Determinants of Apparel Exports in Developed Economies: Application of the Gravity Model and Economic Geography Theory

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Abstract:

The purpose of this study was to examine factors that can explain apparel export in economically developed countries. Theoretical framework is based on the gravity model and economic geography theory. Three factors were investigated in relation to apparel export in developed countries: (a) supply of apparel export, (b) potential apparel demand and (c) existence of fashion capital. Secondary data were collected for thirty-one country-members of Organization for Economic Cooperation and Development. Multiple regression analysis showed that apparel domestic supply and potential apparel demand are strong determinants of apparel export in developed countries. The final model explained the 74% of variance in apparel exports from developed countries. Understanding determinants that drive apparel export could facilitate development of new strategies for fostering competitiveness of domestic apparel industries. The results might be beneficial to multinational companies assessing possible apparel production sites for high-value added products.

Keywords: apparel export | developed countries | gravity model | fashion capital

Article:

Examining factors that explain exports in various industries has been a prominent research stream for many decades (Leonidou & Katsikeas, 2010). Interest has been especially strong within the context of the apparel industry (Baldone, Sdogati, & Tajoli, 2010; Campaniaris, Hayes, Jeffrey, & Murray, 2011; Jin & Moon, 2006; Zhang & Hathcote, 2008) because almost all

countries in the world are involved in apparel trade, making this sector extremely competitive (United Nations, 2013).1 Practically all extant research examining apparel exports has focused on developing and newly developed countries (Chi & Sun, 2013; Li, Kong, Liu, & Qin, 2011; Lu, 2012; Zhang & Hathcote, 2008). Within the context of developed economies, the attention has been primarily on apparel imports (Chi & Kilduff, 2010; Lee, Farr, & Hathcote, 2013), whereas apparel export performance has been largely overlooked.

Previous research on developed countries' apparel industries has examined import growth and decline in domestic production and employment (Brauer, 2008; Greta & Lewandowski, 2010; Hodges & Karpova, 2006) but overlooked apparel export performance. However, it is important to understand that many developed nations continue to be major apparel exporters (United Nations, 2013). For example, five of the top 10 apparel exporters—based on export value—were developed economies in 2011, including Italy with US$22 billion of apparel exports, Germany with US$20 billion, France with US$11 billion, and Spain and Belgium, both with close to US$9 billion(United Nations, 2013). The five countries accounted for nearly 18% of the world's total apparel exports in 2011 (United Nations, 2013). Moreover, industry experts believe that some apparel manufacturing, particularly of high-end products, might be returning to developed countries to ensure higher quality, faster speed to market, easier access to consumers, and environmental compliance (Rivoli, 2009).

To date, no study has examined what factors can explain apparel export in developed countries. A handful of studies that have researched competitiveness of apparel industries in developed nations included descriptions of apparel export trends (Baldone et al., 2010; Campaniaris, et al., 2011; Jin & Moon, 2006), but none provided a systematic analysis of factors to explain it. It is important to fill this gap by investigating factors that influence apparel export in developed countries because the apparel industry continues to be a significant contributor to domestic employment and gross domestic production (GDP) even in these economies (International Labour Organization, 2010).

According to the gravity model, supply in an exporting nation, demand in an importing nation, and the distance between the two are major factors determining trade between the countries (Bergstrand, 1985). Several researchers have used and extended the gravity model to explain trade patterns specifically in the apparel context. For example, Chi and Kilduff (2010) used the gravity model to explain U.S. apparel imports. Similarly, Au and Eve (2010) employed the model to examine factors determining apparel exports from 14 Asian economies to 15 Europe Union countries. Although both studies used extended versions of the gravity model, there was significant unexplained variance in apparel export and import.

Economic geography theory proposes that an industry agglomeration serves as a knowledge center for domestic industry and stimulates industrial productivity to produce more output with the same amount of input (Krugman, 1991; Romer, 1986). Industry agglomeration is:

> A socioeconomic entity characterized by a social community of people and a population of economic agents localized in close proximity in a specific geographic region …

(where various stakeholders) work together in economically linked activities, sharing and nurturing a common stock of product, technology and organizational knowledge in order to generate superior products and services in the marketplace. (Morosini, 2004, p. 307)

Ultimately, industry with a well-established agglomeration has greater competitiveness in the global market (Porter, 1996). An agglomeration increases industry know-how in marketing, management, and craftsmanship in creating innovative high-value-added products (Morosini, 2004). In this study, the existence of industrial agglomeration in an exporting country was considered as one of the factors that might explain apparel exports in developed countries.

The purpose of this study was to examine factors that can explain apparel export in economically developed countries based on the gravity model and economic geography theory. Understanding what factors might determine apparel exports in developed nations contributes to the existing literature theoretically and to the industry practically. Theoretically, this research combines the gravity model and the economic geography theory to explain the reasons behind differences in apparel exports among developed countries. Practically, the findings of this study might be beneficial to multinational companies evaluating potential apparel production sites. At a national level, the results of this research might be useful in facilitating the development of new strategic directions to foster competitiveness among domestic apparel industries.

