affecting manufacturing growth in the United States. Labor follows as a secondary influence.

Erickson and Wasylenko(27) test the site choice decision of relocating firms in seven single-digit SIC industries using data on firms which moved from Milwaukee city to its suburbs between 1964 and 1974. They find that agglomeration economies and available labor forces are important influences in the site choice among suburban locations for firms in all industries and that fiscal variables are of secondary significance in the choice among suburban municipalities. Pascal and McCall(71) adds search costs to three sorts of external economies such as buyer convenience, pools of specialized labor, and access to specialized inputs other than direct labor to explain relocations of firms. The locational choice of the new firm is
analogous to the job choices of young workers. Just as we expect turnover to be higher for young job searchers, we anticipate higher geographical mobility of young firms. Thus, young firms will try to economize on total costs by locating where other similar firms are prospering.

Carlton(15) tests a simultaneous model of both the locations and employment choice of new branch plants across SMSAs by using a non-homogeneous production production. He provides quantitative studies of plant location and the close link between location and firm size which has previously been ignored. He found that taxes and state incentive programs do not seem to have major effects and that existing concentrations of employment matter a great deal with the effects being stronger for industries with smaller average plant size. Carlton(15) and Oates(65) both find that energy costs have a surprisingly large effect. Oates mentions that the development of hydroelectric power in the South because of good and fast river system allowed the decentralization process of textile mills industry to proceed rapidly.
Chapter III

A THEORETICAL ANALYSIS

The intent of this Chapter is to develop a theoretical model under fashion uncertainty. The effect of fashion uncertainty on the choice of location and firm size is examined. Finally we examine the trade-off between scale and the demand for variety. A discussion of the assumptions is in order before proceeding.

3.1 ASSUMPTIONS

We assume a one period model. Goods are nonstorable (perishable). There exists no market demand uncertainty except for the lack of information about fashion so that entrepreneurs' expected sales equal actual sales.

With full information about fashion, let $\bar{p}$ be the price per unit received. The market price under fashion uncertainty is a function of $u$ (location or distance from the fashion center) in linear space, because the obsolescence costs caused by long delivery lags are associated with the distance($u$) from the plant to the information center. Firms can affect the price they pay or receive by their choice of location under fashion uncertainty, but cannot do so by varying the
amounts they buy or sell. We assume that the market is a perfectly competitive. Market demand, \( X \), is a function of \( p(u) \) under fashion uncertainty.

Production costs, \( C \), are a function of \( Z \) (the total volume of output) and \( u \), the distance from the plant to the market center. Thus, \( C = C(Z, u) \), \( C_u > 0 \). A manufacturing firm located far from the market center incurs some costs because of high additional transportation costs under full information about fashion. Assume that all manufacturing firms have increasing obsolescence costs and that transportation costs increase at a decreasing rate with distance. Thus, \( C_u \) is positive and \( C_{uu} \) is negative (\( C_u > 0 \), \( C_{uu} < 0 \)). The locational problem is formulated on a one-dimensional space.

If the production function is linearly homogeneous, the best location for one level of output is the best for all levels of output. Unit production costs are invariant with respect to the level of output but may vary over space (Miller and Jensen(58)). That is, the equation determining the optimal output level for a given location is independent of the equation for the factor mix which in turn feeds into the locational equilibrium condition (Emerson (25)).

A producer rents space for his production process. We assume that his space requirements are independent of scale of the output because in the textile industry, the space rental payment is not a significant portion of total costs. We assume that rental payments are exogeneously determined to be \( r = r(u) \), \( r'(u) < 0 \), \( r''(u) > 0 \).
The profit function for firm $i$ under full information about fashion is:

$$\Pi_i = pX - C(Z, u) - r(u_i),$$

where $r(u_i)$ is the land rental cost for firm $i$.

First, we define the equilibrium distribution of firms between locations under full information about fashion. Second, we analyze the equilibrium distribution of firms under fashion uncertainty and conduct the same comparative statics for the above equilibrium. We predict that the apparel industry, which is subject to more fashion uncertainty than the textile mills industry, will locate closer to the fashion center than the textile mills industry. Third, we examine firm size under fashion uncertainty (or the heterogeneous goods case) and show that firm size will be smaller under fashion uncertainty than under full information about fashion (or the homogeneous goods case).

3.2 WITH FULL INFORMATION ABOUT FASHION

The profit function is defined as:

$$\Pi = \tilde{p}X - W(u) - R - T(u)X - r(u_i) - mM,$$

where $W(u)$ is the wage for local employed workers who are employed at distance " $u$ " from the market center, $R$ is the fixed price of capital, $L$ is labor, $K$ is capital, $r(u_i)$ is a land rental cost, $m$ is the return to entrepreneur ability, and $M$ is a monitoring input.

We use $t(u)$ to represent transportation costs per unit of $X$. Transportation rates increase at a decreasing rate with distance from the market center ( $u=0$) so the first derivative with respect to $u$ will
be positive \(( t'(u) > 0 )\) and the second derivative with respect to \(u\) will be negative \(( t''(u) < 0 )\).

We use \( W(u) \) as the wage for local workers who are employed at distance " \( u \) " from the market center. The wage rate received by any class of workers is assumed to decline at an increasing rate with distance from the market center. In Chapter 4 evidence is provided that \( W'(u) < 0, W''(u) > 0 \).

For firm \( i \), profits are:

\[
\Pi = pX - W(u_i)L - RK - t(u)X - r(u_i) - mM . \tag{1}
\]

Using common assumptions, we postulate that the firm’s production function is linearly homogeneous, continuous, twice differentiable and includes three input variables. This function can be expressed as:

\[
X = f(K,L,M) = X \cdot f(K/X, L/X, M/X) \tag{2}
\]

where \(K\) is capital, \(L\) is a labor, \(M\) is a monitoring input.

If we plug equation (2) into (1), we can rewrite the profit function as:

\[
\Pi = pXf(K/X, L/X, M/X) - W(u_i)L - RK - t(u_i)Xf(K/X, L/X, M/X) - r(u_i) - mM . \tag{3}
\]

When we maximize the profit function with respect to \(u, K/X, L/X,\) and \(M/X\) constrained by \(u \geq 0\), we have the Lagrangian function shown in equation (4).

\[
\Phi = pX - W(u_i)L - RK - t(u)X - r(u_i) - mM + \Phi u \tag{4}
\]
where $X = Xf(K/X, L/X, M/X) = f(K, L, M)$, and $\phi$ is a Lagrangian multiplier.

The five Kuhn-Tucker conditions are:

\[
\frac{\partial \phi}{\partial u} = - W'(u)L - t'(u_1)X - r'(u_1) + \phi \leq 0 \tag{5}
\]

\[
\frac{\partial \phi}{\partial \phi} = u \geq 0 \tag{6}
\]

\[
\frac{\partial \phi}{\partial (K/X)} = pf_K - t(u)f_K - R = 0 \tag{7}
\]

\[
\frac{\partial \phi}{\partial (L/X)} = pf_L - t(u)f_L - W(u) = 0 \tag{8}
\]

\[
\frac{\partial \phi}{\partial (M/X)} = pf_M - t(u)f_M - m = 0 \tag{9}
\]

where $f_K = \frac{\partial f}{\partial (K/X)}$, $f_L = \frac{\partial f}{\partial (L/X)}$, $f_M = \frac{\partial f}{\partial (M/X)}$.

Equations (7), (8), and (9) say that the value of marginal product of each factor must be equal to its price. We assume however that for any change in locations, a firm readjusts its input of capital, labor, and monitoring factors so as to maintain the first-order conditions for equilibrium at a given location.

In equation (5), $\phi$ equal zero if the constraint is nonbinding. Thus, equation (5) is an internal locational equilibrium stating that the manufacturers' net profit on the purchase of land, transportation costs, and wage costs, which results from a very short move, either toward or away from the fashion center, would be equal to zero. There exist trade-offs between transportation costs, rental payments, and wage costs in the choice of the internal equilibrium location. If equilibrium is at a corner solution because of a binding constraint
(that is, at \( u = 0 \)), a small change in these costs will not change the trade-off between transportation costs, rental payments, and wage costs.

The nature of firm equilibrium in urban space is illustrated by Figure 1. The firm is at a location such as \( u^* \). For a stable equilibrium, \( t'(u) X \) must be flatter than \(- r'(u_1) - W'(u)L\). If not, the market center is at the outer edge of the city. The farther from the market center firms are located, the larger are firm's net savings on transportation costs, wage costs, and rental payments. I assume in what follows that the equation (10) holds for a stable equilibrium.

\[-A = - W''(u)L - t''(u)X - r''(u_1) < 0. \quad (10)\]

Then \( A \) is positive.

We obtain the reduced form for the optimal \( u^* \) from equation (5) by using the implicit function theorem.

\[ u^* = u(\bar{w}, \bar{r}, \bar{t}, \bar{R}, \bar{p}) \quad (11) \]

where \( \bar{w} \) is a unit labor cost at \( u^* \) which we assume to be fixed, \( \bar{r} \) is a land rental price at \( u^* \), \( \bar{p} \) is a given market price, and \( \bar{t} \) is a unit transportation cost at \( u^* \), and \( \bar{R} \) is an exogeneously determined unit capital cost.

Increases in rental costs, and decreases in marginal transportation costs will shift the industry location away from the consumption
center. The apparel industry, which uses labor per unit of output more intensively than the textile mills industry, may locate further away from the consumption center, primarily in urban areas in the Northeast and Northcentral, to minimize the per unit labor cost. This result seemingly would not explain the stylized fact that the apparel industry has shifted less rapidly away from the consumption center than the textile mills industry. Changes in factor costs are obviously important, but we focus on the delivery lag effects under fashion uncertainty to explain the stylized fact more accurately in the next section.
Figure 1: FIRM'S LOCATION EQUILIBRIUM UNDER FASHION CERTAINTY
3.3 WITHOUT INFORMATION ABOUT FASHION

Firms in the fashion center, for which \( u = 0 \), can adjust instantaneously to the actual price. Firms which are located away from the fashion center, for which \( u > 0 \), produce output according to expected profit, because change in fashion is stochastic rather than deterministic.

First, we compute the difference in the profitability of the two industry locations. Suppose that two industries have the same production function. A firm may be uncertain of prices in future periods because of obsolescence resulting from long delivery lags, but sales level at each possible price is a nonstochastic decision variable, completely under the control of the firm.

Suppose the price follows the obsolescence process: \( p = \bar{p} + \omega \), where \( \omega \) has a discrete univariate Poisson distribution with mean \( \lambda \) (\( \lambda > 0 \)). Then the probability function \( \omega \) is as follows:

\[
f(\omega | \lambda) = \frac{e^{-\lambda} \lambda^\omega}{\omega!} \text{ for } \omega = 0, 1, 2, 3, \ldots \ldots \ldots \ldots (12)
\]

\[
0 \text{ otherwise}
\]

where \( \lambda \) is the observed average number of obsolescent items per unit interval if we consider a discrete period of variable length, \( u \), such as delivery lag \( u \).

The expected price for firms facing fashion uncertainty is: \( E(p^e) = \bar{p} - \lambda u \). Therefore, we can transform \( E(p^e) \) into \( p(u) \). A long delivery lag will result in obsolescence because firms with a long delivery lag
cannot adjust to the rapid change of fashions due to their lack of information. All manufacturing firms have declining prices with a delivery lag associated with the distance $u$ ($p'(u) < 0$) so that $0 < p(u). < \bar{p}$ if $\omega > u > 0$.

The expected revenue for a firm is:

$$E(R) = p(u) X(p(u))$$

Then, expected profit (assuming that entrepreneur is risk neutral) is:

$$E(\Pi) = E(p^e) X(p(u)) - C(Z, u_1) - r(u_1)$$

If the firm locates in the fashion center, then the firm can adjust instantaneously to actual market demand. The price will be $\bar{p}$.

Profit in the fashion center ($\Pi_1$) is:

$$E(\Pi_1) = \bar{p} X(p) - C(Z, u_1) - r(u_1).$$  \hspace{1cm} (13)$$

If the firm locates on the outside of the fashion center ($u > 0$), then the firm produces at an output level that maximizes expected profits ($E(\Pi_2)$).

$$E(\Pi_2) = p(u) X(p(u)) - C(Z, u_2) - r(u_2).$$  \hspace{1cm} (14)$$

The locational difference in profits can be obtained by subtracting equation (14) from equation (13):

$$E(\Pi_1) - E(\Pi_2) = \bar{p} X(p) - p(u) X(p(u))$$

$$-\{C(Z, u_1) - C(Z, u_2)\} - \{r(u_1) - r(u_2)\}.$$
Note that the first term in the above equation can be assumed to be positive because an increase in price ($\tilde{p} > p(u)$) increases total revenue given that the demand for textiles is inelastic. Taylor and Houthaker(88) estimate that the elasticity of demand for clothing is 0.45. Under fashion uncertainty, the closer the industry locates to the fashion center, the higher are its expected revenue. The optimal location also depends on the differences in land costs, transportation costs, and wages: a topic we turn to now.

Second, we want to derive the same comparative statics as those for the equilibrium under full information about fashion (section 3.2).

Expected profit ($E(\Pi)$) is:

$$E(\Pi) = p(u)X - W(u)L - RK - t(u)X - r(u_i) - mM. \quad (15)$$

The necessary condition for maximum expected profit, with respect to $u$, for a locational equilibrium is:

$$\frac{\partial E(\Pi)}{\partial u} = p'X - W'(u)L - t'(u)X - r'(u_i) = 0 \quad (16)$$

where $p' = \frac{\partial p(u)}{\partial u} = -\lambda$.

From equation (16), we can derive equation (17).

$$-p'X + t'(u)X = -W'(u)L - r'(u_i) \quad (17)$$

There exist trade-offs between transportation costs, rental payments, wage costs, and obsolescence costs in choosing the internal equilibrium location.

We derive equation (18) from equation (16).
\[ u^* = f(\lambda, \bar{w}, \bar{r}, \bar{R}, \bar{p}, \bar{t}) \]  \hspace{1cm} (18)

where \( \lambda \) is a fashion measure, \( \bar{w} \) is a unit labor cost at \( u^* \) which we assumed to be fixed, \( \bar{r} \) is a land rental cost at \( u^* \), \( \bar{R} \) is an exogeneously determined unit capital cost, \( \bar{p} \) is a given market price, \( \bar{t} \) is a unit transportation cost at \( u^* \).

Equation (18) says that the equilibrium location is a function of fashion and factor prices at given location, holding the price of output and unit capital costs independent of location.

Let us return to \( p(u) = \bar{p} - \lambda u \), and derive the total differential of equation (17) with the linearly homogeneous production function given in section 3.2., holding all other variables except \( u \), and \( \lambda \) constant.

We have \(-X \, d\lambda - (W''(u)L + Xt''(u) + r''(u_1)) \, du = 0\) \hspace{1cm} (19)

We have: \( du^*/d\lambda = -(X/A) < 0 \), because the denominator \( A = W''(u)L + t''(u_1)X + r''(u_1) \) is positive from equation (10).

Compare equation (5) and (17). The first positive term, \(- p'X\) on the left hand in equation (17), shifts the total savings curve up as in Figure 2. Under fashion uncertainty, total net savings for a manufacturer with a short move toward the fashion center increases by the change in the total revenue due to the delivery lag change. In figure 2, the equilibrium location of the industry will change from \( u^* \) to \( u^{**} \).
This effect of responding to fashion uncertainty encourages the apparel industry to locate closer to the fashion center than the textile mills industry because the apparel industry is more sensitive to fashion than the textile mill industry. Even if the apparel industry is a low wage industry, the decentralizing effect of the industry's trend toward low-wage areas would be counterbalanced by centralizing forces, such as the short life cycle of fashions created in the information center.
Figure 2: FIRM'S LOCATION EQUILIBRIUM UNDER FASHION UNCERTAINTY
3.4 THE SIZE OF FIRM

3.4.1 FASHION ARGUMENT

In the long run, firm size is indeterminate given constant returns to scale of a production technology. However, it is reasonable to assume that in the short run, capital (including working capital) and labor are more flexible than location and management. In this section, we look at the short run implication of the inflexibility of location and management on the determination of firm size.

