Estimating Penalties for Violating the Minimum Wage and Hiring Illegal Immigrants: The Case of the U.S. Apparel Manufacturing Industry

Marie-Teresa Rangel

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
in
Apparel, Housing, and Resource Management

Dr. Marjorie Norton
Dr. Doris Kincade
Dr. Daniel B. Taylor

September 11, 2006
Blacksburg, Virginia

Keywords: apparel, minimum wage, illegal immigrants, penalties

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Abstract

The U.S. apparel manufacturing industry includes many reputable firms, but is also believed to include many sweatshop operations. Sweatshop workers often work under sub-minimum wages, excessively long hours, and abusive management. Sweatshop establishments in the United States typically violate several U.S. labor laws. Two they commonly violate are the minimum wage under the Fair Labor Standards Act of 1938 and the ban on hiring illegal immigrants under the Immigration Reform and Control Act of 1986. The purpose of the present research was to estimate minimum penalties that would provide no monetary incentive for the average U.S. apparel manufacturing firm to violate the minimum wage and the ban on hiring illegal immigrants.

The minimum per-violation penalties that were estimated to deter violation of the minimum wage are 8 to 28 times the current maximum penalty of $1,000 per violation, and those estimated to deter the hiring of illegal immigrants are 3 to 10 times the current maximum penalty of $10,000 per violation. The estimated penalties are associated with annual probabilities of prosecution ranging from 5% to 15%. The estimated penalties primarily depend on the difference between legal and illegal wage rates. A sensitivity analysis indicated that the estimated penalties are insensitive to the value of the own-price elasticity of production labor demand, which is one of the variables used to calculate the penalties. The results suggest that current federal penalties for violating the minimum wage or the ban on hiring illegal immigrants do not deter infraction of these laws by U.S. apparel manufacturers.

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CHAPTER 1

INTRODUCTION

The use of sweatshop labor has been an increasing concern for U.S. policy makers. Although some sweatshops are found overseas, they have also been discovered in the U.S. (Esbenshade, 2004; Ross, 2004). Incentives for using sweatshop labor may be disproportionally high for the apparel manufacturing industry due to the high level of competition in its markets, as well as its low-skill, labor-intensive technology. The use of sweatshop labor is often associated with illegally low pay levels, substandard working conditions, race or gender discrimination, and other violations of basic worker rights. To further the problem, sweatshops are difficult to detect and prosecute because the operations are small and highly mobile. It is thus useful from a policy standpoint to examine economic incentives that sustain the use of sweatshop labor, and exploit knowledge of these incentives to recommend effective policy measures that would limit labor-law violations. The purpose of the present study is to estimate the minimum penalties that would provide no monetary incentive for the average U.S. apparel manufacturing firms in men's and boys' wear, women's outerwear, and children's outerwear to violate the minimum wage and the ban on hiring illegal immigrants.

The three sub-objectives are to:

1. Define and characterize an apparel sweatshop in terms of U.S. labor-law violations committed by the operator.
2. Estimate the minimum penalties necessary to eradicate incentives for the average apparel manufacturing firm to violate the minimum wage and the ban on hiring illegal immigrants.
3. Compare the estimates to the current penalties in place.

Chapter 1 characterizes a sweatshop by U.S. standards, describes problems that arise from the existence of sweatshops, and provides a description of the U.S. apparel industry and factors that contribute to violation of labor laws in this industry. Chapter 2 presents a literature review on the apparel industry overall, the sweatshop phenomenon, and the economics of labor-law violations. Chapter 3 synthesizes a theoretical model of firm decision making regarding labor use and labor-law violations. Chapter 4 develops an empirical strategy for estimating optimal penalty fines, and describes the data used in the analysis. Chapter 5 presents and discusses the results of the empirical estimation. Chapter 6 provides conclusions drawn from the results and explains policy implications; this final chapter also discusses further research questions that arise from the study.

What is a Sweatshop?

The definition of a sweatshop is vague throughout most literature on labor issues; however, in the U.S. context, common themes in the definition include legal violations involving wages, child labor, employment discrimination, health and safety standards, and employment of undocumented aliens (Johns & Vural, 2000). The U.S. laws that are designed to prevent the abuse of labor include the Fair Labor Standards Act (FLSA) of 1938, the Immigration Reform and Control Act (IRCA) of 1986, the Occupational Safety and Health Act (OSHA) of 1971, and the Equal Employment Opportunity Act (EEOA) of 1965.

The FLSA regulates work hours and wages (U.S. Department of Labor [USDL], 1938). Regulations under this act are designed to prevent excessive work hours and inadequate compensation. The FLSA regulations also encompass the employment of minors under requirements for workers' minimum age and the types of jobs that minors can hold under limitations on minors' number of work hours per week given school requirements (USDL, 2003).

OSHA regulates employers' work environments. This act requires employers to provide a safe working environment that allows an employee to perform work without hazard to health (Occupational Safety and Health Administration, 2005). In addition, regulations under OSHA provide for protective equipment to prevent accidents and ingestion or inhalation of toxins. Poor ventilation, inadequate lighting, and lack of proper sanitation facilities are other examples of violations that can lead to health problems for workers (Piore, 1997).

The IRCA prohibits the employment of people who are not legally allowed to reside or hold jobs in the United States. This law penalizes employers who hire illegal immigrants or neglect to make sure employees have legal status (U.S. Department of Agriculture, 2001). The IRCA also prevents the reinstatement of a job position for an illegal immigrant proven to have been fired unfairly (Ross, 2004).

The Equal Employment Opportunity Act is designed to prevent discrimination among workers based on race, sex, religion, or creed (U.S. Equal Employment Opportunity Commission, 1991). A violation of the Equal Employment Opportunity Act (EEOA) would be systematically declining employment to people who have all necessary qualifications, but identify with one of the populations of people protected by the EEOA. Ross (2004) noted that sweatshop operators commonly employ only people of a particular race or sex for purposes of seeking to control labor, which is an example of discrimination and a violation of the EEOA.

A U.S. employer who systematically and knowingly violates one or more of the U.S. labor-protection laws can be considered to be operating a sweatshop by U.S. standards. Although the clandestine nature of sweatshops in the United States makes it difficult to know the number in operation, recent estimates place the number of operating sweatshops at 2,000 out of the 6,000 apparel factories in New York City, 50 out of the 180 apparel factories in El Paso, Texas, 4,500 out of the 5,000 apparel factories in Los Angeles, and 400 out of the 500 apparel factories in Miami, Florida (U.S. General Accounting Office [USGAO], 1994a). In 2001 the U.S. Department of Labor (as cited in Firoz & Ammaturo, 2002) said that over 50% of U.S. apparel factories are sweatshops. Ross (2004) estimated that, as of 2000, the U.S apparel manufacturing industry employed anywhere from 229,045 to 255,893 sweatshop workers. Of those sweatshop workers, 53,500 were estimated to be "invisible" or undocumented. These numbers suggest that the competitive pressure to produce apparel products at low cost creates a high demand for sweatshop labor.

Problems Associated with Sweatshops

The most common labor-law violation of sweatshops is sub-minimum wage compensation. The majority of workers in the apparel manufacturing industry are paid according to a piece rate or as the apparel industry calls it an incentive rate (U.S. Department of Labor, 2006a). Compensation to a worker is based on how many pieces the worker finishes during work hours. The piece-rate system of compensation does not violate the minimum wage as long as the hourly piece rate per worker adds up to the minimum hourly wage. In order to keep within the law, managers and supervisors must consistently record all the pieces sewn by each worker and adjust the piece rate to accommodate the minimum wage (Glock & Kunz, 2000). Sweatshops commonly do not pay a piece rate that meets the minimum-wage requirement. Indeed, the piece rates paid by these operations are typically in gross violation of the FLSA.

Human rights violations are also a problem in sweatshops, as many of the workers are subject to excessively long hours, unsanitary conditions, and verbal and physical abuse from supervisors (Ross, 2004). Recent cases have been found where workers were forced to work in sweatshops as part of human trafficking schemes (Bao, 2003; Kwong, 2001). Workers often become indentured to apparel manufacturers or contractors in order to pay smugglers for transporting them illegally into the U.S. These workers are essentially slave labor for the owners and supervisors of these manufacturing facilities.

In addition to violating basic human rights, paternalistic corporate figures who govern work in sweatshops prohibit collective organization or unionization, and try to control the workers by inciting fear of not just verbal or physical abuse, but also job loss (Ross, 2004). The right to collective organization or unionization is protected under the National Labor Relations Act of 1935 and is enforced by the National Labor Relations Board and the General Council (National Labor Relations Board, 2006). Sweatshop managers often threaten to take production elsewhere, and workers risk losing their jobs if they try to unionize (Danaher & Mark, 2003). Supervisors deal with each worker individually concerning grievances in order to maintain power over them. Sweatshop employers discourage any talk about pay or working conditions among the workers (Loucky, Soldatenko, Scott, & Bonacich, 1994). Women, especially, are "vulnerable workers" as described by Esbenshade (2004): The added demands of family and household work contribute to the inability to collectively organize or report grievances.

The conditions of sweatshops and the nature of the work environment in them can cause serious illness in workers. Excessive work hours and sleep deprivation are common problems of sweatshop garment workers. The work environment usually has substandard ventilation, lighting, and sanitation (Ross, 2004). Workers are frequently exposed to toxic chemicals and tiny cloth fibers in the air without protective masks to prevent inhalation of the toxins and fibers. Lack of proper breathing protection allows inhalation of fumes and fibers, which can cause chronic respiratory problems. Another health hazard in such facilities is the lack of breaks or rest from working. Many times workers are not allowed to go to the bathroom during the entire work day or are strictly monitored to prevent any slowing of work (Ross, 2004). In addition, sweatshop employers create fire hazards by locking doors to prevent workers from leaving (Danaher & Mark, 2003).

Illegal immigrants make up the majority of the sweatshop labor workforce. Indeed, another common legal violation by sweatshop operators is the hiring of immigrants who lack documents that allow them to work legally in the United States. Immigrant workers, including legal immigrants, are easily targeted by sweatshop employers because of the language barrier many face when trying to find work in this country. Recruitment of immigrant workers can be easily accomplished through personal contacts within immigrant communities (Ross, 2004). Many immigrants are illiterate or lack marketable employment skills; thus low-skill jobs in apparel manufacturing are among their few employment options. Often, they must accept not only the apparel manufacturing positions available to them but also the conditions under which they work in those positions. If they are illegal immigrants, they may be unable to report violations by sweatshop employers because they risk deportation under the provisions of the Immigration Reform and Control Act of 1986 (Howard, 1997).

Apparel Manufacturing

The nature of the apparel industry provides more incentives for using sweatshop labor than does that of many other industries. This is partially due to the large number of apparel suppliers for the relatively few buyers (i.e., retailers). Under these market conditions, retailers have traditionally exerted little pressure for legal manufacturing services, although this is changing as large retailers seek to protect their reputations as socially responsible members of the business community (Danaher & Mark, 2003).

The modern apparel industry is characterized as having a buyer-driven market. Gereffi (1994) described the apparel industry as having a buyer-driven global commodity chain in which retailers exercise most of the purchasing power. Some characteristics of this commodity chain are that production is driven by high-value market research, design, sales, marketing, and financial services that cater to buyers with access to consumer markets (Gereffi, 1994). In a buyer-driven market, the customers (retailers, in the case of the apparel market) have greater market power than their suppliers (Appelbaum & Gereffi, 1994). Retail consolidations in the United States over the last two decades have resulted in fewer and larger retail companies; therefore, a few firms have come to dominate the U.S. retail market. This has reduced the number of retail customers for U.S. apparel manufacturers in the domestic market and has increased the bargaining power of individual large retailers over the manufacturers (Bonacich & Appelbaum, 2000).

The apparel manufacturing industry is also characterized by limited automation and is one of the most labor-intensive manufacturing industries. The main equipment for assembling garments, the sewing machine, has not changed much in 100 years and still needs human hands to operate it (Bonacich, Cheng, Chinchilla, Hamilton, & Ong, 1994). Human beings are aptly suited for sewing because of the ability to manipulate fabric pieces, accommodate pattern changes, and monitor such factors as machine speed and fabric characteristics (Bonacich & Appelbaum, 2000). Sewing is relatively simple manual work, so it is well suited for people with little education and few skills. As apparel assembly requires little capital (i.e., just the cost of factory housing, sewing machines, and materials) production labor supply is very important to the apparel manufacturing industry (Piore, 1997).

Outsourcing abroad has become a valuable tool used by the U.S. apparel industry in recent years. As is true of some immigrant groups in the United States, many less-developed countries have low-wage labor in abundance. Growing numbers of such countries are building their capacity and proficiency in producing and exporting apparel, providing increasing competition for U.S. apparel manufacturers as well as places for U.S. companies to outsource apparel production (Dickerson, 1999). Since the early 1960s, U.S. companies have taken the production of apparel overseas to newly industrialized and less-developed countries to take advantage of the available cheap and easily controlled labor. U.S. apparel companies have also pressured the U.S. government to make trade agreements that ease the importation of apparel from such countries where they have outsourced (Bonacich & Waller, 1994). Although many U.S. manufacturers and retailers import garments, others rely on U.S. produced garments. Apparel production in the United States too often occurs under sweatshop conditions. Factors that foster apparel sweatshops in the U.S. include domestic outsourcing, or contracting of apparel production to factories; limited governmental detection of substandard apparel factories; inadequate enforcement of labor laws; and pressure to maintain low production costs in the face of intense competition from low-wage foreign suppliers (USGAO, 1988).

The practice of outsourcing is important to the survival of apparel sweatshops in the U.S. When companies outsource their labor needs to contractors with large networks of available workers, it may be impossible to identify the actual makers of the garments. Indeed, according to Bonacich et al. (1994) large retailers may have no idea who is making their products or under what conditions the products are being made. The U.S. has no legal requirement for "joint liability”, that is, shared responsibility of the buyer and the contractor for the wages and conditions in the contract shop producing garments ordered by the buyer. Joint liability was stipulated in contracts in the early 1900s between apparel manufacturers and contractors they hired to produce for them (Esbenshade, 2004). The principle of joint liability has not been implemented for many years, but as a deterrent to sweatshops, proponents recommend its modern-day application to instances where either manufacturers or retailers hire contractors to produce apparel (Howard, 1997). Without joint liability, manufacturers and retailers are simply considered buyers of goods from contractors to which they outsource labor and therefore are not legally responsible for worker compensation or working conditions. Ross (2004) described a typical contracting agreement: The manufacturer has legal rights to the parts or finished goods, but is not considered the direct employer of garment workers. Outsourcing to production contractors is a business practice commonly used by U.S. apparel manufacturers, private-label retailers, and apparel marketing companies to maintain competitiveness in the current market environment.

CHAPTER 2

LITERATURE REVIEW

Overview of the Apparel industry

The apparel industry comprises an intricate network of firms that design, produce, market, and distribute apparel goods. The firms that play key roles in the industry include manufacturers, contractors, jobbers, and retailers. In the past, the strategic management practices of apparel producers required long-standing relationships between the different types of firms in the industry, but changes in the trade environment have altered the roles and relationships of the firms. Manufacturers have altered their functions to include services other than apparel assembly. Jobbers and contractors have important roles that add to the flexibility of production and the price sensitivity of the industry's products. Retailers have expanded their roles such that they not only distribute goods to consumers but also have a hand in production.

A Description of Firms in the Apparel Industry

Apparel manufacturers were once considered firms that were responsible for all the entrepreneurial functions for producing and selling garments. An apparel manufacturer can be a firm that controls the design and production of garments, sales to retailers, or any other job related to the production of apparel (Glock & Kunz, 2000). These firms may perform the manufacturing, marketing, and merchandising, or they may contract out all or some of those responsibilities. Firms that take responsibility for all or some of the previously mentioned functions tend to have strategic management systems in place for processes from production to distribution. An apparel manufacturer today may not even assemble garments as long at it can provide other production services (Dickerson, 1999), and may be a firm that just outsources production (Glock & Kunz, 2000). Currently, many firms that previously described themselves as manufacturers are now called apparel design and/or marketing firms, with examples being Adidas and Levi Strauss (Adidas Group, 2005; Gerreffi, 2001; Levi Strauss & Co., 2006).

Manufacturers have also expanded into other functions in the apparel industry. One of the strategies that manufacturers have employed to survive the increased competition is to eliminate the need for a retailer to distribute their products. Entering into retail has allowed these firms to increase profits, reduce costs, and minimize competition from other manufacturers for buyers (i.e., retailers). Some companies that were predominantly manufacturers, such as Bugle Boy, Levi Strauss, and Adidas, now also have retail outlet stores that reduce the costs of dealing with retailers (Adidas Group, 2005; Appelbaum & Gereffi, 1994). In reducing the need for retailers, manufacturers remove themselves from the competition with other manufacturers for the purchase orders of the larger and fewer retailers.

Even though some manufacturers have removed themselves from the competition for retailer orders, other smaller apparel production firms such as contractors have increased in recent years adding to the competition and lowering of wages. Contracting in the apparel industry has become increasingly popular, given the market for flexible production (Appelbaum & Gerreffi, 1994). In 2002, the U.S. Economic Census recorded an estimated 10,785 apparel cut and sew contractors in the United States (U.S. Census Bureau, 2002). The traditional meaning of a contractor is a firm that receives cut garment pieces from other firms and provides the sewing operations for those other firms (Bonacich & Appelbaum, 2000). This type of firm is hired to perform the sewing or to hire other firms to do so. Although some contractors only assemble cut garment pieces, it is increasingly common to find full-package contractors who procure fabrics and other materials and perform cutting and other activities in the apparel manufacturing process

(Dickerson, 1999). Contractors have moved toward full-package services to give themselves an edge in today's intense competition (Abernathy, Dunlop, Hammond, & Weil, 1999). In order to cut costs and speed production in filling orders, contractors may employ homeworkers who assemble garments in their homes. This is an illegal, but common practice in the U.S. that makes use of the vast network of immigrant labor (Green, 2003). Homework is an easy way for a firm to pass production costs on to workers. The homeworker is paid a piece rate and incurs the expense of utilities to do the sewing and often rental fees for the sewing equipment, even if the worker already works full time in the factory (Piore, 1997).

A jobber is a firm that oversees production processes and arranges for the sale of merchandise to retailers. Such firms typically design garments, procure the materials, contract out the actual assembly of the garments (Doeringer & Watson, 1999), and package and ship finished merchandise (Solinger, 1988). A jobber relies exclusively on contracted production of garments (Bonacich & Appelbaum, 2000). The 2002 Economic Census includes jobber under the category of manufacturer (U.S. Census Bureau, 2002). Reference was made earlier to apparel manufacturers that have become design and/or marketing firms. Many of these can be called jobbers, as could firms (e.g., Liz Claiborne) that have never actually produced garments sold under their brand names and only design and market garments they hire contractors to produce. An important factor that distinguishes apparel design and/or marketing firms (or more simply apparel marketing firms) from traditional jobbers is their public prominence and strong brand recognition by virtue of the strength of their design and marketing operations (Ross, 2004).

Retailers have expanded their functions to include in-house logistical capabilities. In addition, many such firms have expanded into private-label production and bypass manufacturers altogether by dealing with contractors to have their private-label merchandise produced (Gereffi

& Memedovic, 2003). This not only allows for reduced costs by cutting out middlemen, but also grants the retailers greater control over the price points and fashion orientation of their garments (Bonacich & Appelbaum, 2000). Many large retailing firms engage in Internet distribution, which provides even more competition for manufacturers, especially if the retail firms are backwardly integrated into production (Gertner & Stillman, 2001; Richardson, 1996). Firms such as Gap and The Limited started as small retail businesses and now have highly successful brands such as Gap, Gap Kids, Banana Republic, and Old Navy in the case of Gap and Victoria's Secret and Express in the case of The Limited (Gap, 2004; Limited Brands, 2004). In 2004, Gap had sales of $16.27 billion with a ranking of 352 on the Forbes 2000 list of most successful companies, and The Limited had sales of $9.41 billion with a ranking of 559 (DeCarlo, 2005). Private-label retailers like Gap and The Limited further reduce the number of retailers in need of manufacturing services and increase competition within the apparel manufacturing industry.

Relationships between Firms in the Apparel Industry

The expansion in function is not the only type of growth that retailers have undergone. Over the past 25 years, an increasing number of mergers and acquisitions have occurred in apparel retail operations (Bonacich & Appelbaum, 2000). These have reduced the number of retailers, thus also reduced the number of retail customers for manufacturers. The newly merged firms are bigger than their forerunners and have each gained a greater share of the consumer market. Increased market share and decreased competition allow a retailer more leverage when negotiating price with a manufacturer (Kilduff, 2005). Large retailers typically place large-volume orders, due to a large consumer base (Bonacich & Appelbaum, 2000). Cho and Kang (2001) found that firms with large import volumes received better service, such as on-time delivery, and more product availability than those firms with smaller import volumes. The authors explained that this may stem from greater bargaining power from large purchases.

Recent trends in the apparel industry include retailers' increased contracting for apparel production (Bonacich & Appelbaum, 2000; Shetty, 1999). This is an efficient and effective method of production for apparel retail firms because it not only reduces these firms' production costs but also provides a great deal of flexibility for production. Appelbaum and Gereffi (1994) described a "profit squeeze" in the apparel commodity chain that has resulted in retailers' altered expectations of apparel manufacturers. Retailers are more likely to choose manufacturers willing to reduce costs and provide increased services and promotional support (Erdem & Harrison-Walker, as cited by Park, 2004). Large retailers can negotiate low prices and the quality, availability, and additional services they want (Cho & Kang, 2001). As production has become more globalized, more and more less-developed countries have gained the means to support manufacturing and enter the global market place, which has increased the supply of producers with which retailers can contract and has put pressure on domestic manufacturers to reduce costs even further (Bonacich & Waller, 1994; Shelton & Wachter, 2005).

