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THE SURVIVAL OF THE SUNSET TEXTILE INDUSTRY INVOLVING BILATERAL FREE-TRADE AGREEMENTS: EMPIRICAL EVIDENCES OF TAIWAN

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ABSTRACT

This study attempts to investigate how bilateral free-trade agreements (FTA) affect competitiveness within Taiwanese textile industry with comparison to other Asian Tiger countries (Hong Kong and South Korea) by utilizing export market share (EMS) and revealed comparative advantage (RCA). The applied regression model is estimated in order to identify which factors would affect the international competitiveness. The results have demonstrated that the gradually released quota by multi-fiber agreement (MFA) has a negative effect on the promotion of international competitiveness. On the other hand, it is estimated that the signing of bilateral FTAs such as economic cooperation framework agreement (ECFA) might substantially help Taiwanese textile industry's international competitiveness. In hope to better understand the relationships between interconnected regional and global integration processes emerging from today's challenging multilateral trading structure within Asia-Pacific regions.

Contribution/ Originality: This study contributes in the existing literature about investigating how bilateral free-trade agreements (FTA) affect competitiveness within Taiwanese textile industry with comparison to other Asian Tiger countries (Hong Kong and South Korea) by utilizing export market share (EMS) and revealed comparative advantage (RCA). The results have demonstrated that the gradually released quota by multi-fiber agreement (MFA) has a negative effect on the promotion of international competitiveness. On the other hand, it is estimated that the signing of bilateral FTAs such as economic cooperation framework agreement (ECFA) might substantially help Taiwanese textile industry's international competitiveness.

1. INTRODUCTION

The Textile industry is known as a labor-intensive industry. Its capital requirements, technology levels and entry thresholds are relatively low, becoming an ideal sector for developing countries looking for industrialization as ways to improve their economic conditions. Asian Tiger countries (Taiwan, Hong Kong, South Korea and Singapore) are counties that have a long history in the textile development. The textile industry of Asian Tiger

countries has made substantial contribution to economic growth in the East Asia and South-East Asia regions since the 1960s. However, nowadays this industry within the Asian Tiger countries is often referred as a "sunset industry" as they have mostly transitioned from their old traditional labor-intensive business production infrastructure into a high-tech one. Despite these facts, according to reports of statistic data[1], surprisingly the fabrics exported from the Asian Tiger countries have not been extremely affected by other high-tech manufactures, remarkably maintaining over 50% of their annual foreign exchange earnings.

Within recent years, most Asian Tiger countries have already transferred their production infrastructure from traditional labor-intensive businesses into high-tech ones. Throughout the years, the general textile sector has been greatly affected by globalization, liberalization and also the past "Multi-fiber Arrangement (MFA)". The Asian Tiger countries have been faced against competitors with lower crude material costs and reduced wages, as a result, Asian Tigers textile industries where impacted by absorbed market shares. Based on the statistical data[2], the international trade of fabrics had previously brought a trade surplus to the Asian Tiger countries, especially to Taiwan. However, given the rapid development of globalization and liberalization, Asian Tiger countries' textile industries are still continuously facing drastic competitions from other developing countries. Even though they have gradually lost part of their existing advantages, the competitive potential of textile industries within the Asian Tiger countries of Taiwan, Hong Kong and South Korea is still remains strong in the global market[3] (due to the small scale of its textile industry, this study excludes Singapore from the analysis). These signs may indicate that if these countries upgrade their international competitiveness of their textile industries in the global market, then their entire competitiveness would also be improved altogether.

In general, the signing of bilateral free-trade agreements (FTA) can greatly increase international industrial competitiveness. In the case of Taiwan, it is expected that the Economic Cooperation Framework Agreement (ECFA) as the bilateral free-trade agreement between Taiwan and Mainland China could help its overall competitiveness. On another note, physical capital, human capital and R&D may also bring great opportunities in order to improve Taiwan's textile competitiveness. Asian Tiger countries, Taiwan included, where faced at a turning point in their textile industries, facing strong competition in their traditional market. Since both economic and non-economic factors can affect the Taiwanese textile industry; how bilateral free-trade agreements and which factors together with what strategies should Taiwan take into account in order to improve their international competitiveness?

To answer these questions, we firstly examine some common indexes of international competitiveness, and select the most suitable variables to analyze Taiwan's textile industry's competitiveness in comparison to Hong Kong and South Korea. We set up an econometric model and then apply regression analysis to bring to light implicit factors that could influence Taiwan's international competitiveness in the textile industry. Hopefully, the empirical results can provide useful information for industry strategies and for government agencies to set up related policies.

The reminders of this paper are organized as follows. Section 2 presents a review of the relevant literature. Section 3 describes the set-ups of econometric model and the characteristics of data series. Section 4 presents the empirical results and analysis. The paper then provides the concluding remarks in section 5.

