

Chapter 1

Vertical Specialization in East Asia: Some Evidence from East Asia Using Asian International Input-Output Tables from 1975 to 2000

Yoko Uchida

Abstract

East Asia has had significant trade growth over past three decades. In East Asia, intermediate input trade has played an important role to the trade growth. Intermediate input trade increases as a result of vertical production network in which countries are specialized in each production stage in the context of international division of labor, otherwise known as vertical specialization (VS). In this paper, we examine vertical specialization trade in East Asia following Hummels Ishii and Yi (2001). We find that VS as a share of export increases over time in most of the countries. Ranges of the total VS shares are from 0.16 (China) and to 0.59 (Singapore). The results show that if a country has a large domestic market, VS tends to be small. In small developing countries show that total VS has high contribution to explain trade growth, but large countries do not have these trend. From the geographic orientation, we find the North are still dominate big share, but it is decreasing its role. The interesting findings are that labor intensive industry has inverted U shape relationship between VS share and per capita income. This means that as per capita income increases, VS for small country increases till the economy reaches certain level. After that, the economy decreases its share of VS.

Keywords: Vertical Specialization, Production Network, Growth of Trade

1. Introduction

Over the past several decades, the volume of world trade has grown rapidly. World manufacturing trade has increased by 5.12 times from 1975 to 2003¹. Krugman (1995) points out that world trade have grown faster than world output and composition of trade has been changed from final goods trade to intermediate input one. He suggests three possible factors to explain why world trade has grown: 1) political factors such as tariff reduction and trade liberalization, 2) boundary issue and 3) technological change, such as reduction of transportation cost. Feenstra (1998) have also pointed out four possible factors to explain trade growth. The first two factors are same as the factors what Krugman (1995) points out, but Feenstra (1998) states two more factors: 1) income convergence among countries and 2) intermediate input trade, in other words, outsourcing or *vertical specialization*.

East Asia has had significant trade growth over past three decades. In East Asia, intermediate input trade has been played an important role among factors which cause trade growth. Campa and Goldberg (1997) show that share of imported to total intermediate input of all manufacturing industries in Canada, Japan, United Kingdom and the United States in 1993. It is 20.2%, 4.1%, 21.6% and 8.2% respectively, while we know from Asian International Input Output table that these are 14.5%, 31.3%, 25.3%, 59.9%, 39.3%, 50.3%, 64.7%, 48.4% for China, Indonesia, Korea, Malaysia, Taiwan, the Philippines, Singapore, and Thailand respectively. This tells us that East Asia has deepens intermediate input trade, compared with Canada, Japan, United Kingdom, and the United States.

Intermediate input trade increases as a result of vertical production network in which countries are specialized in each production stage in the context of international division of labor, otherwise known as vertical specialization. Yi (2003) provides theoretical model of vertical specialization that specifies non-linear relationship between intermediate goods and trade costs. A slight declined in trade costs induces large intermediate trade, assuming close substitute. Without assuming close substitutes between traded goods, vertical specialization is the only way to explain increase in intermediate trade. Figure 1 shows the share of trade, intermediate trade, and trade costs to GDP in East Asia from 1985 to 2000. It tells us that the share of intermediate goods to GDP grows quickly during the period, especially after 1990, while the total trade share increases slowly. Trade costs shares decline quickly until 1990, while after 1990 it declines slowly. This intuitively supports the idea that vertical specialization is encouraged in this region.

The purpose of this paper is to examine to what extent vertical specialization deepens in East Asia using Asian International Input-Output tables from 1975 to 2000, which are compiled by Institute of Developing Economies, Japan External Trade Organization. The structure of this paper is as follows: first, we overview international

production linkage in East Asia in order to see how production process is vertically specialized. Section three provides concept and calculation method of vertical specialization, which is introduced by Hummels, Ishii and Yi (2001). Section four shows result of vertical specialization calculation and decomposition exercise to examine source of growth. We also show geographic orientation in this section. Section five presents some concluding remarks.

2. Vertical Production Linkage in East Asia

In this section, we examine how international production linkage has changed from 1975 to 1995². Data used here is Asian International Input-Output tables from 1975 to 1995. Table 1 shows sector classification employed in this paper.

Since the early 1980s, inward foreign direct investment (FDI) has increased in East Asia as multinational firms, responding to increased labor costs in their home countries, have started to install labor intensive stages of production in neighboring countries. East Asia hosts such production since its labor endowment is relatively abundant and exhibits strong economic fundamentals. The image of international fragmentation of the stages of personal computer production in East Asia is as follows: High value-added parts which need capital and research and development intensively, such as liquid crystal displays, software for operating systems, and CPUs, are produced in Japan and the United States, while low value added parts, such as capacitors and printed boards are produced in Malaysia or Taiwan. These parts are exported and then assembled into the final product, using relatively cheap labor. Each country included in this production process specializes in stages of production where it has a comparative advantage. Developed countries produce parts which are capital intensive, while developing countries specialize in the stage which adds relatively low value to goods.

To overview the structural change of the East Asian production process, we first employ the international backward linkage effect index which measures the degree of production linkage among different industries. This index measures the total amount of required procurement in one industry to respond to an increase in one unit of additional demand in each sector. The larger the index is, the larger the impact on the economy. The backward linkage effect index can be calculated by summing Leontief inverse matrix up column-wise. Using Asian International Input-Output tables, we are able to calculate the index among countries and industries. From this index, we can interpret to what extent each country requires inputs from its domestic market and to what extent it leaks its demand to foreign countries when an additional unit of demand occurs.

Tables 2a, 2b and 2c show the results of the calculation. In Table 2a appears each country's international backward linkage effect index, average, and deviation from the average for each year. Deviation from the average is calculated by summing the

square of each country's distance from the average. The deviation index represents the similarity of the magnitude of the backward linkage effect. Thus, a large (small) deviation index can be interpreted as each country having different (similar) patterns of production. Note that the index might be underestimated for 1975, since China and Taiwan are not included in 1975 table. Table 2b describes the domestic backward linkage effect index. Table 2c shows the geographic orientation of the international backward linkage effect index. To see geographic orientation, we group countries into 4 categories, such as North, South1, South2, South3 and South4. North includes Japan and the United States. South represents developing countries in 1975. South1 contains Korea and Taiwan, and South2 consists of South East Asia countries except Singapore, namely, Indonesia, Malaysia, Philippines and Thailand. Singapore's unique production and trade pattern as an entrepot, falls under its own category, South4. China is a new emerging market with interesting features. We prepare, thus, another individual category, South3, for China. We will use the same grouping category later in section five when we discuss the geographic orientation of vertical specialization shares of total exports.

From 1975 to 1995, the country with the largest index is Japan followed by Korea. In 1995, China and Singapore occupy the top spots. During this period, inward FDI increased in East Asia (See Figure 2). This phenomenon is considered to be the result of increases in multinational firms' overseas operations. Since multinational firms use the same production technology, the production processes they install in each country help create similar production process across different countries. On the other hand, since each country employs different technology in the context of different abundance of factor intensities, similar domestic production technology is not guaranteed. Deviation indexes show that backward linkage effect indexes converge over time. From 1975 to 1995, similarity increases by 2 times.

Now we need to focus on the domestic impact only. (See table 2b). If a country has a large international index, but a small domestic index, it cannot satisfy additional demand from domestic production alone; it must depend on the imported input. A country with both a large international and domestic index has a full set of production stages. From table 2b in 1975, the impact of Korea, which has second largest international impact, is smaller than that of the United States. The United States, thus, has the second largest impact if we focus on domestic impact. This implies that the United States has more stages of production process than Korea. From the index of 1995, we can interpret that China has large parts of the production process within the country, since it still has the highest index after the effect which leaks to foreign countries is removed. The difference between international and domestic indexes of Singapore is considerably large, suggesting that the production process is fragmented into other countries. The deviation index shows that from 1975 to 1985, East Asia's production process similarity decreases, and then it increases from 1985 to 1995. However, if we compare international and domestic deviation in 1995, we notice that domestic deviation

(0.384) is still much larger than international deviation (0.121).

Finally, we investigate to what extent the backward linkage effect is retained domestically and to what extent it leaks to foreign countries (see table 2c). From table 2c, we see that China, Japan, and the United States have a domestic ratio of more than 90%, while the other countries' domestic ratio are from 71 to 88%. If we compare the domestic ratio in 1975 and 1995, there are only two countries, Indonesia and Korea, which have an increasing trend. We can say that Indonesia and Korea increase stages of production over time. The rest of the countries have the opposite trend. This reflects the fact that most countries tend to split their production process into domestic and international. Geographic orientation tells us that all countries except China have strong linkages with the North group. The countries which increase their linkage with the North witness their domestic ratio decline. South countries tend to strengthen their production linkages within the South.

Summary of the findings in this subsection are:

1. International production linkages increase in similarity over time due to the increase in multinational firms' overseas operations.
2. China, Japan, and the United States have a full set of production processes, while South East Asian countries, except Indonesia, have fragmented production processes.
3. Production linkages with the North increase in South East Asian countries, except Indonesia, while Indonesia decreases its linkages with the North as domestic production strengthens.
4. The countries which increase their linkages with the North exhibit lower domestic ratios.
5. South countries tend to increase their production linkages within the South. Only Indonesia and Korea do not appear increasing trends of international leaks of additional demand.

3. Vertical Specialization: Concept and Calculation Method

3.1. Concept

The concept for vertical specialization in this paper is borrowed from Hummels et al. We capture one feature from trade, namely sequential linkage among countries that produce final goods via vertical specialization.

