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The Relationship between Import Penetration and Operation of the U.S. Textile and Apparel Industries from 2002 to 2008

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The Relationship between Import Penetration and Operation of the U.S. Textile and Apparel Industries from 2002 to 2008

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Abstract

The U.S. textile and apparel (T&A) industries have respectively adopted various restructuring strategies in recent years which fundamentally changed the way the two industries operate and the shifting relationship of each sector with imports. This study empirically tests the relationship between import penetration and the operation of the U.S. T&A industries based on data at 4-digit North American Industrial Classification System (NAICS) code level from 2002-2008. Results from the panel data model show that overall the U.S. textile industry formed a weak cooperative relationship with import penetration level in the U.S. market and a neutral relationship was suggested for the U.S. apparel industry with imports. These findings contribute to understanding the global nature of today's U.S. T&A industries and suggest useful perspectives for the U.S. textile trade policies.

Key words: U.S. textile and apparel industries, restructuring, import penetration

1 **Introduction**

2 Since 1960s, the United States has quickly become one of the largest importers of textile
3 and apparel (T&A) in the world (Dickerson, 1999). In 2009, U.S. textile and apparel imports
4 totaled \$17.90 billion and \$63.10 billion respectively, which were nearly four times as much as
5 the import volume in 1990 (OTEXA, 2010). Concurrent with the quick increase of imports, the
6 U.S. domestic T&A industries suffered from steady reduction of output and great loss of
7 employment, especially for those manufacturing-concentrated functions (Abernathy, Volpe, &
8 Weil, 2006). Understandably, imports were largely blamed for causing the difficult situation of
9 the U.S. T&A industries (Nordas, 2004). More specifically, the rising import penetration ratio
10 (IPR)—the percentage of domestic apparent consumption supplied by imports (Morgan, 1988, p.
11 13), was often identified as the threatening and disruptive factor to the survival of the U.S.
12 domestic textile and apparel firms (Krueger, 1996).

13 However, one important aspect of the story often overlooked is the dramatic restructuring
14 process that has occurred in the U.S. T&A industries in response to globalization. For example,
15 after abandoning most of the domestic production capacity in favor of outsourcing, U.S. apparel
16 firms have established solid business relationships with apparel exporting countries, either
17 through cut-and-sew contracts, opening and owning plants, or full package sourcing (Abernathy
18 et al., 2006). Regional trade packs such as the North America Free Trade Agreement (NAFTA)
19 as well as the elimination of the quota system have also enabled the U.S. textile industry to form
20 much closer ties with business partners outside the U.S. borders and to take greater advantage of
21 resources on a global basis (Gereffi,1999).

22 Capturing the relationship between import penetration and the operation of the U.S. T&A
23 industries in the globalized era is of value both to academia and government policy making. For

24 academia, this relationship is important to the understanding of the global nature of today's T&A
25 industries, particularly as to how the adoption of various restructuring strategies fundamentally
26 transformed the way the industry functions in more developed economies. If a non-competing
27 relationship different from the traditional view is suggested by the findings, it may call for
28 rethinking the conclusions of many existing theories built upon old paradigms when
29 globalization was far less influential in depth and in breadth. On the other hand, for policymakers,
30 such relationship matters to the appropriateness of trade and industrial policies intended to create
31 a favored environment for the U.S. domestic T&A industries. In particular, trade restrictions
32 stemmed from grave concerns about the negative impacts of import penetration. This perspective
33 dominated U.S. textile trade policy for decades, resulting in the creation and implementation of
34 various policy tools for the purpose of trade restriction (Dickerson, 1988). However, if imports
35 no longer pose a threat to the survival of the domestic industry, but rather the two have become
36 "partners," then a fundamental shift in the direction of policy might be suggested.

37 Although some studies have been conducted on related topics, research gaps still exist. For
38 example, some studies either focused on the patterns of U.S. T&A imports (such as Nordas,
39 2004) or explored the new business models of U.S. T&A firms as a result of adopting various
40 restructuring strategies such as capitalization, mergers and acquisitions and outsourcing (such as
41 Christoffersen & Datta, 2004; Kilduff, 2005; Parrish, Cassill, & Oxenham, 2006). However, little
42 research has focused on imports as a potentially positive factor in the operation of today's U.S.
43 T&A industries.

44 This paper tried to fulfill the current research gaps by linking the level of import penetration
45 with the operation of the U.S. T&A industries between 2002 to 2008. Specifically, two research
46 questions were studied:

47 1. By adopting the various industry restructuring strategies, do the U.S. domestic textile and
48 apparel industries respectively incorporate imports into their operations?

49 2. Is the rising import penetration level still positively associated with the decline of the
50 domestic U.S. textile and apparel industries after various industry restructuring strategies were
51 adopted?

52 To be noted, the level of import penetration shall not be simply treated as the absolute
53 volume of imports. This is because import penetration is determined jointly by the import
54 volume and the level of apparent consumption in the importing country (Morgan, 1988, p. 13).
55 Compared to the volume of imports, import penetration can more accurately reflect the role of
56 imports in fulfilling the market demand relative to the domestic supply in the importing nation.

57

58 **Literature Review**

59 *Import competition: theoretical views*

60 Many studies in this area referred to the difficult time faced by the U.S. T&A industries
61 over the past decades as the direct result of the intensive competition from rising imports
62 (Christoffersen & Datta, 2004; Hodges & Karpova, 2006). Some classic trade models are
63 helpful in explaining why the U.S. T&A industry appeared to be negatively affected by rising
64 imports, especially those less costly ones produced in the low-wage developing countries.

65 According to the Hecksher-Ohlin model (H-O model), countries usually export products for
66 which it has abundant factors of production and import products for which it has scarce factors
67 (Batra & Casas, 1973). As a capital-abundant country, the United States might be expected to
68 specialize in producing comparatively capital intensive products such as machineries. These
69 products would be exchanged for comparatively labor-intensive T&A products through trade

70 with less-developed countries having more abundant, less costly labor. Despite the overall
71 welfare gains in the United States, the H-O model suggested the “unfavorable” consequences for
72 the import-competing T&A sector in terms of the lowered relative price in the U.S. market and
73 decreased domestic output.