[1]The statistical data of customs in 2014

[2]Taiwan Textile Federation Report in 2014

[3]Due to its small scale, this study excludes Singapore from the analysis, focusing in the other Tigers, which textile industries are comparable.

2. LITERATURE REVIEW

Competitiveness is the ability of a company or country to obtain market returns relative to its competitors. It depends on the relationship between value and quantity of products offered and the inputs needed to get that (productivity) and on the productivity of other suppliers in the market (Chudnovsky and López, 2004).

Porter (1990) said that there are five competitive forces that determine the profitability of any sector. Those define the prices companies can charge, the costs they have to endure, and the needed investments to compete in the sector. To face them is essential to have comparative advantage (Ricardo, 1817) or to create competitive advantages (Porter, 1998). The comparative advantage arises from the possibility of getting some inputs with lower-cost such as natural resources, labor, energy, etc.; whereas competitive advantage derives from a set of characteristics or qualities that a company or a country has, and that distinguishes them from the others. These features are based on providing higher value products that are recognized by customers, either because it is a good product that costs less, or a product that has attributes that distinguish it and makes it worthy of a higher price. There are two main strategic models to obtain competitive advantages: lower cost and differentiation.The first one is based on reducing costs of production, distribution, etc., Enabling to offer a product or service at a lower cost than your competitors, while the latter emphasizes the incorporation of unique attributes such as quality, image, design, reliability, etc., which are perceived by customers, differentiating y from other competitors (Keegan and O'Kelly, 2004).

Both the competitive and comparative advantages are dynamic and evolutionary. They are also depleted over time because continually new products and new skills are found. Therefore, must be renewed through investment in technology, knowledge, human skills, etc. and depend on both micro and macroeconomic factors. Government plays a key role in its development by providing a favorable environment for the industry, which includes maintaining economic stability, adequate infrastructure and establishing policies that promote competitiveness (Porter, 1990). There are several ways to measure international competitiveness and define its determinants. Some economists such as Caves (1980) used the international competitiveness indexes to discuss the export market structure, but other authors like Auquier (1980) had different viewpoints on the discussions by analyzing international trade, market structure, and technological efficiency. In general, the export production efficiency is a good way to analyze international competitiveness, which can be used by the introduction of economies of scope, economies of scale and tariff. The export performance has a positive relation with the scale of firms. If the scale of firms is large enough, the exports would increase more.

Carlin *et al.* (2001) investigated the relationship between export market shares (EMS) and relative unit labor costs using a long panel of twelve manufacturing industries across fourteen OECD countries. The empirical results indicated that the sensitivity of exports to labor costs is lower in high tech industries and in core exchange rate mechanism (ERM) countries. The industry elasticities have increased over time, especially in industries subject to increasing product market competition. Danninger and Joutz (2008) tried to compute Germany's export market shares (EMS) and investigate its determinants. The empirical results indicated that the dominant factors explaining the increase in market share are trade relationships with fast growing countries and regionalized production in the export sector. Improved cost competitiveness had a comparatively smaller impact. There is no conclusive evidence supporting the increased demand for capital goods hypothesis.

Anh-Dao (2010) examined Vietnam's export performance in the face of other counties' emergence as a major competitor in global markets. He still used export market share (EMS) analysis to investigate the influence of factors determining export performance between Vietnam and China for the years 1997–2004.The results suggest that although China has become a huge competitor for the developing economies, this phenomenon has not crowded out Vietnam's exports. Rather, should the country incur losses of market share, it would mainly result from its own export pattern. In a more recent study, Akgün *et al.* (2013) investigated how the important key factors influencing new product development and products' successive factors at overseas nutritional market, and furthermore affect their EMS. They found that there is an ongoing change on customers' needs on selecting customers' needs, which

may influence requirements on designing products and services as well as export sale and company's market shares in domestic and international market.

In relation to the studies of RCA for international competitiveness, Balassa (1986) has provided a test for the Heckscher–Ohlin (H-O) theory for manufactured goods by simultaneously introducing the trade flows, factor intensities, and factor endowments in the framework of a multi-country and multi-product model. The empirical results have shown that countries with abundant capital (labors) export mostly capital (labor) intensive commodities; and that the pattern of trade is further influenced by the policies applied, i.e., many countries may interfere in the international specialization based on maintaining the comparative advantages, and imposing economic costs as protection on the export countries. Balance *et al.* (1987) empirical work strongly suggested that use comparative advantage measures to choose alternative of export seems reasonable with RCA indices. A similar study, conducted by Lundberg (1988) evaluates the changes in the industrial pattern of relative international competitiveness and specialization in the Swedish manufacturing industry. He intended to explain the factors that affect the changes in the industry pattern of relative international competitiveness and international specialization in terms of various industry characteristics assumed to reflect comparative advantage. In particular, he focused on the role of technology and technical progress through R&D in this process. Lundberg found that the Swedish producers had improved the capital-intensive industries, especially in human capital as well as physical capital. This indicates that the pattern of comparative advantage may shift during that period toward capital-intensive products, and away from the highly unskilled labors industries.