Vertical specialization occurs when:

- A. *a good is produced in two or more sequential stages,*
- B. *two or more countries provide value-added during the production process of the good,*
- C. *at least one country must use imported inputs in its stage of the production process,*

and some of the resulting output must be exported. (Hummels, Ishii and Yi, 2001 p. 77)

From this concept, vertical specialization occurs only for the intermediate trade that becomes embodied in exported goods. Figure 3 shows a vertical specialization chain involving 3 countries. Country1 produces intermediate goods that are exported. Country2 combines imported intermediate goods, domestic intermediate goods, and capital and labor to produce the new product. Part of the goods produced in Country2 is consumed in the domestic market and part of the goods is exported as an intermediate good (VS2) and final good (VS3) to Country3. In this paper, we divide VS into 2 parts; VS2 and VS3, while Hummels et al. measure VS as a whole. VS2 measures the use of imported inputs in producing intermediate goods that are exported. VS3 measures the use of imported inputs in producing goods that are exported as a final good. VS3 measures a final stage of vertical specialization, which means that there is no more circulation of this good, and VS2 measures the middle stage of the vertical specialization. VS2 and VS3 measures Country2's participation in international production linkages. We can also capture VS1, which measures country1's participation in the linkage. VS1 measures the value of intermediate exports embodied in Country2's export goods. Hummels et al. point out that VS1 tends to be high when VS is low. Suppose that production process occurs in two stages. In stage one, country1 produces an intermediate input and exports it to Country2. Country2 then produces final goods by adding domestic intermediates, capital and labor, ultimately exporting some of it. In this case, VS1 is expected to have a low share when a country has a high VS share. However, taking into account that the share of intermediate trade in East Asia has been around 60% since 1985, production processes are considered to be more complexly intertwined with each other. Labor abundant countries also engage in intermediate trade among each other, based on their different factor endowments.

3.2 Calculation Method

We follow the method introduced in Hummels et al. to calculate VS share. VS measures Country2's import content of export. The method is as follows:

$$VS = (\text{imported intermediates} / \text{gross output}) * \text{exports} \quad (1)$$

The first term of the right hand side (RHS) of equation (1) is the share of import content to produce one unit of good. By multiplying export by the share of import content ratio, we obtain the dollar value of import content of export. If Country2 does not export, VS is zero, and if Country2 does not use imported intermediates, VS is also zero. Aggregate VS is obtained by summing up VS for each sector. Since we are interested in the composition of VS, VS is normalized by the total export of Country2.

$$\text{VS share of total exports} = \frac{VS_R}{X_R} = \frac{\sum_i VS_{Ri}}{\sum_i X_{Ri}}, \quad (2)$$

where X denotes export. R and i denotes country and sector respectively. VS's share of total exports is rearranged as follows:

$$\begin{aligned} \text{VS share of total exports} &= \frac{VS_R}{X_R} = \frac{\sum_i VS_{Ri}}{\sum_i X_{Ri}} = \frac{\sum_i (VS_{Ri} / X_{Ri}) * X_{Ri}}{\sum_i X_{Ri}} \\ &= \sum_i \left[\left(\frac{X_{Ri}}{X_R} \right) \left(\frac{VS_{Ri}}{X_{Ri}} \right) \right] \end{aligned} \quad (3)$$

The VS share of total exports is the export weighted average of the sector VS export share. To implement this calculation using the Input-Output table, we use the following equation:

$$\text{VS share of total export} = VS_R / X_R = \underline{u} A^M \underline{X} / X_R, \quad (4)$$

where \underline{u} is a $1 \times n$ vector of 1's, A^M is $n \times n$ import coefficient matrix, \underline{X} is an $n \times 1$ vector of Country R 's exports. The Input-Output table has a feature to capture direct and indirect usage of inputs by using the Leontief inverse matrix. We employ this feature in the VS calculation. We can thus capture the whole input amount required to produce a country's exports. Equation (5) calculates the VS share of total exports in final form.

$$VS_R / X_R = \underline{u} A^M [I - A^D]^{-1} \underline{X} / X_R, \quad (5)$$

where I is $n \times n$ identity matrix and A^D is $n \times n$ domestic coefficient matrix.

$[I - A^D]^{-1}$ captures the direct and indirect requirements to produce exports. Our data has matching bilateral trade flows and bilateral import matrix, thus the equation would be:

$$VS_R / X_R = \sum_S \underline{u} [A^{SR} [I - A^{RR}]^{-1} \underline{X}^{RS}] / X_R, \quad (6)$$

where S is the import partner country for R . In this paper, we have 9 countries which correspond to S . A^{SR} is an import coefficient matrix from country S to R . A^{RR} is a domestic input coefficient. To calculate VS2 and VS3, export vector X is divided into two, intermediate exports and final goods exports. Hummels, Ishii and Yi (2001) point

out that at the sector level we would underestimate VS shares in the case where an industry produces two goods and one good uses imported intermediates but does not export, while another good does not use imported intermediates, but does export. In case aggregated VS share for each is zero, VS share could be positive number in sector level.

VS1 can be calculated in a similar manner. VS1 measures export intermediates that are embodied in another country's exports.

$$VS1_R = \sum_s^n (\text{exported intermediates from country } R \text{ to country } S / \text{gross output } S) * \text{exports } S \quad (7)$$

To calculate this equation using the Input-Output table, the equation would be as follows:

$$VS1_R = \underline{u} \sum_S^n [A^{RS} \underline{X}_S] / X_R \quad (8)$$

where A^{RS} is an intermediate goods export matrix from country R to S.

To capture indirect and direct effect, we include the Leontief inverse matrix in equation (8).

$$VS1_R = \sum_S^n \underline{u} [A^{RS} [I - A^{SS}]^{-1} \underline{X}_S] / X_R \quad (9)$$

where A^{SS} is a domestic input coefficient matrix of Country S.

4. Vertical Specialization and Trade Growth

4.1. Result of Calculation: Vertical Specialization as a Share of Total Export

In this subsection, we provide results of the vertical specialization (VS) by sector as well as by country.

In Figure 4 appear the results of VS, VS2 and VS3 within East Asia plus the United States³. The results show that most of the countries except Singapore increase in their VS export share within region over time. Japan and Korea have similar trends: in 1990, VS shares go down and then go up. VS share of the United States and Japan are low over time, ranging between 0.01 to 0.05. VS shares for South East Asian countries such as Malaysia, Philippines and Thailand are high, ranging from 0.1 to 0.37. On the other hand, China and Indonesia exhibit relatively low VS shares. Possibly due to these

countries' import-substitution policies, considerably more full set production systems appear within these countries. They do not import intermediate goods; rather they chose to produce goods by themselves, protecting their markets through import duties. Such a policy appears only in countries which have large domestic markets. From this, we can say that if a country has a large domestic market, VS shares tend to be small.

This result is consistent with the result of Hummels et al. They point out that large countries tend to have lower VS shares and small countries tend to have higher VS shares. The magnitudes of VS shares in this paper are smaller than those in Hummels et al. This is because we only treat imports and exports within one region, while Hummels, Ishii and Yi treat imports and exports from all over the world. If we include imports from the rest of the world, we would expect the results to be higher than the result currently presented, mainly because East Asia has developed production linkages with the EU since 1985.

If we compare VS2 with VS3, all countries except China have larger VS2 shares than VS3. China's exceptional result suggests that it engages more in the final assembly stage than in middle stage of the production. From 1990 to 2000, increase in VS share in Japan, Korea, Taiwan, Philippines and Thailand are led by intermediate exports, since these countries' VS3s stay constant, while VS2s are increasing.

So far, we have seen how the share of vertical specialization changes over time by country. Since vertical specialization is considered to be different by sector, we examine East Asia's vertical specialization by sector in the rest of this sub section. Conditions which enable the fragmentation of production processes geographically are:

1. Abundance of number of processes,
2. Abundance of number of labor intensive production processes,
3. Relatively low investment in facility,
4. Each stage of production creates value added,
5. Low transport costs and tariff.

Electronic products are a good example of a fragmented production process. Chemical and steel products also tend to have fragmented production processes. We see vertical specialization by sector from three different time points, namely 1975, 1985, and 2000. We treat only VS share of manufacturing sectors.

Table 3a shows VS share as a share of total exports by sector. As expected, electronic and chemical products have high VS shares over time. Except Indonesia, VS shares of electronic products are increasing, especially from 1985 to 2000.

Shares of electronic VS to total manufacturing VS in 2000 reach more than 60% in South East Asian countries (See table 3b). Japan, Korea, Taiwan and the United States also have high VS share of electronic products, more than 50%. China also has a high percentage share, but it is relatively small, compared to other countries. Indonesia is only one exception in which electronic product does not have a leading role. We can say that, except in Indonesia, VS shares of electronic products explain more than half of

VS manufacturing shares. In Indonesia, chemical products play an important role. Chemical products were the main explanatory product of VS in 1975 in South East Asia, but in 1985 this role shifted to electronic products.

Two labor intensive industries, textile and timber, wooden products, and furniture industry show interesting results. China, Indonesia, Malaysia, Philippines and Thailand have increasing trends. On the other hand, Japan, Korea and Taiwan are decreasing trends. These results tell us that VS share of labor intensive industry decreases as per capita income increases. An inverted U-shape relationship exists between VS share of labor intensive industry and per capita GDP.

Figure 5 shows VS1 exports as a share of total exports. Overall results show the same trend as we saw in the result of VS; all but Singapore increase their VS1 over time. According to Hummels et al., countries which have high VS tend to have low VS1. However, the results we obtained here are different from what they expected to have. The results of VS1 share are similar to each other, compared to the results from VS. There are not large differences among countries which pose high VS shares and countries which have low VS share. Notice that Indonesia has high VS1. This might be because Indonesia is an oil-exporting country.

Figure 6 depicts to what extent countries are involved in vertical linkage in East Asia. Japan and the United States have a similar pattern of total linkages. Total VS as a share of total exports in the United States is slightly higher than that in Japan. This means that the United States has stronger linkages with East Asia than Japan has. Malaysia, The Philippines, and Thailand have high total VS shares. In 2000, total VS shares of these countries were higher than 0.4. Most notably, the total VS share of Malaysia is higher than 0.5, implying that more than 50% of its exports are vertically specialized. It is almost the same share as Singapore. Only China and Indonesia have relatively low total VS share.