Retailing strategies and advanced communication and transportation systems have aided the shift of the apparel manufacturing labor supply from the U.S to other countries (Kilduff, 2005). Apparel manufacturing firms' investment in new technologies, although less than in textiles, has increased the productivity of the apparel industry by way of information transfer. Abernathy, Dunlop, Hammond, and Weil (1999) described lean retailing strategies that require uniform product classification and sophisticated management systems, frequent but small inventory replenishment, and efficient shipping processes. Quick response (QR) has become a common theme within the U.S. apparel industry, with the objective of reduced lag time of shipments from manufacturers to retailers (Shetty, 1999).

The use of electronic data interchange (EDI) and point-of-sale (POS) data in the apparel industry has allowed retailers to communicate their inventory needs faster and more accurately than was possible with traditional methods, thus reducing idle and lost inventory and increasing turnover (Hunter & Valentino, 1995; Richardson, 1996). Speedy transfer of information is the cornerstone of QR. Hunter (1990) explained that EDI has two major roles in the communication throughout the apparel pipeline. First is transactional information used for initial purchase-order transactions, including shipping and invoicing. Secondly, point-of-sale inventory monitoring and product specifications made possible through bar-coding are other important components of effective QR.

Other strategic management strategies used in the apparel industry include total quality management (TQM) and just in time (JIT). The goal of TQM is to reduce costs due to stale or lost inventory by making products meet the quality expectations of the consumer. Spencer (1994) described TQM as an "amorphous philosophy" that can be applied to different management styles to facilitate a work culture based heavily on leadership, not management, and cooperation between processes or employees, not unit production. TQM involves top-level management support, customer involvement, supplier relationships, workforce management, amenable employee attitudes, the product design process, process-flow management, and quality data and reporting (Martinez-Lorente, Sanchez-Rodriguez, & Dewhurst, 2004). Walton (1986) described the Deming method (following the philosophy of TQM) as requiring changes in work philosophy and emphasizing statistical or benchmark analysis that provides continual feedback to constantly improve productivity.

Just in time, or JIT, is another popular management strategy in the apparel industry that revolves around inventory control. Kanban, an inventory control system that relies on production being “pulled” rather than “pushed” through the system, is an efficient strategy that relies on receiving orders shortly before production and reducing in-process inventory (Oliver, Kincade, & Albrecht, 1994). Golhar and Stamm (1991) summarized JIT practices as eliminating waste, involving employees in decision making, allowing suppliers to participate, and implementing total quality control.

Lee and Kincade (2003, p. 31) defined supply chain management (SCM) as “efforts to reduce inefficiencies and solve the problems throughout the supply chain, from raw materials to final customer.” Lummus and Vokurka (1999, p. 11) summarized SCM as “all the activities involved in delivering a product from raw materials to customer” Firms that use this type of organizational management require close partnerships between all levels of intermediate and final consumers to ensure satisfaction with products at every level of production for all firms involved in the supply chain (Hugos, 2003; Mentzer, 2004). Just as the previously described management systems require advanced communications, so does SCM. Fast and accurate information must be made available from the retailer back up through the suppliers.

The highly competitive environment of the U.S. apparel industry has required both retailers and manufacturers to re-evaluate the traditional relationships that had previously been profitable. Increasingly, both retailers and manufacturers have redefined their roles and functions in the industry. The expansion in functions for both types of entities resulting from the high level of competition for consumers has also contributed to the development and implementation of retail strategies to increase efficiency and decrease cost in order to be profitable. One of the contributors to the high level of competition in the U.S. apparel industry is the labor intensity of apparel production. The following section discusses apparel manufacturing in three different sub-sectors of the U.S. apparel industry.

U.S. Production of Apparel for Men and Boys, Women, and Children

As noted in Chapter 1, the three sub-sectors of the U.S. apparel industry of interest in this study are the producers of apparel for men and boys, for women, and for children. Men's and boys' apparel are combined in one sub-sector because they are typically made in the same factories. According to Dickerson (2000), the men's and boys' sector of the apparel industry includes manufacturers that specialize in specific categories of garment production, designers that present various seasonal lines, and prominent designers of brand-name apparel. Bonacich and Appelbaum (2000) noted that large manufacturing firms produce most of the output of men's and boys' clothing and that the contracting system is less common in the production of men's and boys' clothing than in the production of women's clothing.

Style changes in men's clothing have been traditionally fewer and less drastic than those in women's clothing, which has allowed more standardization of cutting and patternmaking and more opportunity to achieve economies of scale in producing men's clothing (Taplin, 1996). Men's and boys' wear have traditionally had only two fashion seasons per year including fall/winter and spring/summer (Dickerson, 2000). Largely because of the relative standardization of style, firms that manufacture men's and boys' clothing tend to be more capital intensive and larger than those that manufacture women's clothing (Taplin, 1996).

In the last 25 years, however, additional categories of men's and boys' apparel have been introduced. Sportswear and casual office wear have become increasingly popular among young men (Seo, Hathcote, & Sweeney, 2001) and the segment of the market for boys' clothing has followed suit. Apparel firms like Hartmarx have reduced production of men's tailored apparel in favor of a sportswear-oriented line in order to meet changing consumer preferences (Cunningham, 2001). Instead of two fashion seasons per year, four and sometimes even five seasons, depending on the designer, are typical for casual office wear collections. The rapidly changing style elements and design of the clothing in these collections tend to require flexible production services that contractors provide (Dickerson, 2000).

The geographic locations of U.S. producers of men's and boys' clothing vary by the type of clothing. The production of tailored clothing is most concentrated in New York, Pennsylvania, Massachusettes, and Georgia, and the production of shirts and nightwear takes place mainly in North Carolina, Alabama, Georgia, and Tennessee (U.S. Census Bureau, 2003). According to Dickerson (2000) 75% of separate trousers for men and boys were produced in Georgia, Texas, Tennessee, and Mississippi as of 2000. U.S. Census Bureau (2003) County Business Patterns data indicate that the five states with the most manufacturers of men's and boys' apparel in 2003 were California with 179, New York with 96, Pennsylvania with 61, Texas with 43, and North Carolina with 40.

Information on U.S. apparel manufacturing establishments indicates that those that produce clothing specifically for men and boys are relatively large in terms of employment. County Business Patterns data show that 1,501 of the total 2,513 establishments manufacturing men's and boys' wear in 1997 had between 50 and 250 employees and 17% of those establishments employed 100 to 249 workers. The size of such plants appears to have declined over the last decade, however. The data show that approximately 91% of the U.S. establishments producing men's and boys' cut and sew apparel in 2003 had 49 or fewer employees (U.S. Census Bureau, 2003).

The women's apparel manufacturing industry relies heavily on contracted labor for production (Bonacich & Appelbaum, 2000; Taplin, 1996). The heavy use of contracted labor stems from customers' (i.e., retailers') demand for many different, rapidly changing styles and garment types at low prices for women (Bonacich & Appelbaum, 2000). The women's apparel industry has come to have up to five or six lines or collections each year, including spring, summer, fall I, fall II, and resort or holiday fashions (Dickerson, 2000). The rapid change and variety in women's apparel result in less standardization of production processes, such as cutting and apparel assembly, than for men's clothing. Frequent style change puts pressure on producers to provide flexible production services that will accommodate changeovers in pattern-cutting and apparel-sewing techniques at prices demanded (Taplin, 1996). Casual wear and sportswear have become increasingly popular among women, but less so than among men and boys. In addition, the market for women's casual wear is characterized by high demand for low-cost, mass-produced items and correspondingly less style and design variation than for other ready-to-wear categories for women (Rantisi, 2002).

According to County Business Patterns data, the states with the most establishments for producing women's apparel in 1997 were California with 3,717, New York with 2,607, Texas with 356, Florida with 337, and Pennsylvania with 316 (U.S. Census Bureau, 1997). Under the NAICS classification for cut and sew women's and girls' outerwear (NAICS 31523), the number of establishments producing such clothing in those states was much less in 2003 than the number producing women's apparel in 1997. As of 2003, the number of manufacturing establishments under NAICS 31523 by state was 733 in California, 411 in New York, 67 each in Texas and Pennsylvania, and 64 in Florida (U.S. Census Bureau, 2003). Dickerson (2000) noted that New York has historically been the fashion center in the United States, but Bonacich et. al. (1994)

described California as the most important location for apparel manufacturing in the United States.

Manufacturing establishments in the women's apparel sub-sector have tended to be smaller than in the men's and boys' apparel sub-sector. In 1997 approximately 88% of the women's outerwear establishments in the U.S. employed fewer than 49 workers, and 33% of such establishments had only one to four employees (U.S. Census Bureau., 1997). In 2003, nearly 54% of cut and sew apparel contractors for women's, girls', and children's apparel employed four or fewer workers per establishment (U.S. Census Bureau, 2003). The apparent downward trend in the size and number of apparel manufacturing establishments may reflect the effect of the increasingly intense competition in the apparel market, the increasing frequency of outsourcing production abroad, and perhaps but less likely, some movement toward increased capital intensivity in producing women's clothing.

Children's clothing has been traditionally modeled after adult clothing. According to Dickerson (2000), the production and marketing methods used for children's apparel are similar to those for women's apparel. However, children's wear typically has only two to three seasons per year: spring/summer, fall, and holiday. Most U.S. children's apparel companies are small but a few are large. One of the unique characteristics of the children's apparel industry is that firms must be able to accommodate various pattern and sizing changes due to the varied ages and stages of growth of the final consumer (Dickerson, 2000; Jaffe & Rosa, 1990). Most apparel in this category is produced for infants and children up to 12 years of age.

The U.S. had a total of 598 children's apparel manufacturing establishments in 1997. Approximately 28% where located in California, 16% in New York, and 8% in Pennsylvania. Of the total number of establishments in the children's outerwear sub-sector of the apparel industry, 21% employed four or fewer employees, 23% employed 20 to 49 employees, and 30% employed 50 to 500 employees (U.S. Census Bureau, 1997). Changes instituted in 1997 in the classification of business establishments make it impossible to obtain an accurate count of U.S. establishments dedicated to producing children's clothing: Women's and children's clothing have been combined in one category since 1997.

As noted previously, sportswear has become increasingly popular in both men's and boys' apparel and women's apparel. Many sportswear garments, such as sweaters and casual shirts, are made of knitted fabrics, and are thus called knitwear. Many designs for sweaters, skirts, pants, and shirts in this category of casual wear are made of knitted fabrics (Black, 2002; U.S. Census Bureau, 2003). A high proportion of knitwear is produced in vertically integrated knitting mills, which occupy their own category in the government's system of classifying businesses. The knitting mill category is not as disaggregated by the sex and end-user as are cut and sew categories, except in one case that does not apply to sportswear. That one case is knitting mills that produce sheer hosiery for women (U.S. Census Bureau, 2002)

Because of the stretch property of knitted fabrics, especially weft knits, knitwear is sized small, medium, large, and extra large rather than the smaller size gradations used for cut and sew apparel. The broad size ranges in much knitwear allow for much more standardization of production than in making cut and sew apparel. Furthermore, knitting technology has improved greatly over about the last 15 years, enhancing the commercial capabilities of seamless garment knitting and significantly reducing the need for labor in the assembly of sportswear made from knitted fabrics (Black, 2002; Choi, 2005). In 1997, the U.S. Census Bureau recorded 641 apparel outerwear knitting mills, of which 29% employed four or fewer workers. The total number of establishments had declined by 2003 to 356, of which 37% employed four or fewer workers (U.S. Census Bureau, 2003).

Employment and Production in the U.S. Apparel Industry

Apparel manufacturing is one of the most labor-intensive manufacturing industries and is the most labor intensive of the industry sectors that comprise the textile complex. The labor intensity of apparel manufacturing relative to textile manufacturing has increased over the years as textile production processes have become more and more automated. A period of particularly rapid technological change in the textile industry was 1960-1985 when capital investments of textile manufacturers reached new highs and outstripped those of apparel manufacturers by 30% (Cline, 1990). The U.S. Bureau of Labor Statistics (USBLS) (2003a) reported that in 2000 sewing operators alone made up approximately 42% of the labor force in the U.S. apparel industry. Although declining employment of sewing machine operators is projected in the United States, this type of labor remains an important input for the production of apparel in this country and others.

The high labor intensity of apparel manufacturing is in part because of the limited machine technology available for sewing. Fabric and other materials, such as trim and other notions, required for the construction of an apparel product can only be manipulated by human hands due to the materials' limp nature, smooth surfaces, and light weight (Taplin, 1996). The types of sewing machines used in apparel production have not changed in the basic lockstitch function or the requirement of one operator per machine since they were developed in the 1850s (Bellis, 2006; Carr & Latham, 1988).

In addition, apparel manufacturing must be flexible due to the changing nature of fashion and consumer demand (Bonacich & Appelbaum, 2000). The many and increasingly rapid turns of fashion require producers to change inventory frequently to meet the quantity demanded (Taplin, 1996). Producers must be able to change designs and patterns quickly and accurately to make garments that will sell. Human labor is the most flexible factor of production available to manufacturers to adapt to the changes in the apparel market.

The labor intensity of apparel manufacturing is a major factor behind the industry's shrinkage in the United States. According to the USBLS (2003a), the average earnings of workers in the apparel industry are much lower than those in U.S. manufacturing overall. In 1985 apparel production workers earned an average hourly wage of $5.59 compared to $9.65 in manufacturing overall (Cline, 1990). As of 2002, the industry mean hourly wage for a sewing machine operator was $8.99 (USBLS, 2003c), whereas the national mean hourly wage for other production occupations was $13.55 (USBLS, 2003b). Pollin, Burns, and Heintz (2004) indicated that the contribution of labor cost to the unit retail cost of a men's casual shirt made in the U.S. is 85 cents for a shirt that retails for $7.58 in 1997 dollars. They estimated that total non-supervisory labor costs account for 11.2% of the total retail cost of such a shirt, even at an hourly wage of $8.53 in 1997 dollars. Despite the relatively low wages for apparel workers, the wage costs are too high for U.S. apparel manufacturers to compete on a production-cost basis in the global marketplace. Even though the average wage for an apparel worker is much less than the average wages in other U.S. manufacturing industries, the continued high demand for low-cost labor has contributed to the decline of the U.S. apparel industry. The combined cost of wages of U.S. sewing machine operators and other expenses to comply with U.S. labor laws well exceed that for sewing machine operators in less-developed regions such as Hong Kong, the Dominican Republic, and Central America, including Guatemala, whose wage rates between 1995 and 1999 were in the range of $32.34 per day, $1.51 per hour, and $6.11 per day respectively (USDL, 2000).

The environment in which U.S apparel manufacturers operate requires the adoption of new methods of production in order to be competitive in today's global market. The traditional method of production was spurred by the introduction of the assembly line by the Ford company in 1913 (Ford Motor Company, 2006). The progressive bundle system, adapted from assembly line production, fit the needs of apparel producers in that it was easy to implement and manage as each worker did unit production of one aspect of a garment (Taplin, 1996). This worked to the advantage of the manufacturers as it allowed workers to attain quality through job specialization, and it was incorporated with an incentive system of compensation that became the modern-day piece rate (Bonacich & Appelbaum, 2000).

A problem with the progressive bundle system in today's market is that a manufacturer must have large-volume orders in order to make a profit. Lin, Moore, Kincade, and Avery (2002) noted that production of standardized styles using the progressive bundle system helps reduce production costs per unit. Glock and Kunz (2000) explained further that large orders of standardized apparel products allow diminishing marginal unit costs for producers using the progressive bundle system. As previously noted, new retailing strategies require the placing of small, frequent orders with manufacturers. Such orders cannot generate enough revenue for profitable production by large-scale manufacturers who employ the progressive bundle system (Doeringer & Watson, 1999).

Small quantities of individual styles with high quality are possible with the modular system of production. This type of production can give the retailer the quantity and design specifications wanted. Workers in the modular system are empowered to make decisions during work in process in order to identify and correct assembly problems, which can lead to improved garment quality (Berg, Appelbaum, Bailey, & Kalleberg, 1996). In addition, the modular system allows more opportunity than the progressive bundle system for customization of garments (Lin, Moore, Kincade, & Avery, 2002). Drawbacks of customization include slower speed to market and limited availability of any one style, which could cost a retailer revenue if the quantity ordered is less than the quantity demanded.

International Trade in Apparel

The wide availability of low-wage labor in less-developed countries is a major factor in U.S. apparel producers' difficulty in competing with imports from such countries and has contributed to declining employment in the U.S. apparel industry. The U.S. apparel industry employed 277,800 production workers in 2002 (USBLS, 2003b), down from 592,290 in 1997 (USBLS, 2003b) and 1.2 million in 1960 (Cline, 1990). The total value of U.S. apparel imports rose from $590 million in 1961 (Dickerson, 1999) to $68,714 million in 2005 (Office of Textiles and Apparel [OTEXA], 2006c).

Apparel imports from Asia began to noticeably infiltrate the U.S. market in the 1950s when U.S. apparel firms started moving production to first Japan, then to the newly industrialized countries of Hong Kong, South Korea, and Taiwan. Later, the imports began to also come from China, many other Asian countries, Central America, and the Caribbean region (Bonacich et al., 1994). Apparel products from these countries are much less expensive to produce than those made in the United States. The apparel imports have competed with domestic apparel products for market share. U.S. apparel employment and production began to fall in the 1950s (Cline, 1990), providing an environment for the U.S. government to take protectionist measures. These measures have included a number of bilateral agreements to restrict the quantity of apparel imports from several less-developed countries under the multilateral Short-term Arrangement Regarding International Trade in Cotton Textiles of 1961, followed by the Long-term Arrangement in 1962, 1967, and 1970, and finally the Multi-fiber Arrangement (MFA) in effect from 1974 through 1994 (Dickerson, 1999).

The MFA, the most comprehensive of the multilateral arrangements just mentioned, allowed for controlling the rate of import growth in the U.S market at 6% a year (Bonacich & Waller, 1994). During the period 1974-1986, for example, the imports of apparel goods covered under the MFA rose from 1,937 million square yard equivalents (SYE) to 5,796 million SYE (Cline, 1990). The value of the imports increased even more rapidly, despite quota restrictions (Cline, 1990). The real value (in 1982 dollars) of apparel imports climbed from $3,726 million in 1974 to $17,035 million in 1986. The Agreement on Textiles and Clothing (ATC), enacted in 1995, was an agreement among the countries of the World Trade Organization (WTO) to systematically phase out the quotas established under the MFA on apparel and textile products (Office of Textiles and Apparel, 2006a). The phase-out period began in 1995 and continued through December 31, 2004 with the elimination of the quotas on apparel traded among the WTO participating countries.

The North American Free Trade Agreement (NAFTA) of 1994, among the United States, Canada, and Mexico, is another important trade policy regime that has affected U.S. apparel imports. NAFTA provides for trade among the three member countries without quota restrictions and with limited duties on various products, including apparel, if the production and materials meet certain requirements called rules of origin. Such requirements for apparel include the yarn-forward provision, which stipulates that the production of yarns and fabrics used in imported apparel must occur in one of the NAFTA participating countries (OTEXA, 2004). Under

NAFTA, U.S. apparel imports from Mexico increased from $1.3 billion in 1996 to $6.1 billion in 2005 (OTEXA, 2006b). In addition, Mexico displaced Asian countries as the major source of U.S. apparel imports during 1995-1999 (USDL, 2000), although according to OTEXA (2006d) data, it had dropped to number four behind China and the CBI and CAFTA countries (see below) by 2005.

The Caribbean Basin Initiative (CBI), which has been superseded by the Caribbean Basin Trade Partnership Act (CBTPA) of 2000, provided trade benefits for countries such as Guatemala, Jamaica, Haiti, Nicaragua, and other countries in the Caribbean Basin. The proposed Central American-Dominican Republic-United States Free Trade Agreement (CAFTA) would replace the CBTPA for some of those countries, such as Guatemala and Nicaragua; CAFTA may also include Costa Rica, El Salvador, and Honduras (Office of U.S. Trade Representative [USTR], 2004). CAFTA is intended to provide for duty-free and quota-free imported apparel among the U.S. and other member countries, provided the yarns and/or fabric used in the apparel are produced in one of those countries (USTR, 2005). As of June 30, 2006 all of the countries except for Costa Rica had ratified the CAFTA-DR (USTR, 2006).

The low sunk costs and wages paid by apparel producers in less-developed countries allow them to produce apparel for U.S. retailers at lower costs than most domestic apparel. Many of the protectionist measures of the U.S. have been meant to control the rate of import growth and allow domestic producers time to adjust to growing import competition (Blumberg & Ong, 1994). As imports have taken an increasing share of U.S. apparel and textile markets over the years, employment has declined in not only the apparel manufacturing sector, but also other industries that supply intermediate inputs for that sector. Despite the goal of the trade restrictions to allow for a period of adjustment, U.S. apparel producers have been unable to compete with low-wage foreign counterparts on a cost basis (Cline, 1990). In addition, their ability to compete on a quality basis has declined as the proficiency of their foreign counterparts has increased. The result has been a cumulative reduction in U.S. apparel manufacturers' employment of sewing machine operators as the manufacturers have ceased production, moved it overseas, or hired contractors to produce their goods (USBLS, 2006a). The contractors are typically located in foreign countries, but many operate as sweatshops on U.S. soil with low-wage immigrant labor (Bonacich et. al, 1994).