Moreover, Lee (1995) calculated the revealed comparative advantage (RCA) indexes in Korean manufacturing sectors. His empirical results gained the dynamic comparative advantage by forcing capital-intensive industry within a labor-surplus economy. Nevertheless, the comparative advantage of labor-intensive industries may not be underestimated. Haque and Mahbubur (2002) examined the export competitiveness of selected textile and apparel products using indicator like revealed comparative advantage (RCA) analysis. The selected four categories textile and seven categories apparel product are taken into account on the basis of three-digit level Standard International Trade Classification (SITC) for the period between (1985 until 1999). The results also suggest that export gain of Bangladesh for textile and apparel are largely attributed to the size of the market and also to her competitiveness efforts.

In another aspect for analyzing the comparative advantages of commodities and/or among countries, Serin and Civan (2008) used revealed comparative advantage (RCA) and the comparative export performance (CEP) index to detect how the comparative advantages of those commodities are. The results signified that Turkey has a strikingly high comparative advantage in the fruit juice and olive oil markets in the EU but this is not the case in the tomato market. Chien (2010) tried to explore the change in export competitive advantage of Japan, China, South Korea and Taiwan in the US market and to study whether the structure of export industry is changing in each country, by using the every three-year average variation of revealed comparative advantage (RCA) to understand the enhancement rate and reducing rate of comparative advantage of industrial export. The empirical results showed that the demonstration of significant positive correlation between South Korea and Taiwan's export products to the US. Recently, Karambakuwa and Mzumara (2013) investigated the revealed comparative advantage of Swaziland. They examined whether or not Swaziland has comparative advantage in the products it exports to the Common Market for Eastern and Southern Africa (COMESA), Southern African Development Community (SADC), Southern Africa Customs Union (SACU) and the rest of the world. The results indicated that Swaziland has RCA≥1 in 449 product lines hence has comparative advantage in such product lines. Chem wood pulp, sulphite, coniferous unbleached has the highest RCA index of 3106. The product in which Swaziland has comparative advantage includes manufactured and agricultural products. Swaziland could improve the range of the products in which it has comparative advantage through attracting foreign direct investment via transnational corporations and exploration of new resources. Recently, Saboniene (2015) applied RCA index to

evaluate the export competitiveness for manufacturing industries in Lithuanian and compare with other Baltic States. His research results indicate that major domestic commodities such as animal products, prepared foodstuffs, wood and wood articles, textile articles and furniture-maintained competitiveness from 2001 to 2007, because their RCA indexes retained positive values, but the RCA index decreased in traditional industries, which were described as strong trade groups in the aspect of export. The results also reveal that the changes of export competitiveness for manufacturing industries in Lithuanian in accordance with the level of technological developments had shown a gradually growing export of average-high technology and average-low technology industries, however, the parts of high and low technology industries decline.

The above mentioned empirical studies on EMS and RCA provide evidences that the literature focuses more on the measurement of the comparative advantage or international competitiveness for various products, industries and countries of economies. This provides the important revelations to measure and detect the factors affecting the international competitiveness of Taiwan's textile industry under consideration of economic and non-economic factors (bilateral free-trade agreements (FTA)) by comparison to the other Asian Tiger countries of Hong Kong and South Korea. We hope that the empirical results can provide useful information to increase Taiwan's competitive situation, gain better understanding of bilateral FTAs and provide insights for industry strategies and government related policies.

3. ECONOMETRIC MODEL

In this section, Section 3.1 describes Export Similarity Index (ESI) for discussing intra-industrial trades among countries. Section 3.2 and 3.3 depict the international competitiveness by utilizing the export market share (EMS) and revealed comparative advantage (RCA). Finally, section 3.3 specifies the econometric model in order to detect the affecting factors influencing the Taiwanese textile international competitiveness.

3.1. Measurement of the Similarity in Export Patterns

Export Similarity Index (ESI) is utilized to analyze the export structure of Taiwan, Hong Kong and South Korea. ESI requires international trade data, which is available on a standardized basis from most countries. Finger and Kreinin (1979) considered that since the index is intended to compare only patterns of exports across product categories, it should not be influenced by the relative sizes or scales of total exports; ESI is calculated by using the following equation:

$$ESI(a,b) = \left\{ \sum_i Minimum\left[Xi(a), Xi(b) \right] \right\} \cdot 100 \quad \text{.....(1)}$$

where $ESI(a,b)$ is the similarity of the export patterns between country "*a*" and country "*b*", $Xi(a)$ is the share of commodity *i* in country *a*'s exports, $Xi(b)$ is the share of commodity *i* in country *b*'s exports. If the commodity distribution of *a*'s and *b*'s exports are similar, the index will take a value of 100. If *a*'s and *b*'s export patterns are totally dissimilar, the index will take a value of zero.