Summary of the findings in this subsection:

1. VS shares are increasing over time except in Singapore.
2. Large (small) countries tend to have small (large) VS share.
3. China engages more in the final assembly process than in middle stage of production.
4. VS2 increases its presence in some countries after 1990.
5. The electronic industry accounts for most of VS, followed by the chemical industry.
6. Some labor intensive industries show that their share of VS decrease as per capita income increases.
7. VS1 shares have the same trend as VS shares, but the magnitude of VS1 is similar among countries. In 2000, more than 40% of exports can be explained by total VS.

4.2. Trade Growth and Vertical Specialization Growth

In this section, we employ growth accounting to capture sources of growth. We decompose export growth into three parts, VS growth, VS1 growth, and other export growth.

$$\Delta \frac{X_{R,t}}{GO_{R,t}} = \Delta \frac{VS_{R,t}}{GO_{R,t}} + \Delta \frac{VS1_{R,t}}{GO_{R,t}} + \Delta \frac{(X_{R,t} - VS_{R,t} - VS1_{R,t})}{GO_{R,t}}, \quad (10)$$

where $\Delta Z_t = Z_t - Z_{t-1}$. Table 4 shows the result of growth accounting calculation. We chose three periods to calculate growth accounting, namely from 1975 to 1985, from 1985 to 2000, and from 1975 to 2000.

During the first period (1975-1985), “other export growth” contributed more than any other source except in Singapore and the United States, followed by VS1. On average, VS was the last source of the growth across countries. From 1985 to 2000, vertical specialization increased. During this period, the main source of trade growth continued to be “other export growth” for Japan and the United States, while for Malaysia, Philippines and Thailand, the main source shifted to VS. For the latter countries, the second main source of trade growth was “other export growth” and the smallest source was VS1. During the last period from 1975 to 2000, the main contributor to trade growth was, again, “other export growth” in Japan, Thailand, and the United States. Trade growth’s main source in Malaysia, Philippines and Singapore was VS. Indonesia and Korea’s trade growth came mainly from VS1. If we sum up VS and VS1 contributions and examine the contribution of total VS and other exports, we can see these factors’ relationship. From 1975 to 1985, total VS contribution for four countries, the Philippines, Thailand, Singapore and United State, is larger than “other export growth’s” contribution. However, from 1985 to 2000, the total VS of six countries is larger than “other export growth.” Interestingly, Indonesia, Korea and Malaysia have changed their main contribution factor from “other export growth” to total VS, while Singapore and the United States have changed their main contribution factor from total VS to “other export growth.”

Summary of the findings in section IV.2:

1. From 1985 to 2000, In China, Japan, Singapore and US, “other export growth” mainly contributed to export growth, while the biggest portion of export growth in the remaining six countries is explained by Total VS.
2. Total VS growths of the 6 countries explained export growth ranging from 55% (Thailand) to 98%(Korea) during the period from 1985 to 2000.

4.3 Geographic Orientation

In this paper we captured and decomposed the geographic orientation of VS and VS1. We grouped the 10 countries in the same was as in section three, with the only difference

being that we omitted Singapore, South4. Table 5 shows the results of the calculation of the geographic orientation. Each row describes from which group the country imports its intermediates and to which country the country exports. The column vector describes the countries that are to be analyzed. The first row, N-N, describes that Japan imports its intermediates from the North and exports intermediates/final goods to North. In this case, the group North does not include Japan, i.e. the North consists of the United States only. In 1975, the VS shares of Japan and the United States were dominated by North-North trade, which means that Japan depended on the United States and vice versa. North-South2 and South2-North are the second largest contribution to the VS share. In 1975, the North had a strong relationship with the North and South2. In 1985, North-North Share decreased in Japan and the United States. Instead of North-North trade, North-South1 trade shares increased over time.

A large percentage of N-N implies that South1 played its role as an assembly base, using relatively low labor costs in 1975 and 1985. However, the N-N percentage declined by half in 2000. The difference has shifted to N-S1, S2, and trade relating to China, illustrating that South1 started importing fewer intermediate inputs from the North to produce goods for export to developed countries. It should be noted that in 1975 and 1985, there were no transactions between Korea and China. Thus, the geographic orientation with respect to China in 1975 and 1985 is zero.

In South2, we can observe a similar change to South1; N-N share decreased by half from 1975 to 1985. The presence of South2 trade within the region increases from 1975 to 2000. In China, it should be noted that South1 to North trade share is higher than North-North trade. This means that China imports from South1, Korea and Taiwan, and exports to the North, adding labor and capital to the imported intermediates.

In this paper, the geographic orientation of VS1 is also presented in table 6. Recall that VS1 measures export intermediates that were embodied in importing country's exports. We grouped countries in the same manner as above. In 1975, Japanese intermediate exports which were embodied in exports to North (United States) were only 9.4% of Japanese total exports. Japanese intermediate exports played an important role in the export of goods to South1. In 2000, Japanese export intermediates were used to export to South2 at the same rate as exports to South1. Korea's intermediates exports used in other country's production processes appeared solely in exports to the North in 1975 and 1985, but in 2000, they were used to export to each region equally.

Summary of the findings in this section:

1. In each county and each time, N-N trade dominates the share, but the shares are decreasing over time.
2. Instead of N-N trade, S-N and S-S trades increases its share.
3. Geographic orientation for VS1 tells us that the North intermediates are mainly used by South1 export in 1985, but in 2000 it is used by South1 and South2 equally.
4. Intermediates of the South are used by the North in 1975, but in 2000, the main

user has been changed to South1.

5. Concluding Remarks

In this paper, we examine vertical specialization trade in East Asia region following Hummels et al. We find that VS as a share of export increases as a whole, and also VS1 increases. Ranges of the total VS shares are from 0.16 (China) and to 0.59 (Singapore). The results show that if a country has a large domestic market, VS tends to be small. In small developing countries show that total VS has high contribution to explain trade growth, but large small countries do not have these trend. From the geographic orientation, we find the North are still dominate big share, but it is decreasing its role. The interesting findings are that labor intensive industry has inverted U shape relationship between VS share and per capita income. This means that as per capita income increases, VS for small country increases till the economy reaches certain level. After that, the economy decreases its share of VS.

The limitation of this study is that we do not have theoretical model of vertical specialization. The conditions of VS in this paper are more intuitive than theoretical basis. However these conditions we showed in this paper is similar to those in Markusen and Maskus (2001). For the future study, we need to construct the model to clarify the reason why vertical specialization occurs.

Notes

1. WTO (2004), World Trade Statistics, (http://www.wto.org/english/res_e/statistics_e/its04_longterm_e.htm)
2. In this section, we exclude year 2000 table, since it cause singularity when it is taken inverse matrix under our classification.
3. In this paper, we focus on the relationship among East Asia region plus the United States. We don't treat VS with the other countries, such as EU.

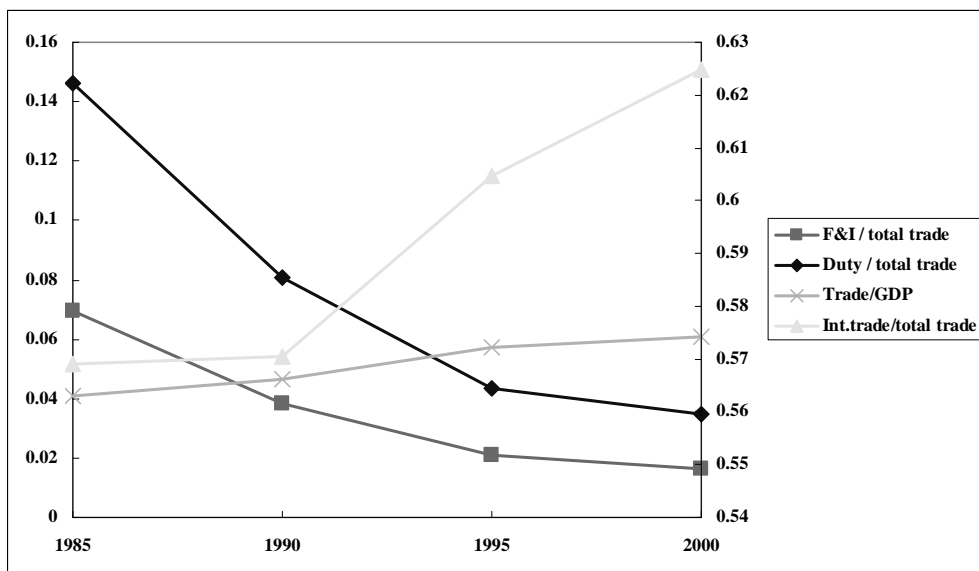
References:

- Campa, J. and L. Goldberg 1997. "The Evolving External Orientation of Manufacturing Industries: Evidence from Four Countries," NBER Working Paper no. 5919, *Economic Policy Review*, The Federal Reserve Bank of New York.
- Deardorff, A. 2001. "Fragmentation in Simple Trade Model," Manuscript, University of Michigan.
- Feenstra, R.C. 1998. 'Integration of trade and disintegration of production in the global economy,' *Journal of Economic Perspectives*, Vol.12, pp. 31-50.
- Hummels, D., J. Ishii, and K. Yi 2001. 'The Nature and Growth of Vertical Specialization in World Trade,' *Journal of International Economics*, Vol. 54, pp.

75-96.