Literature Review

The Gravity Model

The gravity model has been used extensively to examine bilateral trade patterns for different products in various nations and is confirmed empirically to explain trade flows between countries (Baldwin & Taglioni, 2011; Caporale, Rault, Sova, & Sova, 2009; Lau & Bilgin, 2010; Xiong & Beghin, 2011). The standard form of the model includes two countries: one exporting country, i, and one importing country, j, as presented in Equation 1 (Bergstrand, 1985; Schumacher, Siliverstovs, & Berlin, 2004).

$$X_{ij}=f(Y_i,Y_j,D_{ij},A_{ij})=Y_i\times Y_j\times A_{ij}/D_{ij}, \quad 1$$

where

X_{ij} : value of the trade flow from country i to country j;

$Y_i(Y_j)$: value of nominal GDP in country i (j);

A_{ij}: any other factors either aiding or resisting trade between the countries i and j; and

D_{ij}: the distance from the economic center of country i to that of country j.

The model explains that total export (X_{ij}) from country i to country j is determined by the income of country i (Y_i), representing supply of the exporting country, and the income of an importing country j (Y_j), representing demand of the importing country (Redding, 2010; Schumacher et al., 2004). Domestic production output of the exporting country i (Y_i), operationalized as the country's GDP, determines how much this country can potentially export (Redding & Venables, 2004). For example, Jongwanich (2010) found that domestic production of all goods was a crucial factor affecting export performance of eight East and Southeast Asian countries between 1993 and 2008. The author reported that the production of all goods was positively related to all of the eight countries' exports.

The demand of an importing country j (Y_j), represented by its GDP, or the country's income, determines how much this country can potentially import from the exporting country i because the importing country can buy only a limited value of foreign products based on the money they have (Equation 1). In other words, Y_j determines the maximum value of products this market can potentially purchase. The distance between country i and country j (D_{ij}) is interpreted as transportation cost and lead time, which will be higher with a greater distance between the two countries. Demand for export can be captured by taking into account the distance between the exporting country and the importing country (Nordas, 2004; Schumacher et al., 2004). For example, assuming there is only one nation to which a country exports its products, high demand means that the producing/exporting country is located close to the importing country with a large demand and therefore can sell its products with low transportation cost and fast lead time (Harris, 1954).

Potential Demand Index

In this study, Harris' (1954) potential demand index was used to account for the accumulated demand from multiple countries as well as distances between trading countries. The index represents "the intensity of possible contact with markets" (Harris, 1954, p. 321). It measures potential demand for a product at one geographical point (an exporting country), considering that "the whole population exerts over every location in the space" (López-Rodríguez & Faíña, 2006, p. 386). The index has been used in various studies as a measure of a composite demand influenced by the distance between an exporting country and importing countries (Abraham, Studnicka, & Van Hove, 2012; Boulhol & De Serres, 2010; Redding & Venables, 2004). The index allows for incorporating real-world scenarios when exporters deal with simultaneous demands from multiple countries.

According to Harris (1954), the index of potential demand (P_i) in an exporting country i is defined as the accumulative demand, which is a sum of each importing country's demand (M_j) affected by distances between the exporting country and the importing countries (d_{ij}) (Equation 2). Scholars have used the index of potential demand in an exporting country to examine trade

performance. For example, it was found that one of the reasons sub-Saharan African countries do not export much was their location relative to import markets, which accounted for almost 25% of poor export performance (Redding & Venables, 2004).

$$P_i = \Sigma \frac{Mj}{dij}. \qquad 2$$

This research can fill a gap in the apparel trade literature by incorporating Harris' potential demand index. To date, no study has used the accumulated demand from multiple countries and distances between trading nations in the context of apparel trade.

Gravity Model for Apparel Export

This section explains modifications of the standard gravity model (Equation 1), as it applies to apparel exports. In the gravity model, the overall export of a country is based on (a) exporting country's supply of all goods measured by its GDP; (b) importing country's demand for all goods measured by the country's GDP; (c) distance between importing country and exporting country; and (d) other factors that might influence trade between the countries. In this study, the model was modified to account for (a) exporting country's apparel supply (domestic apparel production) rather than supply of all goods measured by country's GDP and (b) importing country's apparel demand (total apparel imports) rather than demand for all goods measured by the country's GDP (Equation 3). By using apparel-specific variables (apparel demand and apparel supply) rather than an overall country's economic indicator (GDP), the study aimed to capture apparel export determinants more precisely.

$$X_{ij}^{a} = f(S_i^a, P_i, A_{ij}) = S_i^a \times P_i \times A_{ij} = S_i^a \times \sum \frac{M_j^a}{d_{ij}} \times A_{ij}, \qquad 3$$

where

$X\frac{a}{ij}$: value of apparel exports from exporting country i to importing country j;

$S\frac{a}{i}$: value of domestic apparel supply in exporting country i;

P_i: value of potential apparel demand in exporting country i;

$M\frac{a}{j}$: apparel import of country j;

d_{ij}: distance between country i and country j; and

A_{ij}: any other factor(s) either aiding or resisting trade between country i and country j.

Based on the modified gravity model that encompasses apparel supply and potential apparel demand—an index of importing countries' accumulative demands affected by distances

between the exporting country and importing countries—the following hypotheses were proposed:

> **Hypothesis 1**: Apparel supply in exporting country is positively related to the country's apparel export.
>
> **Hypothesis 2**: Potential apparel demand in importing countries is positively related to the country's apparel export.