Sweatshops: Monitoring and Penalties

Pressure to produce apparel at costs low enough to compete with imports from less-developed countries may be a major reason that apparel sweatshops operate in the United States, but major factors that sustain the sweatshops are insufficient monitoring of sweatshop operators' compliance with labor laws and insufficient penalties for violating those laws (Esbenshade, 2004; Ross, 2004). As introduced in Chapter 1, the FLSA, OSHA, IRCA, and EEOA are the primary labor laws that sweatshop operators violate. Sweatshop operators' violations of those laws cover a spectrum from minor infractions of payroll bookkeeping to gross neglect of workers' health and welfare.

Monitoring Sweatshops

Different agencies or administrations within the U.S. government enforce the four principal labor laws most commonly violated by sweatshop operators. No single federal agency is devoted to monitoring sweatshops, and different agencies or administrations conduct the audits of violations of the different labor laws that sweatshop operators commonly violate. As a result, any one audit may not report violations of labor laws that are not under the purview of the agency or administration conducting the audit (U.S. General Accounting Office [USGAO], 1994b). A report by the USGAO (1988) cited lack of communication between federal agencies as being largely responsible for the fragmented method of identifying sweatshops. Closer communication between agencies would make more efficient use of each agency's resources and limited number of employees for audits (USGAO, 1988, 1994a). A garment factory cited for multiple OSHA violations is likely to have also violated, for example, the FLSA under the purview of the Wage and Hour Division of the USDL. Closer interagency communication would also improve the chances of discovering violators of each federal labor law.

Privatized monitoring is the basis of the current method of enforcing labor laws and monitoring apparel sweatshops on the national level (Esbenshade, 2004). Privatized monitoring puts the burden of monitoring on private businesses and state and local agencies rather than federal agencies. Limited funding and changes in administrations and political climates account for the reliance on privatized monitoring (Esbenshade, 2004; Ross, 2004). Ross (2004) and Esbenshade (2004) noted that the funding and support for the USDL were more generous during the Clinton administration than they have been during the second Bush administration. The dwindling federal support for protecting workers and monitoring compliance with labor regulations is part of the movement to deregulate the workplace.

Self-monitoring systems promoted by those who favor federal deregulation tend to be corrupt and inefficient in preventing violations of labor laws (Esbenshade, 2004; Ross, 2004). Although the federal government has moved toward promoting self-monitoring by businesses, some state agencies have made special efforts to monitor apparel manufacturers' compliance with labor laws. Both New York and California have state registries for apparel producers. Any apparel producer must register with the state and in so doing indicate compliance with basic federal labor laws in addition to provision of unemployment and workers' disability insurance

(California Division of Labor Standards Enforcement, 2006; New York Department of Labor, 2006a). In New York State it is illegal for firms that buy apparel (e.g., retailers) to do business with apparel producers who are not registered with the state (New York Department of Labor, 2006a). In addition, the New York Department of Labor created the Apparel Industry Task Force in 1996 to provide monitoring of apparel manufacturing firms.

Although the current discussion emphasizes the fragmented nature of the federal method of monitoring compliance with labor laws, it must be noted that some federal administrations have made significant attempts to engage U.S. businesses to employ a uniform system of monitoring practices. During the Clinton administration, the Apparel Industry Partnership (AIP) task force was formed in 1996 under the guidance of then Secretary of Labor Robert Reich (Esbenshade, 2004). This task force started with six apparel companies and eight human rights and labor interest groups. The AIP goals included a standard code of conduct for domestic and foreign operations of all U.S. apparel producers, and provided for voluntary regulation of workers' minimum age, maximum work hours in a week, and minimum wage, as well as a standard method of independent monitoring. Emmelhainz and Adams (1999) noted the ineffectiveness of the AIP in protecting workers' rights as a result of the ambiguous wording of the code of conduct and the independent monitoring system. According to Ross (2004), the code of conduct was highly criticized by labor and human rights groups for creating a standard for a minimum wage that would be determined by a country's minimum wage, because no legal minimum wage exists in many countries where apparel is produced for U.S. companies. Another key point of debate was the implementation of an independent monitoring system, which caused some companies to leave the partnership and discouraged others from signing on. The AIP was disbanded in 1998 with a final report that chartered the Fair Labor Assosciation (FLA). The FLA was boycotted by five of the apparel manufacturers and three of the human rights groups in the original AIP because of the above mentioned disputes (Ross, 2004).

U.S. Labor Laws and Penalties for Violating Them

The Fair Labor Standards Act (FLSA) is one of the labor laws most commonly violated by sweatshop employers. The FLSA regulates pay rates, work hours, age eligibility of employees, and record keeping (USDL, 1938). Many of these areas are violated in sweatshops because they are among the easiest ways to reduce production costs. According to Ross (2004), the average underpayment to a sewing machine operator in a sweatshop is 17% less than the minimum wage, but if one factors in overtime hours the underpayment is estimated at 34%. Docking wages is a simple and effective way to reduce production costs if sweatshop operators face little risk of negative repercussions and their employees have no recourse (Ross, 2004).

An employer can be fined a maximum of $1,000 in civil monetary penalties per violation of the FLSA (USDL, 2006a). The average manufacturing/contracting firm that is found to willfully violate the FLSA and is given the maximum civil monetary penalty pays only a couple thousand dollars and back wages. A common penalty for first-time offenders of the FLSA is merely payment of back wages, which is not really a penalty because the offender would have paid those wages if operating legally (Ashenfelter & Smith, 1979; Esbenshade, 2004). Such a penalty is nevertheless a small expense compared to the revenue made from the goods produced by the workers. Of course, this scenario depends on the application of the maximum penalty, which seldom occurs.

Besides fining violators of the FLSA, the federal government can suspend the shipment of goods made by manufacturers found to consistently violate the FLSA. The suspension of shipments is allowed under the "hot goods" provision of the FLSA (USDL, 2006a). A ban on a manufacturer's shipments is lifted only after the manufacturer has paid damages to its workers and agreed to monitor contractors. Unfortunately, the ability to easily exit the apparel industry allows a manufacturer to simply declare bankruptcy or become defunct, making reparations to workers of little consequence (Esbenshade, 2004). In addition, the "hot goods" provision is flawed because it does not extend to purchasers of the "hot goods" (retailers, in most cases). All penalties are the responsibility of the manufacturer/contractor (USDL, 2006a). Although a manufacturer could pass on the financial responsibility to the retailer, doing so could drive away future customers and has such a high cost that it would cause the manufacturer to lose a competitive edge.

The enforcement of penalties for violating the FLSA depends on the assumption that violators are caught and convicted. The Wage and Hour Division of the USDL (2004) reported that, for its 822 investigators, the average investigator concluded 46 cases a year as of 2004. As the apparel industry is easy to enter and exit, a company may have moved or no longer exist by the time it is investigated for possible violations (Esbenshade, 2004). The easy mobility of sweatshops has made it hard to get convictions, let alone reparations for workers who have been cheated out of wages (Loucky, Soldatenko, Scott, & Bonacich, 1994).

Another law frequently violated by sweatshop operators is the Immigration Reform and Control Act. Under the purview of the Department of Homeland Security, Immigration and Customs Enforcement regulates the provisions of this act (through worksite investigations) and levies penalties for violating it (U.S. Department of Homeland Security, 2006). Apparel sweatshop operators often violate the IRCA because of the advantages of employing illegal immigrants in the labor-intensive production of garments. An employer who knowingly employs illegal immigrants faces a fine of $250 to $10,000 for each illegal immigrant hired. In addition, an employer who persistently violates the IRCA can be jailed for up to 6 months (U.S. Department of Agriculture [USDA], 2001).

It is hard to formally prosecute and convict sweatshop operators for violating the IRCA because many illegal immigrants do not report them out of fear of deportation (Blumberg & Ong, 1994; Ross, 2004; U.S. General Accounting Office [USGAO], 1988). The limited resources available for enforcing the IRCA make it hard to identify operations that have hired illegal immigrants without the help of the workers themselves. Illegal immigrants fear not only deportation, but also lack of other employment opportunities. They are reluctant to disclose their presence or the conditions in which they work (Esbenshade, 2004).

The Occupational Safety and Health Act, or OSHA, is regulated by is own administration under the U. S. Department of Labor. According to the New York Apparel Industry Task Force (New York State Department of Labor, 2006a) and the USGAO (1988), certain types of OSHA violations characterize a sweatshop. These violations include fire hazards (e.g., blocked fire exits, exposed wiring), safety hazards (e.g., blocked aisles, absent safety guards on machines and fans), health hazards, and structural dangers. Currently penalties can range from $10,000 to $70,000 for each violation (OSHA, 2006b).

As of 2004, OSHA had a total of 1,100 inspectors. According to OSHA (2005), only 1% or 300 of the inspections performed in 2004 were referred to the Enhanced Enforcement Program (EEP). The inspections were of all the types of facilities that OSHA inspects, not just apparel manufacturing facilities. A report on enforcement published by OSHA (2006a) indicated that the number of employers referred to the EEP increased to 615 in 2005. Of the employers referred to the EEP, those that repeatedly and willfully violate OSHA standards receive special attention in the enforcement of penalties (OSHA, 2006b). Employers referred to the EEP are subject to multiple follow-up inspections, significant fines, and risk of more severe fines for neglecting to correct violations due to court orders (OSHA, 2006a). The small number of all businesses targeted and inspected, which includes apparel manufacturers and others, gives an idea of the opportunity for undiscovered OSHA violations by sweatshop operators.

The Equal Employment Opportunity Act (EEOA) is another law that sweatshop operators commonly violate. The violations of this law often involve employers' discriminatory hiring and firing of workers who are more easily exploited than others, one example being immigrant workers. Another type of violation is sexual and ethnic discrimination by supervisors who verbally and physically abuse workers (Loucky et. al., 1994). Workers have the burden of monitoring such violations and filing charges with the Equal Employment Opportunity Commission (U.S. Equal Employment Opportunity Commission, 1991). Given the composition of the sweatshop labor force, few if any workers would even know about the EEOA and what it covers and fewer still would file the appropriate charges. The Civil Rights Act of 1991 and the amendment to the Civil Rights Act of 1964 provide for punitive and compensatory damages if an employer is found to willfully violate the EEOA. The compensatory damages can range from $50,000 to $300,000 per person subject to discrimination (U.S. Equal Employment Opportunity Commission, 1991).

This section has discussed the monitoring resources of governing agencies, which include insufficient personnel and funds to adequately collect evidence and prosecute and convict persistent and willful violators of U.S. labor regulations (USGAO, 1989). The federal administration has moved toward putting the burden of monitoring compliance with labor regulations on small state agencies or companies' internal systems which tend to be corrupt in enforcing regulations (Esbenshade, 2004). The inadequacies of the current monitoring scheme and applicable penalties for labor-law violation in the U.S. fail to deter sweatshop operators (USGAO, 1988; 1989). The current civil monetary penalties of thousands of dollars are minute compared to the millions of dollars in revenue that an apparel producer can earn from the goods produced by workers.

Previous Research

The present research builds on theories and methods used in previous research to analyze compliance with labor laws in the U.S. apparel manufacturing industry. The theoretical framework (described in detail in Chapter 3) is based on Ashenfelter and Smith's (1979) profit-maximizing model of minimum-wage compliance by a firm and on Weil's (2002) expansion of the model, which he applied to labor-law compliance in apparel manufacturing. This section reviews the research of those authors.

In their paper entitled *Compliance with the Minimum Wage Law,* Ashenfelter and Smith (1979) constructed a model of compliance assuming the firm participates in profit maximizing behavior and is an actor in a perfectly competitive market. In the model, the probability of getting caught and the penalty for violating the minimum-wage law are applied to demonstrate the decision-making process for an employer choosing between the legal and illegal wages. The model shows that, given a mandated wage versus a possibly lower market wage holding all else constant, an employer would have an incentive to use the lower market wage in order to maximize profit.

Ashenfelter and Smith (1979) used the model to estimate compliance rates and the impact of enforcement schemes. They estimated the compliance rates using data from the May 1973 Current Population Survey on the numbers of workers earning and not earning minimum wage. Their estimates of compliance rates are based on the number of workers earning minimum wage in the presence or absence of a minimum-wage law and the different quantities of labor demanded before and after enactment of the minimum-wage law. They found that, as a whole, the U.S. had a minimum-wage compliance rate of 69% with a confidence interval of 63% to 75%; however, this estimate does not take into account differences in age, region, race, and sex. Ashenfelter and Smith (1979) estimated that compliance rates were higher among groups who would have the lowest wage rates in the absence of a minimum wage. The authors surmised that this result was due to greater detection in government enforcement in such cases. In addition, they estimated that compliance rates were consistently lower with respect to adult workers than younger workers. Ashenfelter and Smith (1979) indicated that, because compliance investigations are based on formal complaints, it is possible that younger workers place less importance on jobs than adult workers, and will make fewer complaints.

Ashenfelter and Smith (1979) examined government enforcement of the minimum wage by determining the difference in compliance rates from 1973 and 1975. In 1975, a minimum wage of $2.10 went into effect along with increased enforcement measures. The results showed that compliance was 7% in 1973 and 60% in 1975, which suggests little if any government enforcement of the minimum wage in 1973. The research by Ashenfelter and Smith (1979) provides a method of evaluating compliance with minimum-wage laws provided that legal wages and market wages are different.

Many researchers have used Ashenfelter and Smith's (1979) model of compliance by either applying it or expanding upon it in analyzing the effect of minimum-wage requirements on firms' decision-making behavior. Chang and Erlich (1985), Bloom and Grenier (1986), and Yaniv (2001) built on the model to analyze the effects of the minimum wage and FLSA enforcement schemes in the U.S. Others have applied Ashenfelter and Smith's (1979) framework to analyze minimum-wage compliance rates of firms in foreign markets. Harrison and Scorse (2003), for example, applied the framework to assess manufacturers' compliance with minimum-wage laws in Indonesia. Their analysis took into account the impact of international competition on the rate of minimum-wage compliance.

Although Ashenfelter and Smith's (1979) model has formed the basis for a number of studies, only that conducted by David Weil (2002) has involved the apparel manufacturing industry. Weil expanded on the work of Ashenfelter and Smith in his study entitled *Compliance with the Minimum Wage: Can Government Make a Difference?* He used contractor-level data for the U.S. apparel industry to analyze patterns of minimum-wage compliance. Specifically, the analysis identified correlates of the incentive for non-compliance with the minimum wage. The correlates include ones that might explain a market wage below minimum wage: employer business characteristics that would lower the probability of detecting non-compliance, the elasticity of product demand, and the elasticity of labor demand.

Weil (2002) used three methods to evaluate the U.S. apparel industry. First, he classified an apparel manufacturer as a minimum-wage violator if the manufacturer had at least one violation. This classification method makes no distinction between different magnitudes of infractions, however. Second, he measured minimum-wage compliance by the proportion of workers in the industry not earning the minimum wage. Another compliance measure was the severity of violation, gauged by the amount of back wages paid to workers. The three types of variables were combined with others as follow: the elasticity of labor demand, the average wage level paid by contractors, the elasticity of product demand, the presence and stringency of monitoring, and a vector of characteristics assumed to be correlated with the probability of minimum-wage compliance. Weil (2002) also used data for product-specific contractors to measure differences in labor intensity and elasticity of labor demand.

One of Weil's (2002) preliminary results was that, using the benchmark of at least one infraction, apparel contractors have a 50% probability of violating minimum-wage laws. Using the benchmark of the proportion of underpaid workers, he found that 27 out of 100 on average were underpaid. Finally, measuring compliance by severity of violation, Weil (2002) found an underpayment of about $5.00 per week. Further analysis supported Ashenfelter and Smith's (1979) research: Weil concluded that increased penalties or risk of detection were needed to deter minimum-wage violations. He also concluded that government can make a difference by using other strategies, such as "holding" goods of contractors who violate minimum-wage laws. This is reminiscent of the FLSA "hot goods" provision.

In addition to minimum-wage violations, IRCA violations are of interest when examining the U.S. apparel manufacturing industry. Immigrants are a high proportion of the labor force for U.S. apparel manufacturers. Those who are illegal are especially vulnerable to mistreatment. Rivera-Batiz (1999) showed that a significant share of the wage disparity among Hispanic immigrant workers in the U.S., taking into account all occupations, can be attributed to exploitation of illegal immigrants. To isolate the share of the observed wage differential that is attributable to exploitation as opposed to differences in productive characteristics, the study used both cross-sectional regression analysis and longitudinal analysis. The cross-sectional analysis used several variables in addition to immigrant status. The other variables are controls for education level, on-the-job experience, English language proficiency, marital status, length of time in the U.S., and occupational group. Rivera-Batiz (1999) noted that, assuming the control variables included all relevant productive characteristics that are systematically different across legal and illegal immigrants, the regression parameter estimate associated with illegal status would measure the extent of exploitation.

Rivera-Batiz (1999) recognized concerns that additional unobserved characteristics may drive the wage differential among workers and that a cross-sectional analysis may not control for these characteristics. Such characteristics may include job stability and cultural characteristics. To address these concerns, Rivera-Batiz (1999) used panel data for illegal immigrants to examine wage differentials before and after legalization, again controlling for all the observed characteristics. The parameter estimate associated with illegal status is more likely to measure exploitation under this scenario as unobserved individual characteristics are likely to remain constant through short periods of time, thus leaving the change in status the only significant change. Rivera-Batiz (1999) concluded that the wage differential attributable to illegal status is 41.8% for men and 40.8% for women.

Other researchers have used the results of Rivera-Batiz (1999) to support their findings on the disparity in workers' earning potential based on citizenship status. These researchers include Mehta, Theodore, Mora, and Wade (2002), who looked at various issues associated with undocumented immigrants in Chicago, such as unemployment, working conditions, and wages. They also produced an estimate of underpayment based on citizenship status, which is only slightly less than that of Rivera-Batiz (1999); however, their estimate only utilizes cross-sectional data, possibly not accounting for the effects of unobserved variables that Rivera-Batiz (1999) did. In a paper called *Coming out of the Shadows: Learning about Legal Status and Wages from a Legalized Population*, the results of Rivera-Batiz (1999) are cited as support for those from an analysis of wage disparities associated with naturalization and market fluctuations (Kossoudji & Cobb-Clark, 2002). In addition, Duncan, Hotz, and Trejo (2005) used the conclusions of Rivera-Batiz (1999) to support their research on Hispanic workers and the effect of human capital, language proficiency, and work experience in the U.S. labor market.

Existing research provides room for further exploration of incentives or disincentives to violate the FLSA and IRCA in the context of U.S. apparel manufacturing. The present research examines economic disincentives to violate the minimum wage and the ban on hiring illegal immigrants in terms of sufficient penalties to deter violations by U.S. apparel producers. Industry-specific data, such as the elasticity of production labor demand, are applied to the model developed by Ashenfelter and Smith (1979) in order to estimate appropriate penalties for deterring employer non-compliance with the two labor laws indicated above. The chapters that follow describe the theoretical framework and analysis procedure for the research, as well as the findings and the conclusions.

CHAPTER 3

SETTING OF THE RESEARCH PROBLEM

Research Purpose and Objectives

The overall purpose of this research is to evaluate whether current federal policy measures are adequate to prevent violation of two different labor laws in the U.S. apparel manufacturing industry. The objective of the study is to estimate the minimum penalties that would provide no monetary incentive for the average firm in each of three sub-sectors in the U.S. apparel manufacturing industry to violate the minimum wage and the ban on hiring illegal immigrants. The sub-objectives are to:

1. Define and characterize an apparel sweatshop in terms of U.S. labor-law violations committed by the operator.
2. Estimate the minimum penalties necessary to eradicate incentives for the average apparel manufacturing firm to violate the minimum wage and the ban on hiring illegal immigrants.
3. Compare the estimates to the current penalties in place.

The first sub-objective was addressed in Chapter 1. Chapters 3, 4, and 5 address the other two sub-objectives. Note that the nature of the research objective and sub-objectives is not amenable to testing hypotheses; thus, no hypotheses are proposed.

Assumptions

1. The variables used in the estimation adequately measure the concepts they are intended to measure.
2. The production technology of a firm can be represented by a neoclassical production function.

3. The firm is a profit maximizer.

4. The firm operates in a perfectly competitive market.

Assumptions 2-4 are fundamental for the model that was estimated. The model is described below. This is a model of firm behavior regarding the decision to violate labor laws in a profit maximization framework. Assumptions 2-4 imply that a well behaved profit function exists. The model developed in the following section uses the profit function to derive explicit conditions under which the firm will choose to comply or not comply with labor laws. Additional assumptions are noted as the model is described.

Theoretical Framework

The model for this research is adapted from one developed by Ashenfelter and Smith (1979) to evaluate minimum-wage violations by firms. Firms are assumed to have access to two different labor markets with equally productive labor. One is the legal market with a mandated wage w_L and the other is an illegal market with an equilibrium wage rate w_I, where w_L is greater than w_I. If a firm chooses to hire from the legal labor market, it makes a profit Π equal to

$$\Pi(w_L, r, p), \tag{1}$$

where w_L is the legal wage, r is the price of capital, and p the price at which the firm can sell its product. Similarly, if the firm chooses to hire from the illegal labor market, in the absence of enforcement of the minimum wage, it makes a profit equal to

$$\Pi(w_I, r, p). \tag{2}$$

The difference in the profit when hiring illegal labor instead of legal labor is

$$\Pi(w_I, r, p) - \Pi(w_L, r, p) > 0, \text{ because } w_L > w_I. \tag{3}$$

Thus, absent law enforcement, the firm will choose to hire illegal labor.