- Institute for Trade and Investment 2004. *Trade Matrix centered on East Asia (in Japanese)*, Institute for Trade and Investment.
- Institute of Developing Economies 1983. *Asian International Input-Output Table 1975*, Institute of Developing Economies, Japan External Trade Organization.
- Institute of Developing Economies 1991. *Asian International Input-Output Table 1985*, Institute of Developing Economies, Japan External Trade Organization.
- Institute of Developing Economies 1996. *Asian International Input-Output Table 1990*, Institute of Developing Economies, Japan External Trade Organization.
- Institute of Developing Economies 2001. *Asian International Input-Output Table 1995*, Institute of Developing Economies, Japan External Trade Organization.
- Institute of Developing Economies 2006a., *Asian International Input-Output Table 2000 part1*, Institute of Developing Economies, Japan External Trade Organization.
- Institute of Developing Economies 2006b. *Asian International Input-Output Table 2000 part2*, Institute of Developing Economies, Japan External Trade Organization.
- Jones, R. W. and H. Kierzkowski 1990. "The Role of Services in Production and International Trade: A Theoretical Framework," in Ronald W. Jones and Anne O. Krueger, eds., *The Political Economy of International Trade: Essays in Honor of Robert E. Baldwin*, Cambridge, MA: Blackwell, pp. 31-48.
- Markusen J.R. 2001. *Multinational Firms and the Theory of International Trade*, MIT press, Chapter 1.
- Yi, K. 2003. "Can Vertical Specialization Explain the Growth of World Trade?," *Journal of Political Economy*, Vol. 3, No.1, pp.52-102.

Figure 1. Trade and Trade costs in East Asia from 1985 to 2000



Source: IDE, Asian International Input-Output Tables

Table 1. Sector Classification

Code	Description
AX001	Agriculture, Fishery and Forestry
AX002	Crude oil and Natural Gas
AX003	Coal and Other Mining
AX004	Food Products, Beverage and Tobacco
AX005	Manufacture of Textile Products
AX006	Manufacture of Wearing Apparel
AX007	Manufacture of Leather Products
AX008	Manufacture of Timber, Wooden Products and Furniture
AX009	Manufacture of Pulp and Paper
AX010	Manufacture of Chemical Products
AX011	Manufacture of Petroleum Products
AX012	Manufacture of Rubber Products
AX013	Manufacture of Ceramics and Mineral Products
AX014	Manufacture of Glass and Glass Products
AX015	Manufacture of Steel and Steel Products
AX016	Manufacture of Non-ferrous Metal Products
AX017	Manufacture of Metal Products
AX018	Manufacture of Ordinary Industrial Machinery
AX019	Manufacture of Electronic Products
AX020	Manufacture of Motor Vehicle and motor cycle
AX021	Manufacture of Other Transport Equipment
AX022	Manufacture of Precision Machines
AX023	Manufacture of Plastic Products
AX024	Other Manufacturing
AX025	Electricity, Water and Gas
AX026	Construction
AX027	Trade and Transportation
AX028	Other Services
AX029	Public Administration
AX030	Unclassified

Table 2a. International Backward Linkage Effect Index (average of manufacturing sectors)

	75	85	95
Average	2.061	2.157	2.141
Deviation	0.240	0.178	0.121
China	--	2.318	2.580
Indonesia	1.900	1.949	1.951
Japan	2.348	2.337	2.171
Korea	2.329	2.335	2.166
Malaysia	1.861	2.086	2.020
Taiwan	--	2.317	2.212
Phillipines	2.030	1.975	1.968
Singapore	2.050	2.066	2.251
Thailand	1.925	2.006	1.978
United States	2.046	2.184	2.115

Source: Author's calculation from Asian International Input-Output Tables 1975, 1985, 1995.

Note: Deviation is calculated by summing square of each country's difference from average.

Table 2b. Domestic Backward Linkage Effect Index (average of manufacturing sectors)

	75	85	95
Average	1.783	1.841	1.826
Deviation	0.447	0.547	0.384
China	--	2.212	2.417
Indonesia	1.552	1.640	1.722
Japan	2.261	2.212	2.081
Korea	1.856	1.951	1.862
Malaysia	1.588	1.611	1.587
Taiwan	--	1.878	1.793
Phillipines	1.758	1.525	1.490
Singapore	1.543	1.526	1.663
Thailand	1.691	1.716	1.591
United States	2.018	2.140	2.058

Source: Author's calculation from Asian International Input-Output Tables 1975, 1985, 1995.

Note: Deviation is calculated by summing square of each country's difference from average.

Table 2c. Decomposition of the Backward Linkage Effect Index (%)

		Domestic Ratio	North	South1	South2	South3	South 4
China	75	--	--	--	--	--	--
	85	95.41	3.95	0.23	0.35	--	0.06
	95	93.66	3.96	1.49	0.67	--	0.21
Indonesia	75	81.71	16.71	0.24	0.23	--	1.12
	85	84.12	11.98	1.76	0.38	0.50	1.25
	95	88.24	7.42	2.08	0.60	0.95	0.71
Japan	75	96.28	2.39	0.26	1.02	--	0.06
	85	94.63	2.65	0.48	0.63	0.75	0.10
	95	95.88	1.80	0.61	0.49	0.71	0.10
Korea	75	79.69	18.55	--	1.69	--	0.07
	85	83.58	13.54	0.38	1.50	0.07	0.20
	95	85.96	9.57	0.45	0.92	2.13	0.21
Malaysia	75	85.32	12.34	0.21	0.48		1.66
	85	77.24	15.11	2.05	0.80	1.07	3.09
	95	78.54	13.12	2.83	0.78	1.52	2.39
Taiwan	75	--	--	--	--	--	--
	85	86.77	11.04	0.22	1.01	0.07	0.24
	95	81.03	13.14	1.03	1.35	1.72	0.48
Phillipines	75	86.59	12.78	0.11	0.48	--	0.04
	85	77.24	15.11	2.05	0.80	1.07	3.09
	95	75.67	13.46	5.34	1.23	2.05	1.51
Singapore	75	75.26	16.99	0.45	7.29	--	--
	85	71.47	14.55	4.07	4.89	2.60	--
	95	73.88	15.01	3.20	4.39	2.02	--
Thailand	75	87.85	11.23	0.24	0.25	--	0.43
	85	85.56	9.68	1.72	1.42	0.56	0.87
	95	80.41	12.58	2.44	1.41	1.53	1.20
United States	75	98.65	1.05	0.11	0.17	--	0.02
	85	97.98	1.11	0.46	0.14	0.10	0.05
	95	97.34	1.30	0.54	0.31	0.31	0.12

Source: Author calculation from Asian International Input-Output Table 1975, 1985, and 1995

Note: Grouping is done in a following manner:

North: Japan and United States,

South1: Korea and Taiwan,

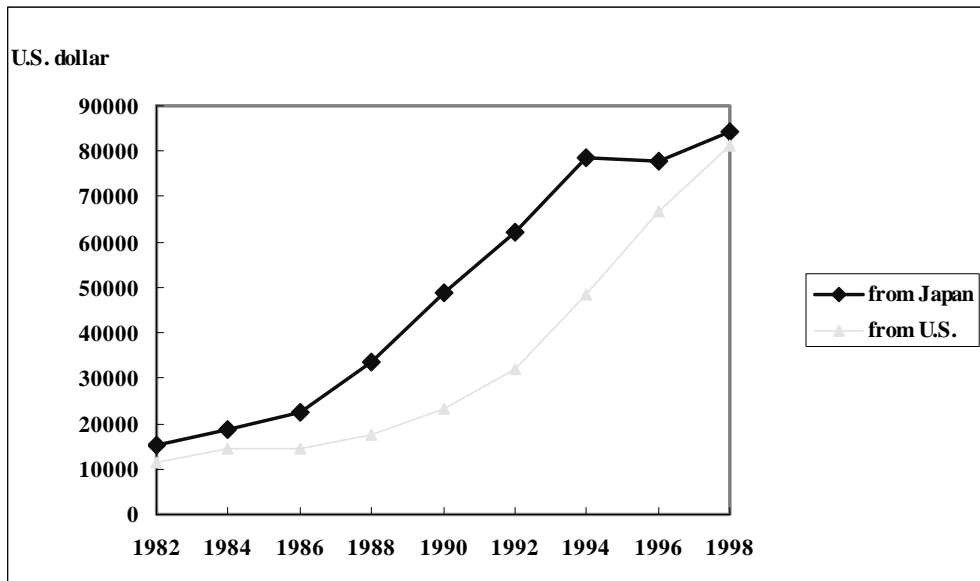
South2: Indonesia, Malaysia, Phillipines, and Thailand,

South3: China,

South4: Singapore.

Domestic ratio is excluded from the group. For example, when we show the production linkage effect for Japan (third row), group north does not include Japanese ratio. It include only United States for the

Figure 2. Inward FDI in East Asia from 1982 to 1998



Source: ITI (2004) FDI matrix centered around East Asia

Note: The value is at current U.S. dollar

East Asia in this table contains 9 countries, China, Hong Kong, Indonesia, Korea, Malaysia, Taiwan, Philippines, Singapore, and Thailand.