Economic Geography Theory and Fashion Capitals

Economic geography theory explains the relationship between an industry agglomeration and domestic production output through knowledge creation and sharing (Romer, 1986). The creation of knowledge and innovation happens through interactions and competition among closely located firms. Therefore, an agglomeration enables the industry to produce more output with the same amount of input because of the greater knowledge and expertise in marketing, management, and craftsmanship in design and product development (Krugman, 1991; Romer, 1986). On the basis of this theory, some developed countries, even under a comparative disadvantage in labor cost, can excel in producing high-value-added apparel products through an established industry agglomeration called fashion capital (Fuhrer & Little, 1996; Scott, 2006).

Fashion capital refers to a city with a cluster of fashion-related companies covering the garment business from design to sales, with apparel assembly and textile production located nearby (Martínez, 2007; Wenting, 2008). They are the innovative centers of fashion design and marketing and provide a large share of total domestic apparel products (Merlo & Polese, 2006). This is because an agglomeration provides "the interactions between knowledge, culture, economics, and technology," and works as "a magnetic and evolving" center (Bertacchini & Borrione, 2009, p. 4). An agglomeration in textile and apparel industries is intensified by "positive externalities"—knowledge acquired through competition and cooperation among local firms (Scott, 2006, p. 1518). This positive cycle intensifies sustainable and growing industry's competitiveness. Fashion capitals are especially important in the context of developed economies in creating a successful and competitive apparel industry (Bertacchini & Borrione, 2009; Merlo & Polese, 2006; Scott, 2006). Products manufactured in fashion capitals command premium prices because consumers (both domestic and foreign) associate them with high quality, style, and image due to fashion capitals' brand name and recognition (Jansson & Power, 2010). As a result, developed countries with fashion capitals are anticipated to export more than countries without fashion capitals when other factors remain the same.

For example, the Garment District in New York city has traditionally been a center of fashion design and production supported by various auxiliary industries such as marketing, distribution, and consulting services including "design schools, buying offices, forecasting services, and trade associations" (Rantisi, 2002, p. 442). The Garment District is an

agglomeration of 4,000 fashion-related businesses including apparel manufacturers, contractors, textile suppliers, resident buying offices, forecasting services, trade publications, fashion schools, and legal and financial services (Rantisi, 2002). This agglomeration makes New York city a recognized world fashion capital with "an aura of authenticity" and "premium prices in the world market" (Scott, 2006, p. 1529). Based on economic geography theory, the following hypothesis was proposed:

> **Hypothesis 3**: The existence of fashion capital in an exporting country is positively related to the country's apparel export.

Extended Gravity Model for Apparel Export

An extended apparel export gravity model was proposed based on the gravity model and economic geography theory (Equation 4). The model incorporates (a) domestic apparel supply in exporting country; (b) potential demand for apparel exports in importing countries; and (3) the existence of fashion capital in exporting country.

$$X_i^a = f(S_i^a, P_i, FC_i) = S_i^a \times P_i \times FC_i = S_i^a \times \sum \frac{M_j^a}{d_{ij}} \times FC_i, \quad 4$$

where

$X\frac{a}{i}$: value of apparel exports from country i to importing countries, U.S. dollars;

$S\frac{a}{i}$: value of domestic apparel supply in exporting country i, U.S. dollars;

P_i: value of potential demand for apparel product in exporting country i, U.S. dollars;

$M\frac{a}{j}$: value of apparel imports in country j, U.S. dollars;

d_{ij}: distance between exporting country i and importing country j, miles; and

FC_i: existence of fashion capital in exporting country i.

Method

Data Collection

Member nations of the Organization for Economic Cooperation and Development (OECD) were used to identify developed countries in this research. OECD is an international nonprofit organization with 34 member countries. It promotes government policies that improve economic and social well-being of people around the world (OECD, 2013). Scholars in various disciplines have used OECD countries to represent developed economies (Boulhol & De Serres, 2010; Van Doorslaer, Masseria, & Koolman, 2006). OECD provides relatively up-to-date and

complete economic data for each member country—specifically, production output by industry that is unavailable through any other source for multiple developed countries. The authors carefully examined the list of OECD countries to make sure that the final data set included only developed economies. Of the 34 total OECD nations, 31 countries were included in the study.2 Three countries (Chile, Mexico, and Turkey) were classified as newly emerging countries (OECD, 2013) and were excluded from the final sample for data analysis.

In addition to the OECD source (2012), data were collected from the United Nations (2013) and GoogleEarth (2011) for the 2005–2007 period. These were the most recent years for which full data sets were available for all 31 countries. The latest data were not critically important because this study was developed to test theoretical propositions that might help explain apparel exports in developed economies.

Yearly apparel export value of country i ($X\frac{a}{i}$) was used to operationalize apparel exports from each OECD country (Athukorala, 2009). The values of apparel exports in current U.S. dollars for each of the 31 OECD countries were collected from the United Nations (2013). The classification of the export data was based on Standard International Trade Classification (SITC). SITC 84 "Articles of apparel and clothing accessories" was used (United Nations, 2013).

Data for yearly apparel production output were collected as a measure of domestic supply ($S\frac{a}{i}$). Production output data for the OECD countries classified as C18 (wearing apparel, dressing and dying of fur) were collected in national currencies (OECD, 2012). The data were converted to current U.S. dollars using average International Monetary Fund (2010) exchange rates for the respective years.