74 The factor-price equalization theorem (H-O-S model) developed by Paul Samuelson
75 suggested that international trade will not only equalize the relative price of trading goods, but
76 also will equalize the factor price in these countries both in relative and absolute terms (Salvatore,
77 2004). This conclusion implies that when importing T&A from lower-wage less developed
78 countries, wage levels in the U.S. T&A industries will be “forced” to go downward until
79 reaching the same level with less-developed countries (Baldwin, 2008).

80 The Rybczynski theorem further argues that holding the price of trading goods in a country
81 constant, the increase of one production factor will result in disproportionately more production of
82 the product intensively using that production factor (Krugman, 2005). Based on the Rybczynski
83 theorem, much quicker capital growth in relation to the labor force in the United States will
84 result in disproportionate reduction of comparatively labor-intensive T&A production.

85 *Import penetration and heterogeneity of the U.S. T&A industries*

86 Historically the U.S. T&A industries, especially the textile sector, unswervingly called for
87 restricting the flood of imports dominating the U.S. domestic market. However, data suggest that
88 the status of import penetration in some segments of the U.S. T&A industries may differ from
89 public perception. By the end of 2008, IPR in the U.S. textile industry (defined by North
90 America Industry Classification System NAICS 313 in this study) was still at a relatively modest
91 level of 29.1% measured by gross output and 17.9% measured by shipment (U.S. Census Bureau,
92 2010; U.S. International Trade Commission, USITC, 2010). This figure means that the majority

93 of market demand for fiber, yarn, thread and fabrics in the United States was still supplied by the
94 U.S.-made textiles instead of by imports. In comparison, the IPR in the U.S. apparel industry
95 (defined by NAICS 315 in this study) was at a much higher level of 84.3% by gross output and
96 79.5% by shipment. On the other hand, although IPR in both textile and apparel industries are on
97 the rise over the past 10 years, the growth rate is much lower for the textile industry compared to
98 the apparel industry. From 2000 to 2008, IPR in the U.S. textile industry only gained 8.9
99 percentage points while imported apparel gained more than 20 percentage points in additional
100 market share (U.S. Census Bureau, 2010; USITC, 2010).

101 The disparity of the U.S. textile industry and the apparel industry in terms of their IPR level
102 reflects the heterogeneous nature of the two industries. In general, textile manufacturing is
103 comparatively more capital and technology intensive than apparel manufacturing (Nordas, 2004).
104 Because of the abundance in capital factors, the United States enjoys more comparative
105 advantage in relatively capital-intensive textile production in relation to imports from labor-
106 abundant less-developed countries. Similarly, import penetration ratio is higher in the U.S.
107 apparel industry because of the more labor-intensive nature of apparel production which favors
108 less-developed countries.

109 *Structural change of the U.S. T&A industries*

110 The heterogeneity of textile and apparel production further affects the nature of structural
111 change and selection of restructuring strategies by the two industries. In terms of the U.S. textile
112 industry, first, the industry boosted production by investing in new machines, equipment, and
113 technology (Christoffersen et al., 2004). Capital intensity of the industry measured by the capital-
114 labor ratio, increased by nearly 20% from 2002 to 2008 (U.S. Census Bureau, 2010).
115 Capitalization and investment in technology also led to the higher productivity and lower cost of

116 textile production (Levinsohn & Petropoulos, 2001). Datta & Christoffersen (2005) suggested
117 that labor saving technical progress helped the U.S. textile industry improve its productivity by
118 2.1% and reduced production cost by 2.4% annually from 1953 to 2001.

119 Second, many U.S. textile firms enlarged production capacity through mergers and
120 acquisitions (M&A) with the main purposes of taking advantage of economies of scale and
121 achieving lower production cost (Mock, 2002). The adoption of the M&A strategy may explain
122 why large firms remain a good proportion in the U.S. textile industry despite the overall decline
123 of the total number of firms (Christoffersen et al., 2004). Empirical studies further suggested that
124 plants that survived in the U.S. textile industry emerged with stronger competitiveness while
125 those that exited were comparatively less productive (Chi, Kilduff, & Dyer, 2009).

126 Third, the U.S. textile mills improved supply chain management. As customers' demands for
127 apparel products have become more volatile and unpredictable with a shorter life cycle, textile
128 production is expected to be more "sensitive" to quick market changes (Christopher, Lowson &
129 Peck, 2004). Two main categories of strategies have been widely adopted in the U.S. textile
130 industry: one category is lean supply with the goal of reducing inventories and shortening the
131 delivery time, and the other is agile supply which intends to deliver the products more
132 "efficiently" by making the high volatility products available to the customers (Oh & Kim,
133 2007). Specific supply chain management strategies commonly applied by the U.S. textile
134 industry include quick response (QR), automatic replenishment, just-in-time (JIT) systems, point
135 of sale information, and mass customization (Oh & Kim, 2007).

136 Fourth, the U.S. textile industry actively engaged in the building of regional production
137 networks with countries that are geographically close to the United States. This strategy received
138 strong support from U.S. trade policymakers by intentionally adding special provisions

139 encouraging the use of United States-made yarns or fabrics in the preferential trade agreements
140 reached with trading partners (Gereffi, Spener & Bair, 2002). In these agreements, imports from
141 partner countries receive preferential tariff treatment. By the end of 2009, the United States had
142 reached eleven such free-trade agreements and four preferential trade agreements with less-
143 developed countries mostly located in the Americas. Statistics from the Office of Textile and
144 Apparel (OTEXA) indicated that from 2000 to 2009, more than 50% of U.S. textile mill exports
145 went to partners under the NAFTA and DR-CAFTA.

