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## **External Sector Development Index: The Case of Chinese and ASEAN Economies**

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### **Abstract**

This paper introduces an alternative index to measure the external sector from a different focus. The indicator, called the “external sector development index” ( $SX_i$ ), is a new analytical tool for studying the external sector behaviour of any country or region. The  $SX_i$  has four objectives. The first objective is to measure the vulnerability of the external sector of any country. The second is to evaluate the external sector performance. The third is to analyze the relationship between “the external sector main variable”  $ES_i$  and GDP growth rates. The fourth is to evaluate the external sector ( $SX_i$ ) cycle based on the table of possible combinations between  $ES_i$  and GDP. In our case, we apply the  $SX_i$  on the Chinese and ASEAN economies.

**Keywords:** *Econographicology, international trade, trade index*

**JEL classification:** *F15*

### **1. Introduction**

For many decades, economists and policymakers have been using a variety of analytical tools in the study of external sector behaviour in different countries and regions. The most common analytical tools applied in such studies so far are the terms of trade (ToT)<sup>1</sup> and the openness index ( $O_i$ )<sup>2</sup>. This paper introduces a new index to measure the external sector of any country or region from a different analytical perspective. This new index is called the “external sector development index” ( $SX_i$ ). The  $SX_i$  is strongly affiliated with the openness index ( $O_i$ ). The difference between these two indices is that the measurement of  $SX_i$  replaces absolute values with growth rates (or relative values), which in turn are the trade volume growth rate ( $\Delta T = \sum \text{export growth rate plus } \sum \text{import growth rate}$ ), foreign direct investment growth rate ( $\Delta FDI$ ) and gross domestic product growth rate ( $\Delta GDP$ ). The  $SX_i$  analysis will also

introduce a new variable called “the external sector main variable” ( $ES_i$ ). The  $ES_i$  is equal to the trade volume growth rate ( $\Delta T$ ) plus the foreign direct investment growth rate ( $\Delta FDI$ ) (see Figure 1). However, the three indicators ( $ToT$ ,  $O_i$  and  $SX_i$ ) have different objectives and analytical foci, but they share something in common – they all aim to evaluate the external sector of any country (see Table 1).

Figure 1 Procedure to Measure the External Sector Development Index ( $SX_i$ )

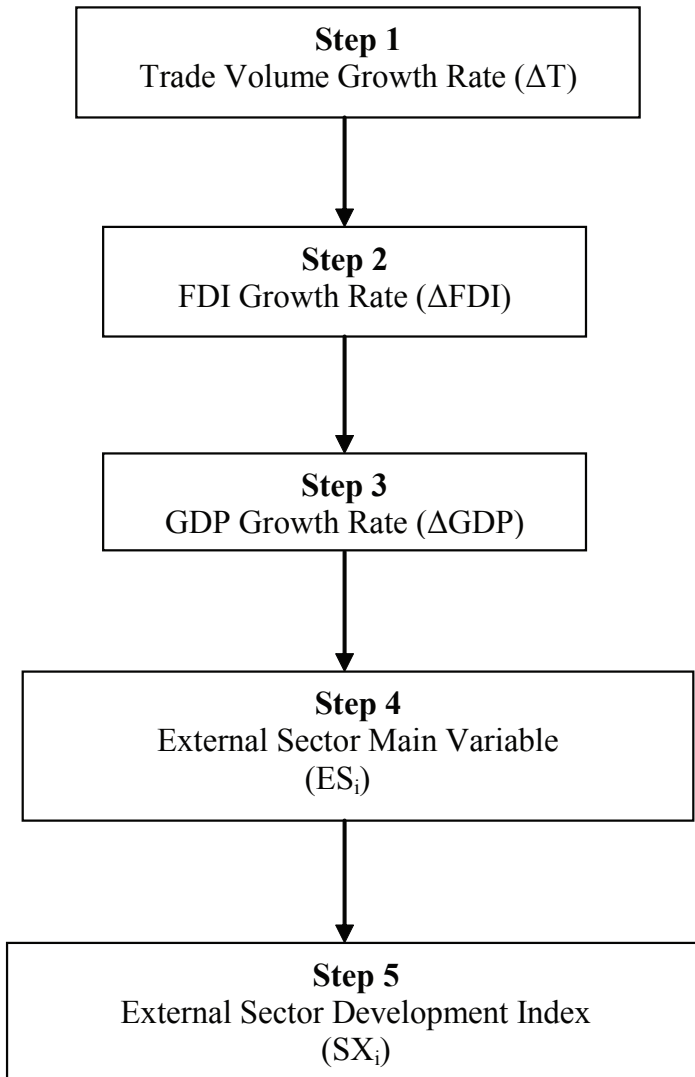


Table 1 Comparison of Terms of Trade, Openness and External Sector Development Index (SX<sub>i</sub>)

