A Study of Taiwan’s Export Competitiveness Based on the CMS Model

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ABSTRACT

The main purpose of this study is to investigate the component factors of change in Taiwan’s exports from 1997 to 2007 and the variations of its export competitiveness, with a view to providing information to exporting companies and government authorities for reference in their respective elaboration of general strategies or policies for the future. The CMS (Constant Market Share) model will be used to evaluate Taiwan’s performance in trade, i.e. through the use of various base periods to calculate multiple CMS values, and for the selection of effective competitors, appropriate for each type of exporters, as an influence effect for the whole market, the factors of variation in Taiwan’s exports from 1997 to 2007 will be calculated on a yearly basis, and “trade effect”, “commodity effect”, “market effect” and “competitiveness effect” will be obtained. The total value of exports to Mainland China, Hong Kong, the United States and Japan taken together and the total value of exports to the latter three taken together will then be used respectively, to represent the whole of Taiwan’s export market in order to calculate multiple CMS values and to analyze the trends in the variation of Taiwan’s export competitiveness. According to the findings of our study, Taiwan’s exports conform more and more to more prosperous market orientations, but exported merchandise items have not followed the demands for growth of merchandise trade in the four markets, which suggests that an adjustment in the structure of Taiwan’s exported commodities and the strengthening of export competitiveness should be the goals of future endeavors.

Keywords: constant market share, export competitiveness.

INTRODUCTION

As Taiwan is an island-type economy, export contributes to a large extent to its economic growth. In recent years, Taiwan’s economic growth has slowed down and unemployment has increased, prompting us to investigate the component factors of change in Taiwan’s exports from 1997 to 2007 and the variations of its export competitiveness.

Furthermore, China, Hong Kong, the United States and Japan have been Taiwan’s four largest export destinations since 2001. Our study will therefore take these four countries as the market for analyzing the variations in Taiwan’s exports. Meanwhile, according to statistics of the Bureau of Foreign Trade, MOEA (Taiwan), the concentration of Taiwan’s exports has gradually shifted from the U.S. to Mainland China, which became Taiwan’s first export country in 2004, its share rising to as much as 59.78% of all Taiwan exports in 2009. As a result, we will attempt to respectively use the total value of exports to China, Hong Kong, the U.S. and Japan, and the total value of exports to Hong Kong, the U.S. and Japan respectively as Taiwan’s export market to investigate how the inclusion of the Chinese market influences various effects in the variations of Taiwan’s exports.

Export expansion is influenced by many factors, and our study will use the CMS (Constant Market Share) model to obtain from export variations four major effects, i.e. “trade effect”, “commodity composition effect”, “market share effect” and “competitiveness effect”. By selecting appropriate, effective competitors to represent the whole market, the CMS model allows the obtaining of different analysis results based on different base years and different world markets. Consequently, in our study we calculated the factors of variation in exports from 1997 to 2007 on a yearly basis and obtained multiple CMS values; by using various effects to analyze the different factors of variation in exports, we investigated the factors influencing Taiwan’s exports, and obtained the four major effects mentioned above, so that the trends in the variation of Taiwan’s exports could be analyzed with a view to providing reference material for the sake of elaborating general strategies. In concrete terms, the main purpose of this study is to investigate the component factors...
of change in Taiwan’s exports from 1997 to 2007 and the variations of its export competitiveness, with a view to providing information to export companies and government authorities for reference in their respective elaboration of general strategies or policies for the future.

LITERATURE REVIEW

The easiest way to measure the export competitiveness of a Taiwanese industrial sector (or product) in comparison with other countries is to look at its export market share, that is to say, to make measurements in terms of the percentage represented by the total export value of the sector/product in question. However, this method has a shortcoming; namely, it does not take into account the percentage occupied by the total trade volume of the country in question in the world total. Therefore, it is common to resort to the Revealed Comparative Advantage Index (or RCA index) to compare the export competitiveness of different sectors or that of the same sector among different countries, and to analyze the variations of such competitiveness (Chien, 2010). The advantage is that, in consideration of the export market shares of the different sectors or the percentages they occupy in the total exports, the size of each country’s economy is taken into account, so that both the relative competitiveness of the same product among different countries and the relative competitiveness of various products within the same country can be expressed with the same indicator.