Figure 3. Vertical Specilization Chain involving 3 countries

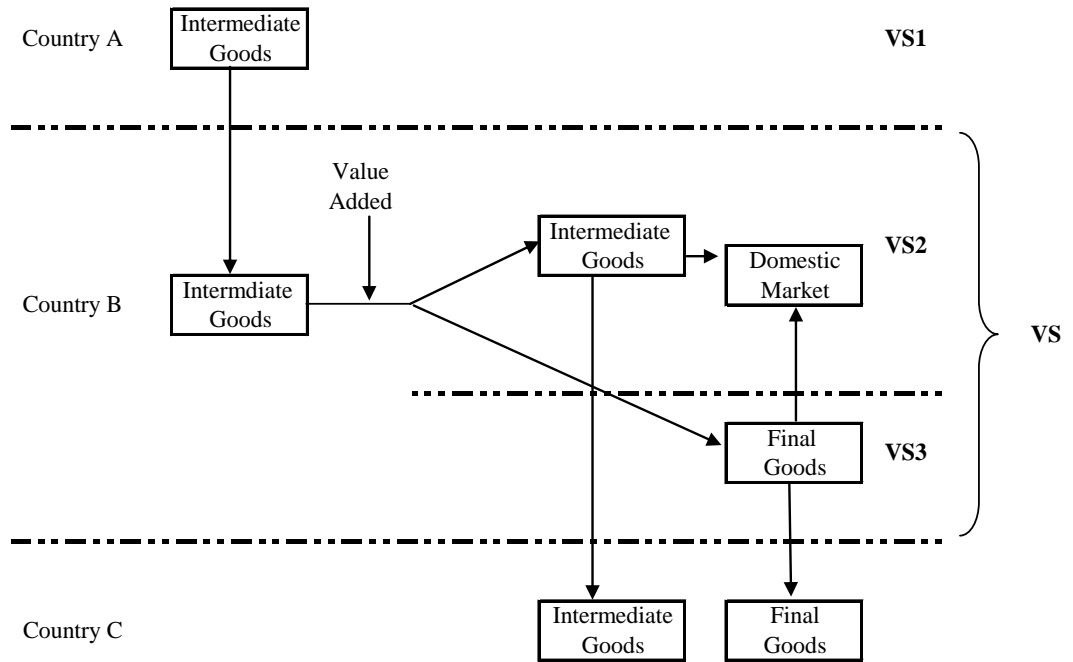
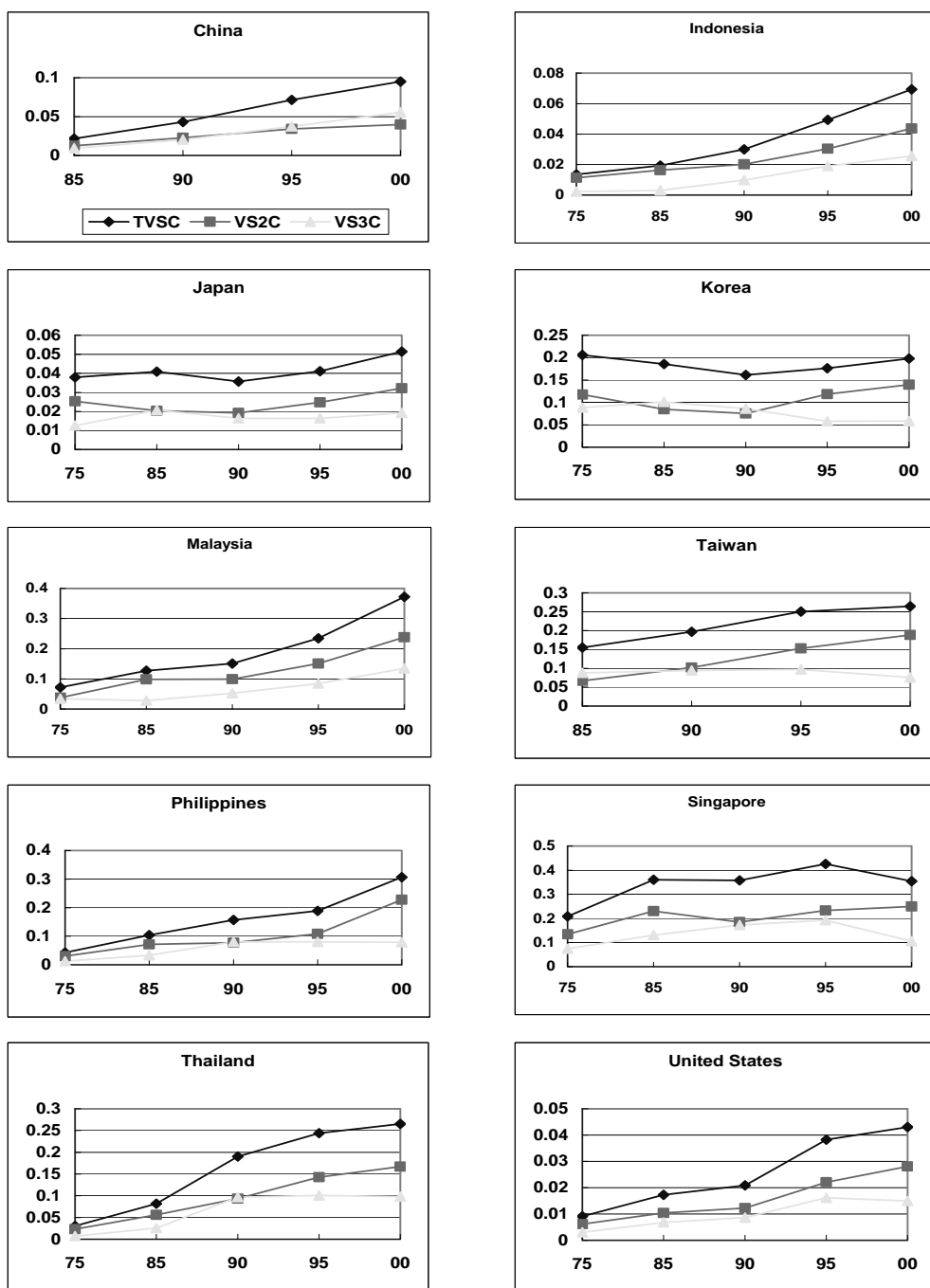


Figure 4. VS as a Share of Total Export



Source: Author's calculation

Table 3a. VS share as a share of Total Export by Sector

	China		Indonesia			Japan			Korea		
	85	00	75	85	00	75	85	00	75	85	00
Total	0.0191	0.0841	0.0115	0.0165	0.0542	0.0154	0.0241	0.0411	0.1337	0.1378	0.1664
Food Products, Beverage and Tobacco	0.0008	0.0006	0.0000	0.0001	0.0007	0.0009	0.0009	0.0006	0.0050	0.0118	0.0020
Textile Products	0.0006	0.0081	0.0007	0.0006	0.0028	0.0005	0.0005	0.0005	0.0084	0.0096	0.0052
Wearing Apparel	0.0000	0.0010	0.0001	0.0000	0.0006	0.0001	0.0000	0.0002	0.0015	0.0003	0.0006
Leather Products	0.0006	0.0029	0.0000	0.0000	0.0010	0.0001	0.0000	0.0000	0.0067	0.0076	0.0005
Timber, Wooden Products and Furniture	0.0004	0.0006	0.0000	0.0000	0.0002	0.0005	0.0003	0.0004	0.0071	0.0005	0.0004
Pulp and Paper	0.0007	0.0026	0.0001	0.0003	0.0023	0.0005	0.0005	0.0005	0.0028	0.0038	0.0021
Chemical Products	0.0092	0.0161	0.0027	0.0064	0.0164	0.0021	0.0027	0.0036	0.0357	0.0238	0.0216
Petroleum Products	0.0001	0.0027	0.0035	0.0016	0.0024	0.0016	0.0031	0.0020	0.0040	0.0050	0.0063
Rubber Products	0.0002	0.0005	0.0001	0.0001	0.0002	0.0005	0.0008	0.0006	0.0002	0.0005	0.0008
Ceramics and Mineral Products	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000	0.0002	0.0002	0.0032	0.0013	0.0005
Glass and Glass Products	0.0000	0.0008	0.0000	0.0001	0.0001	0.0000	0.0001	0.0003	0.0006	0.0017	0.0013
Steel and Steel Products	0.0041	0.0048	0.0009	0.0005	0.0016	0.0021	0.0022	0.0014	0.0192	0.0149	0.0095
Non-ferrous Metal Products	0.0008	0.0031	0.0003	0.0006	0.0026	0.0025	0.0048	0.0028	0.0074	0.0055	0.0048
Metal Products	0.0001	0.0019	0.0003	0.0005	0.0011	0.0004	0.0002	0.0004	0.0010	0.0020	0.0013
Ordinary Industrial Machinery	0.0001	0.0056	0.0012	0.0022	0.0165	0.0011	0.0008	0.0027	0.0041	0.0047	0.0119
Electronic Products	0.0012	0.0280	0.0002	0.0016	0.0018	0.0015	0.0048	0.0206	0.0220	0.0387	0.0903
Motor Vehicle and motor cycle	0.0000	0.0007	0.0010	0.0011	0.0009	0.0001	0.0003	0.0016	0.0003	0.0004	0.0014
Other Transport Equipment	0.0001	0.0000	0.0003	0.0003	0.0019	0.0004	0.0009	0.0007	0.0001	0.0003	0.0004
Precision Machines	0.0001	0.0008	0.0000	0.0002	0.0003	0.0003	0.0004	0.0009	0.0022	0.0021	0.0027
Plastic Products	0.0000	0.0021	0.0000	0.0001	0.0003	0.0000	0.0003	0.0009	0.0000	0.0013	0.0023
Other Manufacturing	0.0002	0.0008	0.0000	0.0000	0.0001	0.0002	0.0001	0.0002	0.0021	0.0019	0.0005