3.2. Measurement of the International Competitiveness Trend

The analysis of competitiveness trend can be calculated by the export market share (EMS) and revealed comparative advantage (RCA). Both of these are discussed as follows:

(1) Export Market Share (EMS)

The EMS can be calculated as the following equation:

$$EMS_{ij} = X_{ij} \Big/ \sum_j X_{ij} \quad \text{.....(2)}$$

where EMS_{ij} is the EMS of the industry i of country j, X_{ij} is the total exports of the industry i of country j, and $\sum_j X_{ij}$ is the total exports of the industry i of the world.

EMS lies between 0 and 1($0 \le EMS_{ij}^{k} \le 1$). If the EMS value in a country is close to 1, its international competitiveness is considered strong; on the contrary, if the EMS value is close to 0, its international competitiveness is assumed weak (Carlin *et al.*, 2001; Danninger and Joutz, 2008). It should be noted that EMS doesn't take the country economic scale into consideration, which may cause some bias for estimations of international trade competitiveness. Thus, in our study we further consider the revealed comparative advantage (RCA) method to estimate a more accurate international competitiveness.

(2) Revealed Comparative Advantage (RCA)

The RCA can be calculated as follows:

$$RCA_{ij} = \frac{X_{ij} \Big/ \sum_i X_{ij}}{\sum_j X_{ij} \Big/ \sum_i \sum_j X_{ij}} \quad \text{.....} \quad (3)$$

where RCA_{ij} is the RCA of the industry i of country j, X_{ij} is the total exports of the industry i of country j, $\sum_i X_{ij}$ is the total exports of all industries of country j, $\sum_j X_{ij}$ is the total exports of the industry i of the world, and $\sum_i \sum_j X_{ij}$ is the total exports of all industries of the world.

If the industrial RCA of a country is larger than those of other countries, it means that the industrial international competitiveness is relatively stronger than other countries. Peterson (1988); Webster (1991); Lee (1995); Rodas-Martini (1998) and Karambakuwa and Mzumara (2013) adopted Balassa's definition of RCA to measure the comparative advantage among the countries. All of these studies considered that the RCA reflects a country's international competitiveness under the product consideration.

3.3. Model Specifications and Estimation Methods

Based on the literature review from above, we apply the regression analysis to investigate the factors affecting EMS and RCA for Taiwanese textile industry from 1995-2014 and to further compare the international competitiveness of Taiwan's textile industry in contrast to Hong Kong and South Korea. Specific details will be discussed in Section 4.

(1) Model Specifications

Model specification for the factors that affecting the export competitiveness (EMS or RCA) can be depicted as follows:

$$Y = f(K, H, R\&D, Z, D_1, D_2) \quad (4)$$

Where

Y: EMS (export market share) index or RCA (revealed comparative advantage) index

K: fixed (physical)capitals (newTaiwan dollars NTD)

H: human-capital intensity (%)

R&D: R&D intensity (%)

Z: economic growth rate (%)

D_1: 1, MFA quota was cancelled, years 2005-2014

0, others

D_2: 1, ECFA was signed, years 2009-2014; 0, others

The description and measurement of variables together with their expected effects on international competitiveness can be described as follows:

The variables influencing international competitiveness can be categorized by two subsets: industrial structure and macroeconomic structure. The main factors of industrial structure include: physical capitals (K), human-capital intensity (H) and R&D intensity (R&D). Physical capitals refer to the amounts of investments on any kind of real or physical assets (such as land, buildings, vehicles and equipment) that are used in the production of a product. Human-capital refers to the amount of investments on the abilities and skills of an individual, especially for those acquired through education and training, here we compute these amounts of investments to total sales to obtain the ratio indicating human-capital intensity (H). R&D intensity is measured by the ratio of R&D expenditures to sales for textile industry.

For the second Subset, economic growth rate (E) is used an expression for the macroeconomic structure in Taiwan. In this study, the cancelation of Multi-Fiber Agreement (MFA) and the signing of the economic cooperation framework agreement (ECFA) during the study periods are also two important factors influencing international competitiveness within the Taiwanese textile industry. We apply two dummy variables D_1 and D_2 to be designed to be equal to 1 individually, to denote the MFA quota cancellation and the signing of the ECFA. Further details on the incorporation of D_1 and D_2 in order to satisfy our purpose of study will be discussed in Section 4.

According to the theoretical considerations, physical capital (K), human-capital intensity (H), R&D intensity (R&D) and economic growth rate (E) are expected to be positively related to the international competitiveness of textile industry. Moreover, the dummy of D_1 is expected to be of negative sign, while D_2 is expected to have a positive effect on the international competitiveness within the textile industry. The theoretical signs for right-hand side variables which influence EMS and RCA can be summarized and shown in Table 1.