The biggest disadvantage of Export Market Share and the RCA index lies in the fact that variations in export market shares are completely attributed to variations in the export competitiveness of the sector itself (Liu and Chien, 1988), while in fact the possibility that variations in export market shares can be attributed to changes in other external general structural factors is even greater than the possibility of those variations being a function of variations in the export competitiveness of the sector itself. The so called Constant Market Share model consists in dividing the variations in the export market share of a specific industrial sector into two parts, one of which is attributed to variations in the export competitiveness of the sector in question, and the other representing variations caused by changes in factors unrelated to variations in competitiveness.

The Constant Market Share (or CMS) model was first proposed by Tyszynski (1951) for application in the analysis of export growth. Fleming and Tsiang (1956) suggested that a change in export share results not only from a change in competitiveness, but also from changes in the conditions of demand of the world market; hence they believed that the demand effect finds its origins in the change in export revenues, and on account of this they analyzed variations in export via the difference between export revenues and constant export share revenues, applying the CMS method to long-term analyses. Leamer and Stern (1970) conducted further research on the correlation between export and changes in the structure of world trade. They all faced the same problem: inconsistency in the use of indicators resulted in inadequate discussion of the residual term in the calculation process. Therefore, Richardson (1971) pointed out that if the market distribution effect is included in the analysis, then the commodity composition and market distribution effects will influence calculation results; meanwhile, he made the following hypotheses: 1) In the execution of the CMS method, subjective hypotheses can be made, leading to subjective changes in the results; and 2) analysis via CMS requires a period of separation, at the end of which both export structure and world export will have changed. In response to these, he proposed the following solutions: 1) use different base weights to calculate multiple CMS values; 2) select appropriate and effective competitors to represent the whole world with regard to a given exporter; and 3) use data about “quantity”.

Bowen and Pelzman (1984)’s empirical work incorporated the sensitivity analysis proposed by Richardson: varying the definitions of i) the base year, ii) the composition level of the commodity, and iii) the world market. He found that changes in commodity composition did not have significant influence on the results, but changes in the base year did have considerable influence. Fagerberg and Sollie (1987) deducted five effects, instead of three, from export variations. The two additional effects were used to measure the ability of a specific country to adapt to import composition commodities and changes in the market and in export structure. This method solved the problem, raised by Tyszynski, of the adaptability of different countries in the face of changes in the world’s trade pattern (Chien, 2005). Wilson (2000) investigated the annual changes in an exporting country’s exports to certain countries during a period of several years. Later, Kellman, Roxo and Shachmurove (2003) incorporated the factor of relative currency rate.
change in their investigation of the sensitivity of CMS variations and relative currency rate variations, with the finding that the more a product is sensitive, the more it will have export competitiveness. Ichikawa (2005) used the CMS model for his analysis of APEC, concluding that APEC could enhance the well-being of the whole region and mutually benefit all participating entities.

Adopting the suggestions of Richardson (1971), Bowen and Pelzman (1984), and Fagerberg and Sollie (1987), our study measured multiple CMS values by using different base periods in order to investigate the way base year change influences research conclusions, and selected appropriate and effective competitors to represent the whole market. In this instance, total exports to Mainland China, Hong Kong, the United States and Japan, and total exports to Hong Kong, the United States and Japan were selected respectively as Taiwan’s total export market to analyze the trends in the variation of Taiwan’s export competitiveness.

**METHODOLOGY AND DATA PRESENTATION**

The growth of a country’s total exports is influenced by the kinds of products it offers and its geographical structure. If an exporting country is specialized in certain specific products, and the destination countries have weaker demands, then the exporting country’s total export share will decrease. The Constant Market Share (CMS) model takes into account the fact that during a given period, variations in a sector’s export market share can on the one hand be attributed to changes in competitiveness, and on the other hand to other general structural factors. Supposing a given country’s world market share does not change over time, then differences in export growth can be caused by four factors: (a) world trade effect, (b) commodity composition effect, (c) market share effect, and (d) residual term (competitiveness effect).