146 Compared with the U.S. textile industry, the U.S. apparel industry had a more difficult
147 time facing the flood of imports coming from the low-wage countries. High domestic production
148 cost, especially labor, is regarded as one of the greatest disadvantages for the U.S. apparel
149 industry to compete on price (Gereffi et al., 2002). On the other hand, contrary to the case in the
150 textile industry, the nature of apparel manufacturing makes it quite difficult to incorporate
151 automation (Dickerson, 1999).

152 Over time as retailers bought increasing quantities of low cost imports, the fierce
153 competition caused the U.S. apparel industry to abandon most of the domestic production
154 capacity in favor of outsourcing and offshore sub-contracting (Kim & Rucker, 2005). Gereffi et
155 al. (2002) proposed that two types of apparel firms emerged quickly in the industry: one is
156 “marketers,” which are engaged in design and marketing activities and characterized as
157 manufacturers without factories (such as Liz Claiborne (prior to name change) and Ralph
158 Lauren). The other type is “branded manufacturers” which still deal with activities ranging from
159 design, cutting, assembly, laundry to marketing (such as Levi Strauss and VF Corporation).
160 However, the key role of “branded manufacturers” is to organize and oversee the whole
161 production process rather than simply manufacture by themselves (Gereffi et al., 2002). Over

162 time, these distinctions are less clear, however, for both “marketers” and “branded
163 manufacturers,” or other types that emerge, their operations are based on the close contracting
164 networks with overseas companies, especially manufacturers in the less-developed countries.
165 These transformed U.S. apparel firms did not regard imports as competitors. Quite the opposite,
166 a large portion of U.S. apparel imports actually were arranged by “marketers” and “branded
167 manufacturers.”

168 Ironically, U.S. retailers became the emerging competitors for U.S. apparel firms. Although
169 retailers were the customers of apparel firms, they became ambitious in establishing their own
170 sourcing network so as to shorten the lead time, reduce the sourcing cost, and enhance their
171 margins (Gereffi et al., 2002; Dickerson, 1999). At the same time, some large-scale-U.S. apparel
172 firms, including branded manufacturers have also extended their business realm into the retailing
173 sector by means of forward integration (Kilduff, 2005). The phenomenon of “scrambled
174 softgoods chain” within which some traditional steps in the supply-chain are skipped may also be
175 found in the U.S. apparel industry (Dickerson, 1999).

176 On the other hand, although imported apparel through sourcing networks has played a
177 dominant role in supplying the U.S. apparel market, the U.S. apparel industry still maintains
178 certain local production bases, such as in New York and Los Angeles (Bailey-Todd, Eckman, &
179 Tremblay, 2008). Compared with imports which target the mass market and achieve profits on
180 high volumes, this locally produced apparel, in most cases, serve a U.S. niche market. They cater
181 to particular needs from the retail customers on quality and flexibility and compete mostly on
182 non-price factors, such as design and service (Parrish et al., 2006).

183

184 *Research Conceptual Models and Hypotheses*

185 Figure 1 and Figure 2 present the conceptual models illustrating the theoretically-suggested
186 relationship between import penetration and the operation of the U.S. T&A industries when
187 taking their respective restructuring strategies into consideration.

188

189 Figure 1 Here

190 In terms of the U.S. textile industry (Figure 1), most of its restructuring strategies intend to
191 focus on building a stronger domestically-based production capability rather than offshore
192 production (Kilduff, 2005). This makes the U.S. domestic apparel manufacturers remain
193 important customers¹ to the U.S. textile industry. However the rising import penetration ratio
194 means the U.S. domestic demand for textiles is fulfilled by a growing volume of imports rather
195 than U.S.-made textile products. The loss of market share suggests the U.S. textile industry
196 suffers from rising imports. Therefore, this study proposes:

197 **Hypothesis 1: After restructuring, the U.S. domestic textile industry still directly**
198 **competes with imports. Therefore, a higher import penetration ratio shall be positively**
199 **associated with the decline of the U.S. textile industry and vice versa.**

200

201 Figure 2 Here

202 In terms of the U.S. apparel industry (Figure 2), with the adoption of various restructuring
203 strategies, it has achieved global operations with traditional manufacturing-oriented functions
204 largely replaced by offshore production and outsourcing (Kilduff, 2005). Under the new business
205 model, on one hand, a good proportion of imports were brought into the U.S. market by the U.S.
206 apparel firms themselves, whose commercial success was heavily dependent on the efficient
207 cooperation with contracted apparel manufacturers overseas. On the other hand, as the

208 transformed U.S. apparel industry treats imported apparel as an integral part of the supply chain
209 instead of competitors, the rising import level reflected by a higher import penetration ratio may
210 no longer imply the U.S. apparel industry “lost” in competing with imports. Although certain
211 domestic apparel manufacturing capacity remained in the United States, in most cases these
212 operations fulfill the needs of the niche market and are supplementary to the imports which
213 basically serve the mass consumer markets (Gereffi, 2001). As the nature of the game has largely
214 changed from zero-sum competition into cooperation, operation of the restructured U.S. apparel
215 industry shall not be negatively affected by rising imports. Therefore, the study proposes:

216 **Hypothesis 2: After restructuring, the U.S. domestic apparel industry no longer**
217 **competes with imports. Therefore, a higher import penetration ratio shall be either**
218 **negatively or neutrally associated with the decline of the U.S. apparel industry and vice**
219 **versa.**

220

221 **Methodology**

222 *Empirical Model Structure*

223 This study develops a revised model based on the work of Greenaway, Hine & Wright (1999)
224 to empirically test the hypothesis. First, assume for a 4-digit NAICS industry i in period t , Q_{it}^s
225 represents the domestic supply of U.S. T&A industries, Q_{it}^d represents the total U.S. market
226 demand. Import supply M_{it} is defined as the difference of U.S. market demand and domestic
227 supply. Based on the common definition, such as that used by Morgan (1988), import penetration
228 ratio (IPR_{it}) is calculated as the share of imports within the total U.S. demand:

$$229 \quad IPR_{it} = \frac{M_{it}}{Q_{it}^d} = \frac{Q_{it}^d - Q_{it}^s}{Q_{it}^d} = 1 - \frac{Q_{it}^s}{Q_{it}^d} \quad (1)$$

230 Second, to describe the behavior of U.S. domestic supply of T&A, assuming Cobb-Douglas
 231 production function is $Q_{it}^s = A_{it}^\lambda K_{it}^\alpha \cdot L_{it}^\beta$, where A_{it}^λ denotes total factor productivity which
 232 changes over time; K and L respectively represents capital and labor input with output elasticity
 233 at α and β .

