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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

Introduction

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

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

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

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

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

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

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

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

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

Literature Review

Import competition: theoretical views

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Research Conceptual Models and Hypotheses

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

Figure 1 Here

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

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

Figure 2 Here

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

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

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

Methodology

Empirical Model Structure

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

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

Second, to describe the behavior of U.S. domestic supply of T&A, assuming Cobb-Douglas 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 changes over time; K and L respectively represents capital and labor input with output elasticity at α and β.

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

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

Third, in term of the behavior of U.S. total domestic demand for industry i in period t, 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 real national income of the United States. b_1 measures the price elasticity of demand in a ceteris paribus condition, i.e. the percentage change of demand for industry i given one percentage change of market price when other factors hold constant; b_2 measures impact of aggregate income elasticity for industry i, i.e., the percentage change of the U.S. demand for industry i given one percentage change of U.S. national income. B is constant.

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

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

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

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

- ϕ_1 (elasticity of supply associated with productivity): which measures the impact of productivity change of the U.S. domestic T&A industries on its market share in relation to imports in the U.S. market. As productivity is positively associated with the supply of U.S.-made T&A, when imports directly compete with U.S. product, productivity growth will result in the rising market share of U.S. domestic products. Therefore, we expect $H_0 : \phi_1 > 0$; $H_1 : \phi_1 \leq 0$ for the U.S. textile industry; and $H_0 : \phi_1 \leq 0$; $H_1 : \phi_1 > 0$ for the U.S. apparel industry.
- ϕ_2 (elasticity of labor input): which measures the impact of labor input (employment) of the U.S. textile and apparel industries on their market share in the United States in relation to imports. As in the case of productivity growth, when imports directly compete with U.S. products, the increase of labor supply will result in domestic supply increasing market shares. Therefore, we expect $H_0 : \phi_2 > 0$; $H_1 : \phi_2 \leq 0$ for the U.S. textile industry; and $H_0 : \phi_2 \leq 0$; $H_1 : \phi_2 > 0$ for the U.S. apparel industry.
- ϕ_3 (elasticity of wage level): which measures the impact of relative wage level of the U.S. T&A industries on its market share in the United States in relation to imports. When productivity is held constant, the rising wage level should be the result of rising product price as $MPL = ML \cdot P = W$. If imports directly compete with U.S. products, in this occasion, supply curve of the U.S. domestic T&A industries will decline. Therefore, we 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 the U.S. apparel industry.

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

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

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

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

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

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

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

Data Source

Data used in this study came from various U.S. government agencies, which are the best sources available for official national-level aggregated industry and trade statistics. Except for otherwise noted, all data were collected at the 4-digit NAICS code level[1], so as to make industry performance and trade activities compatible with each other. More specifically:

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

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

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

Results and Discussions

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

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

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

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

Table 1 (A) and (B) here

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

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

evidence shows that elimination of the quota system had resulted in change of the overall level of U.S. apparel imports[2].

Discussion

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

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

As for the U.S. apparel industry, first, the results may due to the fact that the U.S. domestic apparel output and imported apparel target different segments of the U.S. market. As proposed in Figure 2, while imports largely fulfill the demand from mass market, the U.S. domestic-made apparel has narrowed their focus to niche markets in the United States whose preferences give more weight to added values, services or speed of product delivery that cannot be easily fulfilled by imports (Parrish et al, 2006). Some niche markets are created by U.S. legislation, such as the Berry Amendment[3]. When target markets had little in overlap, it is not too surprising to see that operation of the U.S. apparel industry had minimum impact on the ebb and flow of imports.