Table-1. The Expectation Signs of Factors on Influencing Export Competitiveness

Indexes	Factors	Signs
EMS	1. Physical Capitals (K) 2. Human-Capital Intensity (H) 3. R& D intensity (R&D) 4. Economic Growth Rate (E) 5. MFA was cancelled (D_1) 6. ECFA was signed (D_2)	1. (+) 2. (+) 3. (+) 4. (+) 5. (−) 6. (+)
RCA	1. Physical Capitals (K) 2. Human-Capital Intensity (H) 3. R& D intensity (R&D) 4. Economic Growth Rate (E) 5. MFA was cancelled (D_1) 6. ECFA was signed (D_2)	1 (+) 2 (+) 3 (+) 4 (+) 5 (−) 6 (+)

(2) Estimation Methods

A. Testing the Stationarity for Each Individual Series for Variables

The non-stationarity in the regression model would cause a problem of "spurious regression". The unit root test developed by Dickey and Fuller (1979) can be used to test the stationarity of the model. As far as the augmented Dickey-Fuller (ADF) unit root test is
concerned, three kinds of forms can be discussed as follows.

(i) No Intercept and No Trend $$\Delta Y_t = \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad (5)$$

(ii) Intercept but No Trend $$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad (6)$$

(iii) Both Intercept and Trend $$\Delta Y_t = \alpha + \delta \cdot t + \beta Y_{t-1} + \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad (7)$$

B. Autocorrelation and Multicollinearity

If the error terms are auto-correlated, it will increase the standard error of the estimative value and reduces the estimative efficiency. Therefore, the problem of autocorrelation should be addressed.

Firstly, for the full model structure, Durbin-Watson (DW) test is valid when the equation does not include a lagged dependent variable as an explanatory variable. Secondly, Durbin (1970) derived a statistic (i.e. h statistic) has the following form:

$$Durbin - h = \left(1 - \frac{d}{2}\right)\sqrt{\frac{n}{1 - n\sigma_{\hat{\gamma}}^2}} \quad (8)$$

where n is the number of observations, d is the regular DW statistic and $\sigma_{\hat{\gamma}}^2$ is the estimated variance of the coeffici ent of the lagged dependent variable. For large same observations, this Durbin-h follows a Gaussian distribution.

The multicollinearity is also a big problem in the regression model. If the multi-collinearity is high it would increase the standard deviation of the estimative coefficient. Therefore, this study adopted the Variance Inflation Factors (VIF) (Neter *et al.*, 1985) to inspect the multicollinearity. The VIF equation is:

$$VIF_j = \frac{1}{1 - R_j^2} \quad (9)$$

Where $j = 1,2,3.....K$

VIF_j = variance inflation factor

R_j^2 = the coefficient of determination between j and other independent variables

TOL_j = tolerance value which is 1/ VIF

If the VIF is greater than 10, it implies there is multicollinearity between the independent variables. On the contrary, if the VIF smaller than 10 or tolerance value (TOL) is greater than 0.1, it implies that the problem of multicollinearity among the independent variables is not serious.

4. EMPIRICAL RESULTS AND ANALYSIS

To analyze Taiwan's international competitiveness in the textile industry in comparison to Hong Kong and South Korea and how bilateral FTAs can influence its trading structure, we use exports and imports data from the

WTO Statistics Database. The individual fabric data were collected from WTO Center of Chung Hua Institute for Economic Research Trade Indicators Database in Taiwan. The fabrics were classified from HS50 to HS63[4]. Moreover, the statistical data of independent variables were gathered from the data bank of AREMOS from 1995 to 2014 under the consideration of the cancelation of Multi-Fiber Arrangement (MFA) in 2005 and signing of the ECFA in 2009.

4.1. The Similarity of Export Patterns

To consider the fairness of the comparisons, the similarity of export patterns among Taiwan, Hong Kong and Korea are evaluated, and the index of export similarity (ESI) was adopted to evaluate the similarity. The estimated ESI of textile industry among Taiwan, Hong Kong and South Korea is presented in Table 2. The average ESI values are greater than 70, for. Taiwan/HK it is 74.49, for Taiwan/KR, 81.42 and for HK/KR, 71.23. The results show that the export patterns of similarity when comparing Taiwan to Hong Kong and Korea are somewhat different.

4.2. Analysis of International Competitiveness

In order to further discuss the international competitive tendency, we use export market share (EMS) and revealed comparative advantage (RCA) to analyze the international competitiveness of Taiwanese textile industry.