Concept	Measures	Function	Advantage	Disadvantage
<b>Terms of Trade (ToT)</b>	<b>X Price/M Price</b> <b>X = Export Index Price</b> <b>M = Import Index Price</b>	To study the relationship between export price ratio and import price ratio to find the deteriorating terms of trade among countries	Permits the visualization of the relationship between various international prices in the international market	Difficult to be applied to many countries and goods simultaneously
<b>Openness (O<sub>i</sub>)</b>	<b>TV/GDP x 100%</b> <b>TV = X+M</b>	To measure the level of trade liberalization and the orientation of trade policy	Gives a general idea about how open an economy is in its international trade	Focused on studying how open an economy is from the specific point of view of trade
<b>External Sector Development (SX<sub>i</sub>)</b>	<b>ES<sub>i</sub>/ΔGDP x 100%</b> <b>ES<sub>i</sub> = ΔT + ΔFDI</b>	To measure the level of trade liberalization and investment mobility simultaneously	Observes the trends of the external sector from the perspectives of the international trade sector and the finance sector simultaneously	Difficult to monitor FDI mobility in the short term

## 2. External Sector Development Index (SX<sub>i</sub>)

The objective of the external sector development index (SX<sub>i</sub>) is to observe the external sector behaviour of any economy from a new angle of analysis based on three basic variables: trade volume growth rate ( $\Delta T$ ), foreign direct investment growth rate ( $\Delta FDI$ ) and GDP growth rate ( $\Delta GDP$ ).

The external sector of the SX<sub>i</sub> is represented by two specific growth rates: trade volume growth rate ( $\Delta T$ ) and foreign direct investment growth rate ( $\Delta FDI$ ). This part of the research maintains that the trade volume is equal to the sum of exports flow (FOB) plus imports flow (CIF) in US\$ per year. On the investment side, it is represented by the variation of the FDI growth rate between two years. The idea to include the FDI growth rate ( $\Delta FDI$ ) and trade volume growth rate ( $\Delta T$ ) together into the study of the external sector is basically to analyze the external sector as a whole. The computation of the SX<sub>i</sub> Index requires four preceding steps detailed in Figure 1.

### 2.1. Step 1: Trade Volume Growth Rate ( $\Delta T$ )

The trade volume growth rate ( $\Delta T$ ) is the difference between the trade volume of a given year in millions of US\$  $(X+M)_{n+1}$  and the trade volume of the previous year in millions of US\$  $(X+M)_n$  divided by the trade volume of the previous year in millions of US\$  $(X+M)_n$ .

$$\Delta T = \frac{(X+M)_{n+1} - (X+M)_n}{(X+M)_n} \quad (1.1)$$

### 2.2. Step 2: Foreign Direct Investment Growth Rate ( $\Delta FDI$ )

The foreign direct investment growth rate ( $\Delta FDI$ ) is the difference between the foreign direct investment volume of a given year in millions of US\$  $(FDI)_{n+1}$  and the foreign direct investment of the previous year in millions of US\$  $(FDI)_n$  divided by the foreign direct investment of the previous year in millions of US\$  $(FDI)_n$ .

$$\Delta FDI = \frac{(FDI)_{n+1} - (FDI)_n}{(FDI)_n} \quad (1.2)$$

### 2.3. Step 3: GDP Growth Rate ( $\Delta GDP$ )

The domestic product growth rate ( $\Delta GDP$ ) is equal to the domestic product growth of a given year in millions of US\$  $(GDP)_{n+1}$  minus the domestic

product growth of the previous year in millions of US\$  $(GDP)_n$  divided by the domestic product growth of the previous year in millions of US\$  $(GDP)_n$ .

$$\Delta GDP = \frac{(GDP)_{n+1} - (GDP)_n}{(GDP)_n} \tag{1.3}$$

**2.4. Step 4: External Sector Main Variable (ES<sub>i</sub>)**

The external sector main variable (ES<sub>i</sub>) is equal to the sum of trade volume growth rate ( $\Delta O$ ) and foreign direct investment growth rate ( $\Delta FDI$ ) (see Table 2).

$$ES_i = \Delta T + \Delta FDI \tag{1.4}$$

*2.4.1. Possible results*

If any value is located within ES<sub>i+</sub> then this value is included in the category of acceptable performance in the external sector. If any value is located within ES<sub>i-</sub> or ES<sub>i=0</sub> then this value is included in the category of weak external sector performance.