	Malaysia		Taiwan		Philippines			Singapore			
	75	85	00	85	00	75	85	00	75	85	00
Total	0.0645	0.1135	0.3296	0.1152	0.2343	0.0317	0.0775	0.2776	0.1376	0.3154	0.3127
Food Products, Beverage and Tobacco	0.0020	0.0030	0.0013	0.0068	0.0011	0.0018	0.0016	0.0005	0.0046	0.0068	0.0018
Textile Products	0.0021	0.0042	0.0028	0.0039	0.0030	0.0045	0.0087	0.0142	0.0003	0.0130	0.0008
Wearing Apparel	0.0002	0.0004	0.0006	0.0000	0.0002	0.0000	0.0001	0.0002	0.0006	0.0047	0.0023
Leather Products	0.0000	0.0001	0.0001	0.0009	0.0006	0.0014	0.0019	0.0004	0.0001	0.0003	0.0002
Timber, Wooden Products and Furniture	0.0001	0.0002	0.0005	0.0037	0.0010	0.0000	0.0000	0.0009	0.0005	0.0018	0.0003
Pulp and Paper	0.0014	0.0018	0.0029	0.0025	0.0021	0.0008	0.0008	0.0019	0.0016	0.0031	0.0017
Chemical Products	0.0177	0.0075	0.0186	0.0228	0.0393	0.0147	0.0113	0.0138	0.0137	0.0150	0.0150
Petroleum Products	0.0070	0.0156	0.0111	0.0031	0.0051	0.0001	0.0028	0.0084	0.0011	0.1097	0.0148
Rubber Products	0.0003	0.0010	0.0012	0.0026	0.0008	0.0003	0.0009	0.0015	0.0234	0.0026	0.0020
Ceramics and Mineral Products	0.0002	0.0008	0.0002	0.0008	0.0011	0.0001	0.0000	0.0002	0.0021	0.0012	0.0012
Glass and Glass Products	0.0002	0.0008	0.0003	0.0006	0.0028	0.0003	0.0003	0.0005	0.0000	0.0011	0.0010
Steel and Steel Products	0.0075	0.0041	0.0075	0.0130	0.0107	0.0029	0.0048	0.0065	0.0247	0.0077	0.0034
Non-ferrous Metal Products	0.0005	0.0051	0.0104	0.0064	0.0101	0.0013	0.0041	0.0041	0.0029	0.0090	0.0057
Metal Products	0.0008	0.0021	0.0053	0.0015	0.0010	0.0011	0.0004	0.0020	0.0051	0.0019	0.0073
Ordinary Industrial Machinery	0.0066	0.0035	0.0155	0.0066	0.0158	0.0008	0.0011	0.0029	0.0076	0.0065	0.0457
Electronic Products	0.0145	0.0567	0.2382	0.0344	0.1289	0.0003	0.0375	0.1946	0.0362	0.1249	0.1907
Motor Vehicle and motor cycle	0.0017	0.0029	0.0012	0.0007	0.0015	0.0006	0.0003	0.0017	0.0028	0.0004	0.0003
Other Transport Equipment	0.0002	0.0016	0.0010	0.0017	0.0027	0.0002	0.0006	0.0000	0.0020	0.0005	0.0004
Precision Machines	0.0009	0.0009	0.0029	0.0017	0.0031	0.0001	0.0001	0.0159	0.0066	0.0031	0.0093
Plastic Products	0.0000	0.0006	0.0048	0.0010	0.0028	0.0000	0.0000	0.0019	0.0000	0.0006	0.0084
Other Manufacturing	0.0007	0.0007	0.0033	0.0005	0.0006	0.0002	0.0004	0.0055	0.0018	0.0015	0.0006

	Thailand			United States		
	75	85	00	75	85	00
Total	0.0242	0.0622	0.2368	0.0075	0.0144	0.0390
Food Products, Beverage and Tobacco	0.0003	0.0025	0.0023	0.0002	0.0003	0.0002
Textile Products	0.0029	0.0051	0.0048	0.0001	0.0002	0.0003
Wearing Apparel	0.0002	0.0001	0.0004	0.0000	0.0000	0.0001
Leather Products	0.0000	0.0002	0.0005	0.0000	0.0001	0.0000
Timber, Wooden Products and Furniture	0.0000	0.0004	0.0010	0.0001	0.0002	0.0002
Pulp and Paper	0.0004	0.0009	0.0022	0.0000	0.0001	0.0002
Chemical Products	0.0103	0.0220	0.0237	0.0006	0.0007	0.0015
Petroleum Products	0.0003	0.0075	0.0023	0.0001	0.0003	0.0001
Rubber Products	0.0002	0.0002	0.0006	0.0002	0.0002	0.0004
Ceramics and Mineral Products	0.0000	0.0000	0.0001	0.0001	0.0002	0.0002
Glass and Glass Products	0.0001	0.0002	0.0016	0.0000	0.0001	0.0001
Steel and Steel Products	0.0027	0.0075	0.0095	0.0024	0.0017	0.0010
Non-ferrous Metal Products	0.0024	0.0015	0.0060	0.0005	0.0005	0.0007
Metal Products	0.0008	0.0016	0.0078	0.0004	0.0008	0.0010
Ordinary Industrial Machinery	0.0014	0.0029	0.0113	0.0013	0.0014	0.0032
Electronic Products	0.0003	0.0073	0.1451	0.0009	0.0066	0.0268
Motor Vehicle and motor cycle	0.0010	0.0006	0.0052	0.0002	0.0002	0.0009
Other Transport Equipment	0.0002	0.0003	0.0002	0.0000	0.0001	0.0009
Precision Machines	0.0003	0.0002	0.0030	0.0002	0.0004	0.0005
Plastic Products	0.0000	0.0005	0.0078	0.0000	0.0003	0.0006
Other Manufacturing	0.0003	0.0005	0.0014	0.0003	0.0001	0.0001

Source: Author's calculation

Table 3b. Percentage Share of Each Sector's VS to Total Manufacturing Sector

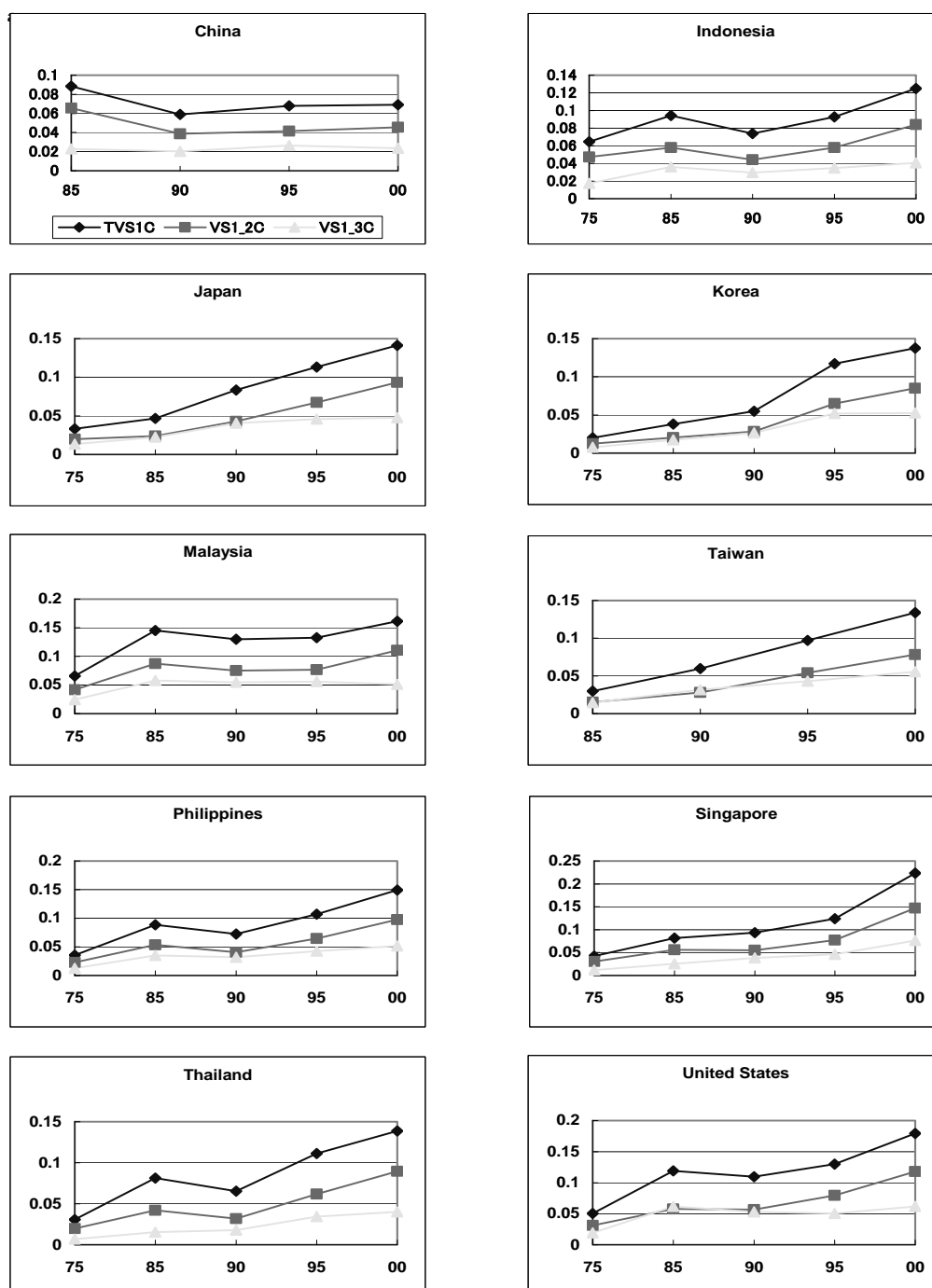
	China			Indonesia			Japan			Korea		
	85	00		75	85	00	75	85	00	75	85	00
Total	0.0191	0.0841		0.0115	0.0165	0.0542	0.0154	0.0241	0.0411	0.1337	0.1378	0.1664
Food Products, Beverage and Tobacco	4.0065	0.6779		0.1712	0.5667	1.3494	5.6462	3.7549	1.3683	3.7131	8.5360	1.1927
Textile Products	3.1791	9.6097		6.2168	3.5959	5.2406	3.2774	1.9385	1.1944	6.2950	6.9993	3.1027
Wearing Apparel	0.0001	1.1948		0.7440	0.0009	1.1918	0.4874	0.1105	0.4276	1.0969	0.2001	0.3720
Leather Products	3.1603	3.4691		0.0085	0.0248	1.8213	0.3286	0.1405	0.0650	4.9801	5.5354	0.3196
Timber, Wooden Products and Furniture	1.9136	0.7699		0.0376	0.0189	0.4527	3.1582	1.2317	0.8658	5.3216	0.3923	0.2607
Pulp and Paper	3.5152	3.0667		0.8813	1.7567	4.2762	3.0221	1.9531	1.1346	2.1113	2.7352	1.2333
Chemical Products	48.0322	19.1768		23.0706	38.9339	30.3060	13.4738	11.3317	8.8111	26.6997	17.2917	13.0088
Petroleum Products	0.4830	3.1944		30.4798	9.8578	4.4969	10.2703	13.0624	4.9367	3.0088	3.6131	3.7998
Rubber Products	0.9890	0.6524		0.8604	0.5819	0.4527	3.4816	3.4965	1.5406	0.1783	0.3301	0.4806
Ceramics and Mineral Products	0.0580	0.1698		0.6936	0.4179	0.0775	0.3020	0.9367	0.4770	2.4144	0.9186	0.3284
Glass and Glass Products	0.1903	0.9679		0.0449	0.3438	0.1825	0.2547	0.5332	0.6534	0.4446	1.2456	0.8077
Steel and Steel Products	21.2845	5.7254		7.6352	3.3287	2.9433	13.9003	9.0648	3.4630	14.3695	10.8492	5.7163
Non-ferrous Metal Products	4.2841	3.7418		2.5752	3.3560	4.8201	15.8841	19.9839	6.7911	5.5348	4.0206	2.8544
Metal Products	0.2619	2.2604		2.6734	3.3329	2.1034	2.6338	0.7700	1.0913	0.7627	1.4525	0.8062
Ordinary Industrial Machinery	0.6309	6.6763		10.2581	13.5752	30.4839	7.4245	3.5239	6.6227	3.0844	3.4036	7.1231
Electronic Products	6.0351	33.3008		1.8078	9.7351	3.3572	10.0383	19.8671	50.1762	16.4557	28.1170	54.2542
Motor Vehicle and motor cycle	0.0967	0.8862		8.5651	6.6172	1.5847	0.6105	1.1411	3.7953	0.2580	0.2819	0.8218
Other Transport Equipment	0.2802	0.0196		2.6882	1.8089	3.4753	2.4628	3.7753	1.7128	0.0785	0.2401	0.2339
Precision Machines	0.5311	0.9985		0.2268	1.4129	0.6217	2.0577	1.8309	2.2414	1.6331	1.5126	1.6457
Plastic Products	0.0000	2.4402		0.0000	0.5084	0.5584	0.0000	1.0534	2.2171	0.0000	0.9318	1.3664
Other Manufacturing	1.0684	1.0013		0.3616	0.2254	0.2045	1.2858	0.4999	0.4148	1.5593	1.3932	0.2718