To formalize these concepts, we assume that location is predetermined. Let production \( Z \) be a function of \( K \) (capital), \( L \) (labor), and \( M \) (monitoring input). The monitoring input is: \( M = b(\bar{H} - hL) \), where \( b \) is the managerial ability parameter which varies across entrepreneur. The dispersion of abilities is a factor which determines the firm size. We use Oi's assumptions which are that the firm has one entrepreneur with a fixed endowment of calendar time \( \bar{H} \), the entrepreneur divides his time between coordinating production and monitoring worker performance, and that all firms incur the same time loss of "\( h \)" hours monitoring each worker. The return to entrepreneur ability (\( m \)) will be his profit.

The cost function is: \( C(Z, u) = W(u)L + RK + r(u_1) + t(u)Z \), where \( W(u) \) is the wage, \( R \) is the price of capital, \( r(u_1) \) is a land rental cost, and \( t(u) \) is the transportation cost per unit of \( Z \).
Production function \( Z \) has the following form if we may separate the monitoring technology from the production technology:

\[
Z = g(M)h(K,L)
\]  \hspace{1cm} (20)

where \( M = b(\bar{H} - hL) \), \( g'(M) > 0 \), \( g''(M) < 0 \) because of diminishing returns to entrepreneur ability, and \( h(K,L) \) is a linearly homogeneous production function.

In the case of full information about fashion, the profit at a given location is:

\[
\Pi = \bar{p} g(M)h(K,L) - W(u)L - RK - r(u) - t(u)g(M)f(K,L)
\]  \hspace{1cm} (21)

where \( M = b(\bar{H} - hL) \).

We form equation (22) by plugging \( M = b(\bar{H} - hL) \) into equation (21).

\[
\Pi = \bar{p}g(b(\bar{H} - hL))h(K, L) - W(u)L - RK - r(u) - t(u)g(b(\bar{H} - hL ))f(K,L)
\]  \hspace{1cm} (22)

The necessary conditions for maximum profit are:

\[
\frac{\partial \Pi}{\partial L} = (\bar{p} - t(u)) (-bhg'(M)h(K,L) + g(M)h_L) - W(u) = 0 \hspace{1cm} (23)
\]

\[
\frac{\partial \Pi}{\partial K} = (\bar{p} - t(u)) (g(M)h_K) - R = 0 \hspace{1cm} (24)
\]

where \( h_L = \frac{\partial h}{\partial L} \), \( h_K = \frac{\partial h}{\partial K} \).

Using equation (23) and (24), we derive equation (25).

\[
\frac{h_L}{h_K} = \frac{(W(u) + (\bar{p} - t(u))bhg'(M)h(K,L))}{R}, \hspace{1cm} (25)
\]
where \((\bar{p} - t(u)) bhg'(M)h(K,L)\) is an implicit monitoring cost and \(h_L/h_K\) is the rate of marginal substitution between labor and capital with full information about fashion.

From equation (25), the ratio of capital to labor is defined as \(K/L = f(b :W(u)/R, \bar{p})\), from the implicit function theorem using a linearly homogeneous function of \(h(K, L)\). We expect that higher implicit monitoring costs incurred by large firms (high "b") induce them to adopt more capital intensive production methods to economize on total monitoring costs. We expect that \(d(K/L)/db > 0\).

Equation (25) can be written:

\[
\alpha(K/L) = h_{L}/h_{K} = (W(u) + \delta)/R
\]  

(26)

where \(\delta\) is \((\bar{p} - t(u))bhg'(M)h(K,L)\), and \(\delta\) is an implicit monitoring cost.

Before we derive \(d(K/L)/db\), we will consider the following comparative statics, \(d\delta/db\). If we know \(d\delta/db\), then we can see the comparative result, \(d(K/L)/db\), from equation (26).

\[
d\delta/db = (\bar{p} - t(u))h(K,L)\cdot h\cdot (g'(M) + b(\bar{H} - hL)g''(M))
\]

\[
= (\bar{p} - t(u))\cdot g'(M)\cdot h(K,L)\cdot h\cdot (1 + (b(\bar{H} - hL)g''(M))/g'(M))
\]

\[
= (\bar{p} - t(u))\cdot g'(M)\cdot h(K,L)\cdot h\cdot (1 - \varepsilon_{g'(M), b})
\]

where \(\varepsilon_{g'(M), b}\) is the elasticity of marginal productivity of the management input with respect to his entrepreneur ability.
If $\varepsilon_{g'}(M), b$ is less elastic, the entrepreneur's ability to allocate his given time will augment marginal productivity of a management input less. Therefore, $d\delta/db > 0$ if $\varepsilon_{g'}(M), b$ is inelastic. From equation (26), we see that the $K/L$ ratio increases with increases in "b" because $\delta$ increases with increases in "b".

Differences in implicit monitoring costs affect the organization of production. Greater ability of entrepreneurs in large firms implies a higher shadow price of time which increases the implicit cost of monitoring workers' performances. Because of principal-agent problem, large firms tend to choose more capital intensive methods to minimize monitoring costs of workers' performance.

Large firms commonly have long-term commitments to organizations that are highly specialized. When there exists fashion uncertainty, highly specialized techniques are not cheap to convert if the firm cannot adjust to fashion because of short life cycles in fashion. Therefore, large firms might try to change the ratio of capital to labor in the case of fashion uncertainty. We prove that firm size will be smaller under fashion uncertainty than under full information on fashion by looking at the ratio of capital to labor in production.

In the case of fashion uncertainty,

$$E(\Pi) = p(u)Z - W(u)L - RK - r(u_i) - t(u)Z$$

$$= (p(u) - t(u)) g(b(\bar{H} - hL))h(K, L) - W(u)L - RK - r(u_i). \quad (27)$$

where $Z = g(b(\bar{H} - hL))h(K, L)$. 

First order conditions for a maximum profit are:

\[ \frac{\partial \Pi}{\partial L} = (p(u) - t(u))(h_L - bhg'(M)h(K,L)) - W(u) = 0 \quad (28) \]

\[ \frac{\partial \Pi}{\partial K} = (p(u) - t(u))h_K - R = 0 \quad (29) \]

Using (28), and (29), we can derive the rate of marginal substitution of capital for labor.

\[ \frac{h_L}{h_K} = \frac{W(u) + (p(u) - t(u))bhg'(M)h(K,L)}{R}. \quad (30) \]

We want to compare equation (25) to equation (30). We can see that

\[ W(u) + (p(u) - t(u))bhg'(M)h(K,L) < W(u) + (\bar{p} - t(u))bhg'(M)h(K,L) \]

because \( \bar{p}bhg'(M)h(K,L) - p(u)bhg'(M)h(K,L) = bhg'(M)h(K,L)(\bar{p} - p(u)) > 0 \).

We can see also that \( \frac{h_L}{h_K} \) under full information about fashion is greater than \( \frac{h_L}{h_K} \) under fashion uncertainty.

When the production function is a linearly homogeneous function,

\[ \frac{h_L}{h_K} = \alpha(K/L), \text{ where } \alpha \text{ is a constant.} \]

From equation (30), we derive equation (31) using the implicit function theorem.

\[ K/L = f(\lambda, \text{ implicit monitoring cost : } W/R, \bar{p}) \quad (31) \]

When we do a comparative statics of \( d(K/L)/d\lambda \) we observe that \( d(K/L)/d\lambda < 0 \) because of \( d\delta/d\lambda = -\lambda bhg'(M)h(K,L) < 0 \). We will look at changes in the ratio of capital to labor due to changes in fashion and implicit monitoring costs empirically, holding W/R and \( \bar{p} \) constant.
The entrepreneur may try to hire more labor than capital under fashion uncertainty by operating low or small production runs because small production runs adapt to frequent changes in fashion more efficiently. Firm size tends to be smaller by choosing less capital intensive production methods (or less energy intensive production) than under full information about fashion if we assume that the size of firm is positively correlated with the ratio of capital to labor. We can say that K/L under full information about fashion is greater than K/L under fashion uncertainty.

3.4.2 VARIETY ARGUMENT

We have shown that under fashion uncertainty, firm size will be smaller than under full information about fashion.

In this subsection, we add a static variety factor as a determinant of the firm size. We set up two cases. One is homogeneity of a good. The other is heterogeneity of a good because of a high demand for variety. Under heterogeneity, we will take Chamberlin's (17) monopolistic competitive model with a group assumption and a uniform assumption. It ignores other firm's reactions to any individual firm's strategy in the same group because of the smallness of firms. Also, we assume their product differences are not so big as to cause cost differences.
From the fashion argument sector, we have the first-order condition with respect to \( p(u) \).

The objective function is:

\[
E(\Pi) = p(u)Z - WL - RK - t(u)Z
\]

The first order condition with respect to \( p(u) \) is:

\[
3 \frac{\partial E(\Pi)}{\partial p(u)} = p(u) \frac{\partial Z}{\partial p(u)} + Z - t(u) \frac{\partial Z}{\partial p(u)} = 0 . \tag{32}
\]

From equation (32), we have \( t(u) = p(u) \left\{ 1 + \left(1 + \varepsilon_d\right) \right\} \), \( \tag{33} \)

where \( \varepsilon_d = \left[ \frac{\partial Z}{\partial p(u)} \right] \left[ p(u)/Z \right] \) is the price elasticity of demand for the homogeneous good, and \( \left\{ 1 + \left(1/\varepsilon_d\right) \right\} > 0 \).

In the case of heterogeneity,

\[
t(u) = p_i(u) \left\{ 1 + \left(1/\varepsilon_d'\right) \right\} . \tag{34}
\]

Dividing equation (33) by equation (34), we have equation (35).

\[
p(u)/p_i(u) = \left\{ 1 + \left(1/\varepsilon_d\right) \right\}/\left\{ 1 + \left(1/\varepsilon_d'\right) \right\} \tag{35}
\]

We know that the price elasticity in the homogeneous case (\( \varepsilon_d \)) is greater than that in the Heterogeneity case (\( \varepsilon_d' \)), and that both values are negative.

From equation (35), we know that \( p_i(u) > p(u) \). \tag{36} 

The market price on the heterogeneous case will be higher than the market price on the homogeneous case.
Next, to derive a demand function, we use the Stiglitz and Dixit's utility function which satisfies the necessary regularity conditions. For nonconvexity in the utility function, we assume that $p$ is greater than zero and less than one.

The utility function is the following:

$$U = u(X_0, \left( \prod_{i=1}^{R} X_i^\rho \right)^{1/\rho}).$$

We have the budget constraint that consumer incomes are in the form of an endowment of an outside good $(X_0)$ with a unit price.

The budget constraint is the following:

$$I = X_0 + qY$$

where

$$Y = \left( \prod_{i=1}^{R} X_i^\rho \right)^{1/\rho}, \quad q = \left( \prod_{i=1}^{R} p_i(u)^{-1/\beta} \right)^{-\beta}, \quad \beta = (1 - \rho)/\rho$$

In the heterogeneity case with a symmetric group assumption, we derive the market demand equation (37) using the straight two-stage utility maximization.

$$X_1 = \frac{(qY)/p_1(u)n}{X_0 + qY} \quad (37)$$

where $n$ is the number of firms.

In the homogeneity case, we assume that $\rho = 1$, all products in the group are perfect substitutes.

The market demand function is:

$$X = qY/p(u) n \quad (38)$$

The above market demand function can be derived from $q = p(u)$, $y = nX$, and $Y$'s budget share $S(q)$, which is equal to $qY/I$. 
If we divide equation (38) by equation (37), we have equation (39).

\[ \frac{X}{X_1} = \frac{p_1(u)}{p(u)} \quad (39) \]

From equation (39) and equation (36), we find that \( X \) is larger than \( X_1 \) (\( X > X_1 \)). The firm with heterogeneous demand faces smaller consumer demand (\( X_1 \)) than the firm with homogeneous demand (\( X \)). In other words, the former has smaller production runs than the latter because each serves a small subset of the market to which its special attributes are best adaptable. High variety demand might cause low or small production runs.

The demand for variety is another factor determining firm size. From equation (31), we obtain equation (40) by adding the variety factor.

\[ \frac{K}{L} = f(\lambda, \text{implicit monitoring cost, product variety : } \bar{p}, W/R) \quad (40) \]
Chapter IV

THE STRUCTURE OF THE TEXTILE INDUSTRY

The textile industry is a labor-oriented industry. Wage rates, and an adequate supply of low-skilled labor in the South have almost certainly been factors in the relocation of this industry. The North-South wage differential is explained by a mixture of trade unions, firm size effects (Garen(30)), community size, and so forth. It is more difficult to draw out factors that explain the differential speed of relocation of the industry. After World War II, both the apparel and the textile mill industries faced difficulty in securing additional labor, mostly female, for their New England mills. Both were able to find several southern areas with a satisfactory surplus of labor with an aid of lenient legislatures in the South. Union power might contribute to labor cost savings in both industries.

The dramatic locational shift of the textile mills industry to the South after World War II is therefore easily explained as the consequence of a change in each region's access to a surplus of unskilled workers and a weak union structure in the South. The slow locational shift of the apparel industry to the South requires more careful consideration. One important difference is the fact that the textile mill industry is less competitive than the apparel industry. Union's effect on labor cost savings in the textile mills industry is
therefore likely to be more significant than that of the apparel industry. The effects of the apparel industry's trend towards moving towards an adequate labor supply in the South might also in part be offset by the advantages of locating near by fashion centers. This chapter investigates these issues.

Rather than dealing with various manufacturing processes in the textile industries, such as spinning, weaving, finishing, knitting, dyeing, and nonwoven processes of fabric forming, I will describe the structure of the U.S. textile industry as a whole. Historically, the U.S. textile industry was composed of small family owned firms, but recently textile mill size has expanded. However, most of textile mill's firms remain medium-sized. The industry is located primarily in the northeast and southern regions. Labor intensity, medium-sized firms, location specialization, overcapacity, unstable raw material price, unpredictable market demand and severe foreign competition have limited rates of return to capital in the U.S. textile industry and have retarded growth.

Textile mill products and apparels constituted one of the major sectors of manufacturing in the U.S. in 1977. Textile mill products were responsible for 2.7% of the value added by manufacturing establishments and thus were the 16th largest SIC industry group in terms of value added. In the same year, apparel and other textile products contributed 3.3% of the value added. As a whole, textile products and apparels constituted 6% of value added in 1977, and ranked 8th among twenty two-digit SIC manufacturing groups. Textile
mills employed over 875,400 people at 7,202 establishments owned by over 5,733 companies in 1977. Apparel and other textile products employed over 1,334,300 people at 26,505 establishments owned by over 24,345 companies in 1977.

The textile mill industry includes establishments engaged in preparation of textile fibers (cotton, wool, silk, synthetics), manufacture of yarn, thread, and other similar products, manufacture of fabric, carpets, and rugs, dyeing, finishing and other treatments of textile products, manufacture of knit apparel. The textile product industry, known as the 'cutting up' trades, produces clothing and fabricated products by cutting and sewing fabrics and related materials such as leather, plastics, and furs. From now on, I will label the aggregation of textile mills and apparels industries as the 'textile industry'.