Table 2 Possible Combinations of  $\Delta T$  and  $\Delta FDI$  to Obtain ES<sub>i</sub>

$\Delta FDI/\Delta T$	+ $\Delta T$	- $\Delta T$	$\Delta T = 0$
+ $\Delta FDI$	$\Delta T + \Delta FDI = ES_{i+}$	$\blacktriangle(-\Delta T) + \blacktriangledown \Delta FDI = ES_{i-}$ $\blacktriangledown(-\Delta T) + \blacktriangle \Delta FDI = ES_{i+}$	$0 + (\Delta FDI) = ES_{i+}$
- $\Delta FDI$	$\blacktriangle \Delta T + \blacktriangledown(-\Delta FDI) = ES_{i+}$ $\blacktriangledown \Delta T + \blacktriangle(-\Delta FDI) = ES_{i-}$	$\blacktriangle(-\Delta T) + \blacktriangledown(-\Delta FDI) = ES_{i-}$ $\blacktriangledown(-\Delta T) + \blacktriangle(-\Delta FDI) = ES_{i-}$	$0 + (-\Delta FDI) = ES_{i-}$
$\Delta FDI = 0$	$\Delta T + 0 = ES_{i+}$	$-\Delta T + 0 = ES_{i-}$	$0 + 0 = ES_{i=0}$

Variables:  $\blacktriangle$  = High  $\blacktriangledown$  = Low  $\Delta FDI$  = Foreign Direct Investment Growth Rate  
 $\Delta T$  = Trade Volume Growth Rate (-) = Negative and (+) = Positive  
 ES<sub>i</sub> = External Sector Main Variable 0 = Zero

### 2.5. Step 5: External Sector Development Index ( $SX_i$ Index)

The external sector development index ( $SX_i$ ) is equal to the external sector main variable ( $ES_i$ ) divided by the GDP growth rate ( $\Delta GDP$ ).

$$SX_i = \frac{ES_i}{\Delta GDP} \quad (1.5)$$

#### 2.5.1. Analysis of the $SX_i$ results

##### High Vulnerability

If the  $ES_i$  and  $\Delta GDP$  are located in these parameters ( $+ES_i / +\Delta GDP$ ) or ( $-ES_i / -\Delta GDP$ ) or ( $ES_i = 0 / \Delta GDP = 0$ ), then the  $SX_i$  can be classified in the category of high vulnerability (see Table 3). The  $ES_i$  and GDP in this category are moving in the same direction, showing the strong connection between these two values ( $ES_i$  and GDP).

##### Normal Vulnerability

If the  $ES_i$  and  $\Delta GDP$  are located in these parameters ( $+ES_i / -\Delta GDP$ ) or ( $+ES_i / 0$ ), then the  $SX_i$  can be classified in the category of normal vulnerability (see Table 3). The category of normal vulnerability shows how the  $ES_i$  grows more rapidly than the GDP, and this result will show not only how the external sector depends on the world trade trend, but also that it cannot be affected so greatly under the GDP growth rate.

##### Low Vulnerability

If the  $ES_i$  and GDP are located in these parameters ( $-ES_i / +\Delta GDP$ ) or ( $-ES_i / 0$ ) or ( $0 / +\Delta GDP$ ) or ( $0 / -\Delta GDP$ ), then the  $SX_i$  can be classified in the category of low vulnerability (see Table 3). The category of low vulnerability shows how the  $ES_i$  growth is slower than the GDP growth rate; this result will show clearly that the external sector is not a key factor when it comes to affecting the GDP growth rate of any country.

### 3. Application of External Sector Development Index ( $SX_i$ )

The external sector development index ( $SX_i$ ) will be applied to analyze ASEAN-5's (Indonesia, Malaysia, the Philippines, Singapore, Thailand) and China's external sector performance and vulnerability between 1985 and 2005 respectively. The reason for applying the  $SX_i$  is to observe performance, vulnerability and  $SX_i$  cycles. The objective for applying the  $SX_i$  Index is to observe how trade and investment growth together can affect growth