	Malaysia			Taiwan		Philippines			Singapore		
	75	85	00	85	00	75	85	00	75	85	00
Total	0.0645	0.1135	0.3296	0.1152	0.2343	0.0317	0.0775	0.2776	0.1376	0.3154	0.3127
Food Products, Beverage and Tobacco	3.0548	2.6018	0.3890	5.9290	0.4601	5.7310	2.0036	0.1851	4.0065	0.6779	0.1712
Textile Products	3.2589	3.7074	0.8381	3.3647	1.2866	14.2428	11.2379	5.1074	3.1791	9.6097	6.2168
Wearing Apparel	0.2329	0.3747	0.1721	0.0000	0.0881	0.0331	0.0843	0.0699	0.0001	1.1948	0.7440
Leather Products	0.0243	0.0538	0.0346	0.7583	0.2570	4.3298	2.4438	0.1469	3.1603	3.4691	0.0085
Timber, Wooden Products and Furniture	0.0913	0.2023	0.1535	3.2433	0.4058	0.0246	0.0152	0.3154	1.9136	0.7699	0.0376
Pulp and Paper	2.1513	1.5997	0.8648	2.1634	0.8981	2.5962	1.0494	0.6793	3.5152	3.0667	0.8813
Chemical Products	27.4784	6.5687	5.6554	19.7700	16.7542	46.4022	14.5465	4.9617	48.0322	19.1768	23.0706
Petroleum Products	10.8402	13.7596	3.3768	2.7030	2.1853	0.2599	3.5574	3.0331	0.4830	3.1944	30.4798
Rubber Products	0.4797	0.9167	0.3715	2.2421	0.3510	1.0210	1.1867	0.5473	0.9890	0.6524	0.8604
Ceramics and Mineral Products	0.3651	0.7070	0.0625	0.6663	0.4699	0.4086	0.0634	0.0682	0.0580	0.1698	0.6936
Glass and Glass Products	0.3399	0.6727	0.0760	0.5332	1.1886	0.9709	0.3399	0.1629	0.1903	0.9679	0.0449
Steel and Steel Products	11.6960	3.6409	2.2779	11.2510	4.5608	9.2691	6.1919	2.3569	21.2845	5.7254	7.6352
Non-ferrous Metal Products	0.8227	4.4827	3.1450	5.5877	4.3125	4.2523	5.3473	1.4781	4.2841	3.7418	2.5752
Metal Products	1.2431	1.8533	1.6122	1.2854	0.4081	3.5942	0.4841	0.7124	0.2619	2.2604	2.6734
Ordinary Industrial Machinery	10.1756	3.0491	4.6983	5.7708	6.7571	2.5322	1.4219	1.0292	0.6309	6.6763	10.2581
Electronic Products	22.4415	49.9063	72.2734	29.8309	55.0385	0.7945	48.3277	70.1015	6.0351	33.3008	1.8078
Motor Vehicle and motor cycle	2.6345	2.5142	0.3634	0.6313	0.6405	1.9466	0.3343	0.6148	0.0967	0.8862	8.5651
Other Transport Equipment	0.2664	1.4185	0.2945	1.4820	1.1724	0.7762	0.7295	0.0041	0.2802	0.0196	2.6882
Precision Machines	1.3723	0.7885	0.8747	1.5094	1.3216	0.1931	0.0670	5.7412	0.5311	0.9985	0.2268
Plastic Products	0.0000	0.5724	1.4620	0.8873	1.1971	0.0000	0.0352	0.7002	0.0000	2.4402	0.0000
Other Manufacturing	1.0310	0.6097	1.0040	0.3908	0.2467	0.6219	0.5330	1.9844	1.0684	1.0013	0.3616

	Thailand			United States		
	75	85	00	75	85	00
Total	0.0242	0.0622	0.2368	0.0075	0.0144	0.0390
Food Products, Beverage and Tobacco	0.5667	1.3494	5.6462	3.7549	1.3683	3.7131
Textile Products	3.5959	5.2406	3.2774	1.9385	1.1944	6.2950
Wearing Apparel	0.0009	1.1918	0.4874	0.1105	0.4276	1.0969
Leather Products	0.0248	1.8213	0.3286	0.1405	0.0650	4.9801
Timber, Wooden Products and Furniture	0.0189	0.4527	3.1582	1.2317	0.8658	5.3216
Pulp and Paper	1.7567	4.2762	3.0221	1.9531	1.1346	2.1113
Chemical Products	38.9339	30.3060	13.4738	11.3317	8.8111	26.6997
Petroleum Products	9.8578	4.4969	10.2703	13.0624	4.9367	3.0088
Rubber Products	0.5819	0.4527	3.4816	3.4965	1.5406	0.1783
Ceramics and Mineral Products	0.4179	0.0775	0.3020	0.9367	0.4770	2.4144
Glass and Glass Products	0.3438	0.1825	0.2547	0.5332	0.6534	0.4446
Steel and Steel Products	3.3287	2.9433	13.9003	9.0648	3.4630	14.3695
Non-ferrous Metal Products	3.3560	4.8201	15.8841	19.9839	6.7911	5.5348
Metal Products	3.3329	2.1034	2.6338	0.7700	1.0913	0.7627
Ordinary Industrial Machinery	13.5752	30.4839	7.4245	3.5239	6.6227	3.0844
Electronic Products	9.7351	3.3572	10.0383	19.8671	50.1762	16.4557
Motor Vehicle and motor cycle	6.6172	1.5847	0.6105	1.1411	3.7953	0.2580
Other Transport Equipment	1.8089	3.4753	2.4628	3.7753	1.7128	0.0785
Precision Machines	1.4129	0.6217	2.0577	1.8309	2.2414	1.6331
Plastic Products	0.5084	0.5584	0.0000	1.0534	2.2171	0.0000
Other Manufacturing	0.2254	0.2045	1.2858	0.4999	0.4148	1.5593