Table-2. The ESI of Taiwan and Its Rival Countries

Year	Country		
	Taiwan / HK	**Taiwan / KR**	**HK / KR**
1995	79.71	74.55	73.23
1996	76.25	75.10	68.40
1997	74.95	78.69	66.40
1998	75.49	82.22	70.94
1999	73.85	78.77	73.14
2000	75.13	76.43	69.50
2001	73.01	77.63	73.73
2002	68.79	83.61	69.51
2003	70.60	84.41	65.73
2004	69.64	82.97	65.06
2005	70.52	83.18	66.11
2006	71.34	84.12	65.38
2007	68.54	82.15	64.11
2008	70.11	83.67	65.10
2009	69.15	81.11	66.18
2010	70.89	80.25	68.14
2011	71.26	82.16	70.01
2012	70.25	83.85	71.11
2013	70.15	83.61	71.25
2014	70.05	83.70	72.01
Average	**74.49**	**81.42**	**71.23**

(1) Export market share (EMS)

Firstly, we use EMS, and as indicted from Table 3, we can see that the EMS of Taiwan's textile industry greatly increased from 1980 to 1997, but then gradually declined to 5.15 in 2004, before bumping back to 5.92 in 2014. The EMS of Hong Kong's textile industry similarly rose until 1997, but then greatly dropped until 2004 when its growth rather stagnated. On the same estimation index, Korea's textile industry also rapidly rose until 1997 and then decreased to 5.57 in 2004, after which it also increased back up to 6.30 in 2014.

[4] See Appendix Table A

As previously mentioned, EMS does not take a country's economic scale into consideration, which in this case might cause some bias when comparing estimations of international trade competitiveness throughout the different nations. As such, we further consider the revealed comparative advantage (RCA) method in hope of estimating a more accurate international competitiveness.

(2) Revealed Comparative Advantage (RCA)

In order to get a better estimation of the international competitiveness, the revealed comparative advantage (RCA) method is applied. The estimated RCA of Taiwan's

Table-3. The EMS of Taiwan, Hong Kong and South Korea (Unit: %)

Year	Country		
	Taiwan	Hong Kong	South Korea
1995	7.79	9.07	8.08
1996	7.87	9.26	8.33
1997	8.19	9.38	8.56
1998	7.42	8.70	7.53
1999	7.43	8.39	7.94
2000	7.69	8.70	8.22
2001	6.73	8.31	7.44
2002	6.18	8.05	7.09
2003	5.39	7.59	6.25
2004	5.15	7.34	5.57
2005	5.21	7.31	5.60
2006	5.25	7.35	5.62
2007	5.58	7.40	5.66
2008	5.28	7.04	5.43
2009	5.55	7.01	5.40
2010	5.35	7.08	5.52
2011	5.45	7.28	6.07
2012	5.65	7.35	6.12
2013	5.71	7.50	6.21
2014	5.92	7.62	6.30
Average	**5.97**	**7.51**	**6.36**

Textile industry showed a strong international competitiveness although experiencing a reduction after 1997 (Table 4). This may mean that the international competitiveness of Taiwan's textile industry is still in robust condition. When comparing the RCA index to Hong Kong and South Korea, the international competitiveness of Taiwanese textile industry was higher than those two countries most of the time, with an average of RCA 2.86 against 2.63 and 2.66 respectively. As we can see after 2005, because of the cancelation of the MFA, RCA was dropped by a little, but after 2009, it rose steadily. Whether these two events really have a substantial effect on the trends of RCA, we need to include these two events as determinants into our model specification.

4.3. Regression Results

Since as previously discussed, ΔEMS might not be an optimal estimation index for international competitiveness in our case. In this study, ΔRCA and the factors (ΔK, ΔH, ΔR&D, ΔE) related to international competitiveness have been tested for the stationarity of time series (Table 5). The results of the ADF unit root test in levels and the first difference for each variable are shown in Table 5. As can be seen, all level variables cannot be rejected. Thus, non-stationary individual series may turn out to be stationary if transformed by the first differences.

Table-4. The RCA of Taiwan, Hong Kong and South Korea

Year	Country		
	Taiwan	Hong Kong	South Korea
1995	3.45	2.58	3.20
1996	3.51	2.65	3.32
1997	3.65	2.76	3.48
1998	3.59	2.73	3.10
1999	3.39	2.72	3.12
2000	3.23	2.75	3.04
2001	3.27	2.68	3.03
2002	2.93	2.59	2.81
2003	2.67	2.53	2.41
2004	2.56	2.56	1.98
2005	2.58	2.55	1.96
2006	2.60	2.59	1.92
2007	2.58	2.62	2.25
2008	2.42	2.25	1.95
2009	2.38	2.38	2.08
2010	2.45	2.40	2.18
2011	2.52	2.58	2.32
2012	2.61	2.61	2.48
2013	2.71	2.65	2.61
2014	2.80	2.69	2.74
Average	**2.86**	**2.63**	**2.66**

Table-5. ADF Unit Root Test

		RCA	K	H	R&D	E	D_1	D_2
Original series	Without intercept and trend	-0.42	-0.89	-0.68	-0.58	-0.91	----	----
	With intercept	-0.62	-0.91	-0.79	-0.61	-1.01	----	----
	With intercept and trend	-0.73	-1.05	-0.98	-0.70	-1.18	----	----
		ΔRCA	ΔK	ΔHΔ	ΔR&D	ΔE	D_1	D_2
First order differencing	Without intercept and trend	-3□61**	-4□15**	-4.26**	-6.38*□*	-8.16***	----	----
	With intercept	-3.79**	-4.52**	-4.63**	-6.97***	-8.34***	----	----
	With intercept and trend	-3.89**	-4.62**	-4.78**	-7.10***	-8.48***	----	----