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

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

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

Conclusions and Implications

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

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

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

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

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

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

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

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

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

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

Note

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

2. The “insignificant” results may be due to two major reasons. First, quota elimination may exert more significant impact on the country structure of import sources rather than the overall import volume which is more closely related to macro economic conditions (Nordas, 2004). Second, the largest textile and apparel exporter to the United States—China, was still subject to quota restriction for many of its most competitive products until the end of 2008.
3. Under the Berry Amendment, clothing, fabrics, fibers, yarns or other made-up textiles procured by the U.S. Department of Defense (DoD) need to be 100% made in the United 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 *quota*	Time *t*
Textile	-0.018	-0.179**	0.17	0.50	-0.23	0.08	-2.52
industry	(0.06)	(0.04)	(0.54)	(0.45)	(1.09)	(3.75)	(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 *quota*	Time *t*
Apparel	0.04	-0.02	-0.15	-0.50*	-0.12	-2.15	0.19
industry	(0.04)	(0.02)	(0.52)	(0.22)	(0.57)	(1.92)	(3.33)
Constant: 82.03 (66.5)							
P-value for F-test of overall significance: 0.00**							

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

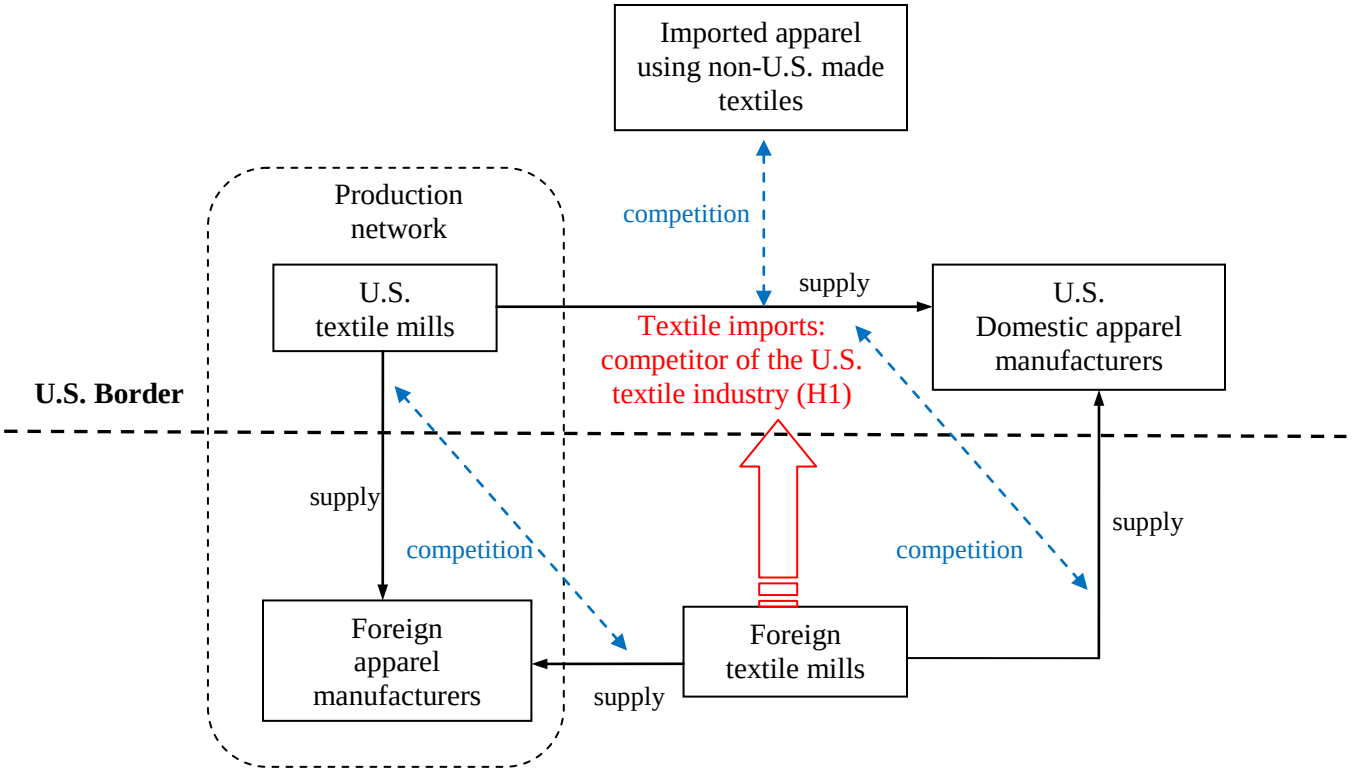

Figure 1 Conceptual Model of the Relationship Between Import Penetration and the Operation of the U.S. Textile Industry[1]

[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).