4.1 THE MARKET STRUCTURE

The textile mill industry consists of a large number of medium sized mills. Seventeen four-digit SIC industries or 56.7% are classified as in the 40 -70 range in terms of eight firms concentration ratio (CR8) measured by value of shipments (See Table 3). In recent years, large integrated textile mills manufacturers have increased in the southern industry both through acquisition of smaller mills and through internal growth. The percentage of 4-digit industries with eight firms concentration ratio over 70 rose from 13 % to 17 % in 1977. Most
textile mill establishments, even those owned by large integrated manufacturers, are small to medium-sized operations.

**TABLE 3**

**DISTRIBUTION OF TEXTILE MILLS IN TERMS OF CR8**

<table>
<thead>
<tr>
<th>CR8 YEAR</th>
<th>BELOW 40</th>
<th>40 - 70</th>
<th>ABOVE 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967 (%)</td>
<td>4 (15.4)</td>
<td>16 (61.5)</td>
<td>5 (23.0)</td>
</tr>
<tr>
<td>1972 (%)</td>
<td>10 (33.3)</td>
<td>16 (53.0)</td>
<td>4 (13.3)</td>
</tr>
<tr>
<td>1977 (%)</td>
<td>8 (26.7)</td>
<td>17 (56.7)</td>
<td>5 (16.7)</td>
</tr>
</tbody>
</table>

Source: 1977 Census of Manufactures

The apparel industry consists of a large number of small-sized mills. The concentration of this industry is relatively lower than that of the textile mills industry. Twenty-two four-digit SIC industries or 66.7% are classified as below the 40 range in terms of CR8 (See Table 4) in 1977.

Generally U.S. industries are categorized as 'concentrated' when the top eight firms control 70 percent of the domestic markets. This general lack of concentration for both industries suggests a high degree of competitiveness in the textile industry, but particularly so in apparels.
TABLE 4

**DISTRIBUTION OF APPAREL INDUSTRY IN TERMS OF CR8**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>BELOW 40 (%)</th>
<th>40 - 70 (%)</th>
<th>ABOVE 70 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>26 (78.8)</td>
<td>7 (21.2)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>1972</td>
<td>24 (72.7)</td>
<td>7 (21.2)</td>
<td>2 (6.0)</td>
</tr>
<tr>
<td>1977</td>
<td>22 (66.7)</td>
<td>9 (27.2)</td>
<td>2 (6.0)</td>
</tr>
</tbody>
</table>

Source: 1977 Census of Manufactures

4.2 LOCATION

The U.S. textile industry is mainly located in the northeastern (New England) and southern region (North Carolina, South Carolina, and Georgia). More of the apparel industry is located in the northeast, especially New York, than is the textile mills products industry (Table 11, 12, 13: see pp.47-48.).

Textile mill firms are located near raw material areas, for example cotton. They have also located in areas of relatively abundant, nonunionized low skilled labor, particularly in the South. Right-to-work laws have made it illegal to require membership in a union as a condition of employment after 1947. About 20 states (Georgia, Tennessee, North Carolina, Texas, etc.) mostly in the South, have adopted such law. These laws led the industry to move to the South to claim labor cost advantages. Another factor important in the
southward movement of the textile mills industry is the differences in fuel cost. The South has a fast river systems which is ideal for generation of power. As we will see in Table 5, the textile mills industry is more capital intensive than the apparel industry. Hence, the former is more sensitive to low fuel costs than the apparel industry when firms decide locations. Low tax rates may also induce movement although the evidence on this is ambiguous.

### TABLE 5

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTILE MILLS</td>
<td>.049</td>
<td>.031</td>
<td>.415</td>
<td>.035</td>
<td>.034</td>
<td>.071</td>
</tr>
<tr>
<td>APPAREL INDUSTRY</td>
<td>.005</td>
<td>.007</td>
<td>.007</td>
<td>.009</td>
<td>.009</td>
<td>.015</td>
</tr>
</tbody>
</table>

Source: Census of Bureau, Department of Commerce

In the early days of American cotton manufacturing, the New England states enjoyed a regional monopoly on production. Ante bellum, the South, with its plantation system and slave labor, confine itself almost exclusively to agriculture. About 100 years ago, however, the southern states began to challenge New England’s leadership. From 1920 to 1963, the southern share of spindles increased rapidly and consistently. Today, southern dominance is a simple fact, especially in coarse goods (See Table 6).

3 Detailed discussions of labor market in textile industry are presented in section 2.3.
TABLE 6

SOUTHERN SHARE OF SPINDLES IN THE COTTON INDUSTRY IN PERCENT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>6.8</td>
<td>40.8</td>
<td>37.9</td>
<td>40.8</td>
<td>43.0</td>
<td>49.0</td>
<td>59.0</td>
<td>68.0</td>
<td>75.0</td>
<td>78.0</td>
<td>81.0</td>
<td>93.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>97.4</td>
<td>98.2</td>
<td>97.5</td>
<td>98.0</td>
</tr>
</tbody>
</table>

Source: Bureau of the Census

* see Clark ' History of Manufacturing in the U.S. A. 1860 -1893' MacCraw Hill Book Company pp100

As another measure of historical migration in the textile mill industry, the average number of employees in the geographical distribution is a reliable indicator. In the textile mill industry, the share of the South in the average number of employees increases from 20.1 % in 1909 to 82 % in 1977 (see Table 7). At the beginning of the present century, the industry was quite decidedly concentrated within the East, with the New England (Massachusetts) and Middle Atlantic states (New York, New Jersey, and Pennsylvania) in possession of more than half the total as measured in terms of workers. Not only has the Southeast dominated the textile mills industry since 1954 but it also dominated the shifts in total employment between 1939 and 1954. Five Southeastern States--North and South Carolina, Georgia, Alabama, and Virginia have accounted for over 50 percent of total textile mill employment since 1954 (See Table 8).

The situation in the Western states is not different from that which previously existed. The textile mill industry has never obtained a
strong foothold in these states, and shows no greater tendency to become important (See Table 8).

When we look at Table 10, the Southeastern states all had absolute upward shifts in employment over these years. The New England states (Maine, and Massachusetts) have accounted for a small percentage of total employment after 1939 in contrast to the middle Atlantic regions (New York, and Pennsylvania). Texas and California had slow upward shifts in employment over these years. Both states had over 10% of total employment in 1977. A large number of low-skilled Mexican workers may be a major contributing factor in upward shifts of employment over time.

However, even with some change in the share of workers in the North in the apparel and other textile products, we can see that apparel and other textile products are concentrated more in the North than in the textile mill products (See Table 9).

| TABLE 7 |
|---|---|---|---|---|---|---|---|---|---|---|
| PERCENT OF SHARE OF THE SOUTH IN THE LABOR FORCES OF TEXTILE MILLS |
| % | 15.6 | 20.1 | 21.4 | 24.1 | 31.2 | 48.2 | 58.8 | 62.8 | 66.4 | 69.5 | 72.0 | 82.0 |

Source; ‘Location of Manufacturing 1899 - 1929’, Census of Manufactures (various issues), Bureau of the Census
### TABLE 8

**HISTORICAL PERCENT OF TEXTILE MILL EMPLOYMENT, SELECTED STATES, 1900 - 1977**

<table>
<thead>
<tr>
<th>STATE</th>
<th>1900</th>
<th>1939</th>
<th>1954</th>
<th>1977</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONNECTICUT</td>
<td>4.9</td>
<td>3.3</td>
<td>2.6</td>
<td>1.2</td>
</tr>
<tr>
<td>MAINE</td>
<td>3.3</td>
<td>1.9</td>
<td>1.9</td>
<td>1.0</td>
</tr>
<tr>
<td>MASSACHUSETTS</td>
<td>22.6</td>
<td>10.5</td>
<td>6.8</td>
<td>2.9</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>9.8</td>
<td>7.0</td>
<td>6.4</td>
<td>4.9</td>
</tr>
<tr>
<td>PENNSYLVANIA</td>
<td>15.4</td>
<td>12.3</td>
<td>9.7</td>
<td>5.3</td>
</tr>
<tr>
<td>NEW JERSEY</td>
<td>7.1</td>
<td>5.1</td>
<td>4.4</td>
<td>2.4</td>
</tr>
<tr>
<td>VIRGINIA</td>
<td>1.0</td>
<td>2.6</td>
<td>3.6</td>
<td>5.0</td>
</tr>
<tr>
<td>GEORGIA</td>
<td>3.0</td>
<td>7.0</td>
<td>10.0</td>
<td>10.1</td>
</tr>
<tr>
<td>SOUTH CAROLINA</td>
<td>4.6</td>
<td>8.3</td>
<td>12.5</td>
<td>16.3</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
<td>4.9</td>
<td>5.8</td>
<td>21.5</td>
<td>27.9</td>
</tr>
<tr>
<td>ALABAMA</td>
<td>0.4</td>
<td>8.6</td>
<td>10.7</td>
<td>4.4</td>
</tr>
<tr>
<td>CALIFORNIA</td>
<td>0.1</td>
<td>0.4</td>
<td>0.5</td>
<td>2.7</td>
</tr>
<tr>
<td>ILLINOIS</td>
<td>0.5</td>
<td>0.1</td>
<td>1.0</td>
<td>0.4</td>
</tr>
<tr>
<td>OHIO</td>
<td>0.4</td>
<td>1.0</td>
<td>1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>TEXAS</td>
<td>0.2</td>
<td>1.7</td>
<td>2.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Source: Census of Manufacturing, various issues

1. Due to rounding problem, the summation of each columns is not exactly 100 percent.
### TABLE 9
PERCENT OF NORTHERN LABOR FORCES IN THE APPAREL AND OTHER TEXTILES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>73.2</td>
<td>72.3</td>
<td>66.3</td>
<td>70.3</td>
<td>61.7</td>
<td>59.0</td>
<td>56.3</td>
<td>50.9</td>
<td>45.5</td>
<td>39.7</td>
</tr>
<tr>
<td>YEAR</td>
<td>1976</td>
<td>1977</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>35.2</td>
<td>34.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Bureau of the Census, Census of Manufactures, various issues

### TABLE 10
PERCENT OF APPAREL EMPLOYMENT, SELECTED STATES, 1900 - 1977

<table>
<thead>
<tr>
<th>STATE</th>
<th>1900</th>
<th>1939</th>
<th>1954</th>
<th>1977</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONNECTICUT</td>
<td>20.3</td>
<td>1.9</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>MAIN</td>
<td>0.7</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>MASSACHUSETTS</td>
<td>5.8</td>
<td>3.9</td>
<td>4.9</td>
<td>2.8</td>
</tr>
<tr>
<td>NEW YORK</td>
<td>42.3</td>
<td>27.5</td>
<td>31.9</td>
<td>15.6</td>
</tr>
<tr>
<td>NEW JERSEY</td>
<td>5.0</td>
<td>6.6</td>
<td>6.5</td>
<td>4.5</td>
</tr>
<tr>
<td>PENNSYLVANIA</td>
<td>10.7</td>
<td>9.6</td>
<td>13.2</td>
<td>10.0</td>
</tr>
<tr>
<td>VIRGINIA</td>
<td>0.3</td>
<td>1.0</td>
<td>1.6</td>
<td>2.5</td>
</tr>
<tr>
<td>GEORGIA</td>
<td>1.1</td>
<td>1.8</td>
<td>3.1</td>
<td>5.7</td>
</tr>
<tr>
<td>SOUTH CAROLINA</td>
<td>0.4</td>
<td>0.4</td>
<td>1.7</td>
<td>3.2</td>
</tr>
<tr>
<td>NORTH CAROLINA</td>
<td>0.6</td>
<td>0.7</td>
<td>1.8</td>
<td>5.2</td>
</tr>
<tr>
<td>TEXAS</td>
<td>1.6</td>
<td>1.2</td>
<td>2.4</td>
<td>5.5</td>
</tr>
<tr>
<td>CALIFORNIA</td>
<td>0.3</td>
<td>2.7</td>
<td>4.7</td>
<td>7.4</td>
</tr>
<tr>
<td>ILLINOIS</td>
<td>7.6</td>
<td>5.4</td>
<td>4.3</td>
<td>1.8</td>
</tr>
<tr>
<td>OHIO</td>
<td>4.7</td>
<td>2.7</td>
<td>2.2</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Source: Census of Manufacturing, various issues

1. Due to rounding problem, the summation of all columns are not exactly 100 percent.
TABLE 11
TEXTILE MILLS PRODUCTS, GEOGRAPHICAL BREAK DOWN, 1977

<table>
<thead>
<tr>
<th></th>
<th>ESTABLISHMENTS</th>
<th>EMPLOYEES</th>
<th>VALUE</th>
<th>VALUE OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>US TOTAL</td>
<td>10,051 (100) 4697 (100)</td>
<td>993.7 (100) 6621.9 (100)</td>
<td>12544.1 (100)</td>
<td>31824.5 (100)</td>
</tr>
<tr>
<td>NORTH EAST</td>
<td>6,601 (65.7) 2197 (46.4)</td>
<td>289.2 (29.1) 1533.7 (23.2)</td>
<td>2730.6 (21.8)</td>
<td>9581.5 (30.1)</td>
</tr>
<tr>
<td>NORTH CENTRAL</td>
<td>140 (1.4) 79 (1.7)</td>
<td>17.7 (1.8) 68.7 (1.0)</td>
<td>121.7 (1.0)</td>
<td>317.6 (1.0)</td>
</tr>
<tr>
<td>SOUTH</td>
<td>2,869 (28.5) 2290 (48.8)</td>
<td>667 (67.1) 4868.7 (73.5)</td>
<td>9362.2 (74.6)</td>
<td>21023.6 (66.1)</td>
</tr>
<tr>
<td>WEST</td>
<td>441 (4.40) 149 (3.2)</td>
<td>19.7 (2.0) 150.6 (2.3)</td>
<td>329.6 (2.6)</td>
<td>901.8 (2.8)</td>
</tr>
</tbody>
</table>

1. includes the State of Utah
2. Due to disclosure law, some data are not reported. However it is not difficult to calculate share.
3. Percentage rates are shown in parentheses underneath each statistic.

Source: Department of Commerce, Bureau of the Census

TABLE 12
MEN'S AND BOY'S SUITS AND COATS, 1977

<table>
<thead>
<tr>
<th>ESTABLISHMENT</th>
<th>NUMBER (1000)</th>
<th>PAYROLL (M)</th>
<th>VALUE ADDED (M)</th>
<th>VALUE OF SHIPMENT (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US TOTAL</td>
<td>737 (100) 467 (100)</td>
<td>87.75 (100) 612.8 (100)</td>
<td>1186.6 (100)</td>
<td>2096.6 (100)</td>
</tr>
<tr>
<td>NORTH EAST</td>
<td>425 (57.7) 260 (55.7)</td>
<td>45.75 (52.1) 383.8 (62.7)</td>
<td>681.6 (57.4)</td>
<td>1232 (58.8)</td>
</tr>
<tr>
<td>NORTH CENTRAL</td>
<td>75 (10.2) 51 (10.9)</td>
<td>10.15 (11.6) 37.3 (6.1)</td>
<td>133.4 (11.2)</td>
<td>200 (9.5)</td>
</tr>
<tr>
<td>SOUTH</td>
<td>169 (22.9) 139 (29.8)</td>
<td>29.25 (33.3) 174.1 (28.4)</td>
<td>335.8 (28.3)</td>
<td>592.4 (28.3)</td>
</tr>
<tr>
<td>WEST</td>
<td>54 (7.3) 16 (3.4)</td>
<td>2.6 (3.0) 17.6 (2.9)</td>
<td>35.8 (3.0)</td>
<td>72.2 (3.4)</td>
</tr>
</tbody>
</table>

Source: The Department of Commerce, Bureau of the Census
Note: Percentage rates are shown in parentheses underneath each statistic.
TABLE 13
WOMEN'S AND MISSES' DRESSES, 1977

<table>
<thead>
<tr>
<th>ESTABLISHMENT</th>
<th>EMPLOYEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>WITH 20 EMPLOYEE MORE</td>
</tr>
<tr>
<td>US TOTAL</td>
<td>6112 (100)</td>
</tr>
<tr>
<td>NORTH EAST</td>
<td>3196 (52.3)</td>
</tr>
<tr>
<td>NORTH CENTRAL</td>
<td>164 (2.7)</td>
</tr>
<tr>
<td>SOUTH</td>
<td>1014 (16.6)</td>
</tr>
<tr>
<td>WEST</td>
<td>1663 (27.2)</td>
</tr>
</tbody>
</table>

Source: the Department of Commerce, Bureau of the Census
Percentage rates are shown in parentheses underneath each statistic.