Note: ***, **, * represent at the significance level of 1%, 5%, 10%

To obtain effectively estimated coefficients in Equation (10), the maximum likelihood estimation (MLE) is applied to obtain more efficient and consistent estimated values to detect the effects of factors affecting the international competitiveness considering the ΔRCA as follows:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta K_t + \beta_2 \Delta H_t + \beta_3 \Delta R\&D_t + \beta_4 \Delta E_t + \beta_5 D_{1t} + \beta_6 D_{2t} + \varepsilon_t \ldots\ldots\ldots\ldots(10)$$

We estimated the equation (10) with five independent variables and two dependent variables (ΔY_i = ΔRCA) based on the equation. D_1 and D_2 are produced as dummy variables and are used to state the degree of canceling the quota of MFA in 2005 and the ECFA signing in 2009. As presented in Table 6, the problem of multicollinearity is not found in this regression analysis because the VIF values are smaller than 10 and the tolerance values (TOL) are greater than 0.1.

Table-6. Test for Multicollinearity

	ΔK	ΔH	ΔR&D	ΔE	D_1	D_2
VIF	6.1572	2.0938	2.145	1.6055	4.1536	3.9815
Tolerance	0.16247	0.4776	0.125	0.6628	0.2048	0.3116

Table 7 depicts the estimated results of international competitiveness of Taiwan's textile industry. The estimated Durbin-h statistics denote that there is no auto-correlation in the error-terms of these two equations, and the F-value of these indexes is statistically significant, besides, the R^2 and adjusted R^2 of the regression models of ΔEMS and ΔRCA are both greater than 90%. The estimations of our model can provide appropriate explanations for each determinant.

Table-7. The Empirical Results of International Competitiveness of Taiwan's Textile Industry

Independent Variables ΔRCA	Estimative coefficients β_i
Intercept	-0.0415** (-2.0278)
ΔRCA_{t-1}	0.8036*** (4.3415)
Fixed Capital (ΔK)	0.00008912*** (3.0141)
Human-capital (ΔH)	0.5214*** (2.5432)
Economic Growth Rate (ΔE)	-0.8125** (-2.0051)
D_1	-0.6714** (-2.1459)
D_2	0.6617* (1.7985)
R^2	0.9526
Adj R^2	0.9348
F-value	44.2626***
Durbin-h	1.0120 (1.3326)

Note 1: The value in parentheses is t-value.
2: ***, **, * represent at the significance level of 1%, 5%,10%

As it is shown in Table 7, the estimated coefficients of fixed (physical) capitals (ΔK), R&D intensity (ΔR&D) and human-capital intensity (ΔH) affecting international competitiveness (ΔRCA) are statistically significant at 1% significant level and have a positive sign. This implies that Taiwanese textile industry is strongly influenced by the increase of fixed (physical) capital (ΔK), human-capital intensity (ΔH) and R&D intensity (ΔR&D), therefore, if these three factors increase in Taiwan, the international competitiveness of the country would increase through ΔRCA measurement. The economic growth rate (ΔE) has a negative relationship with textile industry competitiveness, as it might mean that the country is moving toward other industries in Taiwan. The effect of dummy variable D_1 on international competitiveness (ΔRCA) is statistical significantly negative. Which might be caused by the cancelation of MFA, resulting in more competition and quotas were reduced, causing the decrease of ΔRCA in the Taiwanese textile industry. On the other hand, the estimated coefficient of dummy variable D_2 is positive significantly at 5% significant level. This might indicate that the signing of the bilateral free trade agreement such as ECFA will help Taiwan's international competitiveness in the textile industry. The influence of bilateral free-trade agreements such as ECFA and the MFA might substantially help Taiwanese's general international competitiveness and further expand into interconnected regional and global integration processes bolstering multilateral trading structures within the Asia-Pacific regions.

5. CONCLUDING REMARKS

This study analyzed the changes of international competitiveness within Taiwanese textile industry and discussed the factors influencing its international competitiveness by also taking into account the signing of bilateral agreements. In order to assist the textile industry in Taiwan to further competes effectively with other countries, our estimation analysis is based on EMS and RCA and calculated data from the standard classification of fabric goods (HS50~HS63) in comparison to Hong Kong and South Korea (from 1995-2014).