234 To maximize profit, marginal revenue product of labor (MPL) of industry i in period t shall
 235 equal its wage (W_{it}) level and marginal revenue product of capital (MPK) shall equal rent (C_{it}).
 236 As most concerns for the impacts of import competition are concentrated on the labor side, K is
 237 further expressed as a function of parameter L, W and C, so that Q_{it}^s will be directly dependent
 238 on employment and wage level. By solving equations simultaneously, we get

$$239 \quad K_{it} = \frac{P_{it}\alpha Q_{it}^s}{C_{it}} = \frac{P_{it}\alpha L_{it}W_{it}}{P_{it}\beta C_{it}} = \frac{\alpha L_{it}W_{it}}{\beta C_{it}} \quad (2)$$

240 Third, in term of the behavior of U.S. total domestic demand for industry i in period t ,
 241 assume $Q_{it}^d = B \cdot P_{it}^{b_1} \cdot Y_t^{b_2}$, where P_{it} denotes the market price of industry i in period t ; Y_t is the
 242 real national income of the United States. b_1 measures the price elasticity of demand in a ceteris
 243 paribus condition, i.e. the percentage change of demand for industry i given one percentage
 244 change of market price when other factors hold constant; b_2 measures impact of aggregate
 245 income elasticity for industry i , i.e., the percentage change of the U.S. demand for industry i
 246 given one percentage change of U.S. national income. B is constant.

247 Finally, replacing Q_{it}^s and Q_{it}^d in Equation 2 and taking logarithm of both sides, we have:

$$248 \quad \ln(1 - IPR_{it}) = \phi_0 + \phi_1 \ln(A_{it}) + \phi_2 \ln(L_{it}) + \phi_3 \ln(W_{it}) + \phi_4 \ln(P_{it}) + \phi_5 \ln(Y_t) \quad (3)$$

250 where $\phi_0 = \alpha \ln(\alpha) - \alpha \ln(\beta) - \ln(B) - \ln(C)$; $\phi_1 = \lambda$; $\phi_2 = \alpha + \beta$; $\phi_3 = \alpha$; $\phi_4 = -b_1$; $\phi_5 = -b_2$;

251 In particular, we are interested in the value of the following parameters:

252 • ϕ_1 (elasticity of supply associated with productivity): which measures the impact of
253 productivity change of the U.S. domestic T&A industries on its market share in relation
254 to imports in the U.S. market. As productivity is positively associated with the supply of
255 U.S.-made T&A, when imports directly compete with U.S. product, productivity growth
256 will result in the rising market share of U.S. domestic products. Therefore, we expect
257 $H_0 : \phi_1 > 0$; $H_1 : \phi_1 \leq 0$ for the U.S. textile industry; and $H_0 : \phi_1 \leq 0$; $H_1 : \phi_1 > 0$ for the
258 U.S. apparel industry.

259 • ϕ_2 (elasticity of labor input): which measures the impact of labor input (employment) of
260 the U.S. textile and apparel industries on their market share in the United States in
261 relation to imports. As in the case of productivity growth, when imports directly compete
262 with U.S. products, the increase of labor supply will result in domestic supply increasing
263 market shares. Therefore, we expect $H_0 : \phi_2 > 0$; $H_1 : \phi_2 \leq 0$ for the U.S. textile industry;
264 and $H_0 : \phi_2 \leq 0$; $H_1 : \phi_2 > 0$ for the U.S. apparel industry.

265 • ϕ_3 (elasticity of wage level): which measures the impact of relative wage level of the U.S.
266 T&A industries on its market share in the United States in relation to imports. When
267 productivity is held constant, the rising wage level should be the result of rising product
268 price as $MPL = ML \cdot P = W$. If imports directly compete with U.S. products, in this
269 occasion, supply curve of the U.S. domestic T&A industries will decline. Therefore, we
270 expect $H_0 : \phi_3 < 0$; $H_1 : \phi_3 \leq 0$ for the U.S. textile industry; and $H_0 : \phi_3 \geq 0$; $H_1 : \phi_3 < 0$ for
271 the U.S. apparel industry.

- 272 • ϕ_4 (elasticity of price elasticity): which measures the impact of market price on the market
273 share of U.S. domestic made T&A products. When imports directly compete with U.S.
274 products and both demand and supply are held constant, rising market price will
275 encourage U.S. domestic T&A industries to increase supply and leave less demand for
276 imports to fulfill. Therefore, we expect $H_0 : \phi_4 > 0$; $H_1 : \phi_4 \leq 0$ for the U.S. textile
277 industry; and $H_0 : \phi_4 \leq 0$; $H_1 : \phi_4 > 0$ for the U.S. apparel industry.
- 278 • ϕ_5 (elasticity of demand/income elasticity): which measures the impact of aggregate
279 demand of the United States (aggregate income) on the share of its domestic-made T&A
280 products in the market. Enlarged domestic demand will raise the market price and result
281 in more domestic supply. Therefore, when imports directly compete with U.S. products,
282 we expect $H_0 : \phi_5 > 0$; $H_1 : \phi_5 \leq 0$ for the U.S. textile industry; and $H_0 : \phi_5 \leq 0$;
283 $H_1 : \phi_5 > 0$ for the U.S. apparel industry.

284 For the empirical test, two additional variables are included in Equation 3.

285 One is the dummy variable *Quota* , which is used to capture the potential impacts of the
286 elimination of the quota system on the import penetration level. As variable *Quota* = 0 for years
287 2002-2004 and *Quota* = 1 for years 2005-2008, parameter ϕ_6 can reveal whether IPR has any
288 structural changes in the post-quota era due to the significant changes of the” rules of game.”