Table 3  $SX_i$  Cycle Levels

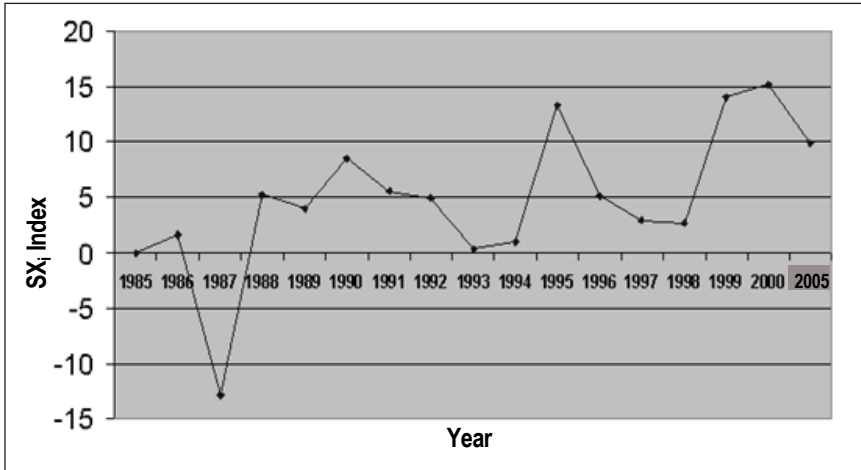
$\Delta GDP$ $ES_i$	$+\Delta GDP$	$-\Delta GDP$	$\Delta GDP=0$
$+\mathbf{ES}_i$	<p><u>Level 1.1</u>  <u>High Vulnerability</u>  <math>+\mathbf{ES}_i / +\Delta GDP = +\mathbf{SX}_i</math>                      Acceptable performance</p>	<p><u>Level 1.2</u>  <u>Normal Vulnerability</u>  <math>+\mathbf{ES}_i / -\Delta GDP = -\mathbf{SX}_i</math>                      Weak performance</p>	<p><u>Level 1.3</u>  <u>Normal Vulnerability</u>  <math>+\mathbf{ES}_i / 0 = \mathbf{SX}_i = \infty</math>                      Acceptable performance</p>
$-\mathbf{ES}_i$	<p><u>Level 2.1</u>  <u>Low Vulnerability</u>  <math>-\mathbf{ES}_i / +\Delta GDP = -\mathbf{SX}_i</math>                      Weak performance</p>	<p><u>Level 2.2</u>  <u>High Vulnerability</u>  <math>-\mathbf{ES}_i / -\Delta GDP = +\mathbf{SX}_i</math>                      Acceptable performance</p>	<p><u>Level 2.3</u>  <u>Low Vulnerability</u>  <math>-\mathbf{ES}_i / 0 = \mathbf{SX}_i = \infty</math>                      Weak performance</p>
$\mathbf{ES}_{i=0}$	<p><u>Level 3.1</u>  <u>Low Vulnerability</u>  <math>0 / +\Delta GDP = \mathbf{SX}_i = 0</math>                      Weak performance</p>	<p><u>Level 3.2</u>  <u>Low Vulnerability</u>  <math>0 / -\Delta GDP = \mathbf{SX}_i = 0</math>                      Weak performance</p>	<p><u>Level 3.3</u>  <u>High Vulnerability</u>  <math>0 / 0 = \mathbf{SX}_i = 0</math>                      Weak performance</p>

Variables:  $\blacktriangle$  = High  $\blacktriangledown$  = Low  $\Delta GDP$  = Gross Domestic Product Growth Rate  
 $ES_i$  = External Sector Main Variable (-) = Negative and (+) = Positive 0 = Zero



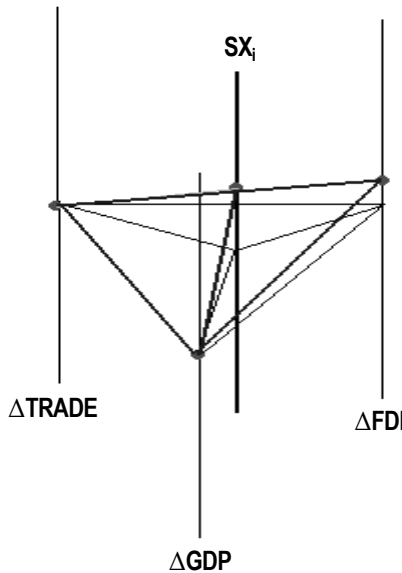
of the GDP. The reason for incorporating FDI growth together with trade volume growth is to observe how both variables can be affected by possible deep international trade or financial crises. Specifically, the  $SX_i$  is applied to the ASEAN-5 members, as well as China, to observe the effect of the 1997 financial crisis on these countries. The application of  $SX_i$  to the above