This model may be expressed in the mathematical identity below:

where:

\[ X_t = \text{exporting country's total export value in period t} \]
\[ X_0 = \text{exporting country's total export value in base period} \]
\[ r = \text{growth rate of world export} \]
\[ r = \frac{(\text{total world export value in period t} - \text{total world export value in base period})}{\text{total world export value in base period}} \]
\[ r_i = \text{growth rate of world export for product i} \]
\[ r_i = \frac{(\text{total world export for product i in period t} - \text{total world export for product i in base period})}{\text{total world export for product i in base period}} \]
\[ r_{ik} = \text{growth rate of country k’s import of product i} \]
\[ r_{ik} = \frac{(\text{value of country k’s import of product i in period t} - \text{value of country k’s import of product i in base period})}{\text{value of country k’s import of product i in base period}} \]
\[ X_0^i = \text{value of export of exporting country’s product i in base period} \]
\[ X^i_k = \text{value of export to country k of exporting country’s product i in period t} \]
\[ X_{ik} = \text{value of export to country k of exporting country’s product i in base period} \]

In the above equation, the calculation values on the right are as follows:

1. \( rX_0^i \) is the world trade effect: *i.e.* during the period in question, the volume by which exports should be increased or decreased if the sector in question wishes to maintain the original level of world export market share.

2. \( r_i \) is the commodity composition effect: *i.e.* during the period in question, whether the growth structure of the export of the country’s products conforms to tendencies of growth in the trade of various products in the world, and whether it is directed toward the products demanded by the world; where \( r_i \) is product i’s growth percentage between two time points, and if the growth in the country’s export of a similar group of commodities is above world average, then \( r_i - r > 0 \), meaning that the fact that the commodities the country concentrates on exporting increases relatively fast is in accordance with growth trends for those commodities in world trade, and not because the country’s commodities are more competitive.
is the market share effect: i.e. during the period in question, whether the area growth structure of the export of the country’s products is in accordance with the growth trends in the imports of the world’s various areas, and whether it is directed toward the markets of the export destinations; where \( r_{ik} \) is the percentage of increase in the export of product \( i \) to market \( k \) between two time points, meaning that if the value is positive, then the fact that the country is comparatively capable of exporting a similar group of commodities to relatively fast-growing markets simply matches the import growth trends in various areas of the world, and is not because the country’s products are more competitive; and if the value is negative, then it shows that export is concentrated on slumping markets.

is the residual term, called the competitiveness effect: i.e. for a given period, the residual term obtained by deducting from export growth the effects of world trade, commodity and market is the real competitiveness effect. The competitiveness effect is a factor for consideration that reflects domestic supply, and is caused by domestic factors rather than factors from the external environment; even if a given country is faced with potentially unfavorable factors in terms of market, commodity and world demand, it can still obtain international market shares, which is often interpreted as the country’s ability to adapt to changes in global circumstances. Here, a positive value expresses an improvement in export competitiveness, and a negative value expresses its deterioration.

We have to mention here that for the purpose of our study, we purchased import-export data from Taiwan External Trade Development Council (TAITRA) HS bipartite data for Taiwan, China, Hong Kong, the U.S. and Japan, and used the CMS model to make calculations and obtain the various effects.

**ANALYSIS OF EMPIRICAL RESULTS**

(1) Various effects in Taiwan’s exports to the China, Hong Kong, U.S. and Japan markets

Due to limitations in terms of data, the period covered in our study goes from 1997 through 2007. During this period, Taiwan’s exports to the China, Hong Kong, U.S. and Japan markets increased by 109,068 million US dollars (see Table 1), where the world trade effect and the market share effect were both positive values, meaning that the increase in exports was in part due to increase in the imports of these four markets, and that Taiwan’s exports were in conformity with the growth trends in the import markets. On the other hand, the commodity composition effect and the competitiveness effect are both negative values, meaning that the commodities Taiwan exported did not follow the growth rate of the trade in commodities imported by the China, H.K. U.S. and Japan markets, and that Taiwan’s export competitiveness suffered a decrease representing 30% of the value of variation in exports (\(-32,947.12 / 109,068.14\)). If we divide the period 1997-2007 into two sub-periods of five years, we discover that for both sub-periods, the competitiveness effect was negative and the market structure effect was positive, while for the latter sub-period the product structure effect was negative. These results show that Taiwan’s exports conformed to more prosperous market orientations, and the fact that the export commodity structure effect changed from positive to negative proves that the commodities Taiwan exported to China, H.K., the U.S. and Japan did not match the growth trends of the trade in those commodities; consequently, Taiwan’s export competitiveness remained to be strengthened.