The government is assumed to enforce labor laws using the following scheme. The government conducts audits such that each firm faces a probability λ of being audited and prosecuted. Should the firm be caught in violation, it will pay back wages as well as a lump-sum penalty D. Under this enforcement scheme, should the company choose to use the illegal labor market, it has expected profit equal to

$$E(\Pi) = (1 - \lambda)\Pi(w_I, r, p) + \lambda\Pi(w_L, r, p) - \lambda D. \quad (4)$$

Equation 4 simply states that the firm makes the profit that it would obtain by using illegal labor with probability $(1 - \lambda)$, which is the probability of not getting caught. Further, it realizes profit equal to $\Pi(w_L, r, p)$ with probability λ, because it would pay back wages if it is caught. It also incurs a lump-sum penalty D with probability λ.

The profit maximizing risk-neutral firm will choose to violate labor laws if

$$E(\Pi) - \Pi(w_L, r, p) > 0, \text{ that is,} \quad (5)$$

$$[(1 - \lambda)\,\Pi(w_I, r, p) + \lambda\,\Pi(w_L, r, p) - \lambda D] - \Pi(w_L, r, p) > 0. \quad (6)$$

The inequality in Equation 6 can be simplified to

$$(1 - \lambda)[\Pi\,(w_I, r, p) - \Pi(\,w_L, r, p)] - \lambda D > 0. \quad (7)$$

Ashenfelter and Smith (1979) showed that a second-order Taylor series approximation around w_I of the bracketed term yields

$$[\Pi(w_I, r, p) - \Pi(w_L, r, p)] \approx Q_{PL}(w_L - w_I) - \tfrac{1}{2}\,(\partial Q_{PL}/\partial w_I)(w_L - w_I)^2. \quad (8)$$

Substituting Equation 8 into Equation 7 yields

$$Q_{PL}(w_L - w_I) + (Q_{PL}/w_I)[\tfrac{1}{2}(w_L - w_I)^2\eta] > \lambda/(1 - \lambda)D, \quad (9)$$

where $\eta = (\partial Q_{PL}/\partial w_I)(w_I/Q_{PL})$ is the own-price elasticity of production labor, Q_{PL} is the quantity of labor used, and all other variables are as already defined. See Appendix A for the derivation of Equation 7 and the computation of Equation 9.

Theoretical Definitions of Major Concepts

A production function is a description of a mixture of inputs used in a technology to produce a final good (Binger & Hoffman, 1998). The mathematical expression of the function depicts the relationship between inputs and the output in production. A neoclassical production function is one that is continuous and quasi-concave.

A function f is quasi-concave if and only if, for any pair of distinct points u and v in the convex set of f and $0 < \theta < 1$ and $f(v) \geq f(u)$, then $f[\theta u + (1-\theta)v] \geq f(u)$ (Chiang, 1984, p. 389). In other words, for any two points u and v such that v yields a higher function value than u, the function value of all points between u and v yields a higher function value than u.

A perfectly competitive market is one where all agents (buyers and sellers) act as price takers. It is generally characterized by a large number of buyers and sellers, with individual buyers or sellers having no market power (Binger & Hoffman, 1998). In this study apparel manufacturers act as sellers and retailers can be considered buyers.

A profit function, $\Pi(P, W)$, is a mathematical expression that maps the maximum profit a firm can make when facing any given set of output and input prices, P and W respectively (Binger & Hoffman, 1998).

“A cost function describes the lowest possible economic cost to produce each output level” (Binger & Hoffman, 1998, p. 264).

Constant returns to scale in a production function means that output increases (decreases) proportionally to increases (decreases) in the bundle of inputs (Binger & Hoffman, 1998).

Own-price elasticity of an input in production is the percentage change in the use of an input in response to a percentage change in its price (Binger & Hoffman, 1998).

Minimum wage is a mandated wage administered and enforced by the Wage and Hour Division of the U.S. Department of Labor (USDL, 2006b) in accordance with the FLSA (USDL, 2003a).

Penalties for violating labor laws are defined as monetary losses of a firm in the form of lump-sum payments to the government incurred for violating labor laws.

A violation for the purposes of this study is considered the underpayment of at least one worker or the hiring of at least one illegal immigrant.

The Theory's Application in the Study

The application of the theory in this study makes use of the notion that if one had knowledge of all the terms on the left-hand side of Equation 9, then one could compute the value of D that satisfies the equation as an equality at several different values of λ. Two different law violations are considered: minimum-wage violations, and hiring of illegal immigrants. As previously noted, W_L and W_I denote the legal and illegal wages used for the current analysis. Because the analysis is conducted separately for each law, each variable is also indexed by F or R, denoting FLSA or IRCA respectively. For the scenario to address minimum-wage violations, W_{LF} is the minimum legal U.S. wage, W_{IF} is the typical wage of underpaid U.S. workers, Q_{PL} is the average number of production labor hours of U.S. apparel manufacturing firms, and D is a monetary penalty in addition to back wages that a violator faces. Similarly, for the scenario that addresses the hiring of illegal immigrants, W_{LR} is the average wage of production workers in the apparel industry, W_{IR} is the average U.S. wage of illegal immigrants, regardless of whether that wage is below or above the minimum wage, and D is a monetary penalty in addition to back wages a violator faces. The next chapter describes how W_L, W_I, Q_{PL} and η were obtained for each scenario, and how η was estimated for use in Equation 9.

CHAPTER 4

RESEARCH PROCEDURE

As indicated in Chapter 3, the research objective is to estimate the minimum penalties that would provide no monetary incentive for the average firm in each of the three examined sub-sectors in the U.S. apparel industry to violate the minimum wage and the ban on hiring illegal immigrants, and to compare these estimates with actual penalties in place. In other words, the objective is to estimate the penalty D that would render the average apparel manufacturer in each of the three examined sub-sectors indifferent between violating and not violating the labor regulations of interest in this study, the minimum wage (under the FLSA) and the prohibition on hiring illegal immigrants (under the IRCA).

Because the minimum penalty D depends on the five factors in Equation 9 and the use of an average representative firm in the analysis, the penalty estimated could differ from that required for any individual firm. The error in the estimated penalty would be larger for firms that are very different from the average firm. To reduce the degree of error, the analysis was conducted separately for three different sub-sectors of the apparel industry. The sub-sectors were chosen in a manner that the firms within each sub-sector are more similar to other firms within that sub-sector than to firms in other sub-sectors. The sub-sectors are:

1. men's and boys' wear,
2. women's outerwear, and
3. children's outerwear.

Overview of the Process to Estimate Penalties D

This section gives an overview of the process to estimate the penalties D for violating the labor regulations of interest in the study. The overview is to orient the reader before describing the separate parts of the process. As shown in Equation 9, the estimation of D for each sub-sector required the following factors:

1. the own-price elasticity of production labor demand, η;
2. the quantity of production labor used by the average firm, Q_{PL};
3. the average wage of production labor in firms that comply with each labor law, w_{LF} and w_{LR};
4. the average wage of production labor in firms that violate the labor regulations of interest, w_{IF} or w_{IR}; and
5. the probability of a compliance audit and prosecution, λ.

The process to estimate D required several sequential steps. First, the own-price elasticity of production labor demand in each of the three sub-sectors of the U.S. apparel manufacturing industry was found by empirically estimating a cost function for each sub-sector. The estimation of cost functions is often problematic due to multicollinearity in the model (Chambers 1998). Recent studies (e.g., Berndt & Woods, 1975) deal with multicollinearity by estimating cost functions jointly with cost share equations. To address potential multicollineatrity concerns in this study, the cost function was estimated jointly with two cost share equations, specifically those for production labor and other labor. The next two sections of this chapter show the derivation of the cost function and the share equations, and they describe the variables used. These variables are the level of apparel output and the prices of apparel production labor, other labor, and capital. Sub-sector time-series data from the U.S. government for the period 1961-1996 provided the measures of these variables by using reported values to compute the values of the variables. Data for 1961-1996 were used because the required time-series data for every variable in the cost function are available only from 1961 through 1996. On the other hand, the data for the entire set of variables are not available for 1977, 1983, and 1984, either because they are not complete for all three sub-sectors or because no surveys were completed. Data for the three indicated years were omitted, and each cost function was estimated with only the data for the remaining years from 1961 through 1996. The decision to proceed without attempting to interpolate or use other methods to estimate the missing values is partially because the inclusion of the estimated values would not add new information or improve the accuracy of the estimated cost function. In addition, estimating the data points for the missing years would require the assumption that the data for complete years fall in a trend. And this assumption would not account for the possibility that the values of the missing data do not fall in the presumed trend. A further consideration is that estimated values for the missing years may not accurately reflect their true values.

The estimated own-price elasticity of production labor demand in a sub-sector is one of the variables used to solve Equation 9 for the sub-sector (see Chapter 3) for the penalties D that would make the average apparel firm indifferent between violating and not violating the minimum wage or the ban on hiring illegal immigrants. The other variables in Equation 9 for a sub-sector are the quantity of production labor used in the average firm in the sub-sector in 1996; the average wage in the sub-sector in 1996; the wage rates of both apparel sweatshop workers and illegal immigrants; the minimum wage in effect in 1996; and the probability of being caught and penalized for violating the minimum wage or the ban on hiring illegal immigrants. The values of the first two of these variables were computed from U.S. Census Bureau data, and the wage rates of sweatshop workers and illegal immigrants were computed from published estimates of the underpayment of such workers. Finally, the probability of being caught and penalized came from a published estimate.

Derivation of the Cost Function for Estimating

the Own-Price Elasticity of Production Labor Demand

It is assumed that the production technology of the representative firm in each sub-sector can be described by a general cost function C(p, y). The cost function C(*) for each of the three sub-sectors was estimated jointly with two cost share equations, using time-series data for 1961-1996, and the estimated parameters of the cost function for a sub-sector were used to compute the own-price elasticity of production labor demand, η, for that sub-sector. One more assumption is necessary at this point. It is assumed that the production technology has constant returns to scale. The assumption of constant returns to scale is necessary when using an aggregate data set. A cost function estimated with data at the sub-sector level represents the technology used in a sub-sector, and can be considered the technology of a representative firm in that sub-sector. A crucial property of such a function is that, for any given level of prices and output, the sum of all costs of individual firms must equal the industry cost (Chambers, 1988). It has been demonstrated that, if firms produce different levels of output, only constant returns to scale technologies would satisfy the above aggregation property (Chambers, 1988).

Another assumption is that the estimation of the cost function used the value-added approach. As a result, the estimated cost functions do not account for the cost of materials (e.g., fabric, fuels, energy), and the measure of output in the cost function is value added instead of total output. The value-added method was used under the assumption that the production technology is weakly separable between the categories of inputs included and those excluded. Also, the estimation of the elasticity of production labor demand excluded the cost of materials. The total cost of production equals the sum of the cost of materials, production labor, other labor, and capital. According to ASM data, materials account for an average share of 64% of the total cost of producing apparel in the U.S. Production labor, other labor, and capital account for approximately 25%, 6%, and 7% respectively.

To impose no further assumptions on C(*), C(*) was estimated using a flexible functional form. A function f(*) is a flexible form of an unknown function C(*) if and only if, at an arbitrary approximation point x^o,

1. f(*) has at least n(n+1)(n+2) independent parameters;
2. $f(x^o) \approx C(x^o)$, where x° is the point of expansion;
3. $\partial f(x)/\partial x_i \approx \partial C(x)/\partial x_i \mid x^o$; and
4. $\partial^2 f(x)/\partial x_i \partial x_j \approx \partial^2 C(x)/\partial x_i \partial x_j \mid x^o$.

Conditions 1-4 imply that the functional form used for the estimation has enough parameters to independently identify the function value, first-order partial derivatives, and one-half of the Hessian matrix (Chambers, 1988). Also, the unknown and the approximated functions have approximately equal function values and first- and second-order partial derivatives if f(*) is evaluated at the point of expansion x^o. The point of expansion is any arbitrary point on the function. For purposes of this study, the expansion point is the sample mean of each variable.

A trans-log cost function satisfies the definition of a flexible functional form, and thus estimation of this function provided all economically relevant information regarding the production technology that allowed the computation of η for each sub-sector. The following briefly describes the derivation of the trans-log cost function used in this study. See Appendix B for a more detailed derivation of the cost function.

Equation 10 below is a second-order Taylor series approximation of a general cost function $C(Y, P_{PL}, P_{OL}, P_k)$ where Y is output, P_{PL} is the price of production labor, P_{OL} is the price of other labor, and P_k is the price of capital. The terms f_i and f_{ij} are defined as $\partial h(C)/\partial h(P_i)$

and $\partial^2 h(C)/ \partial^2 h(P_i)$ respectively, with i, j = {PL, OL, k, Y}. In Equation 10, x^o is the point of expansion of the cost function and each term $[h(x) – h(x^o)]$ is the difference between C(*) and the approximated f(*). In this equation, symmetry is imposed according to Young's theorem. Symmetry implies that $f_{ij} = f_{ji}$.

$$C (P_{PL}, P_{OL}, P_k, Y) = f(x^o) + f_{PL} [h(P_{PL}) - h(P_{PL}^o)] + f_{OL}[h(P_{OL}) - h(P_{OL}^o)] + f_K[h(P_k) - h(P_k^o)] + f_Y[\ln Y - \ln Y^\circ] + ½\{[f_{PLPL} [h(P_{PL}) - h(P_{PL}^o)]^2 + 2[f_{PLOL}[h(P_{PL}) - h(P_{PL}^o)][h(P_{OL}) - h(P_{OL}^o)]] + 2[f_{PLK}[h(P_{PL}) - h(P_{PL}^o)][h(P_k) - h(P_k^o)]] + 2[f_{PLY}[h(P_{PL}) - h(P_{PL}^o)][h(Y) - h(Y^o)]] + f_{OL}[h(P_{OL}) - h(P_{OL}^o)]^2 + 2[f_{OLK}[h(P_{OL}) - h(P_{OL}^o)][h(P_k) - h(P_k)]] + 2[f_{OLY}[h(P_{OL}) - h(P_{OL}^o)][h(Y) - (Y^o)] + P_{KK}[h(P_k) - h(P_k^o)]^2 + F_{YY}[h(Y) - h(Y^o)]^2\}. \quad (10)$$

In order to transform Equation 10 into a trans-log cost function, it is assumed that f(*) = lnC and $h(P_i) = \ln P_i$. Thus, the equation becomes

$$\ln C (\ln P_{PL}, \ln P_{OL}, \ln P_k, \ln Y) = \ln(x^o) + f_{PL}[\ln P_{PL} - \ln P_{PL}^o] + f_{OL}[\ln P_{OL} - \ln P_{OL}^o] + f_K[\ln P_k - \ln P_k^o] + f_Y[\ln Y - \ln Y^\circ] + ½\{ [f_{PLPL} [\ln P_{PL} - \ln P_{PL}^o]^2 + 2[f_{PLOL}[\ln P_{PL} - \ln P_{PL}^o][\ln P_{OL} - \ln P_{OL}^o]] + 2[f_{PLK}[\ln P_{PL} - \ln P_{PL}^o][\ln P_k - \ln P_k^o]] + 2[f_{PLY}[\ln P_{PL} - \ln P_{PL}^o][\ln Y - \ln Y^o]] + f_{OLOL}[\ln P_{OL} - \ln P_{OL}^o]^2 + 2[f_{OLK}[\ln P_{OL} - \ln P_{OL}^o][\ln P_k - \ln P_k^\circ]] + 2[f_{OLY}[\ln P_{OL} - \ln P_{OL}^o][\ln Y - \ln Y^o]] + f_{KK}[\ln P_k - \ln P_k^o]^2 + f_{KY}[\ln P_k - \ln P_k^o][\ln Y - \ln Y^o] + F_{YY}[\ln Y - \ln Y^o]^2. \quad (11)$$

After imposing constant returns to scale, the term $f_Y [h(Y) – h(Y^\circ)]$ in Equation 11 becomes lnY and all terms containing f_{iY} and f_{YY} become 0 respectively (see Appendix B for further details). The equation is now

$$\ln C (Y, P_{PL}, P_{OL}, R) = \ln\alpha^o + \ln Y + f_{PL} [\ln P_{PL} - \ln P_{PL}^o] + f_{OL}[\ln P_{OL} - \ln P_{OL}^o] + F_K [\ln P_k - \ln P_k^o] + ½\{ f_{PLPL} [\ln P_{PL} - \ln P_{PL}^o]^2 + f_{PLOL}[\ln P_{PL} - \ln P_{PL}^o][\ln P_{OL} - \ln P_{OL}^o] + f_{PLK} [\ln P_{PL} - \ln P_{PL}^o][\ln P_k - \ln P_k^o] + f_{OLOL}[\ln P_{OL} - \ln P_{OL}^o]^2 + f_{OLK} [\ln P_{OL} - \ln P_{OL}^o][\ln P_k - \ln P_k^o] + f_{KK} [\ln P_k - \ln P_k^o]^2\}. \quad (12)$$

Rearranging the terms in Equation 12, and denoting the parameters as

$\ln\alpha_o = \ln\alpha^o - \Sigma f_i [\ln P_i^o] + ½ \Sigma \Sigma f_{ij}[\ln P_i^o \ln P_j^o]$,

$\rho_i = f_i - \Sigma f_{ij} [\ln P_j^o]$, and

$\gamma_{ij} = f_{ij}$, with i, j = {PL, OL, k},

the trans-log cost function becomes

$$\ln C(Y, P_i) = \ln\alpha_o + \ln Y + \Sigma \rho_i \ln P_i + ½ \Sigma \Sigma \gamma_i\gamma_j \ln P_i \ln P_j \qquad \text{with } i, j = \{PL, OL, k\}. \tag{13}$$

When expanded, Equation 13 is equivalent to

$$\ln C(Y, P_{PL}, P_{OL}, P_k) = \ln\alpha_o + \ln Y + \rho_{PL}\ln P_{PL} + \rho_{OL}\ln P_{OL} + \rho_R \ln R + 1/2\, \gamma_{PLPL}(\ln P_{PL})^2 +$$

$$\gamma_{PLOL} \ln P_{PL} \ln P_{OL} + \gamma_{PLk} \ln P_{PL} \ln P_k + ½\, \gamma_{OLOL}(\ln P_{OL})^2 + \gamma_{OLR} \ln P_{OL} \ln P_k + ½\, \gamma_{kk}(\ln P_k)^2. \tag{14}$$

Equation 14 is the trans-log cost function that was estimated jointly with two cost share equations as a seemingly unrelated system of equations for each sub-sector. The derivation of the cost shares is presented below. The own-price elasticity η was then computed using the relationship in Equation 15 that Allen (as cited in Berndt & Wood, 1975) developed and estimated using the parameters from Equation 14.

$$\eta_{ij} = S_i^* \sigma_{ij}, \tag{15}$$

where S_i^* are cost shares and σ_{ij} are Allen partial elasticities of substitution. Uzawa (as cited in Berndt & Wood, 1975) demonstrated the derivation of the elasticity of substitution σ_{ij} from a trans-log cost function, as shown in the following equations starting with Equation 16.

$$\sigma_{ii} = (\gamma_{ii} + S_i^2 – S_i) / S_i^2. \tag{16}$$

The cost share equations, S_i are defined as

$$S_i = P_i \cdot x_i^* /C \qquad \text{with } i, j = \{PL, OL, k\} \tag{17}$$

where x_i^* are compensated input demand functions. The cost share equation for input i can be interpreted as the percentage contribution of each input to the total cost of producing output Y: $C = P_ix_i + P_jx_j$.

Differentiating the trans-log cost function in Equation 14 yields

$\partial \ln C/\partial \ln P_i = \partial C/\partial P_i \cdot P_i/C = \rho_i + \Sigma\gamma_{ij} \ln P_i \ln P_j$. (18)

Using Shepard's lemma, the optimum x_i, or compensated input demand function, is

$x_i^* = \partial C/\partial P_i = (\rho_i + \Sigma\gamma_{ij} \ln P_i \ln P_j *C)/P_i$ where $i = \{P_{PL}, P_{OL}, k\}$ (19)

(Berndt & Woods, 1975).

Substituting Equation 19 into Equation 17 yields the cost share equations, as per Equation 20, that were used in the estimation of the system.

$S_i = \rho_i + \Sigma\gamma_{ij} \ln P_i \ln P_j$. (20)

Substituting Equation 16 into Equation 15 yields

$\eta_{ii} = (\gamma_{ii} + S_i^2 - S_i) / S_i$ with S_i given by Equation 20, (21)

where η_{ii} is the computed own-price elasticity of demand for production labor.

Data Used for Estimating η

Industry data for 1961-1996 for the three apparel sub-sectors — men's and boys' wear, women's outerwear, and children's outerwear — were used to estimate η. The data sources used in this study categorize the data for this period according to the Standard Industrial Classification (SIC) system. Data for the 1961-1996 period were used because, with the introduction of the North American Industry Classification System (NAICS) in 1997, the classifications changed for some apparel sub-sectors. Even though the category for men's and boys' wear was nearly unchanged from the SIC to the NAICS, the categories containing the women's outerwear and children's outerwear sub-sectors were not sufficiently consistent between the two classification systems to include data from years later than 1996 in the estimation of the cost functions for the three sub-sectors to provide estimates of η for the sub-sectors.