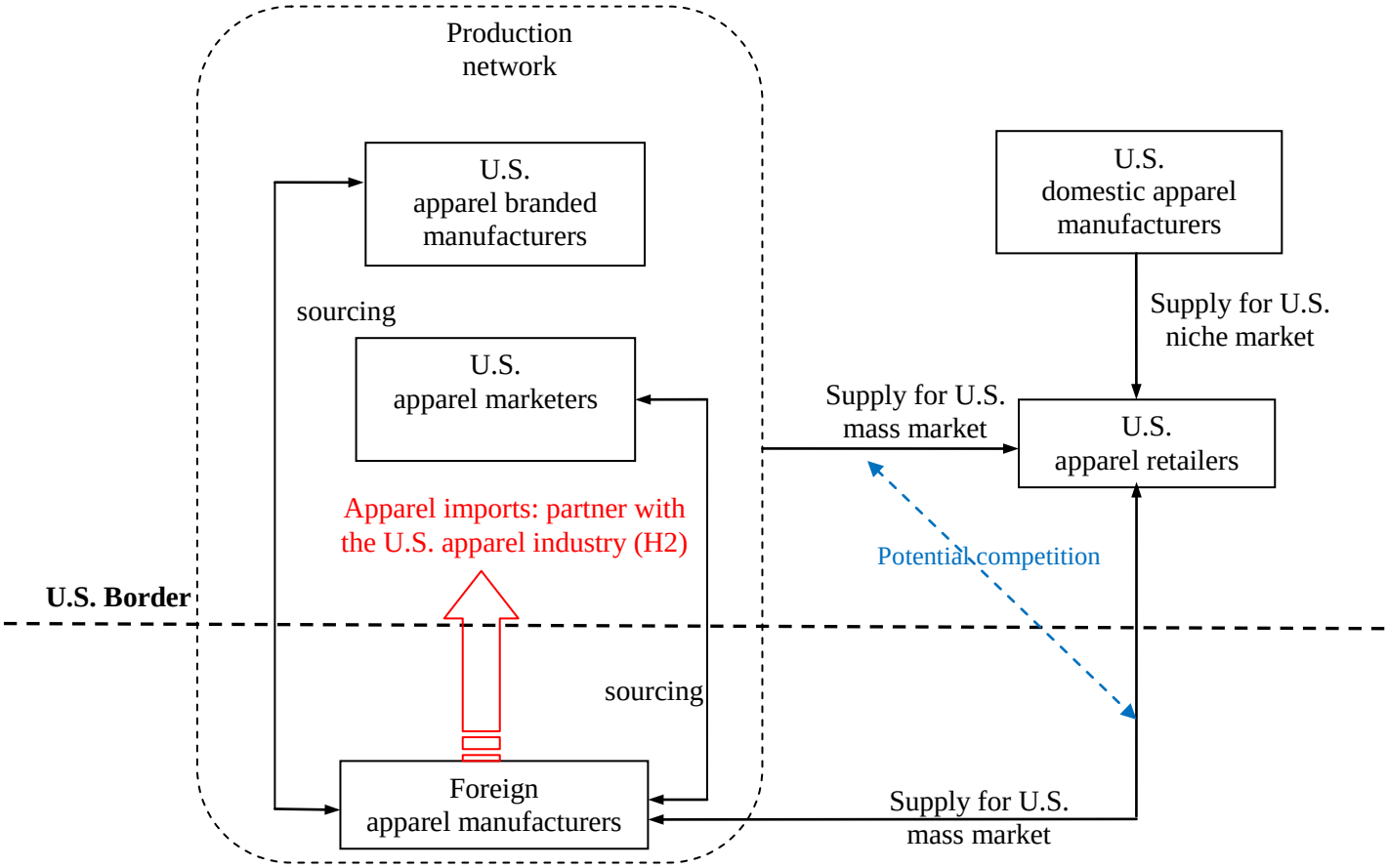

Figure 2 Conceptual model of the Relationship between Import Penetration and the Operation of the U.S. Apparel Industry