(2) The effects brought about by the use of different combinations of countries as Taiwan’s export market

In our study, the China-HK-US-Japan combination and the HK-US-Japan combination are respectively considered as Taiwan’s major export market, and Table 1 shows that the main differences lie in the commodity composition effect and the market share effect. For all periods the commodity composition effect was negative for the HK, US and Japan markets, while it was positive for the China, HK, US and Japan markets in the 1997~2002 sub-period, changing to negative in the 2002~2007 sub-period. This means that the products Taiwan exported did not match the trade growth trends for those products in the China, HK, US and Japan markets. On the other hand, the market share effect for the HK, US and Japan markets changed from negative in 1997~2002 to positive in 2002~2007 (US$ 1,642.67 million), while it is positive all the time for the China, HK, US and Japan markets (US$35,196.25
We can see from this that Mainland China’s import market showed rapid growth, and that the area growth structure of Taiwan’s exports was in conformity with the growth trends in the imports of those markets.

### Table 1: CMS analysis of Taiwan exports to China, HK, US and Japan (HK, US and Japan) markets in the periods 1997~2002, 2002~2007 and 1997~2007 Unit: million USD

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<tr>
<td>(X^t - X^0)</td>
<td>20,785.58</td>
<td>88,282.56</td>
<td>109,068.14</td>
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<td></td>
<td>(-863.40)</td>
<td>(25,379.09)</td>
<td>(24,515.69)</td>
</tr>
<tr>
<td>World trade effect</td>
<td>21,723.96</td>
<td>93,583.37</td>
<td>116,199.51</td>
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<td></td>
<td>(12,245.08)</td>
<td>(43,931.06)</td>
<td>(65,718.83)</td>
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<tr>
<td>Commodity composition effect</td>
<td>159.05</td>
<td>-3,866.36</td>
<td>-7,043.49</td>
</tr>
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<td></td>
<td>(-70.71)</td>
<td>(-4095.74)</td>
<td>(-6367.73)</td>
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<tr>
<td>Market share effect</td>
<td>4,736.96</td>
<td>35,196.25</td>
<td>32,859.24</td>
</tr>
<tr>
<td></td>
<td>(-2,229.81)</td>
<td>(1,642.67)</td>
<td>(-4,136.12)</td>
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<tr>
<td>Competitiveness effect</td>
<td>-5,834.40</td>
<td>-36,630.69</td>
<td>-32,947.12</td>
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<td>(-10,807.95)</td>
<td>(-16,098.90)</td>
<td>(-30,699.29)</td>
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</table>

Source: our calculations

(3) Comparison via different base years of the various effects in Taiwan’s exports to China, Hong Kong, the United States and Japan

If we follow the suggestion of Fagerberg and Sollie (1987) to calculate multiple CMS values by using different base years, and go on to analyze the effects on a yearly basis, we find that positive competitiveness effects appeared in the years 1999~2000 and 2001~2002 (see Table 2), and that competitiveness decreased most significantly in the years 2002~2003 and 2006~2007, representing respectively -62% and -52% of the value of export variation (-7,948 / 12,726 for 2002~2003 and -7,895 / 15,185 for 2006~2007). On the other hand, the commodity structure effect shows a positive value only in the years 1997~1998, 2001~2002 and 2005~2006, while the market structure effect shows a negative value only in the first two years, turning constantly positive thereafter. This means that following the year 2000, Taiwan’s export market was in conformity with the growth trends in the imports of those markets. As to the commodities exported, like in the preceding analysis, they were not completely oriented toward demands in China, HK, the US and Japan.