For the estimation of η, industry data for two SIC categories (231 and 232) were combined to provide the data for the men's and boys' sub-sector. According to the U.S. Economic Census (U.S. Census Bureau, 1997) SIC comprises 231 establishments "primarily engaged in manufacturing men's and boys' tailored suits, coats, and overcoats from purchased woven or knit fabric." SIC 232 comprises establishments "primarily engaged in manufacturing men's and boys' shirts; men's and boys' underwear and nightwear; men's and boys' neckwear; men's and boys' separate trousers and slacks; men's and boys' work clothing; and men's and boys' clothing not elsewhere classified." Under the SIC, women's outerwear and children's outerwear are two separate categories, coded 233 and 236 respectively. The U.S. Economic Census describes SIC 233 as establishments "primarily engaged in manufacturing women's, misses', and juniors' blouses and shirts; women's, misses', and juniors' dresses; women's, misses', and juniors' suits, skirts, and coats; and women's, misses', and juniors' outerwear not elsewhere classified" (U.S. Census Bureau,1997). SIC 236 is described as establishments "primarily engaged in manufacturing girls', children's, and infants' dresses, blouses, and shirts and girls', children's, and infants' outerwear not elsewhere classified."

The variables required for estimating each cost function are the level of output, the price of production labor, the price of other workers, and the price of capital. The primary data source of values used to compute these variables is the U.S. Census Bureau Annual Survey of Manufactures for 1961-1996. The ASM data are complemented by apparel product prices from the Producer Price Index of the U.S. Bureau of Labor Statistics (2006b).

To compute the price of production labor, the first step was to divide the total annual compensation to production labor by the total number of production labor hours used per year, both of which are reported in the ASM. Similarly, the price of other workers was computed by dividing the total annual compensation to other workers by the total number of other workers per year. Labor hours of other workers were not used because these data are not available. The above operations yielded a series of the prices in dollars of the labor of production workers per hour and of other workers per worker. Finally, each of these two series of yearly prices was converted to a unit-less index by the following procedure. First, the price in 1996 was normalized to 100 (i.e., set equal to 100). Second, the original price in 1996 was divided by 100 to yield a conversion factor (see Equation 22).

$$\frac{\text{Price in 1996}}{100} = x = \text{conversion factor} \tag{22}$$

Finally, the price in each year i over 1961-1995 was divided by the value of x, to convert it into a y value relative to 100 (see Equation 23).

$$\frac{\text{Price in year } i}{x} = y = \text{price in year } i \text{ relative to } 100 \tag{23}$$

Each unit-less price index was therefore composed of the value of 100 for 1996 and the value y for each year i over 1961-1995. The price series in the index thus preserves the same relative year-to-year price differences as in the original data. The conversion to indices that measure year-to-year differences in the price of labor was necessary to make the measure of each labor-price series consistent with those for the level of output and the price of capital.

Another variable in the cost function estimated for each sub-sector was the level of output. It was necessary to use a measure of the output level that could be aggregated across firms in a sub-sector. To obtain the measure of the yearly level of output per sub-sector, the total value added due to manufacturing each year in a sub-sector was first deflated by the Producer Price Index (PPI) for that year for the sub-sector by dividing each year's value added by that year's PPI. Value added is in dollars, and the PPI is a unit-less index of year-to-year percent changes in producers' selling price for their products. The PPI was obtained from the Bureau of

Labor Statistics, and the value added from the ASM. The value added due to manufacturing is a "measure of manufacturing activity derived by subtracting the cost of materials, supplies, containers, fuel, purchased electricity, and contract work from the value of shipments (products manufactured plus receipts for services rendered)" (U.S. Census Bureau, 1961-2001). In the deflated value-added series, year-to-year variation in value added is entirely attributable to changes in the quantity of output sold. In this series, the value added of a sub-sector in any given year is the revenue the sub-sector would have earned that year by selling its output at 1996 prices. The second step to obtain the output measure was to convert the deflated value-added series to a unit-less index with 1996 as the base year by setting the value in 1996 to 100 and then following operations like those shown in Equations 22 and 23. Similar to the converted labor-price series, the converted output series measures year-to-year differences in output.

The final variable in the estimated cost function was the price of capital. No data source reports the price of capital at the sub-sector level, nor does any report the total cost and quantity of capital at this level. It was therefore necessary to derive a measure of the apparel sub-sector prices of capital by using data from the U.S. Bureau of Labor Statistics (BLS) (2006c) on the total cost of capital and on the capital services index for the entire apparel manufacturing industry (SIC 23). For both measures of capital from the BLS, capital includes equipment, structures, land, and inventories. The total cost of capital in a year measures the total dollar cost of replacing depreciated capital during the year; the unit-less capital services index measures capital input by year-to-year percentage changes in the physical quantity of capital used. BLS prepares these two measures of capital using data from the Bureau of Economic Analysis and the U.S. Department of Agriculture. Regarding the capital services index, BLS explains that this index measures capital input as the services that flow from the stock of capital, rather than the capital itself. BLS further explains that the rates of service vary among different forms of capital (e.g., computers vs. buildings). BLS also notes that "because of differences in capital services between assets, capital input can increase not only because investment increases the capital stock, but also if investment shifts toward assets (such as equipment) which provide relatively more services per dollar of capital stock" (BLS, 2006c).

The first step to derive the sub-sector prices of capital was the allocation of both the total cost of capital and the capital services index for each year to the three sub-sectors according to the sub-sectors' proportional contributions to total apparel output that year. The second step in the derivation was to normalize each sub-sector's capital services index using 1996 as the base year, so that the value for 1996 was 100 and that for each other year was the change from the value for 1996. The third step was to use each sub-sector's normalized capital services index for each year to deflate its total cost of capital that year by dividing the total cost of capital by the normalized capital services index. The resulting series shows each sub-sector's yearly fixed-services cost of capital, that is, the dollar amount the sub-sector paid for capital services each year at that year's prices for capital, but as if the sub-sector used the same amount of capital services as in 1996. The year-to-year variation in the series for each sub-sector is only due to changes in the price of capital. The final step in the derivation was the conversion of the deflated cost-of-capital series for each sub-sector to a unit-less index with 1996 as the base year by setting the value in 1996 to 100 and then following operations like those in Equations 22 and 23. Similar to the converted labor-price series, the capital-price series measures year-to-year changes in the price of capital.

Data Used for Other Variables

To complete the estimation of the penalties D, the following values were needed: the total number of production labor hours used and the average wage in each apparel manufacturing sub-sector in the most recent year of available data; the minimum wage in effect; recent estimates of the wage rates of apparel sweatshop workers and illegal immigrants; and an estimate of the probability of getting caught and penalized for violating U.S. labor laws. To compute the total number of production labor hours, Q_{PL}, in the average apparel manufacturing firm in each sub-sector, County Business Patterns data for 1996 were used (U.S. Census Bureau, 1996). The quantity Q_{PL} for each sub-sector was computed by dividing the total number of production labor hours used in a sub-sector in 1996 by the number of firms in the sub-sector that year. The average hourly wage for legal production labor in each sub-sector in 1996 was computed by dividing the total expenditure for production labor by the total number of labor hours used in the sub-sector during 1996. Note that, although the use of time-series data was necessary to have sufficient observations to estimate η, it was most relevant to use only one observation for each of the other variables in Equation 9 to estimate D, that is, data for those variables for 1996, the most recent year of data used to estimate η.

The production labor wage, denoted w_{IF}, that violates the minimum wage was calculated by subtracting from the minimum wage in effect in 1996 the dollar amount that corresponds to 17% of that minimum wage; 17% is the percentage by which apparel sweatshop wages undercut the minimum wage, according to Ross (2004). The minimum wage in effect in 1996 was $4.75 per hour, which was taken from the historical account of legal minimum wages in the U.S. (U.S. Department of Labor, 2006b).

The average wage of illegal immigrants, denoted w_{IR}, was computed using the estimate of Rivera-Batiz (1999) of the percentage underpayment of non-citizen Hispanic workers in the U.S. Rivera-Batiz (1999) estimated that such workers are underpaid the industry average wage by 40% and indicated that the underpayment of Hispanic workers is associated with their illegal immigrant status. His estimate was used because the 40% underpayment is based on only citizenship status and is the best estimate found during the course of this research. It was therefore assumed that the average U.S. apparel manufacturing firm underpays illegal immigrants by 40% of the overall industry average legal market wage for apparel production workers. Table 1 shows the data for 1996 that were used to calculate the penalties D.

Table. 1. Data for 1996 to Calculate D: Total Production Labor Hours, Number of Employees, and Hourly Wage for the Average Firm in Each Sub-Sector, the Minimum Wage, and the Hourly Wage of Illegal Immigrants and of Sweatshop Labor

Industry sub-sector	Q_{PL}: Total sub-sector production labor hours	Number of sub-sector employees	w_{LR}: Average sub-sector wage	w_{LF}: Minimum wage	w_{IR}: Illegal immigrant wage	w_{IF}: Sweatshop wage
Men's and boys wear	152,640	83	$7.58/hr	$4.75/hr	$4.47/hr	$3.94/hr
Women's outerwear	50,994	27	$6.83/hr	$4.75/hr	$4.02/hr	$3.94/hr
Children's outerwear	88,889	47	$7.00/hr	$4.75/hr	$4.13/hr	$3.94/hr

Weil (2002) indicated that a study of recent government enforcement activity had implied that the probability of getting caught for violating U.S. labor laws, λ, is about 10%. In his study, he calculated a national value of λ equal to 8% on the basis of the number of establishments and the estimated number of investigations conducted yearly by the Wage and Hour Division of the U.S. Department of Labor. To gain generality in the present study, three different values of λ (5%, 10%, and 15%) were used to separately estimate values of D with Equation 9, that is, the minimum penalty that would make apparel manufacturers indifferent between violating and not violating the minimum wage or the ban on hiring illegal immigrants. All the variables described above were used in Equation 9 to solve for the value of D that satisfies the equation as an equality. Equation 9 was solved separately for violation of the minimum wage and for violation of the ban on hiring illegal immigrants, at each of the three probabilities of being caught and penalized and for each of the three sub-sectors of the apparel industry.

Interpretation of the D Values

It is important to discuss the interpretation and potential uses of the estimates of the minimum penalty D required to render the average firm indifferent between violating and not violating the labor laws in question. D is not the penalty that would eradicate all violations of the labor laws in question by U.S. apparel manufacturers. Firms that have a higher propensity to violate than the average firm would still have an incentive to violate. One is rarely looking for the amount of penalty that removes all incentives for all potential perpetrators. The identification of such a penalty is trivial because one would merely set an infinitely large penalty for violating statutes. In applying penalties, policy makers must consider tradeoffs among efficiency of enforcement, fairness, and political feasibility of punishments. Most often penalties are imposed that remove incentives to violate for many but not all potential perpetrators. The current study calculated D for the average firm as it seems a reasonable minimum requirement that a policy removes incentives to violate laws for at least the typical firm in the industry and for all firms that are less likely to violate than the typical firm.

Notice that the computations underlying the lump-sum penalties (Equation 9) implicitly assume that violating firms have a 100% violation rate. That is, they either underpay 100% of their workforce below the minimum wage, or they only hire illegal immigrants. It may be the case, however, that most firms that commit violations may do so for several but not all of their workers. Regarding IRCA violations, most firms may not exclusively hire illegal immigrants and such immigrants may comprise only part of the workforce. Similarly for minimum-wage violations, companies may underpay their most vulnerable workers, but not all their workforce. For the general case, the version of Equation 9 that would appropriately estimate the penalty D is

$$(v)Q_{PL}(w_L - w_I) + ((v)Q_{PL}/w_I)[½(w_L - w_I)^2\eta] > \lambda/(1 - \lambda)D, \quad (24)$$

where v is the violation rate expressed as a percentage of the workforce, and all other variables are as previously defined. The product $(v)Q_{PL}$ equals the number of violations. Note that the penalty D necessary to deter violation is increasing in v; however, the average per-violation penalty, defined as $D/(v)Q_{PL,}$ is not sensitive to v. To see the latter, Equation 9 can be rewritten as

$$(1 - \lambda)/ \lambda\ (v)Q_{PL}\{(w_L - w_I) + (1/w_I)[½(w_L - w_I)^2\eta]\}/ > D, \quad (25)$$

then,

$$(v)Q_{PL}[(1 - \lambda)/ \lambda\ ]\{(w_L - w_I) + (1/w_I)[½(w_L - w_I)^2\eta]\}/ (v)Q_{PL} > D/(v)Q_{PL}, \quad (26)$$

and

$$[(1 - \lambda)/ \lambda\ ]\{(w_L - w_I) + (1/w_I)[½(w_L - w_I)^2\eta]\} > D/(v)Q_{PL}. \quad (27)$$

It is clear that the per-violation penalty does not depend on the number of violations. To better understand of how large lump-sum penalties must be for different percentages of workers subject to violation, penalties were calculated with v = 100%, 75%, 50%, and 25%.

Comparing D with Current Penalties

Chapter 2 described the main labor laws that U.S. sweatshop operators violate, as well as the penalties applied for discovered violations. The minimum wage and the ban on hiring illegal immigrants are the laws of interest in this research. Also described in Chapter 2 is that the penalties for violating labor laws are applied on a per-violation basis, rather than lump sum; however, the main results of the analysis here are estimates of lump-sum penalties applied to each firm caught in violation. To provide a way to meaningfully compare the estimated D values with the per-violation penalties provided by law, it was necessary to establish an equivalency between per-violation penalties and lump-sum penalties for the average apparel manufacturing firm in each sub-sector that violates the minimum wage or the ban on hiring illegal immigrants. A violation of the ban on hiring illegal immigrants is defined as the employment of any person who does not have a valid U.S. work permit. A violation of the minimum wage is defined as paying any employee less than the minimum wage. Thus, a firm caught in violation under current U.S. law would receive a total penalty computed as the product of the number of violations and the per-violation penalty provided by law. To provide meaningful comparisons of the estimated penalties to the actual penalties, minimum average per-violation penalties necessary to deter violations of the laws in question were computed and compared to the actual per-violation penalties provided under U.S. law. A computed per-violation penalty equals $D/Q_{PL}*(v)$, as defined above. The computed per-violation penalties have the added advantage that they are independent of the number of workers subject to violation of each law in question.

An extensive literature review failed to uncover published estimates of the typical numbers of violations per firm. For minimum-wage violations, Weil (2002) reported in his study of the New York apparel industry that approximately 27 out of 100 apparel workers were underpaid, and the USGAO (1989) reported that 50% of apparel firms were not in compliance with labor laws. This is another reason that violation rates of 25%, 50%, 75%, and 100% for the average firm were applied in this study.

Limitations

The limitations of this research include the following: lack of cross-sectional data on individual firms; lack of compatible sub-sector data for 1996 and for the most recent year of available industry data, 2004; data disaggregation at no higher level than sub-sectors; and lack of data on the magnitude of labor-law violations by sweatshop operators. The inavailability of firm-level data made it necessary to use aggregate sub-sector data, which in turn necessitated the assumption of constant returns to scale. Ideally one could have product-specific, firm-level data for a study like the present one. Such data were unfortunately not available at the time of this study, and disaggreation at the sub-sector level was the most accurate and consistent for the time period of analysis. Thus, averaging errors may have affected the estimation of η. Cross-sectional data on firms, as compared to the time-series data for sub-sectors that were used in this study, would likely provide a more accurate description of the production technology at any one time, such as a year. In addition, despite using the most recent available industry data, those for estimating η ended in 1996. Furthermore, the time-series data for estimating η, the own-price elasticity of production labor demand, only cover 32 years in the period 1961-1996 due to incomplete reports in the ASM for some years.

Another limitation of the data resulted from the change in industry classification systems from the SIC to the NAICS in 1997. That change caused the data for the sub-sectors containing women's and children's outerwear to be incompatible prior to 1996 and after 1997. Various categories referring to children's outerwear under the SIC system were combined with women's outerwear under the NAICS. The incompatibility of the categories in the SIC and the NAICS resulted in less data for this study than would have been desirable. The conversion from the SIC system to the NAICS is the source of a further possible limitation of this study. Data at the sub-sector level were used to reduce the averaging errors that could have resulted from using more aggregated industry-level data. Firms within sub-sectors are believed to be more similar to each other than to firms in different sub-sectors. An upshot of combining of women's and children's outerwear in one NAICS category in 1997, after they had been in separate SIC categories, may be reduced reliability of some penalties estimated with data for 2004 when compared to those estimated with data for 1996. Although firms that produce women's outerwear and those that produce children's outerwear have some similarities, these two types of firms may differ in important ways such as cost structures and some aspects of their production technologies.

Although an effort was made to produce accurate results in this study, the nature of sweatshops causes problems for conducting research related to these operations. One problem for the present study is that little is known about the magnitude of labor-law violations in the U.S. apparel manufacturing industry, including in the portion of the industry that comprises sweatshops. Related to this, an important limitation of this study is the lack of accurate data on the violations of labor laws by apparel sweatshop operators. Most commonly reported violations are sub-minimum wage payment for both regular work hours and for overtime work; however, information specific to U.S. apparel firms regarding violations of the ban on hiring immigrants is almost nonexistent.

A further limitation of this study is that, in order to conduct a quantitative analysis of problems related to sweatshops, it was necessary to simplify the analysis to the estimation of penalties that would make apparel manufacturers in general indifferent to violating or not violating labor laws. In addition, although this thesis discusses the prevalent violation of various labor laws by sweatshop operators and the ease with which sweatshop operators can violate these laws, the analysis deals with only two of the laws. As discussed in earlier chapters, other laws violated by sweatshop operators are OSHA, EEOA, the National Labor Relations Act, and even prohibitions on human trafficking. Although sweatshop operators usually violate more than one or even all of these laws, it is hard to quantify them for analysis; however, the fact that U.S. labor laws are enforced by different agencies, disaggregating means that labor-law violations and associated penalties may be best for conducting research that leads to policy recommendations.

CHAPTER 5

RESULTS AND DISCUSSION

This chapter presents and discusses the estimated minimum lump-sum penalties (D) required to deter violation of the minimum wage and the ban on hiring illegal immigrants by representative firms in the three examined sub-sectors. The corresponding per-violation penalties are also reported. As described previously, the estimation of the lump-sum penalties first required the estimation of the own-price elasticity of production labor demand (η) for each sub-sector. These estimated elasticities are presented and discussed before turning to the main results. The main results are the estimated minimum penalties necessary to deter violation of the two labor laws of interest in this study. These penalties were estimated using data for 1996, the most recent year for which compatible data at the sub-sector level were available for estimating the own-price elasticities of production labor demand. These elasticities are long-run elasticities, assumed to be constant over time. It was therefore possible to use the estimated elasticity values, along with data for 2004, to produce updated estimates of the minimum penalties necessary to deter violations of the two labor laws of interest; 2004 is the most recent year of available ASM data. Thus, the updated penalties are also presented and discussed. A further set of results presented in this chapter are those from a sensitivity analysis of the effect on estimated penalties of the value of the own-price elasticity of production labor demand. In addition to providing information concerning the reliability of the calculated penalties, the results of the sensitivity analysis give further support to using the estimated elasticity values in combination with data for 2004 to produce updated estimates of the penalties.

Estimated Own-Price Elasticities of Production Labor Demand

The estimated own-price elasticities of production labor demand (η) are -0.17, -0.10, and -0.09 for men's and boys' wear, women's outerwear, and children's outerwear, respectively. These negative values are consistent with the law of demand. Together, the elasticity results indicate that production labor demand in the three sub-sectors of the U.S. apparel manufacturing industry is quite inelastic with respect to workers' wages because the absolute values of the elasticities are less than one and thus the demand is relatively unresponsive to changes in wage rates for production workers overall.

The elasticities of -0.17, -0.10, and -0.09 indicate that a 1% increase (decrease) in wages yields respectively a 0.17%, 0.10%, and 0.09% decrease (increase) in the quantity of labor demanded. In other words, a 10% per hour increase (decrease) in wages, equivalent to approximately $0.48 an hour, is associated with respectively 1.5, 0.5, and 0.3 fewer workers demanded per year. It was not possible to test whether the estimated elasticities are statistically different from each other. The elasticities were computed from estimated regression parameters of a rational function, making the variance of the elasticity values difficult to obtain analytically.

A possible explanation for the low elasticity values obtained lies in the second Hicks-Marshall law of derived demand. This law states that the more difficult it is to substitute other factors of production for labor, the more inelastic the demand for labor will be with respect to wages, holding constant other variables that might affect the elasticity values (Ehrenberg & Smith, 2005). Empirical work by Ramcharren (2001) has shown a relatively inelastic substitution of capital for labor in the U.S. apparel manufacturing industry. The unresponsiveness of production labor demand to changes in wages and the low possibilities for substituting capital for labor are consistent with the second Hicks-Marshall law of derived demand.

Weil (2002) used a value of 1.5 for the elasticity of labor demand for the overall U.S. manufacturing industry, and he assumed that this value applied to U.S. apparel manufacturing. This value represents a much more elastic demand for production labor than was estimated in this study for the three examined sub-sectors of U.S. apparel manufacturing. The difference between the elasticity value used by Weil (2002) and the elasticity values estimated in this research may be attributable to the inclusion of industry sectors with more elastic production labor demand than actually exists in the apparel industry.

Estimated Penalties for Violating the Minimum Wage and the Ban on Hiring Illegal Immigrants, Using Data for 1996

This section presents and discusses the minimum lump-sum penalties estimated to deter the average firms in the men's and boys' wear, women's outerwear, and children's outerwear sub-sectors of the U.S. apparel manufacturing industry from violating the minimum wage and the ban on hiring illegal immigrants. Chapter 3 described Equation 9 that was used to calculate the penalties.