TABLE 14
LOCATIONAL DIFFERENCE IN WAGE, TAXES, ELECTRICITY CONSUMED

<table>
<thead>
<tr>
<th>REGION</th>
<th>TOTAL WAGE PER PRODUCTION WORKER (1000 $)</th>
<th>TOTAL STATE LOCAL TAXES PER CAPITA ($)</th>
<th>AVERAGE NET MONTHLY RESIDENTIAL ELECTRIC BILLS FOR 100 KILOWATT 1946*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTHEAST</td>
<td>2.6</td>
<td>100.2</td>
<td>4.96</td>
</tr>
<tr>
<td>NORTH CENTRAL</td>
<td>2.7</td>
<td>72.7</td>
<td>4.28</td>
</tr>
<tr>
<td>SOUTH</td>
<td>2.0</td>
<td>45.5</td>
<td>3.98</td>
</tr>
<tr>
<td>WEST</td>
<td>2.8</td>
<td>87.5</td>
<td>3.61</td>
</tr>
</tbody>
</table>

Note: I look at 1947 data because industry’s migration to the South had been great from 1947.
* units are thousand dollars and I looked at only communities of 10,000 to 50,000 population
Source: U.S. Bureau of the Census
1947 Statistical Abstracts of U.S.
1947 Census of Manufacturing
4.3 LABOR MARKET

4.3.1 LABOR INTENSITY

The textile industry produced 35,775.8 million dollars (6.1%) of value added in the manufacturing sectors in 1977 and employed 11.9% of the workers in the manufacturing sector (See Table 15). From 1900 to 1980, the share of textile industry among total manufacturing employees have exceeded 10 %, although it has decreased (See Table 16). The apparel industry has maintained a share of employment over 7 % and the textile mill industry has maintained a share of employment over 4 % (See Table 15). The ratio of gross book value of assets to total employees in 1977 as the ratio of capital to labor is higher in the textile mill industry than the apparel industry (See Table 15).

Efficient personnel utilization (including careful selection of workers, promotion, training, and compensation) may be a key management responsibility, because of the labor intensity of the textile industry. Labor intensity may also be a significant factor in the relocation of the textile industry.
### TABLE 15

PERCENTAGE OF EMPLOYEES AMONG TOTAL MANUFACTURING, 1977

<table>
<thead>
<tr>
<th>MANUFACTURING SECTORS</th>
<th>RATIO OF GROSS BOOK VALUE OF ASSET TO TOTAL EMPLOYEES</th>
<th>VALUE ADDED</th>
<th>PER MAN HOUR VALUE ADDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTILE MILL PRODUCTS</td>
<td>23.7</td>
<td>585,165.6</td>
<td>$21.9</td>
</tr>
<tr>
<td>APPAREL AND OTHER TEXTILE PRODUCTS</td>
<td>17.0</td>
<td>16,104.5</td>
<td>$10.6</td>
</tr>
<tr>
<td>TEXTILE INDUSTRY</td>
<td>3.1</td>
<td>19,671.3</td>
<td>$9.7</td>
</tr>
<tr>
<td></td>
<td>8.6</td>
<td>35,775.8</td>
<td>(6.1%)</td>
</tr>
</tbody>
</table>

Source; Census of Manufactures in 1977

### TABLE 16

SHARE OF TEXTILE INDUSTRY OF TOTAL MANUFACTURING EMPLOYEE

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>19.4</td>
<td>19.3</td>
<td>18.7</td>
<td>16.2</td>
<td>13.8</td>
<td>11.8</td>
<td>12.2</td>
<td>11.3</td>
<td>11.1</td>
<td>11.4</td>
<td>11.3</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Source; Census of Manufactures, various issues
4.3.2 **SKILL INTENSITY**

Less than a century ago, large groups of textile workers such as weavers were highly skilled. Fathers taught their skills to the next generation and took pride in these skill and craftsmanship. Recently the introduction of new machines, especially in the South, render their special skills obsolete except in fine goods mills. The use of machine has turned the masses of American textile workers into low wage earners, and semi-skilled workers with a larger share of workers being women (See Table 20). Historically the textile industry has always been the greatest industrial employer of females as 'cheap labor'. The apparel industry employs more women than does the textile industry (See Table 17).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TEXTILE MILLS</td>
<td>44.2</td>
<td>43.6</td>
<td>44.0</td>
<td>45.0</td>
<td>46.1</td>
<td>46.0</td>
<td>46.4</td>
<td>46.6</td>
</tr>
<tr>
<td>APPAREL INDUSTRY</td>
<td>51.2</td>
<td>78.0</td>
<td>79.0</td>
<td>80.0</td>
<td>80.9</td>
<td>81.0</td>
<td>80.8</td>
<td>80.9</td>
</tr>
<tr>
<td>TEXTILE INDUSTRY</td>
<td>37.7</td>
<td>49.7</td>
<td>55.2</td>
<td>54.3</td>
<td>55.6</td>
<td>55.5</td>
<td>56.4</td>
<td>55.0</td>
</tr>
<tr>
<td>MANUFACTURING</td>
<td>11.4</td>
<td>31.7</td>
<td>35.1</td>
<td>38.9</td>
<td>39.8</td>
<td>40.5</td>
<td>41.0</td>
<td>41.3</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Labor
Bureau of Labor Statistics
labor force Statistics in 1975, 1980
Fewer labor laws restricting female workers in the South such as limitation of working hours of women to 48 hours a week and night work prohibition of women may be a contributing factors in the textile industry's relocation to the South (Lahne (45)).

For low skilled labor, textile industries in the north depended on immigrants or the descendents of recent immigrants who were typically semi-skilled and unskilled labor. Almost from its very beginnings, the New England augmented the local native labor supply with such newly arrived immigrants. In 1900, immigrants from Canada, Ireland, and Great Britain made up 77.5% of the total labor force in New England cotton mills (See Table 18).

By 1920, the Census of Occupations showed that about 47 percent of the cotton mill workers, 76 per cent of woolen and worsted workers and 69 per cent of the workers in dyeing and finishing plants were either of foreign-born or of foreign parentage.4 By 1920, Canadian French alone were 33.7% of total workers in cotton mills5.

Undoubtedly the restriction on immigration during and since the first world war has changed these proportions. Low wages were the rule for all except the comparatively few persons in the most skilled occupations.

4 See Dunn and Hardy's (25) "Labor and Textiles": pp101
5 See Immigration and Their Children issued by Bureau of the Census in 1927.
Employment in a northern cotton mill was hardly an attraction for the native. The pressures to use low skilled southern labor increased. Most of immigrants who had industrial skills were employed. The low skilled southern work forces came from agricultural backgrounds and were available in large numbers in part because of mechanization of agriculture.

### TABLE 18
NATIONAL ORIGIN OF NEW ENGLAND COTTON MILL, 1900

<table>
<thead>
<tr>
<th>NATIONAL ORIGIN</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATIVE</td>
<td>7.3</td>
</tr>
<tr>
<td>CANADA(FRENCH)</td>
<td>45.5</td>
</tr>
<tr>
<td>IRELAND</td>
<td>19.0</td>
</tr>
<tr>
<td>GREAT BRITAIN</td>
<td>13.0</td>
</tr>
<tr>
<td>POLAND</td>
<td>5.1</td>
</tr>
<tr>
<td>CANADA(ENGLISH)</td>
<td>2.3</td>
</tr>
<tr>
<td>GERMANY</td>
<td>2.3</td>
</tr>
<tr>
<td>AUSTRIA-HUNGARY</td>
<td>0.8</td>
</tr>
<tr>
<td>SCANDINAVIA</td>
<td>0.5</td>
</tr>
<tr>
<td>RUSSIA</td>
<td>0.4</td>
</tr>
<tr>
<td>ITALY</td>
<td>0.4</td>
</tr>
<tr>
<td>OTHER</td>
<td>3.4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: 1900 Census of Manufactures, Special report, Occupations table 41.
In 1975, the apparel industry employed about 400,000 people with less than a ninth-grade education or 34 percent of its workforce. In the textile mills industry 30 percentage of total employees are individuals with less than a ninth-grade education. From Table 19 the differences in demographics such as minorities as a percent of the labor force among the industries (and relative to the U.S. average) are clear. The industry has both a higher proportion of minorities as employees, and has employees with lower schooling than the overall manufacturing industries average.

**TABLE 19**

SELECTED DEMOGRAPHIC CHARACTERISTICS OF TWO INDUSTRIES

<table>
<thead>
<tr>
<th></th>
<th>CLOTHING</th>
<th>BROAD WOVEN FABRICS</th>
<th>KNITTED CLOTHING</th>
<th>OTHER FABRICATED TEXTILES</th>
<th>OVERALL MANUFACTURING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEMALE AS % OF WORKERS</strong></td>
<td>80</td>
<td>42</td>
<td>69</td>
<td>66</td>
<td>29.4</td>
</tr>
<tr>
<td><strong>MINORITY AS % OF WORKERS</strong></td>
<td>12</td>
<td>13</td>
<td>10</td>
<td>12</td>
<td>10.1</td>
</tr>
<tr>
<td><strong>% OF WORKERS WITH FOUR YEAR OF HIGH SCHOOL</strong></td>
<td>29.1</td>
<td>25.1</td>
<td>30.8</td>
<td>31.2</td>
<td>36.8</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Labor; "Demographic and Occupational Characteristics in Trade-sensitive Industries" 1979
Note: I use OECD monograph 88 as reference

---

4.3.3 WAGES AND UNION

At no time from 1899 to 1977 did the earnings of textile mill workers and apparel workers approach the average for all manufacturing industries. From 1899 to 1947, apparel workers had higher earnings than textile workers, perhaps due to relatively higher union membership (See Table 20)\(^7\) or their urban location. From 1947 until 1977, however, textile mill workers have had higher earnings than apparel workers even though they had lower union coverage relative to the apparel industry. This could be because large textile establishments with intensive capital needs workers with high productivity. In addition, the value added of the apparel industry relative to all manufacturing sectors and textile mills industry is lower. This indicates that the relative demand for labor in apparel industry has decreased (See Table 15).

Unionism in the textile industry has been weak because of the low degree of skill required, the large proportion of women, and the predominance of immigrants labor. A union in the textile mill industry was organized in 1901 called the United Textile Workers of America and was led by those of British and Irish origin.

\(^7\) The International Ladies' Garment Worker's union which consists of workers in the women's clothing industry was organized in 1900. It represented approximately 455,000 workers - 55% of all unionized apparel workers in 1980. Union in men's clothing began in 1914 with the formation of the Amalgamated Clothing Worker's Union. It represented approximately 322,000 workers - 40% of all unionized apparel workers in 1980. Their history of struggle is the history of the apparel workers. It had provided workers high wage, reduction of working hours to forty-four to forty a week (See Levine(46) and Arpan(6)).
After the Committee for Industrial Organization (C.I.O.) was established in 1936, the textile mill union was aided by the National Labor Relations Act. Ceteris paribus, those large firms would have been more efficiently organized than the apparel industry. In the more competitive apparel industry, entry of new nonunion firms who could pay wages below the union scale constantly limits successful industry organizing. Small firms industries have less union pressures on wages because of this difficulty of effective organization.

Of interest in this subsection is the relation between the wages paid in the North and in the South. The factor which enabled the South to overtake the North and dominate the textile industry has, in most economists' views, been largely a matter of wages. Historically, the southern wage of textile workers has been below the northern wage (See Table 22). The first reason for the lower southern wage of textile workers is that southern workers make a coarser grade of goods that require less skilled labor. Second, the lack of bargaining power of southern workers is based in part on the lack of unionization, in part on the large and ever present excess supply of labor and on the company-owned mill village system. Southern mill workers were literally at the mercy of the mill owner once they chose to locate there.

\[ \ln W = -7.14 + 0.65 \text{MSH} + 0.002 \text{UNION} - 0.003 \text{WOM} + \varepsilon \]
\[ (-3.59) (3.56) (1.67) (-1.15) \]
\[ R^2 = 0.4349 \]

Where \( W \) is an average wage and MSH is mean year of schooling, and WOM is women's participation rate over four-digit SIC industries. The \( t \)-ratios are reported in parentheses.
In addition to the lack of bargaining power, social legislation such as weak child labor laws and right-to-work laws provided advantages to the South. By 1958, none of northern states in U.S. (such as Connecticut, New Jersey, Maine, Maryland, New York, Massachusetts, Pennsylvania, New Hampshire, etc.) had adopted right-to-work laws (Sultan (80)). However Petersen and Lumsden (74) are suspicious of the effect of right-to-work laws on union membership.

Over the years the North has grown into a relatively advanced region. Accompanying this evolution has been increased demands upon the labor force, increased needs for special labor skills and widespread unionization. All of these have tended to raise the level of wages in the North. In the southern region, a large supply of unskilled labor was released from the agricultural sector on this period because of mechanization of agriculture 10.

-------------
For the textile mill industry,
\[
\ln W = -0.9 + 0.06 MSH + 0.002 UNION - 0.003 WOM + \varepsilon
\]
\[\begin{align*}
R^2 &= 0.5214 \\
(-1.72) & (1.29) & (2.34) & (-4.00)
\end{align*}\]

9 See Mitchel (58) pp84 -pp89.
10 See Arpan, Delatorre and Toyne (6)
### TABLE 20

**AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS**

*(UNIT = $)*

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TEXTILE MILL PRODUCT INDUSTRY</th>
<th>APPAREL INDUSTRY</th>
<th>MANUFACTURING INDUSTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1899</td>
<td>320.9 (NA)</td>
<td>363.9 (NA)</td>
<td>420.5 (NA)</td>
</tr>
<tr>
<td>1909</td>
<td>388.4 (NA)</td>
<td>453.9 (NA)</td>
<td>511.8 (NA)</td>
</tr>
<tr>
<td>1921</td>
<td>905.1 (NA)</td>
<td>1133.9 (NA)</td>
<td>1150.6 (NA)</td>
</tr>
<tr>
<td>1931</td>
<td>842.9 (NA)</td>
<td>947.3 (NA)</td>
<td>1085.3 (NA)</td>
</tr>
<tr>
<td>1937</td>
<td>855.9 (NA)</td>
<td>865.8 (NA)</td>
<td>1180.2 (NA)</td>
</tr>
<tr>
<td>1947</td>
<td>1.06 (2.3)</td>
<td>1.11 (2.45)</td>
<td>1.24 (3.1)</td>
</tr>
<tr>
<td>1950</td>
<td>1.23 (2.5)</td>
<td>1.19 (2.3)</td>
<td>1.46 (3.8)</td>
</tr>
<tr>
<td>1955</td>
<td>1.38 (2.76)</td>
<td>1.37 (2.83)</td>
<td>1.44 (5.2)</td>
</tr>
<tr>
<td>1960</td>
<td>1.61 (3.5)</td>
<td>1.59 (3.4)</td>
<td>2.26 (6.8)</td>
</tr>
<tr>
<td>1963</td>
<td>1.71 (3.9)</td>
<td>1.73 (3.8)</td>
<td>2.46 (7.84)</td>
</tr>
<tr>
<td>1967</td>
<td>2.06 (4.8)</td>
<td>2.03 (4.6)</td>
<td>2.8 (10.12)</td>
</tr>
<tr>
<td>1970</td>
<td>2.45 (5.7)</td>
<td>2.39 (5.5)</td>
<td>3.3 (11.25)</td>
</tr>
<tr>
<td>1977</td>
<td>3.99 (10.6)</td>
<td>3.62 (9.7)</td>
<td>5.59 (21.9)</td>
</tr>
</tbody>
</table>

**Note:**
1. From 1899 to 1937, I calculated average annual earnings of production workers due to lack of man hours data.
2. Parentheses denote value added per man hour.
3. NA means that data are not available.