Figure 2  $SX_i$  Index: Indonesia, 1985-2005



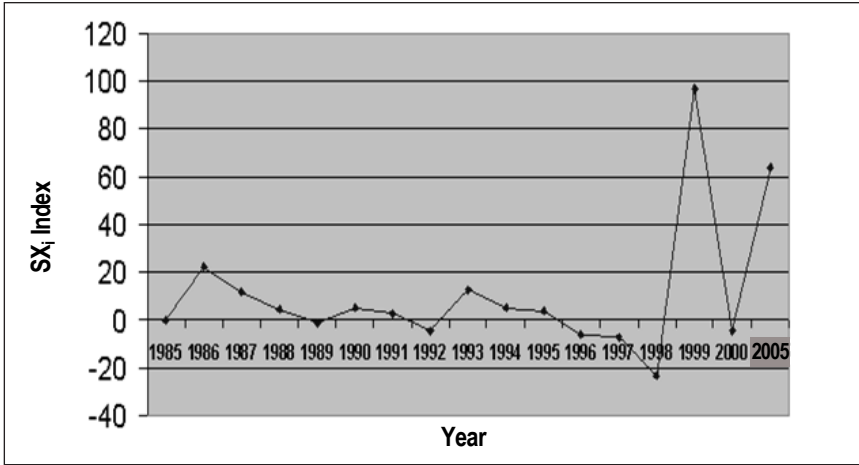
Source: ADB, NBSC WB.

Average  $SX_i$  Index: Indonesia, 1985-2005



countries shows that the countries most affected by the 1997 financial crisis were the Philippines  $SX_{i-1998} = -23$  (see Figure 6), Singapore  $SX_{i-1997} = -20$  (see Figure 3), Thailand  $SX_{i-1997} = -6$  (see Figure 5), Malaysia  $SX_{i-1997} = -4$  (see Figure 4), Indonesia  $SX_{i-1997} = -3$  (see Figure 2) and China  $SX_{i-1997} = 0$  (see Figure 7).

Figure 3  $SX_i$  Index: Singapore, 1985-2005



Source: ADB, NBSC WB.

Average  $SX_i$  Index: Singapore, 1985-2005

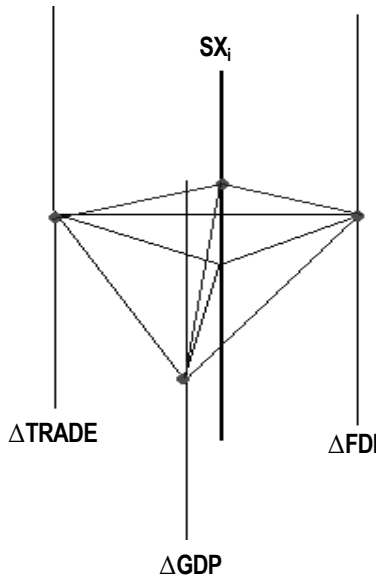
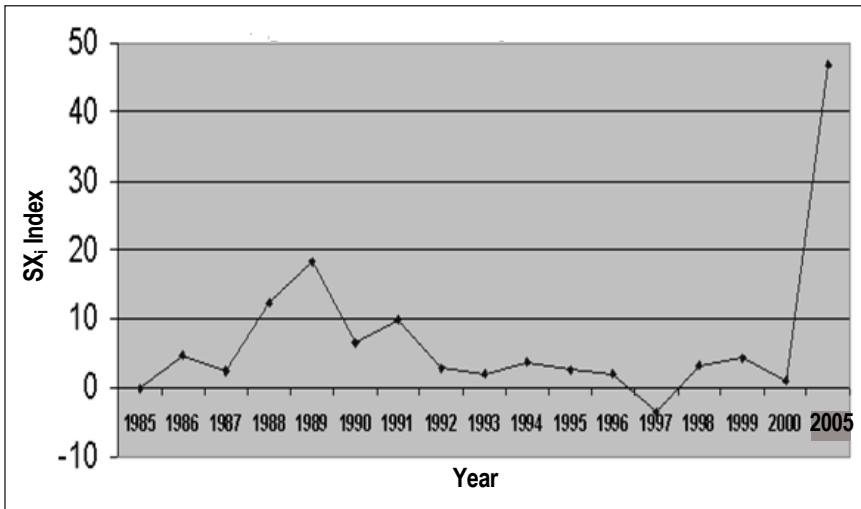


Figure 4  $SX_i$  Index: Malaysia, 1985-2005



Source: ADB, NBSC WB.