To measure the index of potential demand (Harris, 1954), P_i, the top 10 apparel-importing countries were identified based on the 2005 world's apparel import data (United Nations, 2013). The 10 countries included United States, Germany, Japan, United Kingdom, Hong Kong, France, Italy, Spain, Belgium, and the Netherlands. Combined apparel imports of the 10 countries ($M\frac{a}{j}$) accounted for 74% of the world's total apparel imports in 2005 (United Nations, 2013). The top 10 importing countries were chosen for this study (instead of the 143 total apparel-importing countries) to make data collection and analysis more manageable.

Accumulated import of the top 10 apparel-importing countries was used to represent apparel market potential or total potential demand for an exporting country's apparel. The values of apparel imports for the top 10 apparel importers were collected in current U.S. dollars from the United Nations (2013). The distances between an OECD exporter and all top 10 importing countries were measured by determining the distance between the capital city of an exporting country and the capital city of an importing country using GoogleEarth (Google, 2011). Distances and import data were used to calculate the index of potential demand (Harris, 1954).

The index of potential demand (P_i) in an exporting country i was calculated by a summation of each of the 10 apparel countries' imports in U.S. dollars ($M\frac{a}{j}$) divided by the distances (d_{ij}) between an exporting country i and each importing country j (Equation 5).

$$P_i = \sum_{j=1}^{10} \frac{M_j^a}{d_{ij}} = \frac{M_1^a}{d_{i1}} + \frac{M_2^a}{d_{i2}} + \frac{M_3^a}{d_{i3}} + \ldots \frac{M_{10}^a}{d_{i10}}. \quad (5)$$

Based on the fashion capital literature, five fashion capitals were identified: Paris, London, Milan, New York, and Tokyo. The classic big-four fashion capitals included London, Milan, New York, and Paris (Boyd, 2003; Martínez, 2007; Merlo & Polese, 2006; "Stilettos out as," 2008; Wenting, 2008). Tokyo was included as a fashion capital in this study because of its importance in Asia ("Armani to give," 2004; Garger, 2006). Existence of fashion capital (FC_i) was incorporated into the model as a dummy variable. The authors entered 1 (fashion capital) for 5 countries (Italy due to Milan, France due to Paris, Japan due to Tokyo, United Kingdom, due to London, and the United States due to New York city), and 0 (no fashion capital) for the remaining 26 OECD countries.

All the data, including (a) value of apparel production in exporting countries in U.S. dollars; (b) value of apparel export in U.S. dollars; and (c) value of apparel import in U.S. dollars, were converted to the 2006 constant dollar using the consumer purchase index—a rate of the average price change over time for consumer goods and services to account for inflation (Bryan & Cecchetti, 1993; U.S. Bureau of Labor Statistics, 2011a, 2011b). The mid-year of this study, 2006, was chosen as the base year.

Data Analysis

To test the research hypotheses, the apparel export value in country i ($X\frac{a}{i}$) was used as the dependent variable. The three independent variables included supply of exporting country ($S\frac{a}{i}$) measured by value of domestic apparel production; potential apparel demand (P_i) measured by accumulated imports and distances between exporting and importing countries; and existence of fashion capital in exporting country (FC_i). To observe the effects of independent variables on apparel export in the extended gravity model, the study employed a log-linear regression using least square approximation (Anderson, 2010; Institute for Digital, n.d.; Ott & Longnecker, 2010; Equation 6).

$$\log X_i^a = \beta_0 + \beta_1 \log S_i^a + \beta_1 \log P_i + \beta_3 FC_i + \epsilon. \quad (6)$$

Multiple regression analysis was used to test the proposed hypotheses and analyze the relationships between apparel export and factors that might influence it: apparel supply ($S\frac{a}{i}$), potential apparel demand (P_i), and existence of fashion capital (FC_i). Multiple regression analysis was conducted using SAS 9.3. As a preliminary analysis of data, multi-collinearity of the independent variables and the effect of the year were checked. After estimating the extended

gravity model, a stepwise regression analysis was conducted to find the most appropriate independent variables that explained apparel exports in developed countries.

Table 1. Correlation Matrix for Independent Variables.

	Apparel Supply ($\log S_i$)	Potential Apparel Demand ($\log P_i$)	Fashion Capital (FC_i)
Apparel supply ($\log S_i$)	1.0000		
Potential Apparel Demand ($\log P_i$)	-0.0116	1.0000	
Fashion capital (FC_i)	0.0632	-0.0111	1.0000

Table 2. Effect of Year Variables on Apparel Export.

	β	Standard Error	t Statistics	p Value
Intercept	10.10	2.79	-3.62	<.01
Apparel supply ($\log S_i$)	0.78	0.12	6.55	<.01
Potential apparel demand ($\log P_i$)	1.49	0.26	5.66	<.01
Fashion capital (FC_i)	0.07	0.12	0.55	.58
Year 2005 (y2005)	-0.03	0.14	-0.23	.82
Year 2007 (y2007)	-0.03	0.11	-0.22	.82

Results

Multicollinearity Check

A correlation matrix for the independent variables was constructed to check for multicollinearity (Table 1). All of the relationships were less than .5, showing that none of the independent variables were strongly correlated (Ott & Longnecker, 2010).