**Source:** Handbook of Labor Statistics (Bulletin 1845, 1966), Census of Manufactures (1977), Historical statistics of the United States: Colonial times to 1970
TABLE 21
DISTRIBUTION OF UNION OF TEXTILE INDUSTRY, SELECTED YEARS
(In thousands)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TEXTILE MILLS</th>
<th>APPAREL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>8(1.2%)</td>
<td>25(6.8%)</td>
</tr>
<tr>
<td>1921</td>
<td>88(8.7%)</td>
<td>515(62.7%)</td>
</tr>
<tr>
<td>1929</td>
<td>35(2.7%)</td>
<td>218(35.8%)</td>
</tr>
<tr>
<td>1935</td>
<td>40(3.8%)</td>
<td>405(64.2%)</td>
</tr>
<tr>
<td>1968</td>
<td>191(19.9%)</td>
<td>870(64.2%)</td>
</tr>
<tr>
<td>1970</td>
<td>191(20.7%)</td>
<td>852(63.5%)</td>
</tr>
<tr>
<td>1972</td>
<td>176(18.5%)</td>
<td>788(57.6%)</td>
</tr>
<tr>
<td>1974</td>
<td>169(18.1%)</td>
<td>750(57.0%)</td>
</tr>
<tr>
<td>1978</td>
<td>156(18.5%)</td>
<td>683(52.3%)</td>
</tr>
</tbody>
</table>

Parentheses are the percentage of union membership among total workers.
Source: U.S. Dept. of Labor
Handbook of Labor Statistics, various issues
<table>
<thead>
<tr>
<th>YEAR</th>
<th>TEXTILE MILLS</th>
<th>APPAREL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>U.S. NORTH</td>
<td>SOUTH</td>
</tr>
<tr>
<td>1900</td>
<td>26.4</td>
<td>28.9</td>
</tr>
<tr>
<td>1909</td>
<td>32.2</td>
<td>34.9</td>
</tr>
<tr>
<td>1937</td>
<td>70.8</td>
<td>76.2</td>
</tr>
<tr>
<td>1950</td>
<td>48.6</td>
<td>52.9</td>
</tr>
<tr>
<td>1960</td>
<td>63.6</td>
<td>69.8</td>
</tr>
<tr>
<td>1965</td>
<td>78.0</td>
<td>83.1</td>
</tr>
<tr>
<td>1974</td>
<td>126.4</td>
<td>132.4</td>
</tr>
</tbody>
</table>

Note: 1. From 1900 to 1937, data are average annual earnings.
2. All regional figures are the average of the state figures for the states included.
3. Earnings are based on full-time workers.

4.4 THE PATTERN OF MARKET DEMAND

The volume of demand for textile end products is extremely variable and unpredictable. For example, hosiery products including women's pantyhose, stockings, knee-highs and anklets (43%) in 1977 (See Table 23) are subject to sudden style changes, because traditionally women's taste for fashions have shifted more often than have men's. In other words, women's and children's clothing are more variety-related than are men's and boy's (Table 24). Many intermediate textile markets are also sensitive to style changes due to unpredictable demand for end products but typically less so than clothing. Textile mills industry supplies 76.3% of its products to intermediate markets such as home furnishings, and industrial products and 20% of its products to the apparel industry in 1977.

A measure of the relative variability of demand in the two industries can be constructed by examining the relative variance in stock prices from 1967 to 1977 using CRSP (Center for Research Security Price issued by University of Chicago) data. The variance of stock prices in the textile mill industry is 48.3; the variance in apparels is 106.7. Given supply factors in the two sectors are likely to be similar, this suggests that market demand for apparel is much more volatile than the market demand for textile mill products.
### Table 23

**Hosiery Production by Type**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Types</strong></td>
<td>244.1</td>
<td>227.4</td>
<td>224.8</td>
<td>257.4</td>
</tr>
<tr>
<td><strong>Women's Pantyhose</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stockings Knee Highs</td>
<td>125.7</td>
<td>99.9</td>
<td>97.7</td>
<td>110.6</td>
</tr>
<tr>
<td>And Anklets</td>
<td>(51.5%)</td>
<td>(50%)</td>
<td>(43.5%)</td>
<td>(43%)</td>
</tr>
<tr>
<td><strong>Infants' and Children'</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anklets and Knee Highs</td>
<td>20.6</td>
<td>22.7</td>
<td>22.0</td>
<td>28.4</td>
</tr>
<tr>
<td></td>
<td>(8.4%)</td>
<td>(10%)</td>
<td>(9.8%)</td>
<td>(11%)</td>
</tr>
<tr>
<td><strong>Girl's Boys' and Women's</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foot Socks Etc.</td>
<td>33.6</td>
<td>41.2</td>
<td>41.9</td>
<td>49.0</td>
</tr>
<tr>
<td></td>
<td>(13.8%)</td>
<td>(18.1%)</td>
<td>(18.6%)</td>
<td>(19%)</td>
</tr>
<tr>
<td><strong>Men's (Size 10 and Up)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>64.2</td>
<td>63.7</td>
<td>63.2</td>
<td>69.3</td>
</tr>
<tr>
<td></td>
<td>(26.3%)</td>
<td>(28%)</td>
<td>(28.1%)</td>
<td>(26.9%)</td>
</tr>
</tbody>
</table>


### Table 24

**Personal Consumption Expenditure on Clothing and Accessories**

(In billions of dollars)

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Personal Consumption Expenditure</th>
<th>Total Clothing and Accessories Except Footwear</th>
<th>Women's and Children's</th>
<th>Men's and Boy's</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955</td>
<td>254.4</td>
<td>19.4(7.6)</td>
<td>12.4(63.6)</td>
<td>7.0(36.4)</td>
</tr>
<tr>
<td>1960</td>
<td>324.9</td>
<td>22.2(6.8)</td>
<td>14.4(64.9)</td>
<td>7.7(35.1)</td>
</tr>
<tr>
<td>1965</td>
<td>430.9</td>
<td>28.1(6.5)</td>
<td>18.4(65.5)</td>
<td>9.7(34.50)</td>
</tr>
<tr>
<td>1970</td>
<td>621.7</td>
<td>39.0(6.3)</td>
<td>25.2(64.6)</td>
<td>13.8(35.4)</td>
</tr>
<tr>
<td>1977</td>
<td>1205.5</td>
<td>69.1(5.7)</td>
<td>44.8(64.8)</td>
<td>4.3(35.2)</td>
</tr>
<tr>
<td>1980</td>
<td>1672.3</td>
<td>87.4(5.2)</td>
<td>57.2(65.4)</td>
<td>30.2(34.1)</td>
</tr>
</tbody>
</table>

Source: Survey of Current Business in various issues. Percentage rates in parentheses underneath each statistic, are calculated for total clothing and accessories except footwear.
4.5 RAW MATERIAL

The cost of raw materials varies, of course, from one type of product to another, depending upon quality and is significant, in practically all cases except perhaps fine goods. Table 25 shows the percentage cost of raw materials of several types of cotton yarns and fabrics. Variation in the price of raw materials, particularly cotton, leads to severe changes in costs and profits in these sectors.

**TABLE 25**

MANUFACTURING COSTS: SPINNING IN U.S.A.  
(U.S. dollar per kg of yarn)

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>COSTS</th>
<th>PERCENTAGE RATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASTE COSTS</td>
<td>.1474</td>
<td>(4.1%)</td>
</tr>
<tr>
<td>WAGE COSTS</td>
<td>.2901</td>
<td>(8.0%)</td>
</tr>
<tr>
<td>ENERGY COSTS</td>
<td>.0471</td>
<td>(1.3%)</td>
</tr>
<tr>
<td>AUXILIARY MATERIAL COSTS</td>
<td>.0372</td>
<td>(1.0%)</td>
</tr>
<tr>
<td>CAPITAL COSTS</td>
<td>.4496</td>
<td>(12.5%)</td>
</tr>
<tr>
<td>TOTAL MANUFACTURING COSTS</td>
<td>.9714</td>
<td>(26.9%)</td>
</tr>
<tr>
<td>RAW MATERIAL COSTS</td>
<td>1.6635</td>
<td>(46.1%)</td>
</tr>
<tr>
<td>TOTAL COSTS</td>
<td>3.6063</td>
<td>(100%)</td>
</tr>
</tbody>
</table>

In view of the large part of total costs which raw materials comprise, it would be desirable for textile producers that cotton prices remain stable. But a combination of factors such as the weather and the dependence of cotton upon world influences cause cotton prices to fluctuate frequently and widely. The range and annual average of cotton prices are shown in Table 26.

These fluctuations in the price of cotton are a constant threat to the textile manufactures. All cotton mills carry some inventory of raw materials, good in process, and finished goods. The size of the inventory of materials varies from one company to another, depending upon the type of goods manufactured, the size of the company, the financial resources of the company, and the location of the company. The market for raw materials is a national one, indeed an international one, so that regional advantages in this sector are probably slight.
TABLE 26
COTTON, AMERICAN UPLAND: SPOT PRICE PER POUND
(PRODUCTION IN THOUSANDS OF EQUIVALENT 480 POUND BALES)
(1967 CONSTANT DOLLARS)

<table>
<thead>
<tr>
<th>CROP YEAR</th>
<th>PRICE IN CENTS PER POUND</th>
<th>U.S. PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIGHEST</td>
<td>LOWEST</td>
</tr>
<tr>
<td>1968</td>
<td>24.09</td>
<td>20.98</td>
</tr>
<tr>
<td>1969</td>
<td>20.95</td>
<td>19.98</td>
</tr>
<tr>
<td>1974</td>
<td>36.17</td>
<td>23.65</td>
</tr>
<tr>
<td>1975</td>
<td>53.87</td>
<td>28.99</td>
</tr>
<tr>
<td>1977</td>
<td>32.65</td>
<td>25.91</td>
</tr>
<tr>
<td>1978</td>
<td>34.58</td>
<td>28.89</td>
</tr>
<tr>
<td>1979</td>
<td>39.01</td>
<td>32.88</td>
</tr>
<tr>
<td>1980</td>
<td>32.68</td>
<td>29.44</td>
</tr>
</tbody>
</table>

Source: U.S. Dept. of Agriculture, Agricultural Statistics 1983
4.6 FOREIGN COMPETITION

4.6.1 IMPORT AND EXPORT

The U.S. textile mill industry traditionally exports more than the apparel industry. After 1970, U.S. imports of apparels outgrew import of textiles. From 1960 to 1970, textile exports have grown faster than any other major manufactured output. Historically, the average ad valorem tariff rate in the apparel industry has been higher than the average ad valorem tariff rate in the textile mill industry (See Table 27). The tariff rate in the two industries in 1932 was quite high following the Smoot - Hawley Tariff Act of 1930, which raised the average ad valorem rate on dutiable imports to over 50 per cent. Since that time the U.S. has generally followed free trade policies by reducing the tariff rate.

The U.S. exports standardized products (large staples), such as cotton fabric yarns, to developed and developing countries. It imports customized products such as wool, knitwear, worsted yarns, and lace goods silk (manmade fibers), from developed countries (E.E.C., Canada, and Japan). The U.S. imports printcloth fabrics, hosiery, cordage twine, men's and boy's coats and dresses, brassieres, corsets, etc. from developing countries (Asia except Japan, Latin America and Africa). (Source; U.S. Dept. of Commerce, Bureau of Census. 'U.S. Imports in 1977' 'U.S. Exports in 1977') Imported products from
developing countries are more standardized than are products from developed countries. (Aggarval and Haggard(2), and Toyne(91))

Developing countries have a large low skilled labor pool with weak trade unions. They can exploit their comparative advantages in low skill labor over developed countries in these sectors. However, they have comparative disadvantages in fashion goods because of delivery lags resulting from the lack of information about fashion. High import penetration in U.S. textile market from developing countries particularly in standardized products, which are less subject to delivery lag effects than are customized products, might be explained by the low skill labor pool. Most customized product imports come from developed countries, which have a comparative advantage on easy access in consumer information than do the developing countries because of similar consumer information structure.
TABLE 27

U.S. TRADE IN TEXTILE PRODUCTS

(* In millions of dollars)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>IMPORT</th>
<th>EXPORT</th>
<th>TARIFF RATE (%)</th>
<th>TRADE BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>89.9</td>
<td>23.5</td>
<td>51.6</td>
<td>-65.4</td>
</tr>
<tr>
<td>1910</td>
<td>176.6</td>
<td>30.8</td>
<td>51.4</td>
<td>-145.8</td>
</tr>
<tr>
<td>1921</td>
<td>198.0</td>
<td>96.0</td>
<td>28.3</td>
<td>-102.0</td>
</tr>
<tr>
<td>1932</td>
<td>86.9</td>
<td>88.5</td>
<td>48.4</td>
<td>1.6</td>
</tr>
<tr>
<td>1940</td>
<td>382.9</td>
<td>323.5</td>
<td>20.2</td>
<td>-59.4</td>
</tr>
<tr>
<td>1958</td>
<td>438.9</td>
<td>336.5</td>
<td>21.5</td>
<td>-102.4</td>
</tr>
<tr>
<td>1960</td>
<td>626.9</td>
<td>326.6</td>
<td>19.5</td>
<td>-300.4</td>
</tr>
<tr>
<td>1965</td>
<td>851.8</td>
<td>377.4</td>
<td>18.4</td>
<td>-474.4</td>
</tr>
<tr>
<td>1970</td>
<td>1058.6</td>
<td>460.7</td>
<td>18.6</td>
<td>-579.9</td>
</tr>
<tr>
<td>1975</td>
<td>1200.4</td>
<td>1212.8</td>
<td>12.9</td>
<td>12.4</td>
</tr>
<tr>
<td>1977</td>
<td>1653.1</td>
<td>1450.1</td>
<td>13.7</td>
<td>-193.0</td>
</tr>
</tbody>
</table>

APPAREL INDUSTRY

<table>
<thead>
<tr>
<th>YEAR</th>
<th>IMPORT</th>
<th>EXPORT</th>
<th>TARIFF RATE (%)</th>
<th>TRADE BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>31.3</td>
<td>2.2</td>
<td>65.5</td>
<td>-29.1</td>
</tr>
<tr>
<td>1910</td>
<td>21.4</td>
<td>6.4</td>
<td>78.0</td>
<td>-15.0</td>
</tr>
<tr>
<td>1921</td>
<td>54.3</td>
<td>35.8</td>
<td>49.4</td>
<td>-18.5</td>
</tr>
<tr>
<td>1932</td>
<td>35.6</td>
<td>10.3</td>
<td>61.0</td>
<td>-25.3</td>
</tr>
<tr>
<td>1940</td>
<td>22.8</td>
<td>23.1</td>
<td>43.0</td>
<td>0.3</td>
</tr>
<tr>
<td>1958</td>
<td>192.3</td>
<td>136.8</td>
<td>20.9</td>
<td>-55.5</td>
</tr>
<tr>
<td>1960</td>
<td>311.9</td>
<td>156.8</td>
<td>27.9</td>
<td>-155.1</td>
</tr>
<tr>
<td>1965</td>
<td>567.5</td>
<td>203.1</td>
<td>26.4</td>
<td>-364.4</td>
</tr>
<tr>
<td>1970</td>
<td>1148.1</td>
<td>203.1</td>
<td>27.6</td>
<td>-945.0</td>
</tr>
<tr>
<td>1975</td>
<td>3074.3</td>
<td>621.3</td>
<td>23.8</td>
<td>-2453.0</td>
</tr>
<tr>
<td>1977</td>
<td>4763.1</td>
<td>920.5</td>
<td>22.6</td>
<td>-3842.6</td>
</tr>
</tbody>
</table>

* (F.A.S. transaction value basis)

Source: Survey of Current Business, Monthly Statistical Abstract of the United States, various issues Annual Survey of Manufactures in various issues U.S. Commodity Export Import as related to Output, various issues Commerce and Navigation of the United States(1900-1940)
4.6.2 TARIFFS

A complete understanding of the evolution of these industries in the U.S. would not be complete without some consideration of tariff policies. After World War II, the world textile industry expanded significantly. The less developed countries used their abundant labor resources since lower levels of skills are required for labor intensive textile manufactures. As the world's textile capacity expanded and competition increased, many previous textile importing countries became first, self-sufficient, and then net exporters.