Regarding the estimation results of EMS for Taiwanese textile industry, it greatly increased from 1980 to 1997, but then gradually declined to 5.15 in 2004 before rising back to 5.92 in 2014. EMS for Hong Kong's textile industry experienced a similar trend; it rose until 1997, but then greatly dropped until 2004 when its growth rather stagnated. On the same estimation index, Korea's textile industry also rapidly rose until 1997 and then decreased to 5.57 in 2004, after which it also increased back up to 6.30 in 2014. On the other hand, regarding the estimated RCA of Taiwan's textile industry showed a strong international competitiveness although experiencing a reduction after 1997. This suggests that the international competitiveness of Taiwan's textile industry is still in robust condition. When comparing the RCA index to Hong Kong and South Korea, the international competitiveness of Taiwanese textile industry was higher than those two countries most of the time, with an average of RCA 2.86 against 2.63 and 2.66 respectively. As we can see, after 2005, because of the cancelation of the MFA, RCA was dropped by a little, but after 2009, it rose steadily. Generally speaking, the EMS and RCA of the three countries have decreased. However, the international competitiveness of the Taiwanese textile industry is still strong in comparison to the other Asian Tiger countries of Hong Kong and Korea.

The cancelation of the MFA, as the quota of MFA was completely cancelled in 2005, it had somehow influenced the development of Taiwanese textile industry. To avoid this negative influence, the textile industry is suggested to transfer to a capital, technological and knowledge-intensive industry to increase its international competitiveness. The estimated coefficient of D_1 is negatively significant. The reason may be that the MFA was cancelled to increase liberalization in Taiwanese textile industry and impact on its international competitiveness. The estimated coefficient of D_2 is positive and statistically significant at 5% significant level. It seems that the signing the bilateral free trade agreement such as ECFA will help Taiwan international competitiveness of textile industry even when Taiwanese economic situation faced the subprime mortgage and financial tsunami.

Regarding to regression results, bilateral free-trade agreements do indeed affect the international competitiveness of Taiwanese textile industry. The abolishment of the Multi-Fiber Arrangement (MFA) in 2005 lessened the trading barriers and promoted the free trade in the global textile market. Its original purpose was to set a quota for a country exporting their fabrics and ready-made clothes to developed countries. Its cancelation clearly increased competition and reduced quotas available for Taiwan. In recent years, rapid economic growth has changed the industrial structures within Asian Tiger countries as they could possibly benefit from high-tech industries against traditional industries, leading to a decrease in the international competitiveness of the textile industry in Asian Tiger countries. It needs to be noted that the estimated coefficient of D_1 is negatively significant. To avoid the negative influence a bilateral agreement abolishment such as MFA, the Taiwanese textile industry could be suggested to transfer into a capital, technological and knowledge-intensive industries in order to increase its international competitiveness; since our study found that human-capital intensity (ΔH) and R&D intensity ($\Delta R\&D$) are also crucial factors for improving international industry competitiveness.

In general, bilateral FTAs can substantially increase international industrial competitiveness. In the case of Taiwan, it is expected that the Economic Cooperation Framework Agreement (ECFA) as the bilateral free-trade agreement between Taiwan and Mainland China can help its overall competitiveness. The estimated coefficient of D_2 is positive and statistically significant at 5% significant level. Since our study found that EFCA does in fact affect international competitiveness. This most certainly indicates that the signing of the bilateral free trade agreement such as ECFA will help Taiwan's international competitiveness in the textile industry.

Although regarding the textile industry most Asian Tiger countries have already transferred their production infrastructure from traditional labor-intensive businesses into high-tech ones and is often regarded as a "Sunset Industry". However, it is still a main part of the foreign exchange earnings for Asian Tiger countries, especially for Taiwan. To improve the international competitiveness of Taiwanese textile industry not only do we need to consider economic factors such as fixed (physical) capitals (ΔK), R&D intensity (ΔR&D) and human-capital intensity (ΔH), but we also need to consider non-economic factors such as bilateral free-trade agreements (e.g., MFA and ECFA) through ΔRCA measurement. These are the important strategic implications of essential consideration in order to altogether enhance Taiwan's international competitiveness and further understand the complex questions that cut across many disciplines: economic, political, social and legal. Which have been increasingly arising within multilateral trading structures involving separate or interconnected regional/global integration processes in Asia-Pacific regions.

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APPENDIX

Table-A. The HS Numbers and the Names of Fabrics

HS Number	Name
HS 50	Silk
HS 51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric
HS 52	Cotton
HS 53	Other vegetable textiles fibers, paper yarn and woven fabric of paper yarn
HS 54	Man-made filaments
HS 55	Man-made staple fibers
HS 56	Wadding, felt and nonwovens; special yarn, twine, cordage, ropes and cables and articles thereof
HS 57	Carpets and other textile floor coverings
HS 58	Special woven fabrics; tufted textile fabrics; lace, tapestries; trimmings; embroidery
HS 59	Impregnated, coated, covered or laminated textile fabrics; textiles articles of a kind suitable for industrial use
HS 60	Knitted or crocheted fabrics
HS 61	Articles of apparel and clothing accessories, knitted or crocheted
HS 62	Articles of apparel and clothing accessories, not knitted or crocheted
HS 63	Other made up textile articles; sets; worn clothing and worn textile articles; rags

Data Source: Chung Hua Institute for Economic Research (Taiwan WTO Center)