Effect of the Year

The effects of different years on apparel export performance were checked to assure the study could use three different years to construct a linear model without a time lag (Wei, 1994).

The year 2006 was used as the base year for building the model. Dummy variables for years 2005 (y2005) and 2007 (y2007) were included in the model to identify the effects of different years (Equation 7).

$$\log X_i^a = \beta_0 + \beta_1 \log S_i^a + \beta_1 \log P_i + \beta_3 FC_i + \beta_4 y2005 + \beta_5 y2007 + \epsilon. \quad (7)$$

The dummy variables for 2005 and 2007 were statistically insignificant at the .01 level. The p values for the 2005 and 2007 estimators were .82 (Table 2). Therefore, it was assumed that three different years had no effect on apparel export in this study. The final model was estimated without year variables.

Estimation of the Extended Gravity Model

A full regression model using the extended gravity model (Equation 6) was constructed. The full regression model testing the hypotheses with the logarithm of apparel export ($X\frac{a}{i}$) as the dependent variable and all three independent variables (apparel supply in exporting country, potential apparel demand in importing countries, and existence of fashion capital in exporting country) was found to be statistically significant, $F(3, 77) = 75.01$, $p < .01$ (Table 3). Of the total variance in apparel exports from 31 OECD countries, 74% was explained by the three independent variables (adjusted R2 = 74%). The parameter estimators of apparel supply in an exporting country ($\beta_1 = .78$, $p < .01$) and potential apparel demand in importing markets ($\beta_2 = 1.49$, $p < .01$) were statistically significant. According to the extended gravity model's estimates, there were positive relationships between apparel export and apparel supply in the exporting country and apparel export and potential apparel demand in the same direction in importing countries. The results supported Hypotheses 1 and 2. The parameter estimator of fashion capital was not statistically significant ($p = .55$), failing to support Hypothesis 3.

A stepwise regression analysis was conducted to achieve parsimony of the modeling procedure (Ott & Longnecker, 2010). The stepwise regression analysis chose apparel supply ($\log S_i$) and potential apparel demand ($\log P_i$) as the variables in the final model. The reduced model's significance level improved to $F(2, 77) = 112.84$, $p < .01$ (Table 4). The parameter estimators were $\beta_1 = .79$, $p < .01$ for apparel supply and $\beta_2 = 1.48$, $p < .01$ for potential apparel demand.

According to the final gravity model's estimates, there were positive relationships between apparel export and apparel supply in exporting country and apparel export and potential apparel demand in importing countries. A 1% increase (decrease) in apparel production in OECD exporting countries resulted in a .79% increase (decrease) in apparel export in these countries. Further, a 1% increase (decrease) in potential apparel demand resulted in a 1.48% increase (decrease) in apparel exports from these developed countries. The adjusted R2 did not change from the full model, remaining at .74. The results showed that apparel export was inelastic to domestic apparel production ($\beta 1 = .79$): a 1% increase in apparel production in exporting country resulted in a less than 1% increase in apparel export from this country. Interestingly, the study

showed that apparel export was elastic to potential apparel demand in importing markets (β2= 1.48): a 1% increase in potential apparel demand in importing markets resulted in a more than 1% increase in export from the exporting country.

Table 3. Results of Multiple Regression With Log Transformation in Both Explanatory and Dependable Variable Using the Extended Gravity Model.

	β	Standard Error	t Statistics	p Value
Intercept	-10.16	2.66	-3.82	<.01
Apparel supply (log S_i)	0.79	0.10	7.94	<.01
Potential apparel demand (log P_i)	1.48	0.27	5.58	<.01
Fashion capital (FC_i)	0.08	0.10	0.77	.44

Note. Adjusted R^2 = .74 (p value < .01).

Table 4. Results of Multiple Regression With Log Transformation in Both Explanatory and Dependable Variable Using the Reduced Gravity Model.

	β	Standard Error	t Statistics	p Value
Intercept	-9.86	2.60	-3.79	<.01
Apparel supply (log S_i)	0.79	0.10	7.95	<.01
Potential apparel demand (log P_i)	1.46	0.26	5.58	<.01

Note. Adjusted R^2 = .74 (p value < .01).

Conclusions and Implications

Based on the gravity model and economic geography theory, this study proposed an extended gravity model to explain apparel exports in developed economies. Specifically, relationships between apparel export and the three factors—domestic apparel supply in exporting country, potential apparel demand in importing countries, and existence of fashion capital—were examined for 31 developed countries belonging to the OECD. Using the proposed extended

gravity model, multiple regression results showed that domestic apparel supply (production output) and potential demand (an index combining demand in importing countries and distances between trading countries) are significant predictors of apparel export in developed countries. Apparel domestic supply and potential demand in importing countries were positively related to apparel export. The final regression model explained 74% of the variance in apparel export (adjusted R2 = .74) and indicated parsimony in the model building. Because the elasticity of potential apparel demand (1.48) was higher than the elasticity of apparel supply (0.79), we concluded that the former has a stronger effect on apparel export growth in developed countries.