The American textile and apparel industries are usually thought of as a "mature" if not declining industry. As predicted by product life cycle theories (Vernon (113)), domestic firms have faced severe foreign competition from many previous textile importing countries. Through technological innovation, and through specialization in higher value added segments, a number of firms, both large and small in these industries, have survived. Naturally some of this success might be partially attributed to protection measures such as tariff and nontariff barriers.

The U.S. textile industry has historically benefited from higher and more generalized protection from competing imports than have other manufacturing industries. Looking back upon the political history of the legislative shift, interest industry groups (fiber, fabric, and clothing industry) have shaped U.S. governmental policies in textiles
and apparel, particularly in tariff and nontariff barriers (Ratner(75), Aggarwal(2)). We can observe that after the Tokyo Round (1974), tariffs in textile products are higher than that of all other industrial products (excluding petroleum) and fabrics (See Table 28).

Another important measure, the Generalized System of Preferences (G.S.P.) implemented by nineteen OECD countries to help the developing countries' economies, could have had important consequences in this period. G.S.P. allows industrial products and processed agricultural products coming from developing countries to enter developed countries' markets duty free or at reduced duty rates. However, the widespread exemption to preferential tariff treatment in the area of textiles and apparel indicates that the system has had little impact on the volume of textiles and clothing exports of developing countries (See Table 29).

### TABLE 28

**POST TOKYO ROUND (1974) TARIFFS ON PRODUCTS IN U.S.**

<table>
<thead>
<tr>
<th>FIBERS</th>
<th>FABRICS</th>
<th>CLOTHING</th>
<th>ALL TEXTILE PRODUCTS(A)</th>
<th>ALL INDUSTRIAL PRODUCTS(EXCL. PETROLEUM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>W</td>
<td>S</td>
<td>W</td>
<td>S</td>
</tr>
<tr>
<td>2.9</td>
<td>3.4</td>
<td>11.7</td>
<td>11.5</td>
<td>9.8</td>
</tr>
</tbody>
</table>

(A) including fibers, yarns, fabrics, made up articles and clothing.
S: simple W: weighted
Note: weighting is according to import of MFN origin. Tariff reductions will be phased in over eight year period and the rate shown in the table will normally apply as of 1st January, 1987
Source: GATT, OECD in 1983 pp103
### TABLE 29

**U.S. REDUCING G.S.P. TREATMENT WITH RESPECT TO ALL BENEFICIARIES, 1981**

<table>
<thead>
<tr>
<th>PRODUCT EXCLUSIONS FROM G.S.P.</th>
<th>TEXTILE AND APPAREL PRODUCT</th>
<th>ALL INDUSTRIAL PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>85.4%</td>
<td>39.2%</td>
<td></td>
</tr>
</tbody>
</table>

Source: OECD Publication 2 (May 1983), GATT pp160

4.6.3 **NONTARIFF BARRIERS**

Textile and apparel imports are affected by many nontariff barriers, mainly in the form of quantitative limitation. The present complex system of nontariff restrictions on international trade in textiles can be traced back to the 1950's when both Europe and the United States applied import controls on cotton textiles in particularly competitive industries. Those national measures were subsequently placed within the framework of multilateral agreements under GATT by a coalition of the textile and apparel industry. Three successive arrangements, or 'orderly market arrangement' such as STA, LTA, and MFA were thus negotiated in 1961 under the auspices of GATT. These arrangements considered to be temporary, have in fact been maintained for twenty years. Originally, their purpose was to facilitate structural adjustments in the textile and clothing industry. During the late 1960's and 1970's, nontariff barrier policies became the focus of great attention as tariff barriers declined. For the first time Tokyo Round negotiations (1972 - 1979) included nontariff barriers as tariff measures.
Morici and Megna (59) estimated the tariff equivalents of nontariff barriers (NTB's), which discouraged imports in the textile industry. They first calculated changes in import share due to NTB's and then the elasticity of import demand to calculate NTB's affecting producer and consumer prices. Second, they calculate export subsidies (XS) and domestic production subsidies (DPS). Finally, the tariff equivalents of nontariff barriers are calculated. From Table 31, apparel and other textile products have higher NTB's than textile mills products. Overall protective benefits in U.S. apparel industry are higher than those in U.S. textile mills products.

There are various nontariff measures, such as tariffs with quotas, total or conditional prohibition, automatic authorization with licensing, antidumping countervailing duties, control of the minimum import price level, price investigation and surveillance, and measures to restrain volume (quota). The E.E.C. uses a quota system (67%) as a nontariff barrier, much more than do developing countries. The U.S. uses antidumping countervailing duties (13%), and quotas (14%) as nontariff measures. Developing countries uses total (11%) or conditional prohibition (3%) as their nontariff barriers (See Table 30). Although it is not the principal focus of this research, political forces have clearly played a significant rate in this evolution of this industry and cannot be ignored in this empirical work to follow.
### TABLE 30

**INCIDENCE OF NONTARIFF MEASURES OVER COUNTRIES (PERCENTAGE), 1983**

<table>
<thead>
<tr>
<th>Nontariff Measure</th>
<th>E.E.C.</th>
<th>Japan</th>
<th>U.S.A.</th>
<th>Developing Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariff with Quota</td>
<td>34</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total Prohibition</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>11</td>
</tr>
<tr>
<td>Conditional Prohibition</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Automatic Authorization With Licensing</td>
<td>23</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Antidumping Countervailing Duties</td>
<td>5</td>
<td>-</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Control of Minimum Import Price Level</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Antidumping Price Investigation and Surveillance</td>
<td>67</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Measures to Restrain Volume (Quota)</td>
<td>69</td>
<td>7</td>
<td>14</td>
<td>23</td>
</tr>
</tbody>
</table>

Source: OECD Publication 2 (May 1983), GATT

Note: 1. This table uses the UNCTAD data base.
2. 22 developing countries accounting for some 50 per cent of the total imports of developing countries are included, namely, Algeria, Brazil, Chile, Guatemala, Hong Kong, Indonesia, Ivory Coast, Kenya, Malawi, Mexico, Nigeria, Pakistan, Peru, the Philippines, Korea, Saudi Arabia, Sri Lanka, Thailand, Tunisia, Turkey, United Republic of Cameroon, and Venezuela.
3. CCCN (Customs Co-Operation Council Nomenclature) four digit product is used for nontariff measures

### TABLE 31

**Ntb Tariff Equivalents At R+ 2%, Textile Industry, 1976 (%)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Total NTBs</th>
<th>Total Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Manufacturing</td>
<td>1.14</td>
<td>9.56</td>
</tr>
<tr>
<td>Textile Mill Products</td>
<td>0.25</td>
<td>23.73</td>
</tr>
<tr>
<td>Apparel &amp; Other Textile Products</td>
<td>8.76</td>
<td>37.39</td>
</tr>
</tbody>
</table>

Source: NPA (National Planning Association), 1983 Report pp119

Note: R + 2 % is the interest rate set 2 percentages points higher than the assumed market interest rate.
Chapter V
AN EMPIRICAL ANALYSIS

5.1 TESTABLE HYPOTHESES

Looking back upon the stylized facts presented in Chapter 4, we may note that one testable hypothesis is that the firm size is partly determined by the trade-off between the risks the firm faces under fashion uncertainty and mass production. Mass production techniques (with the large volume effect) achieve lower per unit costs as the batch becomes larger, but are very risky under fashion uncertainty because, among other things, they commonly involve long-term commitments to the organization that are highly specialized. Should a plan prove to be wrong because of a short fashion life cycle, highly specialized techniques are expensive to convert. Therefore, high variety demand may change the optimal firm size by less usage of capital compared to the certain world.

Textile industries are labor intensive industries whose product lines are correlated. Firms in these industries have no incentive to integrate backward or upward in order to diversify risks under the uncertainty.

The second hypothesis is that the consumer information structure may alter the optimal location of an industry. Access to the consumer information structure at a low cost is very important for fashion
sensitive industries. The apparel industry is located near fashion centers, usually the large urban areas of the Northeast, and Northcentral regions of the U.S., because firms in the apparel industry finds it advantageous to be close to large urban cities so that they may provide quick delivery on special orders. Industries which are close to large urban fashion setting cities may gather fashion information at a lower cost than industries located far away from the fashion center. The former rapidly follows the change in fashion with less cost than the latter.

The apparel industry is also a low wage industry. However, the dispersing effect of the industry's trend towards low-wage areas might be counterbalanced by a concentrating force exerted by fashion centers - especially New York.

Finally, we can apply the above two hypotheses to the international shift in the locus of production. U.S. imported products from developing countries are less subject to style changes than are those from developed countries because the former's products are more standardized than the latter's products.

So far no formal empirical work has been done in these areas. The problem, of course, is the general lack of data on fashion (or variety). First we are going to present a simple ordinary least square estimates, selecting plausible variables as proxies for fashion. Next we alleviate the data problem by constructing a linear structural relations model (Lisrel model). The Lisrel model corrects an
unobservable variable by using multiple indicators of a latent variable such as fashion. We will examine which model provides robust parameters estimates for our testable hypotheses.

5.2 DATA AND SOME SIMPLE SUMMARY STATISTICS

The textile and apparel industries (SIC 22 and 23) are divided into sixty-three sectors based on the four-digit level of industrial classification. Most of the sample covers the year 1977 for which data are published by the Bureau of Foreign and Domestic Commerce. Cross-sectional analysis is used due to lack of data over time. Hopefully, this "steady state" analysis, when combined with changes in independent variables over time, will give some insight into the evolution of the apparel and textile mill industries over time.

In Table 32, we describe the variable names and our method of measurement. Means and standard deviations of the variables of interest are shown in Table 33.

5.3 SIMPLE MODEL SPECIFICATION

The theoretical analysis in the preceding chapter suggests that firm size and its location depend on changes in the consumer information structure such as changes in fashion or in the demand for variety. In this section, we discuss a simple ordinary least squares model specification for two testable hypotheses which deal with fashion's impact on the firm size and its location.
In order to estimate an equation for the location hypothesis, we use a linear approximation of equation (18) in chapter 3. I assume that $r^*$, $p$, $t^*$, are constant cross-sectionally because $r^*$ is insignificant for the textile industry, $p$ is constant in the perfect competitive market, and $t^*$ is insignificant in the industry. This gives us the linear estimating equation:

\[ u^* = \beta_0 + \beta_1 \log(w^*) + \beta_2 \log(R) + \beta_3 \log(\lambda) + \varepsilon \]

where $u^*$ is the distance from the fashion center to the manufacturing center, $w^*$ is a unit labor cost which is dependent on distance, $R$ is a unit capital cost independent of location, and $\lambda$ is a fashion. The error in the model is assumed to be normally distributed, nonautocorrelated, and homoscedastic.

Regressors except for $w^*$ are predetermined, and $w$ is a function of distance ($u$) and the ratio of skilled to unskilled workers used in production ($S$). Assuming that the choice of $S$ is determined by the relative wage of skilled to unskilled workers and the production technology, and further assuming that the relative wage ratio is independent of $u$, then we can write $w = f(u, S)$ where $S$ is an exogeneous variable which is independent of distance. If we ran a regression of $w$ on $u$ and $S$, we would obtain $\hat{w} = f(u, S)$. At a given location $u^*$, $\hat{w} = f(u^*, S)$. To eliminate the endogeneity problem concerning $w$, we will use $S$ as an instrumental variable instead of $\hat{w}$. Killingsworth ((42) pp.387.) summarizes how analysts have tried to eliminate the endogeneity problem when estimating the relationship
between the marginal tax rate and labor supply. He reports that most researchers have used instrumental variables or proxy variables for the marginal tax rate. The technique used here applies their methodology to the similar problem of endogeneity faced in our empirical analysis.

Assume northern areas in the U.S. such as New York City are fashion centers; their influence on fashion still dominants over that of Dallas and Los Angeles. The distance $u$ from the fashion center to the manufacturing place is measured by the percentage share of southern employees of total employees (PST). We investigate the existing locational pattern of the textile industry through examining shifts in manufacturing employment that have taken place in recent years. Both textile industries have been continuously relocating from the North to the South. This migration has been more rapid and complete in the textile mill products industry than in apparel industry.

Three possible substitute variables for the skilled to unskilled ratio are (1) production workers covered by collective bargaining agreements with expected negative sign, (2) percentage of women workers among total employees with positive expected sign, and (3) years of median schooling completion with negative expected sign.

Production workers covered by collective bargaining agreements in 1974 (PN) is used for the unit labor cost ($w^*$). The rise of trade unions after the National Labors Relation Act was primarily effective in the North. Its effect has been largest on large firm industries,
such as the textile mill product industry, where unions may be easily and effectively organized. In the apparel industry, there is less union pressure on wages because firms are small in size. The textile mill product industry is more sensitive to less union coverage of workers in the South than is the apparel industry. This variable is not available on the SIC four-digit level for classification. Data on the fraction of production workers covered by collective bargaining agreements are obtained from Freeman and Medoff (1979).

Other possible substitute variables for the unit labor cost ($w^*$), the percentage of women workers among total employees in the industry and median years of schooling completion are also used in this study. The reduction in flow of immigrants due to restrictive immigration laws during and after World War I has required the textile industry to use internally supplied low-skilled labor, partly provided by the mechanization of agriculture. Unskilled labor is measured by the median years of schooling completion or percentage of women workers among total workers. Median years of schooling completion is taken from the 1970 Census of Population. The South has few labor laws regarding women such as limitations of working hours of women to 48 hours a week, and night work prohibition. Concerning relocation, the textile industry may be sensitive to changes in the percentage of women workers in a region. Both variables are strongly significant in each industry from our estimated logarithmic wage earning equations.¹¹

¹¹ See footnote 8
Fuel and electricity purchased per unit value of shipments in the textile industry (FC) is used for the unit capital cost variable. Because of a good, fast river system, the South had relatively larger reductions in energy costs with the development of hydroelectric technology than other regions. We expect that highly capital intensive (or highly energy intensive) firms will take advantage of the low energy costs in the South.