289 Another variable is *t*, which is used to capture the potential time trend that existed in the data.
290 Failing to control the time trend may result in a spurious regression problem (Wooldridge, 2002),
291 especially when time-series data are not stationary.

292 Besides, c_i refers to the possible unobserved sectoral effect and μ_{it} denotes error terms.
293 Because of the interconnection between the textile industry and the apparel industry, simply

294 simulating the Equation 3 individually for each 4-digit NAICS code is likely to result in biased
295 estimation of parameters due to the correlation among μ_{it} for different textile and apparel
296 subsectors (Wooldridge, 2002).

297 To achieve unbiased and consistent estimation, the panel data modeling technique is
298 adopted in this study, which is specifically developed to tackle a dataset involving both cross-
299 sectional and time-series data. Compared to the traditional cross-sectional regression, a panel
300 data model can help solve the potential problem of cross-sectional heteroskedasticity in the
301 dataset and reveal the potential dynamics in the dataset which cannot be detected by the cross-
302 sectional regression (Wooldridge, 2002). Moreover, the generalized least square (GLS) method
303 instead of pooled ordinary least square (POLS), is used to ensure consistent and efficient
304 estimation of the parameters. GLS has the advantages of tolerating a certain degree of correlation
305 among independent variables (Wooldridge, 2002). This is particularly useful in this study given
306 the linkage among productivity, wage level and employment size in Equation 3.

307 *Data Source*

308 Data used in this study came from various U.S. government agencies, which are the best
309 sources available for official national-level aggregated industry and trade statistics. Except for
310 otherwise noted, all data were collected at the 4-digit NAICS code level¹, so as to make industry
311 performance and trade activities compatible with each other. More specifically:

312 For import penetration ratio (variable *IPR*), volumes of imports for each 4-digit NAICS
313 code sectors were measured in dollar terms (USITC, 2010). Domestic supply of each 4-digit
314 NAICS code U.S. T&A industry was measured by the total value of shipments (U.S. Census,
315 2010). In particular, by the U.S. Census's definition, value of shipment means the total value of
316 all products shipped by the producers (U.S. Census, 2010). Therefore, this index is more

317 appropriate than production output to reflect the U.S. domestic supply of textiles and apparel in
318 the market. Employment level (variable L) was measured by the total number of employees (U.S.
319 Department of Labor, 2010a). Wage level (variable W) was measured by the average hourly
320 earnings of all employees either in the U.S. textile industry or in the apparel industry (U.S.
321 Department of Labor, 2010a). Productivity (variable A) was measured by the productivity index
322 (year 2002=100) (U.S. Department of Labor, 2010b). According to the Bureau of Labor
323 Statistics, definition, labor productivity is the “ratio of output of goods and services to the labor
324 hours devoted to the production of that output.” Producer price index (PPI) was used as the
325 proxy for market price (variable P) (U.S. Department of Labor, 2010b). According to the
326 definition of BLS, PPI measures the average change over time in the selling prices received by
327 domestic producers for their output (U.S. Department of Labor, 2010c). Last but not least,
328 aggregate demand (income) in the United States was measured by Gross Domestic Product (U.S.
329 Department of Commerce, 2010).

330 Data used in this study range from 2002 through 2008. Year 2002 was the first time when
331 statistics collected based on NAICS were available. Prior to that, industry activities in the United
332 States were collected based on the Standard Industrial Classification (SIC) system, whose
333 industry classification method was different and incompatible with NAICS. Further, because of
334 time lag in availability of government data at the time of the study the latest statistics based on
335 NAICS was through 2008.

336

337 **Results and Discussions**

338 *Relationship Between Imports and the U.S. T&A Industry: Empirical results*

339 First, the Breusch and Pagan Lagrangian Multiplier (BP) test was conducted to see whether
340 unobserved sectoral effect c_i was present. As Chi-square of the BP test is 58.00 ($p=0.01$),
341 therefore at 95% confidence level we reject the null hypothesis, i.e., unobserved sectoral effect
342 c_i was suggested present in the empirical model (5).

343 Second, the Hausman test was conducted to see whether the unobserved sectoral effect c_i was
344 correlated with other independent variables in Equation 3. For the U.S. textile industry, Chi-
345 squares of the Hausman test is 5.0 ($p=0.08$), therefore at 95% confidence level, we fail to reject
346 the null hypothesis, i.e. sectoral effect c_i is suggested uncorrelated with other independent
347 variables. In such case, both the fixed effect model (FE) and the random effect model (RE) can
348 generate consistent estimation. However, RE estimation usually is more efficient than FE
349 (Wooldridge, 2002), therefore RE is chosen for studying the U.S. textile industry. For the U.S.
350 apparel industry, Chi-squares of the Hausman test is 10.57 ($p=0.01$) $P\text{-value}=0.01<0.05$,
351 therefore at 95% confidence level, we reject the null hypothesis. Fixed effect model (FE)
352 therefore is chosen for studying the U.S. apparel industry and its relationship with import
353 penetration level.

354 Third, RE and FE models were run by STATA 10.0 and the estimation results were shown
355 in Table 1 (A) and (B). For both RE and FE model, $P\text{-value}$ of the F-statistics were smaller than
356 0.01 at the 95% confidence level. This suggests that overall the dependent variable
357 $1 - IPR_{it}$ which measures the share of U.S. domestic-made T&A in the U.S. market, has strong
358 correlation with independent variables describing the operation of the U.S. textile and apparel
359 industries, namely productivity, employment, wage level, market price and GDP.