Some components of Equation 9 are the minimum wage and two variables specific to sub-sectors: the average quantity of production labor hours and the average wage for production workers. Recall from Chapter 4 that data for 1996 on the quantity of production worker hours were used to calculate the D values because the η values were estimated with data only up through 1996, owing to the incompatibility of the SIC and NAICS industry classification systems at the sub-sector level. This section reports the per-firm lump-sum penalties calculated using data for 1996, and then the corresponding average per-violation penalties. The lump-sum and per-violation penalties for violating the minimum wage are presented first, followed by the lump-sum and per-violation penalties for violating the ban on hiring illegal immigrants.

Lump-sum Penalties for Violating the Minimum Wage

Recall that v is the rate of violating a labor law and λ is the probability of getting caught in violation of a labor law. A range of values was used for both v and λ to provide insight into the lump-sum penalties a firm might face for being in violation for different percentages of its production workforce and for different probabilities of getting caught in violation. Tables 2 through 4 show the estimated minimum per-firm, lump-sum penalties to remove incentives for the average firm in each sub-sector to violate the required minimum wage. The interpretation of each lump-sum penalty is as follows. Each is the dollar penalty that would be imposed on an average firm for violating the minimum wage, given a particular annual percentage of production workers for whom the firm is in violation and given a particular annual probability of getting caught in violation. The penalty is the minimum needed each year to eliminate the incentive to earn excess expected profit from violating the minimum wage. As an example, the figure in the first row and second-to-left column of Table 2 is the annual minimum lump-sum penalty needed to deter violation of the minimum wage by the average firm in the men's and boys' apparel sub-sector under the following conditions: The firm faces a 5% annual probability of getting caught, pays less than the minimum wage by the average percentage of underpayment, and does so for 100% of the firm's production workers in a year.

Table 2. Men's and Boys' Wear (SIC 231 and 232): Per-firm, Annual Lump-Sum Dollar Penalties for Violating the Minimum Wage

Violation rates	Probability of being caught (λ)		
	0.05	0.10	0.15
100%	2,301,112.94	1,090,000.87	686,296.84
75%	1,725,834.70	817,500.65	514,722.63
50%	1,150,556.47	545,000.43	343,148.42
25%	575,278.23	272,500.21	171,574.21

At a 5% probability of getting caught in violation of the minimum wage, a firm in the men's and boys' wear sub-sector faces lump-sum penalties of $2,301,112.94 , $1,725,834.70, $1,150,556.47, and $575,278.23 assuming respectively 100%, 75%, 50% and 25% violation rates (see Table 2). Increasing the probability of getting caught to 10% produces an average decrease of approximately 53% in the per-firm lump-sum penalties with, penalties ranging from $1,090,000.87 for being in violation for 100% of its workforce to $272,500.21 for being in violation for 25% of its production workforce. With an increase in the probability of getting caught to 15%, the per-firm lump-sum penalties decrease further by an average of 37%, with penalties of $686,296.84, $514,722.63, $343,148.42, and $171,574.21 across the different violation rates.

Table 3 shows that the average firm in the women's outerwear sub-sector would pay lump-sum penalties ranging from $774,362.70 to $193,590.67 for violating the minimum wage over the range of violation rates from 100% to 25% of the firm's production labor workforce and at a 5% probability of being caught. At a 10% probability of being caught, the per-firm lump-sum penalties are $366,803.38, $275,102.54, $183,401.69, and $91,700.85 for the respective violation rates of 100%, 75%, 50%, and 25%. The penalties at a 10% probability of getting caught average 53% less than the penalties at a 5% probability of getting caught. The per-firm lump-sum penalties at a 15% probability of getting caught range from $230,950.28 to $57,737.57 from the highest to lowest violation rate, and average 37% less than those at a 10% probability of being caught.

Table 3. Women's Outerwear (SIC 233): Per-firm, Annual Lump-sum Dollar Penalties for Violating the Minimum Wage

Violation rates	Probability of being caught (λ)		
	0.05	0.10	0.15
100%	774,362.70	366,803.38	230,950.28
75%	580,772.02	275,102.54	173,212.71
50%	387,181.35	183,401.69	115,475.14
25%	193,590.67	91,700.85	57,737.57

The per-firm lump-sum penalties shown in Table 4 are those that the average children's outwear firm would face for violating the minimum wage. At the lowest probability of getting caught, the penalties are $1,351,208.02, $1,013,406.01, $675,604.01, and $337,802.00 for the respective violation rates of 100%, 75%, 50%, and 25%. As with men's and boys' wear and women's outerwear at a10% probability of getting caught, a children's outerwear firm faces lump-sum penalties that average 53% less than those at a 5% probability of getting caught. The penalties at the 10% probability of getting caught range from $640,045.90 with a violation rate of 100% to $160,011.48 with a 25% violation rate. At a 15% percent probability of getting caught, the lump-sum penalties that the average children's outerwear firm would face are $402,991.87,

$302,243.90, $201,495.93, and $100,747.97 over the respective violation rates from 100% to 25%.

Table 4. Children's Outerwear (SIC 236): Per-firm, Annual Lump-sum Dollar Penalties for Violating the Minimum Wage

Violation rates	Probability of being caught (λ)		
	0.05	0.10	0.15
100%	1,351,208.02	640,045.90	402,991.87
75%	1,013,406.01	480,034.43	302,243.90
50%	675,604.01	320,022.95	201,495.93
25%	337,802.00	160,011.48	100,747.97

Notice that at every violation rate and every probability of getting caught, the per-firm lump-sum penalties for the men's and boys' wear sub-sector are the largest, those for the children's outerwear sub-sector are the second largest, and those for the women's outerwear sub-sector are the smallest. Also notice that, as implied by Equation 27, all the estimated lump-sum penalties increase proportionally with the share of workers paid wage rages that violate the minimum wage. In addition, for each of the examined sub-sectors the per-firm lump-sum penalties decrease as the probability of getting caught increases from 5% to 15%. Recall from Chapter 4 that the probability of getting caught is strongly associated with enforcement efforts by authorities, in that the probability that a given firm will be audited in any given year increases with the frequency of audits. The results of this study therefore suggest that a particular level of compliance with a labor law can be reached by lowering the penalties for violation or by increasing enforcement efforts.

The differences in the per-firm lump-sum penalties among the three examined sub-sectors at any probability of getting caught are a result of differences among the sub-sectors in the annual average number of production workers per firm and the own-price elasticities of demand for production labor. Annual Survey of Manufactures data for 1996 indicate that, of the three sub-sectors, men's and boys' wear had the largest firms with an average of 83 production workers per firm, which contributed to the larger lump-sum penalties for this sub-sector than for the other two.[1] The children's outerwear sub-sector had approximately 47 workers per firm, which was close to the median number of production workers per firm across the three sub-sectors and resulted in proportionally lower lump-sum penalties. The women's outerwear sub-sector had the lowest number of production workers per firm, at 27, and consequently the lowest lump-sum penalties.

Per-Violation Penalties for Violating the Minimum Wage

Table 5 shows, for each of the three different probabilities of being caught in violation, the three apparel sub-sectors' per-violation penalties for violating the minimum wage. The per-violation penalties were obtained by dividing the per-firm lump-sum penalties by the number of violations per firm. The number of violations per firm came from the number of employees in the average firm. Results are not reported for different violation rates because the per-violation penalties are independent of the violation rate and thus identical for the different rates.

[1] Differences in the sub-sectors' elasticities of production labor demand also contributed to differences in the estimated penalties, although differences in the size of the labor force in the sub-sectors primarily drove differences in the lump-sum penalties for the sub-sectors.

Table 5. Per-violation Annual Dollar Penalties for Violating the Minimum Wage

Apparel sub-sectors	Probability of getting caught (λ)		
	0.05	0.10	0.15
Men's and boys' wear	27,437.22	12,996.58	8,183.03
Women's outerwear	27,637.39	13,091.40	8,242.73
Children's outerwear	27,666.01	13,104.95	8,251.27

At a 5% probability of getting caught, the per-violation penalties for the men's and boys' wear, women's outerwear, and children's outerwear sub-sectors are respectively $27,437.22, $27,637.39, and $27,666.01. By increasing the probability of getting caught from 5% to 10%, the per-violation penalty decreases in each sub-sector by approximately 53%; ordering the sub-sectors the same as above, the respective per-violation penalties are $12,996.58, $13,091.40, and $13,104.95. A further decrease of 37% in the penalty for each sub-sector occurs when the probability of getting caught increases from 10% to 15%; in this case, the penalties are $8,183.03, $8,242.73, and $8,251.27 for men's and boys' wear, women's outerwear, and children's outerwear respectively.

Notice in Table 5 the similarity of the sub-sectors' per-violation penalties at each probability of getting caught. At a 5% probability of getting caught, the per-violation penalty for the men's and boys' wear sub-sector differs by only $147, or 5.0%, from that for the women's outerwear sub-sector. A firm in the children's outerwear sub-sector would face the largest per-violation penalty, but this penalty is only approximately 3.5% greater than that for the men's and boys' wear sub-sector. The differences between the sub-sectors' per-violation penalties at the 10% and 15% probabilities are consistent with those seen at a 5% probability of being caught.

The differences between the sub-sectors in the per-violation penalties are due to differences in the elasticities of demand for production labor.

Lump-sum Penalties for Violating the Ban on Hiring Illegal Labor

This section presents and discusses the per-firm lump-sum and per-violation penalties estimated to deter the average firm in each of the three sub-sectors of interest from hiring illegal immigrants. The IRCA, or Immigration Reform and Control Act, prohibits the knowledgeable and willful hiring of illegal immigrants. For this reason, this section sometimes uses "IRCA violations" to refer to violations of the ban on hiring illegal immigrants. Tables 6 through 8 show the lump-sum penalties for the average firms in the three sub-sectors at different violation rates and different probabilities of getting caught and fined.

Table 6 shows that, at a 5% probability of getting caught, the average firm in the men's and boys' sub-sector would pay lump-sum penalties of $8,8480,750.75, $6,360,563.06, $4,240,375.38, and $2,120,187.69 when the violation rates are respectively 100%, 75%, 50%, and 25%. With an increase in the probability of getting caught to 10%, the penalties for the average firm are 53% less than those at the 5% probability of getting caught for all rates of violation. The lump-sum penalties decline by 37% when the probability of getting caught is increased another 5%, and range from $2,529,346.72 to $632,336.68 over the violation rates from 100% to 25%.

Table 6. Men's and Boys' Wear (SIC 231 and 232): Per-firm, Annual Lump-sum Dollar Penalties for Hiring Illegal Immigrants

Violation rates	Probability of getting caught (λ)		
	0.05	0.10	0.15
100%	8,480,750.75	4,017,197.72	2,529,346.72
75%	6,360,563.06	3,012,898.29	1,897,010.04
50%	4,240,375.38	2,008,598.86	1,264,673.36
25%	2,120,187.69	1,004,299.43	632,336.68

As shown in Table 7, the lump-sum penalties the average women's outerwear firm would face are $2,618,898.67, $1,964,174, $1,309,724, and $654,724.67 at a 5% probability of getting caught and the respective violation rates of 100%, 75%, 50%, and 25%. The lump-sum penalties at the 10% and 15% probabilities of getting caught follow the same pattern of proportional decreases, with 53% reductions in the penalties as the violation rate declines. At a 10% probability of being caught, the penalties range from $1,240,530.95 with a 100% violation rate to $310,132.73 with a 25% violation rate. At the 15% probability of getting caught, the penalties range from $781,075.04 to $195,268.76 from the highest to lowest violation rates.

Table 7. Women's Outerwear (SIC 233): Per-firm, Annual Lump-sum Dollar Penalties for Violating the Banned Hiring of Illegal Immigrants

Violation rates	Probability of getting caught (λ)		
	0.05	0.10	0.15
100%	2,618,898.67	1,240,530.95	781,075.04
75%	1,964,174.00	930,398.21	585,806.28
50%	1,309,449.34	620,265.47	390,537.52
25%	654,724.67	310,132.73	195,268.76

The lump-sum penalties for the average firm in the children's outerwear sub-sector (see Table 8) exhibit the same percentage decrease across the three probabilities of getting caught as seen for the men's and boys' wear and women's outerwear sub-sectors. The lump-sum penalties differ by 53% between the λ values of 0.05 and 0.10 and between the λ values of 0.10 and 0.15. The penalties range from \$4,696,201.00 to \$1,174,051.75 at λ = 0.05, \$2,224,519.10 to \$556,129.77 at λ = 0.10, and \$1,400,623.14 to \$350,155.78 at λ = 0.15.

Table 8. Children's outerwear (SIC 236): Per-firm, Annual Lump-Sum Dollar Penalties for Violating the Banned Hiring of Illegal Immigrants

Violation rates	Probabilities of getting caught (λ)		
	0.05	0.10	0.15
100%	4,696,201.00	2,224,519.10	1,400.623.14
75%	3,522,155.24	1,668,389.32	1,050,467.35
50%	2,348,103.49	1,112,259.55	700,311.57
25%	1,174,051.75	556,129.77	350,155.78

As for the per-firm lump-sum penalties for minimum-wage violations described previously, the lump-sum penalties for hiring illegal immigrants in the different sub-sectors partially reflect the influence of firm size in terms of the number of production workers. As in the case of minimum-wage violations, differences across the sub-sectors in the own-price elasticity of demand for production labor, as well as the average wage rate also contribute to differences in the estimated lump-sum penalties. The men's and boys' sub-sector has the largest lump-sum penalties at every value of λ and every rate of violation, due partially to having the largest average number of production workers. The second largest lump-sum penalties are for the children's outerwear sub-sector, followed by those for the women's outerwear sub-sector.

Per-violation Penalties for Violating the Ban on Hiring Illegal Immigrants

As for violations of the minimum wage, the per-violation penalties for hiring illegal immigrants were calculated in addition to the lump-sum penalties for the three apparel sub-sectors. Table 9 shows the per-violation penalties for hiring illegal immigrants across the three probabilities of getting caught and the three sub-sectors.

Table 9. Per-violation Annual Dollar Penalties for Hiring Illegal Immigrants

Apparel sub-sectors	Probability of getting caught (λ)		
	0.05	0.10	0.15
Men's and boys' wear	101,119.86	47,898.88	30,158.55
Women's outerwear	93,469.80	44,275.17	27,876.96
Children's outerwear	96,154.93	45,547.07	28,677.79

For each sub-sector, the penalty decreases approximately 50% when the probability of getting caught increases from 0.05 to 0.10, and decreases a further 37% with an increase in the probability to 0.15. For the men's and boys' sub-sector, the per-violation penalties range from

$101,119.86 at a 5% probability of being caught in violation of the ban on hiring illegal immigrants to $30,158.55 at a 15% probability of being caught. For the women's outerwear sub-sector, the per-violation penalties range from $93,469.80 to $27,876.96 across the 5% to 15% range of probabilities of being caught in violation and fined. The penalties per violation for the children's outerwear sub-sector are higher than those for the other two sub-sectors and range from $96,154.93 to $26,677.79 from the lowest to highest probability of being caught in violation of the IRCA. These per-violation penalty estimates are proportional to the lump-sum penalties shown in Tables 5 through 7. At a 10% probability of getting caught, the men's and boys' wear sub-sector has the highest per-violation penalty at $47,898.88, followed by children's outerwear at $45,547.07, and women's outerwear at $44,275.17.

Sensitivity of Penalties to Changes in the Own-price Elasticity of Production Labor Demand

As described in Chapter 4, the estimated values of the own-price elasticity of production labor demand (η) for the three apparel sub-sectors of interest were used to calculate the lump-sum penalties specific to each sub-sector. As a way to check the reliability of the estimated penalties, an analysis was conducted of the sensitivity of the per-violation penalty values to the value of η. The analysis was performed on the per-violation penalties, rather than the lump-sum, because the per-violation penalties were to be compared to the current penalties, which are assessed on a per-violation basis.

Tables 10, 11, and 12 show for the three sub-sectors the changes in the calculated per-violation penalties that are associated with different values of η over the range from 0 (perfectly inelastic behavior) to -1.5 (very elastic behavior). The range of η values includes those estimated for the respective sub-sectors. The elasticity value of -1.5 is included because Weil (2002) used it in his study as the representative value of η for U.S. apparel producers. Tables 10 through 12 also show the percentage by which each listed penalty changes from the penalty associated with the estimated value of η for the respective sub-sector. The table for each sub-sector provides separate comparisons for penalties for violating the minimum wage and for violating the ban on hiring illegal immigrants.

It stands out in Tables 10, 11, and 12 that the per-violation penalties decline with increases in the value of η but the degree to which the penalties decline is much less for those for violating the minimum wage than for those for hiring illegal immigrants. The larger impact of η on the penalties for hiring illegal immigrants is because the per-violation penalties are much larger for hiring illegal immigrants than for violating the minimum wage.

Overall, the estimated per-violation penalties for violating the minimum wage are relatively insensitive to changes in the own-price elasticity of production labor demand (see Tables 10-12). For small changes in η (specifically, the change to η = 0 from the estimated values of η) the penalties change minimally by 0.9%. The largest changes in the penalties (-14.0 % and -14.5%) are associated with increasing the absolute value of η to -1.5 from - 0.17 or less. These changes in the penalties are quite small, however, if one considers that they are brought about by increasing the absolute value of η by 140%. As seen above, the penalties estimated for violating the minimum wage are quite robust to changes in the value of η, indicating that small errors in the estimation of η would have little influence on the magnitude of the penalties.

Table 10. Men's and Boys' Wear: Sensitivity of Per-violation Dollar Penalties to Changes in η

η	Per-violation penalties (minimum wage)	Change from the estimated η = - 0.17		η	Per-violation penalties (hiring illegal Immigrants)	Change from the estimated η = - 0.17
0	13,226.85	1.0%		0	50,905.77	6.0%
- 0.17	12,996.58	n/a		- 0.17	47,898.88	n/a
- 1.00	11,872.30	- 9.0%		- 1.00	33,218.17	- 31.0%
- 1.50	11,195.02	-14.0%		- 1.50	24,374.37	- 49.0%

Table 11. Women's Outerwear: Sensitivity of Per-violation Dollar Penalties to Changes in η

η	Per-violation penalties (minimum wage)	Change from the estimated η = - 0.10		η	Per-violation penalties (hiring illegal Immigrants)	Change from the estimated η = - 0.10
0	13,226.85	1.0%		0	45,868.92	3.6%
- 0.10	13,091.40	n/a/		- 0.10	44,275.17	n/a
- 1.00	11,872.29	- 9.3%		- 1.00	29,931.41	- 32.0%
- 1.50	11,195.02	- 14.5%		- 1.50	21,962.66	- 50.0%

Table 12. Children's Outerwear: Sensitivity of Per-violation Dollar Penalties to Changes in η

η	Per-violation penalties (minimum wage)	Change from the estimated η = - 0.09		η	Per-violation penalties (hiring illegal Immigrants)	Change from the estimated η = - 0.09
0	13,226.86	0.9%		0	47,017.36	3.2%
- 0.09	13,104.95	n/a		- 0.09	45,547.07	n/a
- 1.00	11,872.30	- 9.4%		- 1.00	30,680.82	- 32.6%
- 1.50	11,195.03	-14.5%		- 1.50	22,512.55	- 50.5%

Compared to the per-violation penalties to deter violation of the minimum wage, those to deter violation of the IRCA are more sensitive to changes in the value of η (see Tables 10 -12). The penalties for violating the IRCA change by 3.2% to 6.0% with changes in η from the estimated values to $\eta = 0$, but they change by - 31.0% to - 32.6% with increases in the absolute value of η from the estimated values to $\eta = -1.0$ and by - 49.0% to - 50.5% with increases in the absolute value of η from the estimated values to - 1.5. These results suggest, therefore, that small errors in estimating η would have little effect on the magnitude of the calculated penalties for violating the IRCA, but that large errors in estimating η would substantially affect the penalties. The results of the sensitivity analysis, along with the relatively small differences across the examined sub-sectors in the estimated values of η, suggest that if the unit of analysis in this study had been U.S. apparel manufacturing as a whole, rather than sub-sectors of this industry, errors in estimating the value of η would have had little influence on the calculated penalties. On the other hand, if the value of $\eta = -1.5$ had been used as in Weil (2002), the calculated penalties would have been much smaller, by about 50%, than those calculated in this study.

Penalties for Violating the Minimum Wage and the Banned Hiring of Illegal Immigrants, Using Data for 2004

The analysis to determine penalties that would deter violation of the two labor laws in question was extended by using the estimated values of the own-price elasticity of production labor demand in combination with the most recent available data for the other variables in Equation 9. The most recent available data are for 2004. The elasticities estimated for the three apparel sub-sectors of interest are long-run elasticities, assumed to be constant over time. Thus, although the elasticities were estimated with data for 1961-1996, they can be used with data for 2004 on the other variables in Equation 9 to solve for a set of updated penalties to deter the violation of labor laws. In addition, even if slightly different values of η were estimated with data that extended through 2004, the sensitivity analysis indicates that the penalties calculated with these values would differ minimally from those calculated with the values of η estimated in this study. Table 13 describes the data for 2004 that were used to calculate the updated penalties. The sub-sector data are for two sub-sectors rather than three, for the reason explained below.