Average  $SX_i$  Index: Malaysia, 1985-2005

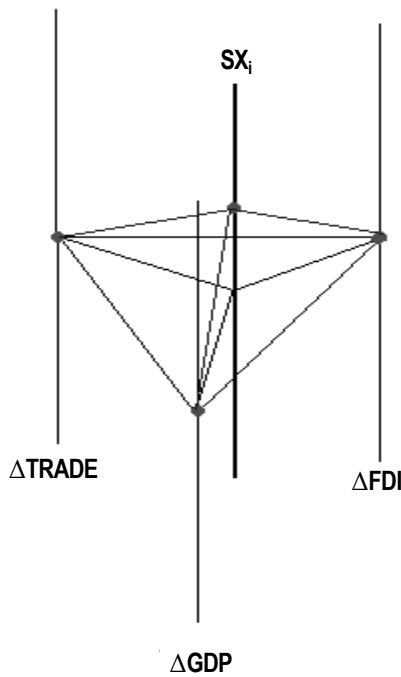
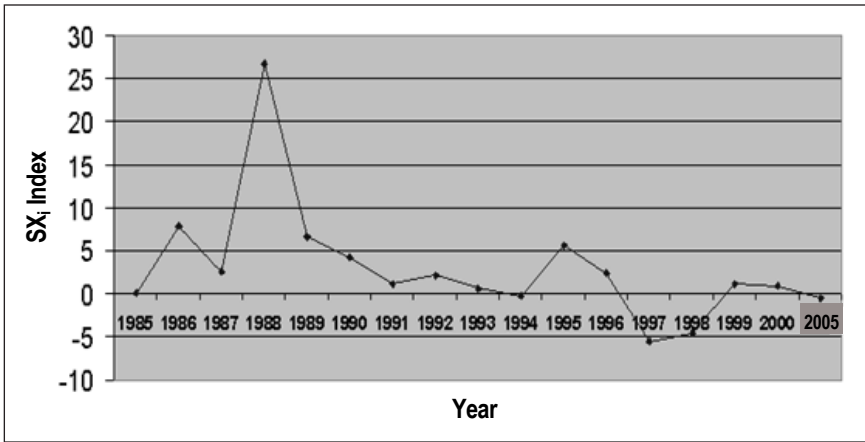


Figure 5  $SX_i$  Index: Thailand, 1985-2005



Source: ADB, NBSC WB.

Average  $SX_i$  Index: Thailand, 1985-2005

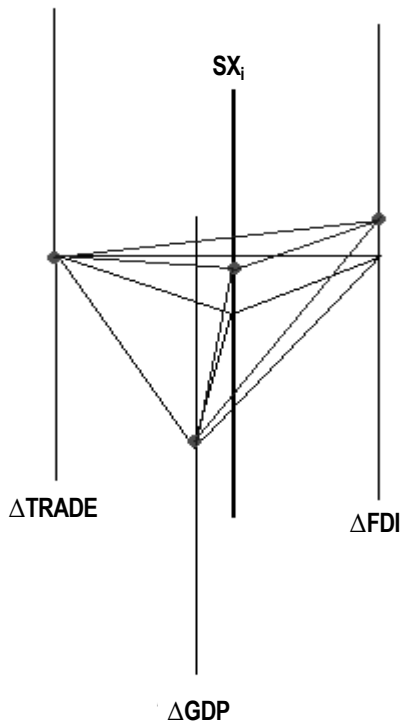
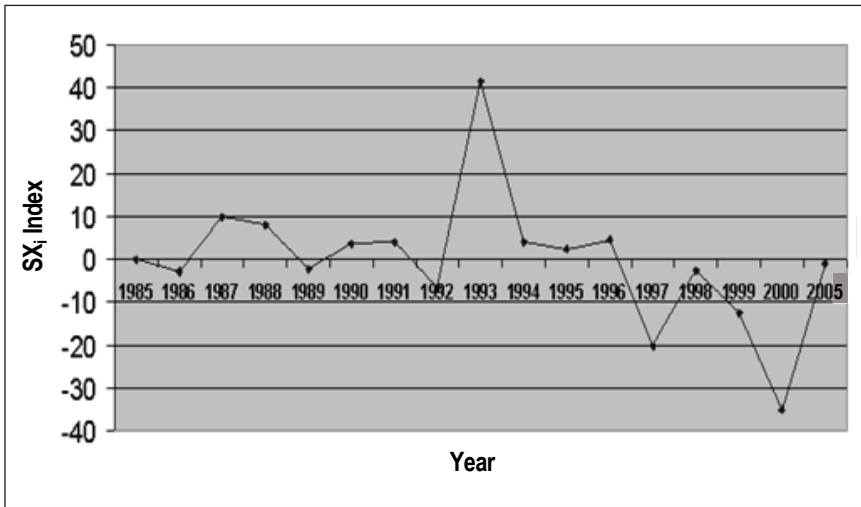


Figure 6  $SX_i$  Index: Philippines, 1985-2005



Source: ADB, NBSC WB.