The research results supported the importance of the potential demand index within the context of apparel trade. In this study, potential apparel demand was measured as accumulated apparel imports from the top 10 apparel-importing countries and geographic distances between exporting and importing countries. The results showed that a 1% increase in potential apparel demand in importing markets in relation to the distance between exporting and importing countries resulted in a 1.48% increase in apparel export in a developed economy. The increasing importance of exporting country's location in apparel trade has been suggested in previous studies (Lu, 2012; Nordas, 2004). This study was the first to empirically confirm it.

The results of this study demonstrate that countries with a strong domestic supply tend to export more apparel than countries with a lower volume of domestic production. This supports previous propositions by Krugman (1990), Lall (2004), and Romer (1986) who argued that once the supply is established in an industry, it would likely continue to produce similar products. However, the research findings showed that the increase in apparel supply (being inelastic) has only a limited effect on the growth of apparel export.

Based on economic geography theory, the existence of fashion capital in an exporting country was added to the extended gravity model. Fashion capital was found to be insignificant in explaining apparel export, which did not support the premise of scholars and industry experts insisting on the importance of a knowledge and expertise cluster for industry competitiveness in developed economies (Krugman, 1991; Rantisi, 2002). A possible explanation for this result might be the use of a dummy variable to represent fashion capital. The dummy variable might not have fully captured the role of fashion capitals in developed nations' apparel industries. The use of a quantifiable index to represent fashion capital is recommended for future research. Further conceptualization and operationalization of apparel industry agglomerations beyond just fashion capital might be important to better understand performance of apparel industries and trade in developed economies.

This study made important theoretical contributions to the apparel trade literature and international trade literature. It was the first research to empirically examine factors influencing apparel export in developed countries. Extant research has focused on apparel exports in developing and newly developing nations (Chi & Sun, 2013; Li et al., 2011; Lu, 2012; Zhang & Hathcote, 2008) or apparel imports in developed economies (Chi & Kilduff, 2010; Lee et al., 2013). Second, this study proposed an extended gravity model for apparel export. The proposed model had a high explanatory power, predicting 74% of variance in apparel export. Third, this

study for the first time used index of potential demand (Harris, 1954) within the context of apparel trade. Finally, this study showed how potential apparel demand and apparel supply affect apparel export in developed countries. These contributions are important stepping stones for understanding apparel trade in general and, specifically, apparel export in developed countries. The proposed extended gravity model can be used for studying other industries and countries. It is applicable for examining apparel industries in developing nations and other labor-intensive industries such as footwear. Furthermore, this research provided additional empirical study that proved parsimony and empirical robustness of the gravity theory in terms of the international trade literature (Porojan, 2001).

The research findings have practical implications for government and apparel businesses in developed countries. This study showed that although domestic apparel production was positively related to apparel export, this relationship was inelastic, which means that there is only limited effect of the growth of domestic apparel production on apparel export. In contrast, potential demand in importing countries was elastic, indicating a stronger positive impact on the growth of apparel export. The Department of Commerce as well as professional organizations (such as American Footwear and Apparel Association) might provide up-to-date information about potential apparel demand (e.g., economic growth of emerging markets) in the global markets to help strengthen domestic apparel export, rather than trying to increase domestic apparel production.

Countries with existing apparel manufacturing might use the extended apparel export gravity model to estimate potential demand from importing countries and determine optimal location sites for apparel assembly. For example, a multinational apparel company (with multiple manufacturing sites across the world) can more effectively and efficiently address an economic growth in an importing country by placing apparel assembly in closer proximity to the growing market. Thus, the company can redistribute its resources to strengthen selected assembly sites based on potential demand. Furthermore, multinational apparel firms can use the findings of this study to help choose optimal locations for building new apparel assembly sites, depending on the production supply in an exporting country and distances between the country and final destination markets.

In future research, scholars might identify factors that explain the remaining unexplained portion of the gravity model (26%) by looking at other determinants of apparel export, such as time lags brought about by changes in domestic apparel supply and potential demand or consumer preferences for imported merchandise. The original gravity model (Bergstrand, 1985; Schumacher et al., 2004) includes factors aiding or resisting trade between exporting and importing countries. In this study, these factors were not accounted for. Future research can expand the proposed model to include special trade agreements or provisions as well as certain restrictions (e.g., tariff rates) between exporting and importing countries, which might contribute to even greater explanatory power of the model. To account for full apparel demand, domestic production in importing countries can also be considered because consumers can always substitute domestic products for imported. Further exploration of economic geography theory

and determining the role of fashion capitals and industrial agglomerations in apparel export from developed economies is needed. The inclusion of not only the top 10 but all countries importing apparel from developed economies might extend the findings of this study and further increase the explanatory power of the model.

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Notes

1. For example, in 2011, a total of 143 countries imported and 135 countries exported apparel products (United Nations, 2013). This is nearly 95% of all countries for which trade data were available in the United Nations' database for the year of 2011.

2. Thirty-one Organization for Economic Cooperation and Development (OECD) countries were included in the study: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States (OECD, 2012).

References

Abraham, F., Studnicka, Z., & Van Hove, J. (2012, September). Determinants of the duration of Belgian chocolate trade. Paper presented at the first Conference on Economics and Politics of Chocolate. University of Leuven, Leuven.