### Table 2: CMS analysis of Taiwan’s annual exports to China, Hong Kong, the U.S. and Japan from 1997 to 2007 Unit: Million USD

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<tbody>
<tr>
<td>(X^t - X^0)</td>
<td>-4,173.8</td>
<td>6,973.8</td>
<td>19,180.4</td>
<td>-10,989.3</td>
<td>9,794.5</td>
<td>12,726.4</td>
<td>25,013.3</td>
<td>13,630.1</td>
<td>21,727.6</td>
<td>15,185.1</td>
</tr>
<tr>
<td>World trade effect</td>
<td>-2,136.7</td>
<td>7,721.2</td>
<td>16,997.5</td>
<td>-4,902.5</td>
<td>3,014.1</td>
<td>14,015.5</td>
<td>22,939.1</td>
<td>19,359.0</td>
<td>19,469.7</td>
<td>16,597.3</td>
</tr>
<tr>
<td>Commodity composition effect</td>
<td>1,183.7</td>
<td>-100.1</td>
<td>-660.9</td>
<td>-620.8</td>
<td>512.6</td>
<td>-666.2</td>
<td>-271.6</td>
<td>-1951.4</td>
<td>315.9</td>
<td>-594.4</td>
</tr>
<tr>
<td>Market share effect</td>
<td>-715.9</td>
<td>-150.0</td>
<td>1,542.5</td>
<td>1,851.7</td>
<td>3,225.0</td>
<td>7,325.2</td>
<td>5,626.5</td>
<td>1,748.2</td>
<td>3,588.1</td>
<td>7,077.5</td>
</tr>
<tr>
<td>Competitiveness effect</td>
<td>-2,504.9</td>
<td>-497.4</td>
<td>1,301.4</td>
<td>-7,317.7</td>
<td>3,042.8</td>
<td>-7,948.1</td>
<td>-3,280.6</td>
<td>-5,525.7</td>
<td>-1,646.1</td>
<td>-7,895.3</td>
</tr>
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</table>

Source: our calculations

**CONCLUSIONS AND SUGGESTIONS**

The above analysis via the CMS model shows that during the period 1997~2007, the competitiveness effect of Taiwan’s exports to China, HK, the US and Japan is US$ -32,947.12 million, representing 30% of the value of export
variation, and the commodity effect is US$ -7,043.49 million. This means that on the one hand, Taiwan’s export competitiveness decreased over the period, and on the other hand, the demand for export of Taiwan’s products was lower than the total import demand of China, Hong Kong, the U.S. and Japan, that is to say, it did not follow the growth demand of merchandise trade in the four markets. In terms of market effect, Taiwan’s export matched the import growth trends of the four markets, being more and more in conformity with more prosperous market orientations. Based on the above analysis, the problems facing Taiwan’s exports lay firstly in a decrease in competitiveness, and secondly in product-related factors. Meanwhile, the market share effect for the HK, US and Japan markets turned from negative in 1997~2002 to positive in 2002~2007, while it was positive in both periods for the China, HK, US and Japan markets, reaching US$ 35,196.25 million, as compared with the US$ 1,642.67 million for HK, the US and Japan; these findings show a rapid growth in the import market of Mainland China. Analysis of annual data further shows that during the period 1997~2007 Taiwan’s exports to China, HK, the US and Japan experienced the most serious decrease in competitiveness in 2003 and 2007, representing respectively 62% and 52% of the value of export variation. This is in conformity with the suggestions of Richardson (1971), Bowen and Pelzman (1984), and Fagerberg and Sollie (1987) to calculate multiple CMS values by using different base periods and then analyze the effects on a yearly basis, which is significant in that the key year in which export competitiveness changes can thus be observed. Our study shows that starting from the year 2000, Taiwan’s exports were constantly in accordance with the import growth trends in those markets. From the above analyses, we realize that in the future, Taiwan’s endeavors should be centered on enhancing the quality of Taiwan’s products, continuously obtaining export shares from more advanced countries, strengthening Taiwan’s export competitiveness, and responding to changes in the global economic environment by adapting the commodities it exports.

We finally suggest that in the future researchers carry out analyses via the CMS model on more detailed commodity categories so as to gain further understanding of the variations in the export competitiveness of each commodity.

REFERENCES