Table.13. Data for 2004 to Calculate D: Total Production Labor Hours, Number of Employees, and Hourly Wage for the Average Firm in Each Sub-Sector, the Minimum Wage, and the Hourly Wage of Illegal Immigrants and of Sweatshop Labor

Industry sub-sector	Q_{PL}: Total sub-sector production labor hours	Number of sub-sector employees	w_{LR}: Average sub-sector wage	w_{LF}: Minimum wage	w_{IR}: Illegal immigrant wage	w_{IF}: Sweatshop wage
Men's and boys' cut & sew manufacturing	92,370	49	$9.09/hr	$5.15/hr	$5.36/hr	$4.27/hr
Women's and girls' cut & sew manufacturing	38,078	19	$8.18/hr	$5.15/hr	$4.82/hr	$4.27/hr

Industry data in the Annual Survey of Manufactures and the County Business Patterns are currently reported under the North American Industry Classification System (NAICS) rather than the Standard Industrial Classification (SIC) system, under which industry data were reported from the 1930s through 1996. The development of the NAICS included reclassification of some industry sectors in categories different from those in the SIC system. Relevant to this study is that the NAICS does not contain a separate category for either women's outerwear or children's outerwear. According to the bridge table for the NAICS and SIC (U.S. Census Bureau, 1997), the NAICS categories that most closely correspond to the men's and boys' wear, women's outerwear, and children's outerwear categories in the SIC are called men's and boys' cut and sew apparel manufacturing (NAICS 31522) and women's and girls' cut and sew apparel manufacturing (NAICS 31523). As a result, the penalties calculated with data for 2004 refer to only those two NAICS categories (see Tables 13 and 14).

Table 14. Per-violation Dollar Penalties for Violating the Minimum Wage, Using Data for 2004

Apparel sub-sectors	Probabilities of getting caught (λ)		
	0.05	0.10	0.15
Men's and boys' cut & sew manufacturing	30,913.82	14,643.38	9,219.91
Women's and girls' cut & sew manufacturing	32,381.74	15,338.72	9,657.71

Table 15. Per-violation Dollar Penalties for Hiring Illegal Immigrants, Using Data for 2004

Apparel sub-sectors	Probabilities of getting caught (λ)		
	0.05	0.10	0.15
Men's and boys' cut & sew manufacturing	126,017.26	59,692.39	37,584.10
Women's and girls' cut & sew manufacturing	120,974.39	57,303.66	36,080.08

As to the per-violation penalties for violating the minimum wage (see Table 14), those for women's and girls' cut and sew apparel manufacturing are approximately 4.5% higher than those for men's and boys' cut and sew apparel manufacturing at each probability of getting caught and fined. For the women's and girls' sub-sector, the penalties range from $32,381.74 to $9,657.71 over the 5% to 15% range of probabilities of getting caught. For the men's and boys' sub-sector, the penalties for violating the minimum wage range from $30,913.82 to $9,219.91.

The per-violation penalties for hiring illegal immigrants (see Table 15) follow a reverse pattern from those above in that those for men's and boys' cut and sew apparel manufacturing are 6.4% greater than those for the women's and girls' cut and sew apparel manufacturing at each probability of getting caught and fined. For men's and boys' cut and sew apparel manufacturing, the penalties range from $126,017.26 to $37,584.10 over the λ values from 0.05 to 0.15. For women's and girls' cut and sew apparel manufacturing, the penalties range from $120,974.39 to $36,080.08.

At each probability of getting caught, the per-violation penalty for violating the minimum wage that was calculated with data for 1996 for men's and boys' wear is approximately 10% less than that calculated with data for 2004 for men's and boys' cut and sew apparel manufacturing. At a 10% probability of getting caught, for example, the per-violation penalty calculated with data for 1996 is $12,996.58, compared to the penalty of $14,643.39 calculated with data for 2004 for men's and boys' cut and sew apparel manufacturing. At each probability of being caught, the per-violation penalty calculated with data for 1996 for the women's outerwear sub-sector is 14% less than that calculated with data for 2004 for women's and girls' cut and sew manufacturing. The per-violation penalty for the women's outerwear sub-sector is $13,091.40, and that for women's and girls' cut and sew manufacturing is $15,338.72.

Comparison of Estimated and Actual Penalties

This section compares the penalties estimated with data for 2004 to the penalties currently in effect for violating the minimum wage and the ban on hiring illegal immigrants. As noted in Chapter 2, the current maximum civil monetary penalties for violating the minimum wage and the ban on hiring illegal immigrants are respectively $1,000 and $10,000 per violation. The per-violation penalties for breaking the minimum-wage law that were estimated using data for 2004, assuming a 15% probability of getting caught, are eight times the current per-violation penalty. Assuming a 10% probability of being caught, the estimated penalties are approximately 13 times the current maximum penalty. At a 5% probability of getting caught, the estimated penalties grow to nearly 28 times the current maximum penalty. The analogous estimated per-violation penalties for hiring illegal immigrants exceed the current maximum penalty of $10,000 per violation by approximately 10 times at $\lambda = 0.05$, 4.5 times at $\lambda = 0.10$, and 3 times at $\lambda = 0.15$

In his study of New York City apparel contractors, Weil (2005) reported that a lump-sum fine of $49,000 for violating the minimum wage would be necessary to deter the average contracting firm from paying below the minimum wage. This dollar amount is lower than any lump-sum penalty estimated in the present study; however, Weil pointed out that, if a firm incurred a fine of $49,000, it could also lose up to $100,000 worth of business in awarded contracts, causing the firm to ultimately suffer a much larger effective penalty than $49,000. Serrano (2002) reported that in 2002 the U.S. Department of Labor had imposed a total penalty of $337,000 on two apparel production companies owned and operated by the same two people for the willful violation of the minimum wage. Serrano (2002) also reported that the U.S. Department of Labor had imposed fines ranging from $9,562 to $70,000 for minimum-wage violations on several California apparel companies. Although these penalties are large, they are not as large as those estimated in this study. In addition, the imposed penalties noted above may constitute only a few of the fines assessed by the Department of Labor for minimum-wage violations in the apparel industry. As mentioned in Chapter 2, fines are seldom imposed and the more common action by the Department of Labor is to only require payment of back wages. Ralsky (2002) reported that a total of $6 million in back wages was collected for 263,593 apparel workers in 2002. Although $6 million in back wages is a large total amount, it did not penalize the firms when taking into account their excess profits while violating the minimum wage.

As described in Chapter 2, the inspection of firms for suspected hiring of illegal immigrants and the assessment of fines for hiring such immigrants have been historically infrequent and unorganized (U.S. Department of Justice, Office of the Inspector General, 1996).

Prior to 2003, when the Immigration and Naturalization Service oversaw IRCA regulation, worksite inspections were a low priority. The INS devoted only approximately 2% of its worksite enforcement staff to worksite inspections, resulting in minimal risk to firms of being investigated for potential violations of the IRCA (USGAO, 1999). The USGAO (1999) reported that, between October 1996 and May 1998, 2,643 illegal immigrants were arrested in the U.S. for working in the apparel and textile industry. Given the total number of employer investigations, the average number of illegal immigrants per firm would have been about eight, resulting in a total maximum fine of about $80,000 per employer. Current reports available from the U.S. Immigration and Customs Enforcement (2006) describe penalties assessed in 2005, but none is specific to the apparel industry.

Summary of Findings

The own-price elasticity of production labor demand (η) estimated for each of the three apparel sub-sectors indicates relatively inelastic demand for production labor in the sub-sectors. The sensitivity analysis performed with a range of η values from 0 to - 1.5 indicates that calculated penalties vary little with the value of η. The calculated per-violation penalties depend more on the probability of getting caught and fined and the disparity between the wages paid and the wages required by the labor laws in question.

The estimates of the own-price elasticity of production labor demand indicate an inelastic response to changes in production wages in the U.S. apparel sub-sectors examined. Compared to the other two sub-sectors, the men's and boys' wear sub-sector has a relatively more elastic response to changes in wages with a 0.17% decrease (increase) in the quantity of production labor for a 1% increase (decrease) in wages. The women's outerwear and children's outerwear sub-sectors have similar η values of - 0.10 and - 0.09 respectively, indicating less response to changes in production labor wages than in the men's and boys' wear sub-sector. One likely explanation for the inelastic response of production labor demand to changes in wages in U.S. apparel manufacturing is the industry's limited substitution of capital for labor, as demonstrated by Ramcharran (2001).

The sensitivity analysis shows that, even over a wide range of values of the own-price elasticity of demand for production labor, the per-violation penalties estimated to deter violation of the two labor laws in question are greater than the per-violation penalties currently in place. This is true for the penalties for minimum-wage violations and for hiring illegal immigrants, although the differences between the estimated and actual penalties are larger in the case of the minimum wage at each probability of being caught from 0.5 and 0.15. The per-violation penalties estimated in this study to deter violation of the minimum wage are 8 to 28 times the current maximum penalty. The per-violation penalties estimated to deter violations of the IRCA are 3 to 10 times the maximum penalty provided by law.

CHAPTER 6

CONCLUSIONS AND IMPLICATIONS

The purpose of this study was to estimate monetary penalties that would make the average U.S. apparel manufacturer indifferent between violating and not violating the minimum wage or the ban on hiring illegal immigrants. The major conclusions of the study follow.

1. In all three apparel sub-sectors examined, the own-price elasticity of production labor demand is quite inelastic to changes in production labor wage rates. Partly, for this reason, firms in the three examined sub-sectors would be motivated to seek out cheap labor, which helps explain why wages in apparel manufacturing are among the lowest of any U.S. manufacturing industry. Furthermore, the motivation to keep wages low may make it more likely that, compared to firms in manufacturing industries with more elastic labor demand, firms in the three sub-sectors of interest would violate labor laws that can have the effect of raising wage rates. The minimum wage and the ban on hiring illegal immigrants are two such labor laws. The inelastic own-price production labor demand that was found in this study for each examined apparel sub-sector indicates that firms in each sub-sector require a given amount of labor to operate apparel factories and, in order to maintain the necessary workforce, would be forced to pay higher wages should wage rates increase.

2. For the model to estimate penalties for violating the two labor laws in question, the elasticity of demand for production labor with respect to workers' wages had an influence on the penalties needed to dissuade apparel firms from violating the labor laws over the range of elasticity values considered; however, the results of the sensitivity analysis indicate that the value of the elasticity of production labor demand has less effect on the penalties for minimum-wage violations than on those for IRCA violations.

3. The current penalties for violating the minimum wage and the ban on hiring illegal immigrants appear insufficient to deter apparel manufacturers from violating those labor laws. Considering the current relatively low risk of being caught in violation and the current maximum civil monetary penalties if caught (USDL, 2006a; U.S. Department of Agriculture, 2001), the expected profit a firm can earn when underpaying workers provides a strong motivation for unscrupulous firms to operate sweatshops. On the basis of the evidence provided by this study, the financial incentives for an apparel manufacturing firm to violate the minimum wage or hire illegal immigrants could be greatly reduced by increasing the fines for violations.

The current maximum penalty for violating the minimum wage is $1000 per violation (USDL, 2006a) and that for hiring illegal immigrants is $10,000 per violation (U.S. Department of Agriculture, 2001). Across all the examined apparel sub-sectors, labor laws, violation rates, and probabilities of being caught and fined, the calculated penalties for making the average apparel firm indifferent between violating and not violating the labor laws in question were much higher than those currently in place. The per-violation penalties for violating the minimum wage that were calculated with the most recent available data, those for 2004, are approximately 8 to 28 times the maximum penalty currently in place for minimum-wage violations. The penalties for hiring illegal immigrants that were calculated with data for 2004 are 4 to 13 times the maximum penalty currently in place.

Implications

As discussed in Chapter 2, the U.S. apparel industry has come to be dominated by retailers, who wield considerably more market power than the manufacturers. The U.S. apparel industry has changed dramatically in other ways. The dramatic change is partially reflected in the decline in the number of manufacturing establishments in the three examined apparel sub-sectors from 1996 to 2004, as shown in the County Business Patterns data discussed in Chapter 2. The decline in the number of U.S. manufacturing establishments has occurred as the production of apparel for the U.S. market has progressively moved to low-wage countries (Bonachich et. al, 1994). The movement of production to low-wage countries has greatly increased the import competition in the U.S. apparel market. The imported goods often carry lower prices than domestically produced apparel, which has put pressure on firms producing apparel domestically to keep their product prices low to meet retailers' price demands. The combination of low-price apparel imports and the lowering of prices for domestically produced apparel is an important factor behind the price deflation trend in the U.S. apparel market since the mid-1990s (Dickerson, 1999). The price deflation trend is characterized by a reduction of apparel prices relative to the prices for other consumer goods. The penalties estimated in this study are high enough that a domestic apparel manufacturer forced to pay them would take a loss in profit. The firm could try to pass the cost of the penalty on to retailers in the form of a price increase for goods, but the increased prices charged to retailers would reduce the competitiveness of the apparel manufacturer for retailer contracts. Given the competitive market environment in the apparel industry, it is unlikely that a manufacturing firm would pass the cost of a penalty on to retailers if it wished to remain in business.

Increasing the probability of getting caught in violation of the minimum wage and the ban on hiring illegal immigrants (perhaps through increased monitoring efforts) would greatly reduce the penalty needed to deter sweatshop operators. The monitoring of the apparel industry's compliance with labor laws has declined in recent years, however, due in part to the low priority given to such monitoring. Increased costs and reduced funding for hiring investigators have hindered the monitoring efforts of the Department of Labor (Ross, 2004). The hindrance to monitoring may have allowed sub-minimum wage rates and employment of illegal immigrants to flourish in the U.S. apparel manufacturing industry. The prospect of paying much larger penalties than those currently in effect for violating labor laws may serve as an effective deterrent to breaking those laws without additional expense to the government, and therefore provide a cost-effective and reasonable means to reduce the use of sweatshop labor in the United States. Although monitoring efforts at the federal level have dwindled, enforcement agencies in states like New York and California are actively monitoring apparel manufacturers' compliance with labor laws. State-level agencies that monitor compliance would be interested in knowing which apparel firms to target in order to efficiently use time and resources. Differences between the examined sub-sectors' per-violation penalties could give insight into the types of firms that may require the most monitoring.

The penalties estimated in this research were calculated using national industry data at the sub-sector level. Nevertheless, the penalties are similar enough across the three examined apparel sub-sectors that the average of the penalties for violating either labor law in question would provide a substantial penalty that would deter infraction of the law by the average firm in any of those sub-sectors. A reasonable assumption is that penalties assessed for breaking a particular federal labor law would be the same for any employer in any industry, regardless of differences in the violation rate among industries; however, because available evidence suggests that the incidence of apparel sweatshops is largest in regions having large concentrations of apparel producers, state-specific penalties in excess of federal penalties for labor-law violations may be necessary to root out sweatshops in the states most affected. States with high concentrations of apparel producers, notably California and New York, have task forces and investigative agencies devoted solely to monitoring apparel firms' compliance with labor laws.

These states may benefit from having the authority to assess penalties for labor-law violations that are close to those estimated in this study, in addition to federal monetary penalties.

A further implication of the results of this study relates to the large difference between the per-violation penalties calculated with data for 1996 and those calculated with data for 2004. The large difference suggests that allowable fines for labor-law infractions require frequent periodic evaluation of the need to adjust them for inflation. The penalties calculated with data for 2004 average 10% higher than those calculated with data for 1996 because of inflation. Although the labor laws of interest in this study do allow the adjustment of the penalties for inflation, failure to adjust the penalties in a timely manner reduces the deterrence over time to break the statutes. Without updating the penalties to keep up with inflation, sweatshop operators or other apparel manufacturers could continue to violate labor laws with less and less threat to their business.

Future research

This research provides information that can be used to develop a cost-effective policy solution to some of the major problems with apparel sweatshops in the United States. The information provided by this research may also increase understanding of the dimensions of the sweatshop problem. This thesis has noted the paucity of data of many types concerning sweatshop operations. Research and data gathering to provide detailed accounts of U.S. sweatshop facilities and practices, including legal violations, would aid the formulation of solutions to labor abuses in these operations.

Examples of needed information are current data on the degree of underpayment of sweatshop workers, the number of undocumented workers in sweatshops, the proportion of such workers in the sweatshop labor force, and the specific locations of U.S. sweatshop facilities.

Current data on the number of violations of the minimum wage and the ban on hiring illegal immigrants in the U.S. apparel industry are also needed. It is nevertheless recognized that research and data gathering to generate the indicated information would be difficult because of the clandestine nature of sweatshops.

Research on potential programs for information sharing between federal enforcement agencies could provide insight into ways to improve the efficiency of monitoring compliance with labor laws and thereby increase the penalization of sweatshop operators for labor-law infractions. It is of interest to see if labor-law monitoring practices could benefit from information sharing; for example, if the Wage and Hour Division of the U.S. Department of Labor investigated the payroll of a firm discovered to employ illegal immigrants, it may be useful to share that information with the U.S. Immigration and Customs Enforcement, which enforces the prohibition of hiring such immigrants. Along similar lines, analyses directed to finding ways to improve U.S. apparel manufacturers' compliance with regulations under the Occupational Safety and Health Act and the Equal Employment Opportunity Act could produce policy recommendations to help resolve the sweatshop problem in the United States.

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APPENDIX A

Derivation of Equation 7 and Computation of Equation 9

The derivation of Equation 9 requires several steps. The variables in the equation are as follow:

r = price of capital;

w_L = legal wage;

w_I = illegal wage;

λ = the probability of getting caught violating labor laws;

$(1 - \lambda)$ = the probability of not getting caught violating labor laws; and

D = the lump-sum penalty for violating labor laws.

The first step is to derive the expected value of the profit function in Equation 7 from Equation 6, labeled here respectively as Equations 7.0 and 6.0.

$$(1 - \lambda)\Pi(w_I, r, p) + \lambda\Pi(w_L, r, p) - \lambda D - \Pi(w_L, r, p) > 0. \quad (6.0)$$

Factor out $\Pi(w_L, r, p)$, the second and fourth terms in Equation 6.0, to yield Equation 6.1.

$$(1 - \lambda)\Pi(w_I, r, p) + (\lambda - 1)\,\Pi(w_L, r, p) - \lambda D > 0. \quad (6.1)$$

Multiply the term $(\lambda - 1)$ in Equation 6.1 by 1, as follows.

$$(-1)(-1)(\lambda - 1) = (-1)\,[(-1)\,\lambda - (-1)(1)]\,. \quad (6.2)$$

When Equation 6.2 is applied to Equation 6.1, this results in

$$(1 - \lambda)\Pi(w_I, r, p) + (-1)(1 - \lambda)\,\Pi(w_L, r, p) - \lambda D > 0. \quad (6.3)$$

Factor out $(1 - \lambda)$ from Equation 6.3 to obtain Equation 7.0.

$$(1 - \lambda)[\,\Pi(w_I, r, p) - \Pi(w_L, r, p)] - \lambda D > 0. \quad (7.0)$$

The next step is to derive Equation 8.0 from Equation 7.0. Following Ashenfelter and Smith (1979), the profit functions in the bracketed term of Equation 7.0 can be approximated by a Taylor series expansion so that the bracketed term ultimately becomes

$$[\Pi(w_I, r, p) - \Pi(w_L, r, p)] \approx Q_{PL}(w_L - w_I) - \tfrac{1}{2}(\partial Q_{PL}/\partial w_I)(w_L - w_I)^2, \qquad (8.0)$$

where

$Q_{PL} = \partial\Pi/\partial h_{wI}(w_I) = f_{wI}$ = quantity of production labor hours, and

$\partial Q_{PL}/\partial w_I = \partial^2\Pi/\partial h_{wI}(w_I)\partial h_{wI}(w_I)$.

The equations below, from Equation 7.1 to Equation 8.0, describe the steps neccessary to produce Equation 8.0 from Equation 7.0. The terms in these equations are defined as follow:

$w_I =$ a constant equal to the wage at which the profit function is evaluated; in this case $w_I =$ the illegal wage.

$f_i = \partial\Pi/\partial h_i(i)$ with $i = \{w_I, w_L, r, p\}$

$f_{ij} = \partial^2\Pi/\partial h_i(i)\partial h_j(j)$ with $i, j = \{w_I, w_L, r, p\}$.