Most of the variables mentioned above are measurable, but the fashion variable (\( \lambda \)) is a latent variable. We must introduce a measurable variable as a proxy for the fashion variable. \(^{12}\) Import share from developed countries, the average ad-valorem tariff rate or (and) the ratio of final goods inventory to total inventories will be our proxies for a fashion variable (\( \lambda \)). Firms in developed countries know the consumer information structure of the U.S. better than those in developing countries because they have similar consumer information structures. We expect that U.S. firms, which face higher import penetration from developed countries, may produce more fashionable products than other firms. Tariffs on textile products have been higher than on any products from other manufacturing industries.

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\(^{12}\) Variety has two dimensions. One are at any point in time a number of closely related but different products and the other are across points in time closely related but different products. Fashion might be the latter case. I will use variety or fashion interchangeably.
Exemption from G.S.P. for developing countries' textile products may explain why textile products from developing countries face higher tariffs than those from developed countries. Fashion goods, mostly made-to-order, have a low ratio of final goods inventory to total inventories (including raw material and work-in-process inventories) (Zarnovitz(118)).

We use equation (40) in Chapter 3 to form the empirical equation for the firm size hypothesis. Using a linear approximation, we have the following linear estimating equation;

\[ \log(K/L) = \beta_0 + \beta_1 \log(\lambda) + \beta_2 \log(\text{IMPLICIT MONITORING COST}) + \beta_3 \log(\text{PRODUCT VARIETY}) + \varepsilon \]

The error in the second model is assumed to be normally distributed, nonautocorrelated, and homoscedastic. The regressors are predetermined.

The ratio of capital to labor \((K/L)\) is measurable. The ratio of total administrative workers to total employees over the four-digit level of industrial classification \((T/L)\) is used as a proxy for differences in monitoring cost. Increase in firm size is accompanied by a high fraction of employees in supervisory positions. A high ratio of total administrative workers to total employees causes large monitoring costs on workers' performances in a heterogeneous firm.

The fashion variable \((\lambda)\) is a latent variable which is not observable. We use observable proxies such as import share from
developed countries, tariffs, or the ratio of final good inventory to total inventories for the latent variable \( \lambda \).

Tangible evidence of the relative importance of product differentiation will be the size of advertising and other sales promotion cost in ratio of the sales. Since product differentiation can be expected to occur most commonly in the consumer goods sector, consumer good ratio which is defined to be the fraction of industry output sold for personal consumption will be used as a plausible variable for product differentiation. The consumer goods ratio can be derived from the detailed input-output table. However, data at the four-digit level industrial classification are not readily accessible.
5.3.1 OLS RESULTS

These initial ordinary least squares (OLS) results are merely exploratory with more complete analysis to follow. When the unobservable variable (Fashion) has a functional relationship with the observable variable, that is, when the model has multiple indicators or multiple causes of a single latent variable, the maximum likelihood estimator using the Lisrel method is preferred in terms of efficiency (Goldberger and Joreskog (34)).

From column 1 in Table 34, we may see that fuel cost (LOG(FC)) is a significant factor for the textile mill industry to be located to the South. The coefficient of import share from developed countries (LOG(IMSD)) is strongly significant with an expected negative sign. Products from developed countries are high-quality, fashion-sensitive products. U.S. firms which face severe foreign competition from developed countries may produce fashion goods. They are willing to stay in the North where they have been since the 19th century to prevent their products from being obsolete because of long delivery lags.

From column 2 in Table 34, the coefficient of import share from developed countries (LOG(IMSD)) is significant with an expected negative sign with a 95% confidence interval. Products from developed countries are high-quality, fashion-sensitive products. The average tariff rate (TAR) which we interpret as a proxy for the variable "Fashion" is strongly significant. The U.S. imposes heavy tariffs on
developing countries which produce few fad items. Firms which produce items with high tariff rates are less sensitive to fashions than firms which produce items with low tariff rates. The latter might be located in the South to take advantage of the surplus of unskilled labor in the South. We use median years of schooling completion as the proxy for unskilled workers. Its coefficient is not strongly significant but has the correct expected sign.

From Table 35, we may note that firms which have high import penetration from developed countries produce fashion items. They do not use capital intensive production methods because they do not want to commit to long term plans because of frequent changes in the consumer information structure. They are willing to substitute labor for capital to reduce the ratio of capital to labor.

Firms which produce heterogeneous products face less elastic consumer demand curves than firms which produce homogeneous products. Namely, firms with a demand for variety might reduce their scale of economy because they have a smaller fraction of the market than firms with little demand for variety if we assume equal price changes in both market. The estimated coefficient for advertising is negative as expected, but not strongly significant. We do not take this to mean that demand for variety has no effect on the size of firms. Instead we believe the effect of the 'Fashion' variable on firm size cannot be clearly isolated until we remove the effect of the 'variety' variable on the firm size.
TABLE 32
VARIABLE DEFINITIONS

TL; the ratio of total administrative employees to total employees which explains the monitoring cost of the manager.

KL; the ratio of capital to labor which is measured by the ratio of gross book value of assets to total numbers of employees.

PST; percentage of southern share of employees of total employees in the textile industry

IMSD; import share which is measured by the ratio of total import to total shipments in the four-digit industry from developed countries (E.E.C., Japan, Canada, etc.)

FC; purchased fuel and electricity energy per unit value of shipment of each four-digit industry

IMS; import share in each four-digit industry

PN; Freeman and Medoff (1979) data on fraction of production workers covered by collective bargaining agreements in 1974

ED; median years of schooling completion

WN; wage rate of production workers in 1977

WOM; percentage of women workers among total employees

TAR; average ad-valorem tariff rate

AS; the ratio of advertising expenditure to total shipments in 1977

FVS; the ratio of final good inventory to total inventory
TABLE 33
MEANS AND STANDARD DEVIATION FOR SELECTED VARIABLES

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>MEAN</th>
<th>STANDARD DEVIATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>KL</td>
<td>9.415</td>
<td>7.695</td>
</tr>
<tr>
<td>TK</td>
<td>0.145</td>
<td>0.041</td>
</tr>
<tr>
<td>PST</td>
<td>49.266</td>
<td>25.422</td>
</tr>
<tr>
<td>LOG(IMSD)</td>
<td>0.537</td>
<td>1.564</td>
</tr>
<tr>
<td>LOG(FVS)</td>
<td>0.0604</td>
<td>0.0319</td>
</tr>
<tr>
<td>LOG(FC)</td>
<td>-4.419</td>
<td>0.7968</td>
</tr>
<tr>
<td>LOG(WN)</td>
<td>1.887</td>
<td>0.096</td>
</tr>
<tr>
<td>LOG(ED)</td>
<td>2.348</td>
<td>0.012</td>
</tr>
<tr>
<td>TAR</td>
<td>0.145</td>
<td>0.042</td>
</tr>
<tr>
<td>AS</td>
<td>0.008</td>
<td>0.026</td>
</tr>
<tr>
<td>LOG(PN)</td>
<td>3.73</td>
<td>0.853</td>
</tr>
<tr>
<td>LOG(MSH)</td>
<td>2.37</td>
<td>0.108</td>
</tr>
</tbody>
</table>

Note: For variable definitions, see table 32.

TABLE 34
OLS RESULTS ON LOCATION HYPOTHESIS

<table>
<thead>
<tr>
<th>EQUATION NUMBER</th>
<th>1 TEXTILE MILL</th>
<th>2 APPAREL</th>
</tr>
</thead>
<tbody>
<tr>
<td>VARIABLE</td>
<td>ESTIMATED COEFFICIENTS</td>
<td>ESTIMATED COEFFICIENTS</td>
</tr>
<tr>
<td>PST</td>
<td>135.4(1.53)</td>
<td>64.5(0.58)</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-9.1(-2.14)</td>
<td>-2.8(-1.59)</td>
</tr>
<tr>
<td>LOG(IMSD)</td>
<td>5.1(0.24)</td>
<td></td>
</tr>
<tr>
<td>LOG(WN)</td>
<td>23.2(2.42)</td>
<td>-1.7(-0.1)</td>
</tr>
<tr>
<td>LOG(ED)</td>
<td></td>
<td>-19.6(-0.79)</td>
</tr>
<tr>
<td>TAR</td>
<td></td>
<td>147.2(2.39)</td>
</tr>
<tr>
<td>R²</td>
<td>0.31336</td>
<td>0.5099</td>
</tr>
</tbody>
</table>

Note 1: Equation (1), and (2) use PST (per cent share of southern employees among total employees) as a dependent variable.
Note 2: Parentheses denotes t-values.
Note 3: For variable definitions, see table 32.
### TABLE 35

**OLS RESULTS ON FIRM HYPOTHESIS**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>ESTIMATED COEFFICIENTS (TEXTILE INDUSTRY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOG(KL)</td>
<td>1.125 (0.86)</td>
</tr>
<tr>
<td>CONSTANT</td>
<td></td>
</tr>
<tr>
<td>LOG(IMSD)</td>
<td>-0.235 (-2.50)</td>
</tr>
<tr>
<td>LOG(AS)</td>
<td>-0.198 (-1.40)</td>
</tr>
<tr>
<td>LOG(TL)</td>
<td>0.594 (1.12)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.184209</td>
</tr>
</tbody>
</table>

Note 1: We use LOG(KL) (the ratio of the capital to labor) as dependent variable.

Note 2: For variable definitions, see table 32.
5.4 LISREL METHODOLOGY

First we set up structural models (1A or 2A) and measurement models (1B or 2B) for each hypothesis.

\[
PST = \beta_0 + \beta_1 \text{FASHION} + \beta_2 \text{LOG(PN)} + \beta_3 \text{LOG(FC)} + \epsilon_1
\]  
(or \text{LOG(ED)})  

(1A)

\[
\text{IMSD} = \Theta \text{FASHION} + \nu_1
\]  

(1B)

\[
\text{LOG(KL)} = \beta_0' + \beta_1' \text{FASHION} + \beta_2' \text{TK} + \epsilon_2
\]  

(2A)

\[
\text{IMSD( AS or FVS)} = \Theta' \text{FASHION} + \nu_2
\]  

(2B)

Error terms are assumed to be normal variable and independent.

Least squares method yields biased and inconsistent estimators because the classical assumption about independence of the stochastic term and the regressor is violated. Using a proxy variable such as the ratio of final goods inventory to total shipments (or average ad valorem tariff rate or import share from developed countries) in each industry for the "Fashion" variable will cause the estimators to be biased and inconsistent. However, this leads to a smaller asymptotic bias than if the missing variable is simply omitted (Macallum(52)).

Use of a maximum likelihood procedure to obtain consistent estimators (asymptotic unbiasedness) is preferred when unobservable variables have a functional relationship with other observable variables. It fails due to insufficient information in the model, thus raising the question of the model identification. To identify the equations, we need extraneous information regarding the error terms of one form or another. Another possible way to identify an equation,
when we know of relationship between the true but unknown variable and a set of observational variables, is to add this new equation to the model. However, the difficulty in implementing the Lisrel model is to find valid indicators of the latent variable.

Our model for the first hypothesis is the following:

\[
PST = \theta \text{UPST}(\eta) + \epsilon 
\]

\[
\text{UPST} = \gamma_0 \text{FASHION}(\lambda) + \gamma_1 \text{LOG(UWN)} + \gamma_2 \text{LOG(UFC)} + \zeta_1
\]

(or \text{LOG(UED)})

\[
\text{LOG(TAR)} = \theta_{11} \text{FASHION}(\xi_1) + \delta_1
\]

\[
\text{LOG(IMSD)} = \theta_{21} \text{FASHION}(\xi_1) + \delta_2
\]

\[
\text{LOG(PN)} = \theta_{32} \text{UPN}(\xi_2) + \delta_3
\]

(or \text{LOG(ED)} = \theta_{32} \text{UED}(\xi_2) + \delta_3)

\[
\text{LOG(FC)} = \theta_{43} \text{UFC}(\xi_3) + \delta_4
\]

With the assumptions,

1) \(\zeta_1\) is uncorrelated with each independent variable in equation 3B.
2) \(\epsilon\) is uncorrelated with a exogenous variable in equation 3A.
3) \(\delta_i\) is uncorrelated with exogenous variables in equation 3C, 3D, 3E, and 3F.
4) \(\zeta_1, \delta_i, \epsilon\) are mutually uncorrelated.

For second hypothesis,

\[
KL = \theta \text{UKL}(\eta) + \epsilon
\]

See appendix A

UPST, UPN, UFC, UKL, and UTL are technically created unobservable variables for the Lisrel method. Variables with a prefix "U" denotes technically created unobservable variables.
UKL = \gamma_0 \text{FASHION}(\xi_1) + \gamma_1 \text{UTL}(\xi_2) + \zeta_2 \quad (4B)

FVS = \theta_{11} \text{FASHION}(\xi_1) + \delta_1 \quad (4C)

IMSD = \theta_{21} \text{FASHION}(\xi_1) + \delta_2 \quad (4D)

TL = \theta_{32} \text{UTL}(\xi_2) + \delta_3 \quad (4E)

With the assumptions,

1) \zeta_2 is uncorrelated with each independent variable in equation 4A.

2) \varepsilon is uncorrelated with a exogenous variable in equation 4B.

3) \delta_1 is uncorrelated with exogenous variables in equation 4C, 4D, and 4E.

4) \zeta_2, \delta_1, \varepsilon are mutually uncorrelated.

Before discussing the maximum likelihood estimates, let us first examine the identification of the model (group of equations 3) in the case of two multiple indicators of fashions. I do not show the identification problems for equations 4 because it is the same model as equations 3.

We can rewrite equations 3 as the following;

\begin{align*}
Y &= \alpha + \beta X + \varepsilon \\
X_1 &= \theta_1 X + V_1 \\
X_2 &= \theta_2 X + V_2
\end{align*}

(5)

where Y, X1, and X2 are observable variables, X is the latent variable. We assume that V1, and V2 are mutually and serially independent with mean vector zero and constant variances \( \sigma^2_{V1} \) and \( \sigma^2_{V2} \). They are also independent of the true value of X1, and X2. (X1, X2, Y) are normally distributed with mean vector \((\theta_1 \mu, \theta_2 \mu, \alpha + \beta \mu)\) and covariance matrix
We have 9 parameters to be estimated (\( \theta_1, \theta_2, \mu, \alpha, \beta, \sigma^2_x, \sigma^2_v1, \sigma^2_v2, \sigma^2_\varepsilon \)) and 9 estimation equations. The model is just identified in the sense that each parameter may be uniquely determined. If all the parameters in the model are identified, we say that the whole model is identified. Otherwise, the model is said to be non-identified. If a third indicator of same type is available, overidentification results.\(^{15}\)

From our path diagram in Figure 3, the structural and measurement models have 4 \( X \)'s and \( Y \) (which are observable variables), and four unobservables (3\( \xi \), 1\( \eta \)). We have 13 parameters to estimate which includes coefficients in the structural and measurement models. Since \( \xi \) and \( \eta \) are unobserved, they do not have a definite scale. To define the model properly, the origin and the unit of measurement in each latent variable must be assigned. The most convenient way of assigning a unit of measurement is to fix ones in each column of \( \theta_y \) and \( \theta_x \). When \( X3 = \xi_2 \), and \( X4 = \xi_3 \), then \( \theta_{32} \), and \( \theta_{43} \) equal to one, and \( \delta_3 \), and \( \delta_4 \) will be zero.

For the maximum likelihood estimates of the parameters, we use the Lisrel program to test each hypothesis. This is a general computer program for estimating the unknown coefficients in a set of linear structural equations. Variables in the system may be either directly observed variables or latent variables which are not observed, but related to observed variables.

To obtain maximum likelihood estimators, this program uses a covariance matrix or correlation matrix between observable variables.