360 Table 1 (A) and (B) here

361 According to Table 1 (A), Hypothesis 1 which suggests a “competing” relationship
362 between imports and the U.S. domestic textile output was not supported. In most cases, import
363 penetration level seems independent of the operation of the U.S. textile industry. Changes of the
364 productivity and wage level of the U.S. textile industry were both suggested having no
365 statistically significant impacts on the changes of the import penetration level. Neither did the
366 market price nor aggregate U.S. demand show a significant relationship with the import
367 penetration level. The only exception occurs in the case of employment. Results in Table 1 (A)
368 imply that expansion of the workforce in the U.S. textile industry will not help the U.S. textile
369 industry gain more market share in the domestic market, but rather will end up with more
370 imports. Moreover, the estimated parameter for the dummy variable *quota* is not statistically
371 significant, suggesting that impact of the quota elimination did not lead to changes of the import
372 penetration level in the U.S. textile industry as a whole.

373 Hypothesis 2 was supported by the empirical results shown in Table 1 (B). Overall, results
374 suggested the operation of the U.S. apparel industry and imports were “immune” to each other.
375 Variables describing operation of the U.S. apparel industry were mostly found having no
376 statistically significant impacts on the relative market position of imports in relation to U.S.
377 domestic output. This means a rising import penetration in the U.S. market was not associated
378 with negative development of the U.S. domestic apparel industry. Moreover, empirical results
379 suggest that holding other variables constant, 1% change of the U.S. market price would result in
380 0.5% decline of the market share of the domestic output in the same direction. This means
381 imports will continue increasing when output of the U.S. domestic-made apparel moves toward
382 the higher-end of the market. On the other hand, as the case in the U.S. textile industry, no

383 evidence shows that elimination of the quota system had resulted in change of the overall level of
384 U.S. apparel imports².

385

386 *Discussion*

387 Despite some inconsistencies with the two hypotheses, results of the empirical tests may still
388 be explained by certain factors. For the U.S. textile industry, first, with shrinkage of U.S.
389 domestic demand, operation of the U.S. textile industry relied more heavily on its performance in
390 overseas markets. With a growing proportion of industry output shipped outside the U.S. border,
391 it may explain why import penetration ratio could still rise when the U.S. domestic fiber, yarn
392 and thread mills improve productivity, enlarge employment, and raise wage level. When the U.S.
393 textile industry no longer specifically targets the domestic market, it seems reasonable that
394 neither the rising market price nor the expanded aggregate demand (income) in the United States
395 results in more industry supply.

396 Second, although the U.S. textile industry still largely focuses on domestic production after
397 the adoption of various restructuring strategies, the industry may still have undergone substantial
398 structural changes reflected on the nature of its output. Statistics show that, only 14% of the total
399 U.S. fiber output was used for apparel production by the end of 2008, reduced from 18% in 2004
400 (Fiber Organon, 2009). In comparison, technical textiles which was widely used in military,
401 healthcare/medical, construction, engineering and agriculture industries (Dickerson, 1999; Chi,
402 2010), accounted for 41% of total fiber usage in the United States in 2008, increased from 34 %
403 in 2004 (Fiber Organon, 2009). It is likely that although imported textiles and the U.S. domestic
404 textile output were counted under the same 4-digit NAICS code, they were heterogeneous in
405 nature with different end-use purposes.

406 As for the U.S. apparel industry, first, the results may due to the fact that the U.S. domestic
407 apparel output and imported apparel target different segments of the U.S. market. As proposed in
408 Figure 2, while imports largely fulfill the demand from mass market, the U.S. domestic-made
409 apparel has narrowed their focus to niche markets in the United States whose preferences give
410 more weight to added values, services or speed of product delivery that cannot be easily fulfilled
411 by imports (Parrish et al, 2006). Some niche markets are created by U.S. legislation, such as the
412 Berry Amendment³. When target markets had little in overlap, it is not too surprising to see that
413 operation of the U.S. apparel industry had minimum impact on the ebb and flow of imports.

414 Second, statistical insignificance of the empirical results could also attribute to the fact that
415 multiple parties in the U.S. softgoods industry are involved in importing apparel. In particular, it
416 has become a common practice for large apparel retailers in the United States to set up
417 departments solely responsible for global sourcing of an increasing share of private-label
418 products in their total sales (Dickerson, 1999). However, under the NAICS system, apparel
419 retailers (NAICS 448) and apparel firms (NAICS 315) were classified separately, which means
420 their industry activities such as output, productivity and employment were independently
421 collected and released. Unfortunately retailers' participation in international trade currently is
422 not traced and reported by official statistical sources. Since apparel imports sourced by retailers
423 have reached a sizable scale but cannot be separated from total import volumes, it unavoidably
424 weakens the sensitivity of data in reflecting the actual linkage between imports and the operation
425 of the U.S. apparel industry (NAICS 315).

426 Third, the diversity of apparel products may further complicate the empirical estimation of
427 the relationship between imports and the operation of the U.S. domestic firms. In contrast to the
428 highly standardized textiles products such as fiber, yarn and fabric, apparel products are more

429 heterogeneous in nature due to consumers' seeking of uniqueness. Apparel imports from
430 different sources have demonstrated a wide range of average price measured by dollars per
431 square meters (SME). Some studies already argue that origin of imports matters for their impact
432 on an importing country's domestic industries (Bernard, Jensen, & Schott, 2006). Similarly, the
433 proposed cooperation between imports and the operation of the U.S. apparel industry could be
434 more remarkable if empirical tests were narrowed down to a smaller group of apparel firms and
435 imports from certain geographic regions.

436

437 **Conclusions and Implications**

438 This study empirically evaluated the relationship between import penetration and the
439 operation of the U.S. textile and apparel industries by using a panel data model based on data at
440 4-digit NAICS code ranging from 2002 through 2008.

441 First, the random effect model suggests that overall the U.S. textile industry formed a weak
442 cooperative relationship with imports in the U.S. market. Specifically, employment size of the
443 U.S. textile industry was found negatively associated with its market share in relation to imports
444 in the U.S. market. However, no evidence showed that productivity and wage level of the U.S.
445 domestic textile industry nor the aggregate demand in the United States had statistically
446 significant impacts on the import penetration level in the U.S. textile market. Nor was the
447 elimination of the quota system in 2005 shown to have statistically significant impact on the
448 overall import penetration level in the U.S. textile market.