Average  $SX_i$  Index: Philippines, 1985-2005

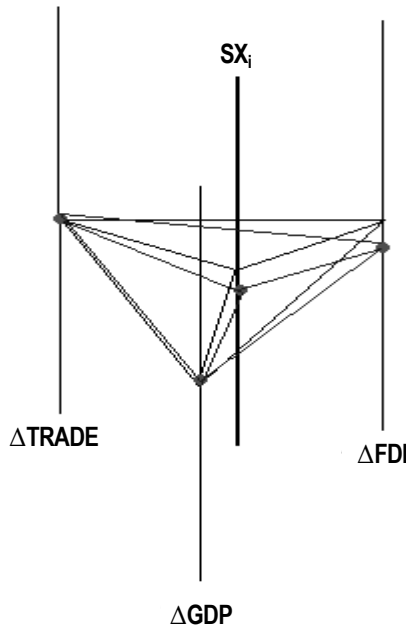
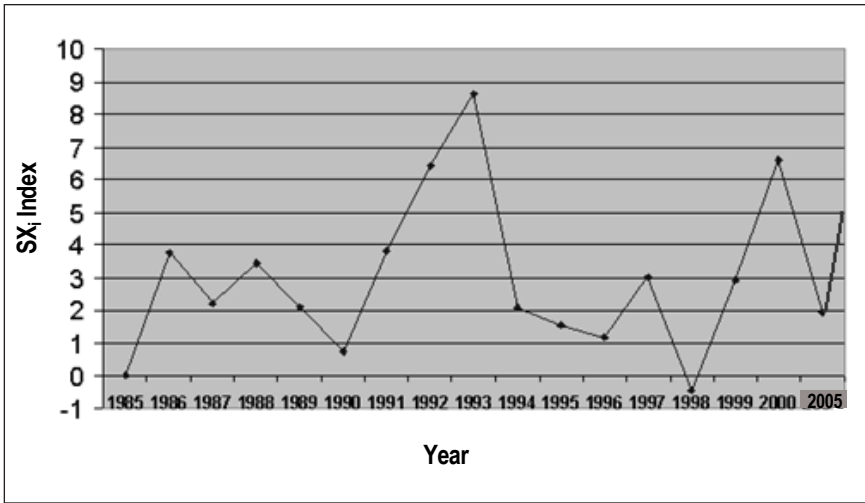
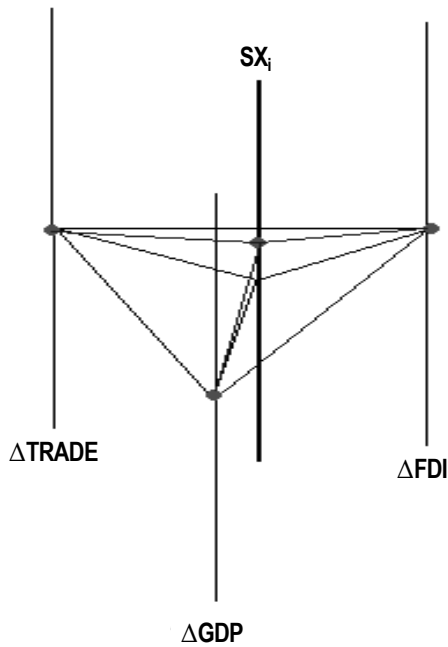


Figure 7  $SX_i$  Index: China, 1985-2005



Source: ADB, NBSC WB.

Average  $SX_i$  Index: China, 1985-2005



We can observe clearly that the financial crisis strongly affected the Philippines (1997), Singapore (1997-1998), Thailand (1997-1998), Indonesia (1997) and Malaysia (1997). In the case of China (1998), the country was affected but not at the same level as among the ASEAN-5 members. The results show how strong the dependency is on the external sector of ASEAN-5 members and China; these countries are highly vulnerable to financial and world trade crises. In the period of 1985-2005, the external sector of ASEAN-5 members and China presented an acceptable performance, but irregularities in external sector behaviour between 1985 and 2005 can be detected in two ASEAN-5 members: the Philippines (low participation of the external sector in the world trade) and Singapore (high exposure of the external sector in the world trade). China had the best performance of its external sector compared to many ASEAN-5 members between 1985 and 2005.