16 A one way arrow between two variables indicates a postulated direct effect of one variable on another. Observed variables such as X- and Y- variables are enclosed in rectangles. Latent variables are enclosed in circles.
We use a correlation matrix between observable variables because some vectors in a covariance matrix are very small. The maximum likelihood estimators are obtained by means of an iterative procedure which minimizes a definite function by successively improving the parameter estimates. In particular maximum likelihood estimators are, under the usual regularity conditions, consistent and asymptotically efficient.

For the location hypothesis, labor market variables might be important factors for industry's migration to the South. The apparel industry might move to the South for the access to low skill workers and the textile mill industry is likely to move to the South for the low hourly wages perhaps caused by low union power in the South. We used fraction of production workers covered by collective bargaining agreement in 1974 or mean of schooling completion as labor variables in each industry.

For the firm hypothesis, we propose the monitoring cost argument as the alternative hypothesis in the apparel industry and textile mill industry. We use the ratio of total administrative employees to total employees as a proxy for the monitoring cost variable.

For both hypotheses, we use import share from developed countries (IMSD), and the average ad-valorem tariff rate (TAR) as multiple indicators of Fashion (or the demand for variety). For the firm hypothesis, we use the ratio of final good inventory to total inventory (FVS) as a proxy for Fashion (λ) in addition to the import penetration from developed countries (IMSD).
5.4. LISREL RESULT

The maximum likelihood estimates using Lisrel VI for both hypotheses are presented Tables 36, 37, and 38. Note 1 in Tables 36, 37, and 38 give two measures of the overall fit of the whole model. The $\chi^2$-measure evaluates the overall fit of the model to the data. The $\chi^2$-measure is the likelihood ratio test statistic for testing the model against the alternative that $E$ is unconstrained. As another measure of goodness of fit to the data, adjusted goodness of fit index is used in the analysis. Overall, the three models acceptably fit the data.

In Table 36, the coefficients for Fashion ($\gamma_0$), and UFC ($\gamma_2$) in textile mill industry show the expected signs, but neither coefficient is significant at the 99 percent level using two tail t-test. The negative coefficient on Fashion ($\gamma_0$) implies that the more fashionable a firm's product is, the more likely that firm is located in the North. The positive coefficient on UFC ($\gamma_2$) implies that industries locate in the southern part of the U.S. to take advantage of low fuel costs. The negative coefficient on UPN ($\gamma_1$) implies that firms in the North have higher proportions of unionized workers among total workers than firms in the South. However, this coefficient is not significant in this model.
Assuming that the U.S. is a major market due to the size and diversity of its domestic markets, the positive coefficient on IMSD ($\theta_{21}$) with a 99 percent level of significance indicates that industries with higher import penetration from developed countries tend to produce fashion items because of similar information structures. Imports from less developed countries are restricted by the Multi-Fiber arrangement for all textile and apparel products (1974 - present) and high tariffs. Exporters facing quotas, mostly developing countries such as Hong Kong, Taiwan, and Korea, shifted their exports from low quality, low priced standardized products to high quality, high priced customized products through subcontracting with developed countries, and thereby eliminating delivery lag effects. The negative coefficient on TAR ($\theta_{11}$) suggests that fashion goods, mostly from developed countries, are subject less to tariff rates than nonfashion goods.

The estimated coefficients required to test the first hypothesis on the apparel industry is presented in Table 37. Their values differ from the textile mill industry. Estimated coefficients for Fashion ($\gamma_0$), UED($\gamma_1$), and UFC($\gamma_2$) show the expected signs with two coefficients on Fashion ($\gamma_0$) and UED ($\gamma_1$) significantly above the 95% level by two tail t-test.

The negative estimated coefficient on Fashion implies that firms in the apparel industry which produce fashion items locate in the North. The negative estimated coefficient on UED ($\gamma_1$) implies that firms in the apparel industry which use unskilled workers (low educated people) locate in the South. The estimated coefficient on UFC ($\gamma_2$) is not
significant in explaining the variation in the southern share of total employees because of a small scale economy. The negative value of the TAR variable ($\theta_{21}$) coefficient suggests that products with high tariffs are nonfashion goods. The positive coefficient on IMSD ($\theta_{11}$) implies that most of fashion items are imported from developed countries.

The estimated model required to test the second hypothesis (firm size hypothesis) for the whole textile industry are presented in Table 38. The explanatory variables explain 89.2 percent of the variation in the capital to labor ratio. Estimated coefficients on Fashion ($\gamma_0$), and UTL ($\gamma_1$) show the expected signs. However, the coefficient on Fashion is significant at over the 95 percent level using two-tail t-test and more significant than estimated coefficients of UTL ($\gamma_1$). The positive coefficient on FVS ($\theta_{11}$) implies that the firms which produce fashion goods have higher ratios of final goods inventory to total inventory because of a rapid change in the demand for variety. The negative coefficient on Fashion ($\gamma_0$) implies that the firm size will be smaller the more fashionable are its products, and the more demand for variety it face. The negative coefficient on Fashion ($\gamma_0$) may explain the trade-off between economies of scale and demand for variety.

The positive coefficient on UTL ($\gamma_1$) implies that the ratio of capital to labor will be high when there exists a high ratio of administrative workers to total workers. The high ratio of administrative staff to total employment causes the rising cost of supervision for the firm. The higher monitoring cost on worker's performance induces them to adopt more capital-intensive methods which
economize on total monitoring costs. In the batch assembly line production, homogeneous labor forces and fixed proportions simplify the monitoring task so that part can even be delegated to hired supervisors.
<table>
<thead>
<tr>
<th>COEFFICIENTS</th>
<th>INITIAL ESTIMATORS</th>
<th>MLE ESTIMATORS (t-ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST ($\theta_y$)</td>
<td>0.9</td>
<td>0.512 (1.743)</td>
</tr>
<tr>
<td>IMSD ($\theta_{14}$)</td>
<td>1.0</td>
<td>0.687 (2.700)</td>
</tr>
<tr>
<td>TAR ($\theta_{21}$)</td>
<td>-0.282</td>
<td>-0.410 (-1.963)</td>
</tr>
<tr>
<td>PN ($\theta_{32}$)</td>
<td>1.0</td>
<td>1.0 (7.623)</td>
</tr>
<tr>
<td>FC ($\theta_{43}$)</td>
<td>1.0</td>
<td>1.0 (7.618)</td>
</tr>
<tr>
<td>FASHION ($\gamma_0$)</td>
<td>-0.665</td>
<td>-1.442 (-1.137)</td>
</tr>
<tr>
<td>UPN ($\gamma_1$)</td>
<td>-0.424</td>
<td>-0.722 (-1.304)</td>
</tr>
<tr>
<td>UFC ($\gamma_2$)</td>
<td>0.578</td>
<td>1.065 (1.282)</td>
</tr>
</tbody>
</table>

Note 1: Adjusted Goodness fit index is 0.701
Chi-Square with 3 degree of freedom is 5.03
(Probability level is 0.170)
Parentheses denote t-values.

Note 2: For variable definitions, see Table 32.
TABLE 37
LISREL RESULTS FOR THE FIRST MODEL ON APPAREL

<table>
<thead>
<tr>
<th>COEFFICIENTS</th>
<th>INITIAL ESTIMATORS</th>
<th>MLE ESTIMATORS (t-ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PST ($\theta_{1}$)</td>
<td>0.9</td>
<td>0.870 (7.892)</td>
</tr>
<tr>
<td>IMSD ($\theta_{11}$)</td>
<td>1.0</td>
<td>1.528 (2.641)</td>
</tr>
<tr>
<td>TAR ($\theta_{21}$)</td>
<td>-0.155</td>
<td>-0.136 (-1.120)</td>
</tr>
<tr>
<td>ED ($\theta_{32}$)</td>
<td>1.0</td>
<td>1.007 (8.041)</td>
</tr>
<tr>
<td>FC ($\theta_{43}$)</td>
<td>1.0</td>
<td>1.004 (8.010)</td>
</tr>
<tr>
<td>FASHION ($\gamma_{0}$)</td>
<td>-0.775</td>
<td>-0.40 (-1.721)</td>
</tr>
<tr>
<td>UED ($\gamma_{1}$)</td>
<td>-0.569</td>
<td>-0.47 (-2.035)</td>
</tr>
<tr>
<td>UFC ($\gamma_{2}$)</td>
<td>-0.025</td>
<td>0.18 (0.957)</td>
</tr>
</tbody>
</table>

Note 1: Chi-Square with 3 degree of freedom is 6.91 (Probability level is 0.075)
Adjusted Goodness of fit index is 0.635
Parentheses denote t-values.

Note 2: For variable definitions, see Table 32.
TABLE 38
LISREL RESULTS FOR THE SECOND MODEL ON TEXTILE INDUSTRY

<table>
<thead>
<tr>
<th>COEFFICIENTS</th>
<th>INITIAL ESTIMATORS</th>
<th>MLE ESTIMATORS (t-ratio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UKL ($\theta_y$)</td>
<td>0.9</td>
<td>0.843 (6.519)</td>
</tr>
<tr>
<td>FVS ($\theta_{11}$)</td>
<td>1.0</td>
<td>0.338 (2.109)</td>
</tr>
<tr>
<td>IMSD ($\theta_{21}$)</td>
<td>0.237</td>
<td>0.611 (2.500)</td>
</tr>
<tr>
<td>TK ($\theta_{32}$)</td>
<td>1.0</td>
<td>1.00 (11.045)</td>
</tr>
<tr>
<td>FASHION ($\gamma_0$)</td>
<td>0.311</td>
<td>-0.593 (-1.857)</td>
</tr>
<tr>
<td>UTL ($\gamma_1$)</td>
<td>0.280</td>
<td>0.246 (1.521)</td>
</tr>
</tbody>
</table>

Note 1: Chi-Square with 3 degrees of freedom is 1.35
(Probability level is 0.245)
Adjusted Goodness of fit index is 0.892
Note 2: For variable definitions, see Table 32.
Chapter VI

CONCLUSION

Product demand fluctuations and corresponding information requirements appear to have a substantial impact on industrial organization. Our empirical study indicates that the Lisrel (Linear Structural Relations) method provides more robust parameters estimates than selecting plausible variables for proxies for use in ordinary least squares. The Lisrel approach simultaneously estimates a reduced form model of fashion with multiple indicator functions. Important indicators of "fashion" are shown to be tariff rates, import share from developed countries, and the ratio of final goods inventory to total inventories.

The empirical relationship between the demand for variety (or fashion) and a firm's location is apparently strong, more so in the apparel industry than in the textile mill industry. The differences in location trends between textile mill products and apparel industries is due to the demand for variety (or fashion) in the case of the latter. Changes in other locational factors over time have transformed the industrial location structure in the U.S. as well. For the textile mill industry, the reduction in energy costs with the development of hydroelectric technology in the South was a major factor in their relocation to the South. For the apparel industry, the necessity of

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internally supplied low-skilled labor, partly provided by the mechanization of agriculture in the South, was a contributing factor for their relocation to the South.

The empirical relationship between capital intensity and fashion is demonstrated to be weak but our estimates still have the expected signs. This analysis shows that firm size is changed not only by changes in monitoring costs, but also by changes in fashion (or the demand for variety). Our empirical work suggests that the latter factor affects firm size more than the former factor. High demand for variety implies low or small production run (and small firms) which use less capital intensive and less energy intensive production methods.

Our results suggest that small firms are more efficient at adapting to dynamic change in the demand for variety than large firms, and that with fashion uncertainty, firms tend to locate in information centers (or market centers), mostly in the urban areas of the northeast and northcentral in the U.S.. These findings explain the U.S. textile firms' strategy of producing variety goods in the 1960's and 1970's rather than undifferentiated standardized products.

Finally the empirical relationship between import share from developed countries and fashion is strong in this study. Small-sized producers in developed countries adjust efficiently to market randomness by producing made-to-order products, mostly fashion goods. Developed countries have a comparative advantage in producing and exporting fashion goods among themselves because similar consumer
information structures exist in each developed country which minimize the decision lag effects. Developing countries have a comparative disadvantage in producing fashion goods because of delivery lags. However buyers from developed countries (wholesalers, or retailers) use a subcontracting system with developing countries through which firms in developing countries produce made-to-order products according to buyer's order. Developing countries have low production costs because of a large low-skilled labor pool, and weak trade unions. The role of subcontracting with developed countries is one method by which developing countries acquire market information and increase penetration in the developed countries' markets.
Appendix A

PROBLEM OF IDENTIFICATION

In a simplistic way, we will make equation (1A) and (1B) into equation (1) and equation (2). We have the structural equation (1) and equation (2).

\[ Y = \alpha + \beta X_1 + \nu \]  
\[ X = X_1 + \kappa \]

Let us assume that \( \text{Cov}(X, \kappa) = \text{Cov}(X, \nu) = \text{Cov}(Y, \kappa) = \text{Cov}(Y, \nu) \) with \( \kappa \) and \( \nu \) mutually and serially independent. It follows that the pairs of measurement \( (X_1, Y_1) \cdots (X_T, Y_T) \) are normally and independently distributed with the mean vector \( (\mu, \alpha + \beta \mu) \) and covariance matrix,

\[
\begin{pmatrix}
\sigma_X^2 & \sigma_{XY} \\
\sigma_{YX} & \sigma_Y^2
\end{pmatrix}
= 
\begin{pmatrix}
\sigma_{X1}^2 + \sigma_{K}^2 & \beta \sigma_{X1} \\
\beta \sigma_{X1} & \beta^2 \sigma_{X1}^2 + \sigma_{\nu}^2
\end{pmatrix}
\]

\( X_i \) and \( Y_i \) are normally distributed with six parameters, \( \mu, \sigma_{X1}^2, \sigma_{\nu}^2, \sigma_{K}^2, \alpha \) and \( \beta \). We can only estimate \( \mu \), and \( \alpha + \beta \mu \), \( \sigma_X^2 = \sigma_{X1}^2 + \sigma_{K}^2 \), \( \sigma_Y^2 = \beta^2 \sigma_{X1}^2 + \sigma_{\nu}^2 \), and \( \text{Cov}(X, Y) = \beta \sigma_{X1}^2 \) with sufficient statistics such as \( (\Sigma X, \Sigma Y, \Sigma X^2, \Sigma Y^2, \Sigma XY) \). That is, maximum likelihood estimators of
parameters of the normal distribution of \((X, Y)\) can be solved for from the following equation.

\[
\begin{align*}
\hat{\mu} &= \bar{X} = \left(\frac{1}{T}\right) \sum X_i \\
\alpha + \hat{\beta}X &= \bar{Y} = \left(\frac{1}{T}\right) \sum Y_i \\
\hat{\sigma}_K^2 &= \left(\frac{1}{T}\right) \sum (X_i - \bar{X})^2 \\
\hat{\sigma}_Y^2 &= \left(\frac{1}{T}\right) \sum (Y_i - \bar{Y})^2 \\
\hat{\beta} \hat{\sigma}_{X1}^2 + \hat{\sigma}_{Y}^2 &= \left(\frac{1}{T}\right) \sum (X_i - \bar{X})(Y_i - \bar{Y})
\end{align*}
\]

We have five equations in six unknowns \((\hat{\mu}, \hat{\sigma}_{X1}, \hat{\sigma}_Y, \hat{\sigma}_K, \alpha, \hat{\beta})\). The system of five equations will not have a unique solution for the six parameters. The only parameters that can be uniquely determined is \(\hat{\mu} (=\bar{X})\). Thus, we can say that \(\hat{\mu}\) is identified and the rest of the parameters are unidentified or nonidentified. This discussion suggests that for a unique solution for parameters, we need one additional equation in addition to equation (1) and equation(2) to provide additional information.
REFERENCES


66. Oi, W.Y. "Heterogeneous Firms and The Organization of Production" The Economic Inquiry, Spring 1983.