449 Second, the fixed effect model suggests that the U.S. apparel industry overall formed a
450 neutral relationship with imports in the U.S. market. No evidence indicated that productivity,
451 employment and wage level of the U.S. domestic apparel industry as well as the aggregate

452 demand in the United States had statistically significant impacts on the import penetration level
453 in the U.S. apparel market. However, market price was found negatively associated with the
454 share of U.S. domestic-made apparel in the U.S. market. Similar to the case in the U.S. textile
455 industry, impact of the quota elimination on the import penetration level in the U.S. apparel
456 market was found not statistically significant.

457 Findings of this study have several important implications both regarding the evolution of
458 the U.S. textile and apparel industries and many broader issues critical to the global economy
459 and its governance in the 21st century. First, results of this study present a somewhat more
460 encouraging picture of the current status of the U.S. textile and apparel industries than many
461 previous studies suggested. Although pessimistic and stereotyped public images of a dying U.S.
462 textile and apparel industry are to an extent still popular, this study argues that the two industries
463 overall have stabilized as a result of their sweeping restructuring. In particular, indexes often
464 used to measure the size of an industry such as employment and output may not be solely
465 appropriate for evaluating an industry which is undergoing significant structural changes.
466 Instead, a more comprehensive and objective assessment of the conditions of the U.S. textile and
467 apparel industries should also take aspects such as product structure, productivity growth,
468 demand for occupations at different skill levels and export dependency rate into consideration.
469 Overall, it is important to keep in mind that both the U.S. textile and apparel industries today are
470 but a shadow of what they were even a decade ago. However, the two industries have survived
471 through strategic transformation and are expected to continue development in the future.

472 Second, findings of this study raise questions on whether there is a basis to be nervous
473 about rising imports, especially in the context of an integrated global economy in which global
474 fragmented production and trade networks predominate. Actually, the validity of arguments

475 stressing the adverse impacts of rising imports largely depends on the assumption that imports
476 and output of importer's domestic industry necessarily constitute a "zero-sum" game. However,
477 this assumption is questionable when international trade in an integrated global economy today is
478 no longer arm's-length transaction in nature (Cattaneo, Gereffi & Staritz, 2010). Findings of this
479 study also pose challenges to the "zero-sum" game assumption. The suggested non-competing
480 relationship implies that not only has the U.S. apparel industry extensively incorporated imports
481 into its global-based operation, but also the U.S. textile industry may benefit from imports and
482 offshore production, although the detailed mechanism needs further exploration.

483 Perhaps findings of this research call for shifting the orientation of U.S. textile and apparel
484 trade policy from focusing on import restriction to greater export promotion. To a large extent,
485 curbing the growth of imports dominates the history of the U.S. textile and apparel trade policy
486 over the past 40 years. Such single-focused policy orientation reflects certain policymakers'
487 strong suspicion, skepticism and deep anxiety about rising imports and their presumed negative
488 impacts on the health of the U.S. domestic industries. However, evidence provided in this study
489 shows that with the adoption of various restructuring strategies, maintaining today's U.S. textile
490 and apparel industries largely depend on the free flow of goods and services across the borders.
491 Even if imports were restricted, those lost jobs—mostly low-skill types, would not simply go
492 back to the United States as wished. Instead, with the rising dependency on markets outside the
493 U.S. border, perhaps policymakers should more wisely spend precious policy resources to
494 strengthen the competitiveness of U.S. textiles and apparel products in the global marketplace
495 which is of growing importance to the industries' future prosperity.

496 Despite the interesting and meaningful results of the findings, several changes might be
497 made to further improve the quality of the future similar studies. First, it could be better if longer

498 time-series data were available. A longer time-series data will help improve the overall reliability
499 of the estimation by increasing the number of data points and degrees of freedom for the model.
500 However, cautions should also be given to the possible new “noises” brought in with data from a
501 longer time span. For example, if data prior than 2002 were used in the model, questions arise on
502 how to deal with China’s WTO accession effect as well as the correspondence of NAICS with
503 the SIC system because categories changed. Second, it could be improved if empirical tests can
504 be conducted at even more disaggregated data level. Particularly, the heterogeneity of different
505 sub-sectors within the textile and apparel industries might also cause the insignificance of the
506 estimation results. Third, the study might be improved if the interactions between the textile
507 industry and the apparel industry can be taken into consideration. In this study, the relationship
508 between imports and the operation of the U.S. textile and apparel industries were evaluated based
509 on products within the same NAICS-code sector, while future study may take cross-sector
510 connections into consideration. Last but not least, structure of the empirical model can be further
511 improved by taking the potential existence of stochastic trends in the dataset into consideration.
512 With the presence of stochastic trends, the dataset will be non-stationary and may lead to biased
513 estimation even when time trend variable t is included in the model. As one solution, the Dickey-
514 Fuller test or related tools may be used in the future to detect the potential existence of stochastic
515 trends.

516 Note

517 1. In this study, the U.S. textile industry covers NAICS 3131 (Fiber, yarn and thread), NAICS
518 3132 (Fabrics) and NAICS 3133 (Fabric finishing and coating); the U.S. apparel industry
519 covers NAICS 3151 (Knitted apparel), NAICS 3152 (Cut and sew apparel) and NAICS3159
520 (Apparel accessories).

- 521 2. The “insignificant” results may be due to two major reasons. First, quota elimination may
522 exert more significant impact on the country structure of import sources rather than the
523 overall import volume which is more closely related to macro economic conditions (Nordas,
524 2004). Second, the largest textile and apparel exporter to the United States—China, was still
525 subject to quota restriction for many of its most competitive products until the end of 2008.
- 526 3. Under the Berry Amendment, clothing, fabrics, fibers, yarns or other made-up textiles
527 procured by the U.S. Department of Defense (DoD) need to be 100% made in the United
528 States (U.S. Department of Defense, 2011).