Anderson, J. E. (2010). The gravity model (Working paper No. w16576). Cambridge, MA: National Bureau of Economic Research. Armani to give free advice on Bangkok fashion city project. (2004, May 25). Bangkok Post. p.2.

Athukorala, P. C. (2009). The rise of China and East Asian export performance: Is the crowding-out fear warranted? The World Economy, 32, 234–266.

Au, K. F., & Eve, C. M. (2010). The impact of social, economic variables and logistics performance on Asian apparel exporting countries. In J. Wang (Ed), Innovations in

supply chain management for information systems: Novel approaches (pp. 204–215). Hershey, PA: Business Science Reference.

Baldone, S., Sdogati, F., & Tajoli, L. (2010). Moving to central-eastern Europe: Fragmentation of production and competitiveness of the European textile and apparel industry. Rivista di Politica Economica, 92, 209–282.

Baldwin, R., & Taglioni, D. (2011). Gravity chains: Estimating bilateral trade flows when parts and components trade is important (Working Paper No. w16672). Cambridge, MA: The National Bureau of Economic Research.

Bergstrand, J. H. (1985). The gravity equation in international trade: Some microeconomic foundations and empirical evidence. The Review of Economics and Statistics, 67, 474–481.

Bertacchini, E., & Borrione, P. (2009). The city mouse and the country mouse: The geography of creativity and cultural production in Italy. (Working Paper No. 2/2009). Retrieved from International Centre for Research on the Economics of Culture, Institutions, and Creativity website: http://www.eblacenter.unito.it/WP/2009/2_WP_Ebla_CSS.pdf

Boulhol, H., & De Serres, A. (2010). Have developed countries escaped the curse of distance? Journal of Economic Geography, 10, 113–139.

Boyd, S. (2003). Canadian cool. Maclean's, 116, 14.

Brauer, D. (2008). Factors underlying the decline in manufacturing employment since 2000. Washington, DC: Congressional Budget Office. Retrieved from http://digitalcommons.ilr.cornell.edu/key_workplace/585

Bryan, M. F., & Cecchetti, S. G. (1993). The consumer price index as a measure of inflation(Working Paper No.w4505). Cambridge, MA: The National Bureau of Economic Research.

Campaniaris, C., Hayes, S., Jeffrey, M., & Murray, R. (2011). The applicability of cluster theory to Canada's small and medium-sized apparel companies. Journal of Fashion Marketing and Management, 15, 8–26.

Caporale, G. M., Rault, C., Sova, R., & Sova, A. (2009). On the bilateral trade effects of free trade agreements between the EU-15 and the CEEC-4 countries. Review of World Economics, 145, 189–206.

Chi, T., & Kilduff, P. P. (2010). An empirical investigation of the determinants and shifting patterns of US apparel imports using a gravity model framework. Journal of Fashion Marketing and Management, 14, 501–520.

Chi, T., & Sun, Y. (2013). Development of firm export market oriented behavior: Evidence from an emerging economy. International Business Review, 22, 339–350.

Fuhrer, J. C., & Little, J. S. (Eds.). (1996). Technology and growth. Boston, MA: Federal Reserve Bank of Boston.

Garger, I. (2006, May 8). Land of styles. Time International (South Pacific Edition), p. 18.

Google. (2011). GoogleEarth (Version 5.1.3533.1731) [Software]. Retrieved from http://www.google.com/earth/index.html

Greta, M., & Lewandowski, K. (2010). The textile and apparel industry in Italy: Current state and challenges to further growth. Fibres & Textiles in Eastern Europe, 18, 83.

Harris, C. D. (1954). The market as a factor in the localization of industry in the United States. Annals of the Association of American Geographers, 44, 315–348.

Hodges, N. N., & Karpova, E. (2006). Employment in the US textile and apparel industries: A comparative analysis of regional vs. national trends. Journal of Fashion Marketing and Management, 10, 209–226.

Institute for Digital Research and Education UCLA. (n.d.). stat > sas > f&q > sas_interpret_log.htm. Retrieved from http://www.ats.ucla.edu/stat/sas/faq/sas_interpret_log.htm

International Labour Organization. (2010). Laborsta. Retrieved from United Nations, ILO Department of Statistics website http://laborsta.ilo.org/

International Monetary Fund. (2010). Data and statistics. Retrieved from http://www.imf.org/external/data.htm/

Jansson, J., & Power, D. (2010). Fashioning a global city: Global city brand channels in the fashion and design industries. Regional Studies, 44, 889–904.

Jin, B., & Moon, H. C. (2006). The diamond approach to the competitiveness of Korea's apparel industry:

Michael Porter and beyond. Journal of Fashion Marketing and Management, 10, 195–208.

Jongwanich, J. (2010). Determinants of export performance in East and Southeast Asia. The World Economy, 33, 20–41.

Krugman, P. (1990). Increasing returns and economic geography (Working Paper No. w3275). Cambridge, MA: The National Bureau of Economic Research.

Krugman, P. (1991). Industry competitiveness and economic geography. The Journal of Political Economy, 99, 483–499.

Lall, S. (2004). Reinventing industrial strategy: The role of government policy in building industrial competitiveness (G-24 Discussion Paper Series). United Nations conference on Trade and Development. Retrieved from G24 website: http://www.g24.org/Publications/Dpseries/28.pdf

Lau, C. K. M., & Bilgin, M. H. (2010). Export conditions of the Chinese textile industry: An analysis in comparison with selected ASEAN countries. Textile Research Journal, 80, 2028–2045.