The bracketed term in Equation 7.0, $[\ \Pi(w_I, r, p) - \Pi(w_L, r, p)]$, is approximated using a Taylor series approximation as follows.

$$\begin{aligned}
& f(w_I) + f_{wI}[h_{wI}(w_I) - h_{wI}(w_I)^o] + f_r[h_r(r) - h_r(r)^o] + f_p[h_p(p) - h_p(p)^o] + \tfrac{1}{2}\{f_{wIwI}[h_{wi}(w_I) - h_{wI}(w_I)^o]^2 + \\
& f_{wIr}[h_{wi}(w_I) - h_{wI}(w_I)^o][h_r(r) - h_r(r)^o] + f_{wIp}[h_{wI}(w_I) - h_{wI}(w_I)^o][h_p(p) - h_p(p)^o] + f_{rr}[h_r(r) - h_r(r)^o]^2 + \\
& f_{rp}[h_r(r) - h_r(r)^o][h_p(p) - h_p(p)^o] + f_{rwI}[h_r(r) - h_r(r)^o][h_{wI}(w_I) - h_{wI}(w_I)^o] + f_{pp}[h_p(p) - h_p(p)^o]^2 + \\
& f_{pr}[h_p(p) - h_p(p)^o]\ )][h_r(r) - h_r(r)^o] + f_{pwI}[h_p(p) - h_p(p)^o][h_{wI}(w_i) - h_{wI}(w_I)^o]\} - \{f(w_I) + f_{wI}[h_{wi}(w_L) - \\
& h_{wi}(w_I)^o] + f_r[h_r(r) - h_r(r)^o] + f_p[h_p(p) - h_p(p)^o] + \tfrac{1}{2}\{f_{wIwI}[h_{wL}(w_L) - h_{wi}(w_i)^o]^2 + f_{wIr}[h_{wL}(w_L) - \\
& h_{wi}(w_I)^o][h_r(r) - h_r(r)^o] + f_{wIp}[h_{wL}(w_L) - h_{wi}(w_I)^o][h_p(p) - h_p(p)^o] + f_{rr}[h_r(r) - h_r(r)^o]^2 + f_{rp}[h_r(r) - \\
& h_r(r)^o][h_p(p) - h_p(p)^o] + f_{rwI}[h_r(r) - h_r(r)^o][h_{wI}(w_I) - h_p(w_I)^o] + f_{pp}[h_p(p) - h_p(p)^o]^2 + f_{pr}[h_p(p) - \\
& h_p(p)^o]\ )][h_r(r) - h_r(r)^o] + f_{pwI}[h_p(p) - h_p(p)^o][h_{wL}(w_L) - h_{wi}(w_I)^o]\}. \qquad (7.1)
\end{aligned}$$

Application of Young's theorem, which states that two cross-partial derivatives are identical as long as they are continuous, imposes symmetry and allows the elimination of terms. In addition, evaluating both profit functions in the bracketed term in Equation 7.0 at w_I causes several terms in Equation 7.1 to become zero or cancel out, as shown in Equation 7.2.

$$
\begin{aligned}
& f(w_I) + f_{wI}[h_{wI}(w_I) - h_{wI}(w_I)^o] + f_r[h_r(r) - h_r(r)^o] + f_p[h_p(p) - h_p(p)^o] + \tfrac{1}{2}\{f_{wIwI}[h_{wi}(w_I) - h_{wI}(w_I)^o]^2 + \\
& f_{wIr}[h_{wi}(w_I) - h_{wI}(w_I)^o][h_r(r) - h_r(r)^o] + f_{wIp}[h_{wI}(w_I) - h_{wI}(w_I)^o][h_p(p) - h_p(p)^o] + f_{rr}[h_r(r) - h_r(r)^o]^2 + \\
& f_{rp}[h_r(r) - h_r(r)^o][h_p(p) - h_p(p)^o] + f_{rwI}[h_r(r) - h_r(r)^o][h_{wI}(w_I) - h_{wI}(w_I)^o] + f_{pp}[h_p(p) - h_p(p)^o]^2 + \\
& f_{pr}[h_p(p) - h_p(p)^o])][h_r(r) - h_r(r)^o] + f_{pwI}[h_p(p) - h_p(p)^o][h_{wI}(w_i) - h_{wI}(w_I)^o]\} - \{f(w_I) + f_{wI}[h_{wi}(w_L) - \\
& h_{wi}(w_I)^o] + f_r[h_r(r) - h_r(r)^o] + f_p[h_p(p) - h_p(p)^o] + \tfrac{1}{2}\{ f_{wIwI}[h_{wL}(w_L) - h_{wi}(w_I)^o]^2 + f_{wIr}[h_{wL}(w_L) - \\
& h_{wi}(w_I)^o][h_r(r) - h_r(r)^o] + f_{wIp}[h_{wL}(w_L) - h_{wi}(w_I)^o][h_p(p) - h_p(p)^o] + f_{rr}[h_r(r) - h_r(r)^o]^2 + f_{rp}[h_r(r) - \\
& h_r(r)^o][h_p(p) - h_p(p)^o] + f_{rwI}[h_r(r) - h_r(r)^o][h_{wI}(w_I) - h_p(w_I)^o] + f_{pp}[h_p(p) - h_p(p)^o]^2 + f_{pr}[h_p(p) - \\
& h_p(p)^o])][h_r(r) - h_r(r)^o] + f_{pwI}[h_p(p) - h_p(p)^o][h_{wL}(w_L) - h_{wi}(w_I)^o]\}\}. \qquad (7.2)
\end{aligned}
$$

The cancelling of terms shown in Equation 7.2 yields Equation 7.3.

$$\{[-Q_{pl}][h_{wI}(w_L) - h_{wI}(w_I)^o]\} + \tfrac{1}{2}\{[-\partial Q_{PL}/\partial h_{wL}(w_I)][h_{wL}(w_L) - h_{wi}(w_I)^o]^2\}. \qquad (7.3)$$

Assume $h_{wa}(w_a) = w_a$ so that substituting Q_{PL} for $\partial\Pi/\partial h_{wI}(w_I)$ and $\partial Q_{PL}/\partial w_I$ for $\partial^2\Pi/\partial h_{wI}(w_I)\partial h_{wI}(w_I)$ yields,

$$Q_{PL}(w_L - w_I) + \tfrac{1}{2}(-\partial Q_{PL}/\partial w_I)(w_L - w_I)^2. \qquad (8.0)$$

By substituting the approximated expression in Equation 8.0 for the bracketed term in Equation 7.0, the resulting equation is

$$(1 - \lambda)\,[Q_{PL}(w_L - w_I) + \tfrac{1}{2}(-\partial Q_{PL}/\partial w_I)(w_L - w_I)^2] - \lambda D > 0. \qquad (8.1)$$

Rearranging Equation 8.1 yields

$$Q_{PL}(w_L - w_I) + \tfrac{1}{2}(-\partial Q_{PL}/\partial w_I)(w_L - w_I)^2 > \lambda D/(1 - \lambda). \qquad (8.2)$$

Multiply $(-\partial Q_{PL}/\partial w_I)$ by 1 to write $(Q_{PL}/w_I * w_I/ Q_{PL})$, which is then substituted in Equation 8.2 to give

$$Q_{PL}(w_L - w_I) + ½(-\partial Q_{PL}/\partial w_I)(Q_{PL}/wI * wI/ Q_{PL})(w_L - w_I)^2 > \lambda D/(1-\lambda). \quad (8.3)$$

Substituting η for $(-\partial Q_{PL}/\partial w_I)(w_I/ Q_{PL})$ generates Equation 9.0, which is the same as Equation 9 in Chapter 3. The term η is the own-price elasticity of demand for production labor.

$$Q_{PL}(w_L - w_I) + ½(Q_{PL}/wI)(w_L - w_I)^2 \eta > \lambda D/(1 - \lambda). \quad (9.0)$$

APPENDIX B

Derivation of C(*) Using a Taylor Series Approximation

A Taylor series expansion was used to approximate the cost function C(*) for each apparel manufacturing sub-sector of interest. The derivation of the function that was estimated is shown below. The variables in the cost function are as follow:

Y = level of output;

P_{PL} = price of production labor;

P_{OL} = price of other labor; and

P_K = price of capital.

Assume the following.

$f_{PL} = \partial f(*)/\partial\, h(P_{PL})$ $\quad f_{PLPL} = \partial^2 f(*)/\partial h(P_{PL})\partial\, h(P_{PL})$

$f_{OL} = f(*)/\partial h(P_{OL})$ $\quad f_{OLOL} = \partial^2 f(*)/\partial h(P_{OL})\partial h(P_{OL})$

$f_K = f(*)/\partial\, h(P_k)$ $\quad f_{KK} = \partial f^2(*)/\partial h(P_k)\partial h(P_k)$

$f_Y = \partial f(*)/\partial\, h(Y)$ $\quad f_{YY} = \partial f^2(*)/\partial h(Y)\partial h(Y)$

The initial step in the derivation is to expand the cost function and impose symmetry on the expanded function.

$$C\,(P_{PL}, P_{OL}, P_k, Y) = f(x^o) + f_{PL}\,[h(P_{PL}) - h(P_{PL}{}^o)] + f_{OL}\,[h(P_{OL}) - h(P_{OL}{}^o)] + f_K\,[h(P_k) - h(P_k{}^o)] + f_Y\,[Y - Y^\circ] + \tfrac{1}{2}\{\, [f_{PLPL}\,[h(P_{PL}) - h(P_{PL}{}^o)]^2 + 2[f_{PLOL}[\, h(P_{PL}) - h(P_{PL}{}^o)][h(P_{OL}) - h(P_{OL}{}^o)]] + 2[f_{PLK}[h(P_{PL}) - h(P_{PL}{}^o)][h(P_k) - h(P_k{}^o)]] + 2[f_{PLY}[h(P_{PL}) - h(P_{PL}{}^o)][h(Y) - h(Y^o)]] + f_{OL}\,[h(P_{OL}) - h(P_{OL}{}^o)]^2 + 2[f_{OLK}[\, h(P_{OL}) - h(P_{OL}{}^o)][h(P_k) - h(P_k)]] + 2[f_{OLY}[\, h(P_{OL}) - h(P_{OL}{}^o)][h(Y) - (Y^o)] + P_{KK}[\, h(P_k) - h(P_k{}^o)]^2 + f_{YY}[h(Y) - h(Y^o)]^2\}. \qquad (10)$$

The next step is to transform Equation 10 into a trans-log function, defining f(*) = lnC and $h(P_i) = \ln P_i$ and $f_i = \partial \ln C/\partial \ln P_i$ where i = {PL, OL, K}.

$$\ln C\ (\ln P_{PL}, \ln P_{OL}, \ln P_{k}, \ln Y) = \ln(x^{o}) + f_{PL}\ [\ln P_{PL} - \ln P_{PL}^{o}) + f_{OL}\ [\ln P_{OL} - \ln P_{OL}^{o}] + F_{K}\ [\ln P_{k} - \ln P_{k}^{o}] + F_{Y}$$

$$[\ln Y - \ln Y^{\circ}] + \tfrac{1}{2}\{\ [f_{PLPL}\ [\ln P_{PL} - \ln P_{PL}^{o}]^{2} + 2[f_{PLOL}[\ \ln P_{PL} - \ln P_{PL}^{o}][\ln P_{OL} - \ln P_{OL}^{o}]] + 2[f_{PLK}[\ln P_{PL} -$$

$$\ln P_{PL}^{o}][\ln P_{k} - \ln P_{k}^{o}]] + 2[f_{PLY}[\ln P_{PL} - \ln P_{PL}^{o}][\ln Y - \ln Y^{o}]] + f_{OL}[\ln P_{OL} - \ln P_{OL}^{o}]^{2} + 2[f_{OLK}[\ln P_{OL} -$$

$$\ln P_{OL}^{o}][\ln P_{k} - \ln P_{k}^{\circ}]] + 2[f_{OLY}[\ \ln P_{OL} - \ln P_{OL}^{o}][\ln Y - \ln Y^{o}]] + f_{KK}[\ \ln P_{k} - \ln P_{k}^{o}]^{2} + f_{KY}[\ \ln P_{k} - \ln P_{k}^{o}][\ln Y -$$

$$\ln Y^{o}] + F_{YY}[\ln Y - \ln Y^{o}]^{2}\}. \quad (11.0)$$

Multiply through and remove the brackets to obtain

$$\ln C\ (\ln P_{PL}, \ln P_{OL}, \ln P_{k}, \ln Y) = \ln(x^{o}) + f_{PL}\ln P_{PL} - f_{PL}\ln P_{PL}^{o} + f_{OL}\ln P_{OL} - f_{OL}\ln P_{OL}^{o} + F_{K}\ln P_{k} -$$

$$F_{K}\ln P_{k}^{o} + F_{Y}\ln Y - F_{Y}\ln Y^{\circ} + \tfrac{1}{2}f_{PLPL}(\ln P_{PL})^{2} - f_{PLPL}\ln P_{PL}\ln P_{PL}^{\circ} + \tfrac{1}{2}f_{PLPL}(\ln P_{PL}^{o})^{2} + f_{PLOL}\ln P_{PL}\ln P_{OL}$$

$$- f_{PLOL}\ln P_{PL}^{o}\ln P_{OL} - f_{PLOL}\ln P_{PL}\ln P_{OL}^{\circ} - f_{PLOL}\ln P_{PL}^{\circ}\ln P_{OL}^{\circ} + f_{PLK}\ln P_{PL}\ln P_{K} - f_{PLK}\ln P_{PL}^{o}\ln P_{k} -$$

$$f_{PLK}\ln P_{PL}\ln P_{k}^{\ \circ} + fP_{PLK}\ln P_{PL}^{\circ}\ln Pk^{\circ} + f_{PLY}\ln P_{PL}\ln P_{Y} - f_{PLY}\ln P_{PL}^{o}\ln Y - f_{PLY}\ln P_{PL}\ln Y^{\circ} +$$

$$f_{PLY}\ln P_{PL}^{\circ}\ln Y^{\circ} + \tfrac{1}{2}f_{OL}(\ln P_{OL})^{2} - f_{OL}\ln P_{OL}\ln P_{OL}^{o} + \tfrac{1}{2}f_{OL}(\ln P_{OL}^{\circ})^{2} + f_{OLK}\ln P_{OL}\ln P_{K} -$$

$$f_{OLK}\ln P_{OL}^{o}\ln P_{k} - f_{OLK}\ln P_{OL}\ln P_{k}^{\circ} + f_{OLK}\ln P_{OL}^{\circ}\ln P_{k}^{\circ} + f_{OLY}\ln P_{OL}\ln Y - f_{OLY}\ln P_{OL}^{o}\ln Y -$$

$$f_{OLY}\ln P_{OL}\ln Y^{\circ} - f_{OLY}\ln P_{OL}^{o}\ln Y^{o} + \tfrac{1}{2}f_{KK}(\ln Pk)^{2} - f_{KK}\ \ln P_{k}\ln P_{k}^{o} + \tfrac{1}{2}\ f_{KK}(\ln P_{k}^{o})^{2} + f_{KY}\ln P_{k}Y -$$

$$f_{KY}\ln P_{k}^{o}\ln Y - f_{KY}\ln P_{k}\ln Y^{\circ} - f_{KY}\ln P_{k}^{\circ}\ln Y^{\circ} + \tfrac{1}{2}f_{YY}(\ln Y)^{2} - f_{YY}\ln Y\ln Y^{o} + \tfrac{1}{2}f_{YY}(\ln Y^{o})^{2}. \quad (11.1)$$

The restrictions implied by constant returns to scale are then imposed on Equation 11.1. Constant returns to scale imply that

$(\partial \ln C/\partial \ln Y) = 1.$

The proof of the above relationship follows.

Constant returns to scale require that $C(\lambda Y) = \lambda C(Y)$, where C is a cost function, Y is output, and λ is a constant. The expression simply requires that an increase in output is associated with a proportional increase in cost.

$$\partial \ln C/\partial \ln Y = \frac{\Delta C}{\Delta Y} * \frac{Y}{C},$$

where ΔC is $C_2 - C_1$ and ΔY is $Y_2 - Y_1$; further, C_2 and Y_2 are λC and λY respectively, where λ is some constant. It is therefore seen that

$$\frac{C_2 - C_1}{Y_2 - Y_1} * \frac{Y}{C} = \frac{\lambda C - C}{\lambda Y - Y} * \frac{Y}{C} = \frac{(\lambda-1)C}{(\lambda-1)Y} * \frac{Y}{C} = 1.$$

The first derivative, $\partial \ln C/\partial \ln Y$, which is the cost elasticity of output, is a constant equal to 1 under constant returns to scale; therefore, all terms containing f_{iY} in Equation 11.1 are equal to zero, as the slope of a constant is zero. This is shown by the following example.

$f_{YY} = \partial\ (\partial \ln C/\partial \ln Y)/\ \partial Y = \partial 1/\partial Y\ = 0.$

Thus, $\frac{1}{2}\ f_{YY}(\ln Y)^2 = 0$.

After imposing constant returns to scale on Equation 11.1, the equation becomes,

$$\ln C\ (Y,P_{PL}, P_{OL}, R) = \ln\alpha^o + \ln Y + f_{PL}\ [\ln P_{PL} - \ln P_{PL}{}^o] + f_{OL}[\ \ln P_{OL} - \ln P_{OL}{}^o] + F_K\ [\ \ln P_k - \ln P_k{}^o] + \tfrac{1}{2}\{\ f_{PLPL}\ [\ln P_{PL} - \ln P_{PL}{}^o]^2 + f_{PLOL}[\ln P_{PL} - \ln P_{PL}{}^o][\ln P_{OL} - \ln P_{OL}{}^o] + f_{PLK}\ [\ln P_{PL} - \ln P_{PL}{}^o][\ln P_k - \ln P_k{}^o] + f_{OLOL}[\ln P_{OL} - \ln P_{OL}{}^o]^2 + f_{OLK}\ [\ln P_{OL} - \ln P_{OL}{}^o][\ln P_k - \ln P_k{}^o] + f_{KK}\ [\ln P_k - \ln P_k{}^o]^2\}. \quad (12.0)$$

The following steps show the substitution of terms in Equation 12.0 to ultimately yield Equation 14 in Chapter 4. Equation 12.1 below is the expansion of Equation 12.0.

$$\ln\alpha^\circ = \ln(x^o) + f_{PL}\ln P_{PL} - f_{PL}\ln P_{PL}{}^o + f_{OL}\ln P_{OL} - f_{OL}\ln P_{OL}{}^o + F_K\ln P_k - F_K\ln P_k{}^o + \ln Y - \ln Y^\circ + \tfrac{1}{2}f_{PLPL}(\ln P_{PL}{}^o)^2 + f_{PLOL}\ln P_{PL}{}^\circ\ln P_{OL}{}^\circ + fP_{PLK}\ln P_{PL}{}^\circ\ln Pk^\circ + f_{PLY}\ln P_{PL}{}^\circ\ln Y^\circ + \tfrac{1}{2}f_{OL}(\ln P_{OL}{}^\circ)^2 + f_{OLK}\ln P_{OL}{}^\circ\ln P_k{}^\circ + f_{OLY}\ln P_{OL}{}^o\ln Y^o + \tfrac{1}{2}\ f_{KK}(\ln P_k{}^o)^2 + f_{KY}\ln P_k{}^\circ\ln Y^\circ. \quad (12.1)$$

In Equation 12.1, all terms that contain only constants, denoted $P_i{}^\circ$, are factored out and the sum is denoted α°. Next, all terms that only contain P_i multiplied by constants are isolated, and P_i is factored out. As shown below, the constant terms multiplied by P_i are denoted ρ_i where $i = \{PL, OL, K, Y\}$. Thus,

$\ln P_{PL}\ \rho_{PL}$ where $\rho_{PL} = - f_{PLPL}\ln P_{PL}{}^\circ - f_{PLOL}\ln P_{OL}{}^\circ - f_{PLK}\ln P_k{}^\circ - f_{PLY}\ln Y^\circ$

$\ln P_{OL}\rho_{OL}$ where $\rho_{OL} = - f_{OL}\ln P_{OL}{}^o - f_{PLOL}\ln P_{PL}{}^o - f_{OLK}\ln P_k{}^\circ - f_{OLY}\ln Y^\circ$

$\ln P_k \rho_k$ where $\rho_k = - f_{PLK} \ln P_{PL}^o - f_{OLK} \ln P_{OL}^o - f_{KY} \ln Y^\circ - f_{KK} \ln P_k^o$

$\ln Y \rho_Y$ where $\rho_Y = - f_{PLY} \ln P_{PL}^o - f_{OLY} \ln P_{OL}^o - f_{KY} \ln P_k^o \ln Y$.

Finally, γ_{ij} is substituted in Equation 12.1 for the terms containing only variables that are cross-partial derivatives f_{ij}, where i, j = {PL, OL, k}. This operation yields Equation 14.

$$\ln C(Y, P_{PL}, P_{OL}, P_k) = \ln \alpha_o + \ln Y + \rho_{PL} \ln P_{PL} + \rho_{OL} \ln P_{OL} + \rho_R \ln R + 1/2\, \gamma_{PLPL} (\ln P_{PL})^2 + \gamma_{PLOL} \ln P_{PL} \ln P_{OL} + \gamma_{PLk} \ln P_{PL} \ln P_k + ½\, \gamma_{OLOL} (\ln P_{OL})^2 + \gamma_{OLR} \ln P_{OL} \ln P_k + ½\, \gamma_{kk} (\ln P_k)^2 \quad (14)$$

Equation 14 can also be written as

$$\ln C (\ln Y, P_i) = \ln \alpha^\circ + \ln Y + \Sigma \rho_i \ln P_i + 1/2 \Sigma\Sigma\, \gamma_i \gamma_j \ln P_i \ln P_j \qquad \text{with } i, j = \{PL, OL, k\}. \quad (13)$$

After the trans-log cost function has been estimated, the parameters of the function can be used to estimate η. The own-price elasticity of production labor demand, η, is computed according to the relationship used by Berndt and Woods (1975) as follows.

$$\eta = S_{PL} * \sigma_{PLPL}, \quad (15)$$

where $\sigma_{PLPL} = (\gamma_{PLPL} + S_{PL}^2 – S_{PL})/ S_{PL}^2$. (16)

Completion of the trans-log cost function for estimating η, requires finding S_{PL}, the share of production labor in the total cost of production. The definition of a cost share is

$$S_{PL} = P_{PL} x_{PL}/C, \quad (17)$$

where x_{PL} is the optimal quantity of production labor demanded, also known as the compensated labor demand, which is found by using Shepard's lemma so that

$$x_{PL} = \partial C/ \partial P_{PL}. \quad (18)$$

Using the trans-log cost function,

$$(\partial C/ \partial P_{PL}) = (\rho_{PL} + \rho_{PLOL} \ln P_{OL} + \rho_{PLk} \ln P_k) * C/P = x_{PL}. \quad (19)$$

Substituting Equation 19 into Equation 17 cancels out the P_{PL} and C terms to yield

$$S_{PL} = \rho_{PL} + \rho_{PLOL} \ln P_{OL} + \rho_{PLk} \ln P_k. \quad (19.1)$$

Now, substitute the term S_{PL} into Equation 16, and substitute Equation 16 into Equation 15 to solve for η.