On the other hand, this part of this research is also interested in demonstrating whether the  $ES_i$  and GDP growth have a correlation. The results show that in China ( $r = 0.68$ ), Malaysia ( $r = 0.67$ ) and Indonesia ( $r = 0.77$ ), there exists a strong correlation between the  $ES_i$  and GDP; in the case of Singapore ( $r = 0.30$ ), Thailand ( $r = 0.23$ ) and the Philippines ( $r = -0.23$ ), there is a lower or negative correlation. This shows that China, Malaysia and Indonesia have a high dependency on the performance of its external sector on international trade, together with FDI growth. Thailand and Singapore have been classified in the category of normal vulnerability; the normal vulnerability of Thailand is caused by its lower trade volume and FDI, but in the case of Singapore (low correlation), which also demonstrates normal vulnerability, this is due to the different proportions of growth between trade volume and FDI growth. The Philippines shows a negative correlation between the  $ES_i$  and GDP growth; it shows low vulnerability of the external sector, where its trade volume growth and FDI growth are slow and small.

In the  $SX_i$  cycles between 1985 and 2005 (20 years) among these ASEAN-5 members and China, we observe that the  $SX_i$  cycles have these results: China shows the best performance, it is located in Level 1.1 (15 years) and Level 2.1 (1 year). Among the ASEAN-5 members the  $SX_i$  cycles show that Malaysia is in Level 1.1 (12 years), Level 2.2 (3 years) and Level 1.2 (1 year). On the other hand, Indonesia and Thailand show close behaviour in their  $SX_i$  cycles: Indonesia has Level 1.1 (11 years), Level 2.2 (4 years) and Level 1.2 (1 year), whereas Thailand is located in Level 1.1 (11 years), Level 2.2 (1 year), Level 2.1 (1 year) and Level 1.2. (3 years). In the specific case of Singapore, this country is located in Level 1.1 (9 years), Level 2.2 (1 year), Level 2.1 (5 years) and Level 1.2 (1 year). The reason why Singapore shows different results in its  $SX_i$  cycles is its high dependency on the international markets, especially the United States of America. The Philippines is located in Level 1.1 (8 years), Level 1.2 (5 years) and Level 2.1 (3 years) owing to

the low participation of its external sector in the world economy, which is in turn because of its small amount of export products with high added value to the international markets.

#### 4. Concluding Remarks

With the application of the external sector development index ( $SX_i$ ) to the study of trade liberalization and openness, we observe that trade volume and FDI volume growth need to be joined into a single variable in order to study the external sector of any country or region. This single variable will be called the external sector main variable ( $ES_i$ ). The external sector development index ( $SX_i$ ) can thus be used as an alternative index to study trade liberalization cycles effectively. In fact, the  $SX_i$  can be considered a complementary analytical tool together with the terms of trade (ToT) and the openness index ( $O_i$ ).

#### Notes

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1. The terms of trade (ToT) is considered an analytical tool which can explain the relationship between the ratio of export prices (export index price =  $IP_x$ ) and the ratio of import prices (import index price =  $IP_m$ ) to find the deteriorating terms among countries (Balassa, 1985). However, ToT continues to be used by many experts on international trade to explain the behaviour of the external sector of any country.

$$\text{ToT} = \text{IP}_x / \text{IP}_m \times 100\%$$

2. The openness index ( $O_i$ ), on the other hand, studies the relationship between the total trade volume (i.e. exports plus imports) and GDP (Edwards, 1998). It measures the level of trade liberalization as well as the orientation of the trade policy of any country. The objective of the  $O_i$  is to show how much participation the external sector (export plus imports) has on the GDP as a whole, or how open an economy is to the international markets.

$$O_i = \text{X+M}/\text{GDP} \times 100\%$$

#### References

- Asian Development Bank (ADB) (2010), General Information and Database Statistics. <<http://www.adb.org/>>
- Balassa, B. (1985), "Exports, Policy Choices and Economic Growth in Developing Countries after the 1973 Oil Shock", *Journal of Development Economics*, Vol. 18, No. 2, pp. 23-35.



Edwards, S. (1998), "Openness, Trade Liberalization, and Growth in Developing Countries", *Journal of Economic Literature*, Vol. 31, No. 3, pp. 1358-1393.

Ministry of Commerce of People's Republic of China (NCPRC) (2010), General Statistical Database. <<http://english.mofcom.gov.cn/>>

National Bureau of Statistics of China (NBSC) (2010), General Statistical Database. <<http://www.stats.gov.cn/english/>>

World Bank (WB) (2010), General Information and Database Statistics. <[www.worldbank.org](http://www.worldbank.org)>