Lee, J., Farr, C., & Hathcote, J. (2013). Comparative analysis of apparel import by fiber content: The case of the United States and Japan. Journal of Fashion Technology & Textile Engineering, 1, 1.

Leonidou, L. C., & Katsikeas, C. S. (2010). Integrative assessment of exporting research articles in business journals during the period 1960–2007. Journal of Business Research, 63, 879–887.

Li, X., Kong, F., Liu, Y., & Qin, Y. (2011, October). Applying GM (1, 1) model in China's apparel export forecasting. In Computational Intelligence and Design (ISCID), 2011

Fourth International Symposium on 28-30 October, 2011. (Vol. 2, pp. 245-247). Hangzhou, China.

López-Rodríguez, J., & Faíña, J. A. (2006). Does distance matter for determining regional income in the European union? An approach through the market potential concept. Applied Economics Letters, 13, 385–390.

Lu, S. (2012). China takes all? An empirical study on the impacts of quota elimination on world clothing trade from 2000 to 2009. Journal of Fashion Marketing and Management, 16, 306–326.

Martínez, J. G. (2007). Selling avant-garde: How Antwerp became a fashion capital (1990—2002). Urban Studies, 44, 2449–2464.

Merlo, E., & Polese, F. (2006). Turning fashion into business: The emergence of Milan as an international fashion hub. Business History Review, 80, 415.

Morosini, P. (2004). Industrial clusters, knowledge integration and performance. World Development, 32, 305–326.

Nordas, H. K. (2004). The global textile and clothing industry post the agreement on textiles and clothing. Geneva, Switzerland: World Trade Organization (WTO).

Organization for Economic Cooperation and Development. (2012). OECD.StatExtracts: Structural analysis (STAN) databases: STAN database for structural analysis (ISIC Rev.3). Retrieved from the Organisation for Economic Co-operation and Development website http://stats.oecd.org/

Organization for Economic Cooperation and Development. (2013). Members and partners. Retrieved from the Organisation for Economic Co-operation and Development website http://www.oecd.org/about/membersandpartners/

Ott, L., & Longnecker, M. (2010). An introduction to statistical methods and data analysis. Belmont, CA: Duxbury Press.

Porter, M. E. (1996). Competitive advantage, agglomeration economies, and regional policy. International Regional Science Review, 19, 85–90.

Porojan, A. (2001). Trade flows and spatial effects: The gravity model revisited. Open Economies Review, 12, 265–280.

Rantisi, N. M. (2002). The competitive foundations of localized learning and innovation: The case of women's garment production in New York City. Economic Geography, 78, 441–462.

Redding, S. J. (2010). The empirics of new economic geography. Journal of Regional Science, 50, 297–311.

Redding, S., & Venables, A. (2004). Geography and export performance: External market access and internal supply capacity. In R. E. Baldwin & L. A. Winters (Eds.), Challenges to globalization: Analyzing the economics (pp. 95–130). Chicago, IL: University of Chicago Press.\

Rivoli, P. (2009). The travels of a t-shirt in the global economy: An economist examines the markets, power, and politics of world trade. Hoboken, NJ.: John Wiley & Sons.

Romer, P. M. (1986). Increasing returns and long-run growth. The Journal of Political Economy, 94, 1002–1037.
Schumacher, D., Siliverstovs, B., & Berlin, D. I. W. (2004). Size and factor-endowment effects on comparative advantage in a gravity approach. Berlin, Germany: German Institute for Economic Research.
Scott, A. J. (2006). The changing global geography of low-technology, labor-intensive industry: Clothing, footwear, and furniture. World Development, 34, 1517–1536.
Stilettos out as New York threatens London's place in fashion calendar times. (2008, September 6). The Times (United Kingdom), p. 28.
United Nations. (2013). UN comtrade. Retrieved from the United Nations Commodity Trade Statistics Database website http://comtrade.un.org/db/
U.S. Bureau of Labor Statistics. (2011a). Consumer price index: Frequently asked questions (FAQs). Retrieved from http://www.bls.gov/cpi/cpifaq.htm
U.S. Bureau of Labor Statistics. (2011b). CPI inflation calculator. Retrieved from http://data.bls.gov/cgi-bin/cpicalc.pl
Van Doorslaer, E., Masseria, C., & Koolman, X. (2006). Inequalities in access to medical care by income in developed countries. Canadian Medical Association Journal, 174, 177–183.
Wei, W. W. S. (1994). Time series analysis: Univariate and multivariate methods. Boston, MA: AddisonWesley Publishing Company.
Wenting, R. (2008). Spinoff dynamics and the spatial formation of the fashion design industry, 1858–2005. Journal of Economic Geography, 8, 593–614.
Xiong, B., & Beghin, J. (2011). Disentangling the demand-enhancing effect and trade-cost effect of technical measures in agricultural trade among OECD countries (Working Paper No. 11019). Retrieved from Iowa State University website: http://ideas.repec.org/p/ags/iatr11/116898
Zhang, Q., & Hathcote, J. M. (2008). Factors influencing apparel imports from China. Clothing and Textiles Research Journal, 26, 23–40.

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