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Table 1 (A) Results of Random Effect Model on the U.S. Textile Industry

| $Ln(1-IPR_{it})$ | Productivity $Ln(A_{it})$ | Employment $Ln(L_{it})$ | Wage $Ln(W_{it})$ | Market price $Ln(P_{it})$ | GDP $Ln(Y_t)$ | Quota <i>quota</i> | Time <i>t</i> |
|--|------------------------------|----------------------------|----------------------|------------------------------|------------------|-----------------------|------------------|
| Textile industry | -0.018 (0.06) | -0.179** (0.04) | 0.17 (0.54) | 0.50 (0.45) | -0.23 (1.09) | 0.08 (3.75) | -2.52 (7.31) |
| Constant: 6.01(135.02)* | | | | | | | |
| P-value for F-test of overall significance: 0.00** | | | | | | | |

* denotes $p < 0.05$, **denotes $p < 0.01$.

Table 1 (B) Results of Fixed Effect Model on the U.S. Apparel Industry

| $Ln(1-IPR_{it})$ | Productivity $Ln(A_{it})$ | Employment $Ln(L_{it})$ | Wage $Ln(W_{it})$ | Market price $Ln(P_{it})$ | GDP $Ln(Y_t)$ | Quota <i>quota</i> | Time <i>t</i> |
|--|------------------------------|----------------------------|----------------------|------------------------------|------------------|-----------------------|------------------|
| Apparel industry | 0.04 (0.04) | -0.02 (0.02) | -0.15 (0.52) | -0.50* (0.22) | -0.12 (0.57) | -2.15 (1.92) | 0.19 (3.33) |
| Constant: 82.03 (66.5) | | | | | | | |
| P-value for F-test of overall significance: 0.00** | | | | | | | |

* denotes $p < 0.05$, **denotes $p < 0.01$.

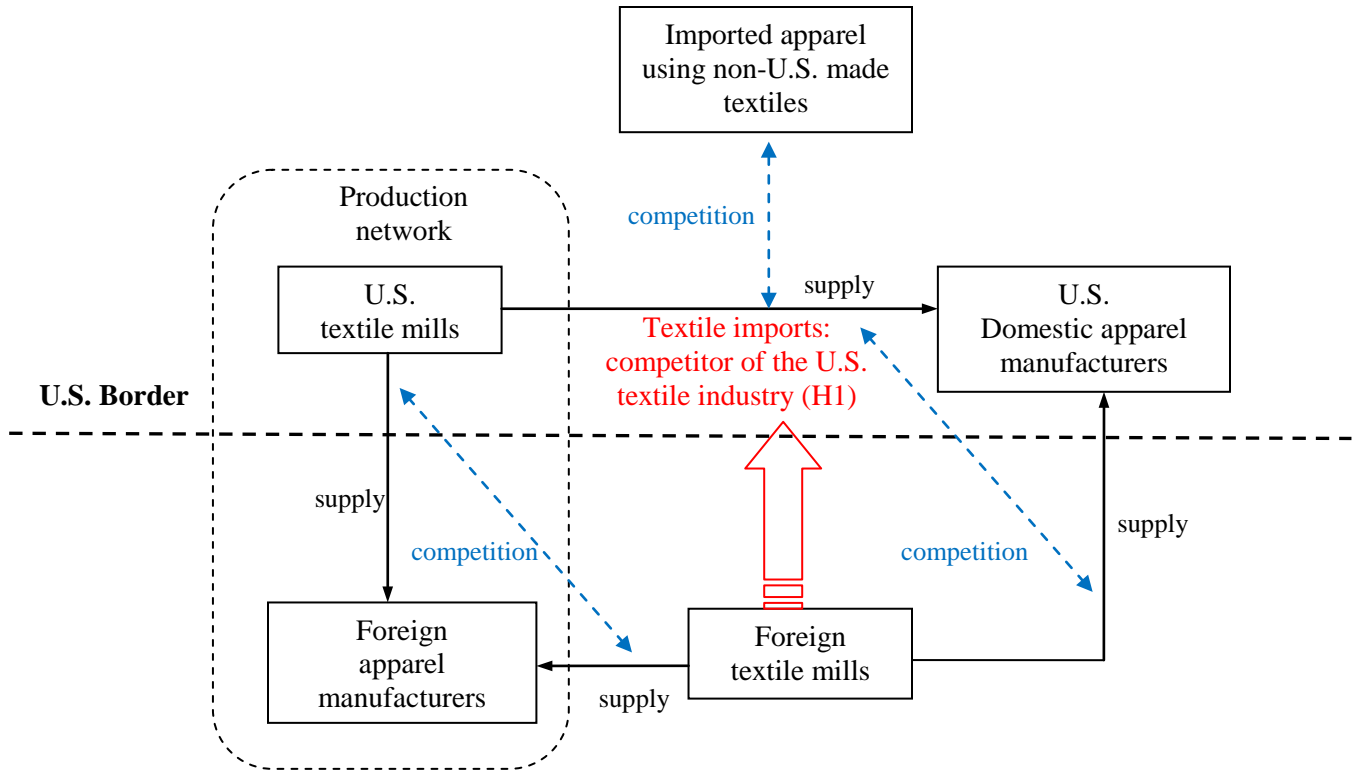


Figure 1 Conceptual Model of the Relationship Between Import Penetration and the Operation of the U.S. Textile Industry¹

¹ Two other things need to be noted in Figure 1, although they will not be tested in this paper. First, the U.S. domestic textile industry is not only directly competing with textile imports, but also competes directly with imported apparel which uses non-U.S.-made textile products, although in an indirect way. With the quick rise of apparel imports since the 1990s, output of the U.S. apparel industry first started to decline and then followed up by the U.S. textile industry. This pattern suggested that a good proportion of prior U.S. domestic demand for textiles disappeared because of the shrinkage of U.S. domestic apparel production as the result of rising apparel imports. Second, the U.S. textile industry also competes with foreign-made textiles in third-country markets such as Mexico and Central-South American countries (Gereffi, 2002).