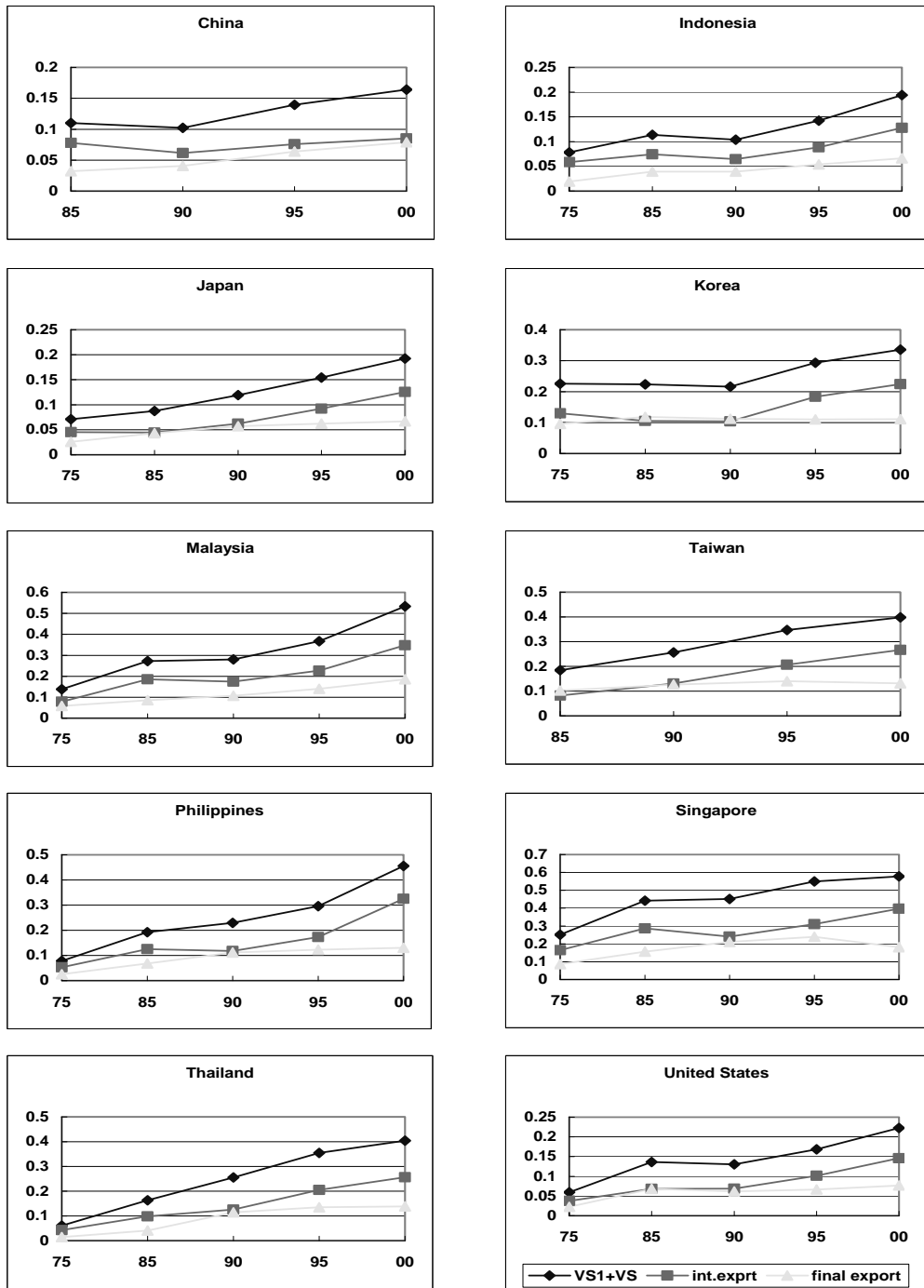
Source: Author's calculation

Figure 5. VS1 Share as a Share of Total Exports



Source: Author's Calculation

Figure 6. VS plus VS1 as a Share of Total Exports



Source: Author's Calculation

Table 4. Results of Growth Accounting

Period	1975-1985			
Country	change in export share of output	VS contribution	VS1 contribution	Other export cont.
CHN	--	--	--	--
IND	-0.01	-4.34	-22.79	127.13
JPN	0.02	4.36	5.84	89.80
KOR	0.00	-14.38	32.98	81.40
MYS	0.08	18.84	23.40	57.75
TWN	--	--	--	--
PHI	0.01	33.47	29.00	37.53
SIN	0.06	67.66	16.28	16.07
THA	0.01	26.07	25.94	48.00
US	0.00	7.69	62.48	29.83

Period	1985-2000			
Country	change in export share of output	VS contribution	VS1 contribution	Other export cont.
CHN	0.03	14.90	5.49	79.61
IND	0.02	37.85	31.42	30.73
JPN	0.00	-4.68	-74.95	179.63
KOR	0.01	26.85	71.62	1.53
MYS	0.12	73.11	18.56	8.34
TWN	-0.01	249.93	96.53	-246.46
PHI	0.10	44.41	19.03	36.56
SIN	0.00	232.43	-4514.15	4381.72
THA	0.09	36.91	17.14	45.95
US	0.00	9.16	29.34	61.50

Period	1975-2000			
Country	change in export share of output	VS contribution	VS1 contribution	Other export cont.
CHN	--	--	--	--
IND	0.01	109.00	122.81	-131.80
JPN	0.02	6.61	25.96	67.42
KOR	0.02	16.43	61.85	21.72
MYS	0.20	50.98	20.53	28.49
TWN	--	--	--	--
PHI	0.11	43.04	20.27	36.68
SIN	0.06	66.06	60.29	-26.34
THA	0.10	35.70	18.12	46.18
US	0.00	8.89	35.44	55.67

Source: Author's Calculation

Table 5. Geographic Orientation for VS

	North						South1					
	Japan			United States			Korea			Taiwan		
	75	85	00	75	85	00	75	85	00	75	85	00
N-N	34.49%	27.21%	14.67%	42.42%	24.52%	11.30%	83.45%	77.19%	37.55%	--	72.97%	34.90%
N-S1	7.43%	6.05%	7.14%	7.17%	11.29%	10.37%	2.37%	0.96%	6.17%	--	1.31%	2.95%
N-S2	11.64%	3.27%	4.66%	11.21%	7.09%	6.10%	--	4.30%	6.70%	--	3.40%	6.58%
N-S3	0.00%	5.90%	3.57%	--	5.38%	3.83%	--	0.00%	12.04%	--	2.89%	13.57%
S1-N	3.82%	6.87%	12.25%	0.55%	4.51%	8.55%	--	2.76%	4.07%	--	1.07%	7.35%
S1-S1	0.81%	1.50%	5.90%	0.55%	4.51%	8.55%	--	0.03%	0.68%	--	0.03%	0.65%
S1-S2	1.25%	0.85%	4.12%	0.77%	2.81%	5.68%	--	0.12%	0.67%	--	0.07%	1.30%
S1-S3	--	1.70%	3.19%	--	2.00%	3.22%	--	0.00%	1.02%	--	0.09%	2.48%
S2-N	7.01%	2.58%	3.77%	18.73%	9.30%	6.51%	--	10.97%	8.46%	--	12.44%	10.20%
S2-S1	4.81%	4.48%	5.38%	3.13%	4.43%	5.61%	--	0.13%	1.43%	--	0.22%	0.90%
S2-S2	7.01%	2.58%	3.77%	2.69%	2.08%	3.87%	--	0.56%	1.56%	--	0.32%	1.77%
S2-S3	--	4.87%	2.90%	--	1.47%	2.15%	--	0.00%	3.13%	--	0.25%	3.31%
S3-N	--	5.42%	5.61%	--	0.30%	1.22%	--	0.00%	5.58%	--	0.00%	3.42%
S3-S1	--	1.75%	2.95%	--	0.81%	3.19%	--	0.00%	0.81%	--	0.00%	0.27%
S3-S2	--	0.92%	1.93%	--	0.33%	1.88%	--	0.00%	1.02%	--	0.00%	0.67%
S3-S3	--	1.51%	1.70%	--	0.30%	1.22%	--	0.00%	2.29%	--	0.00%	1.47%

	South2											
	Indonesia			Malaysia			Philippines			Thailand		
	75	85	00	75	85	00	75	85	00	75	85	00
N-N	48.34%	46.27%	22.69%	49.02%	37.27%	26.29%	85.67%	43.59%	36.60%	67.78%	36.02%	30.53%
N-S1	3.83%	3.72%	4.39%	1.82%	3.35%	5.89%	0.90%	2.29%	9.53%	2.64%	3.22%	4.94%
N-S2	1.68%	6.26%	7.19%	4.32%	3.40%	3.45%	3.01%	6.56%	6.44%	11.17%	6.17%	7.94%
N-S3	--	2.53%	3.33%	--	0.60%	3.16%	--	0.83%	2.90%	--	3.39%	4.01%
S1-N	1.21%	6.56%	11.05%	0.53%	3.72%	8.68%	0.59%	9.38%	14.05%	2.18%	8.06%	8.73%
S1-S1	0.08%	0.46%	1.79%	0.03%	0.39%	1.93%	0.00%	0.48%	2.87%	0.07%	0.63%	1.40%
S1-S2	0.03%	1.02%	2.65%	0.03%	0.43%	1.12%	0.02%	1.33%	2.01%	0.32%	1.17%	2.13%
S1-S3	--	0.31%	1.12%	--	0.09%	1.04%	--	0.19%	0.89%	--	0.70%	1.11%
S2-N	0.99%	1.26%	8.33%	3.18%	6.57%	7.60%	7.05%	14.16%	7.80%	3.12%	12.80%	8.88%
S2-S1	0.10%	0.16%	2.92%	0.42%	0.75%	1.66%	0.10%	0.91%	1.57%	0.07%	1.10%	1.51%
S2-S2	0.03%	0.29%	2.43%	0.15%	0.49%	0.92%	0.21%	1.88%	1.15%	0.32%	1.86%	2.28%
S2-S3	--	0.13%	1.24%	--	0.24%	0.93%	--	0.34%	0.53%	--	0.87%	1.28%
S3-N	--	--	--	--	--	--	--	--	--	--	--	--
S3-S1	--	2.55%	6.36%	--	1.34%	2.44%	--	9.16%	2.35%	--	3.32%	5.69%
S3-S2	--	0.17%	1.70%	--	0.24%	0.53%	--	0.53%	0.30%	--	0.30%	0.92%
S3-S3	--	0.35%	1.59%	--	0.15%	0.34%	--	1.39%	0.24%	--	0.54%	1.38%
S3-S3	--	0.12%	0.76%	--	0.06%	0.32%	--	0.19%	0.10%	--	0.32%	0.73%

	South3			Not in any category		
	China			Singapore		
	75	85	00	75	85	00
N-N	--	64.39%	32.73%	0.86%	30.13%	23.26%
N-S1	--	0.00%	3.97%	0.02%	1.88%	7.04%
N-S2	--	8.17%	2.69%	0.04%	9.32%	16.66%
N-S3	--	--	--	--	0.82%	3.76%
S1-N	--	10.19%	36.37%	0.00%	4.99%	4.96%
S1-S1	--	0.00%	4.02%	0.01%	0.26%	1.52%
S1-S2	--	0.50%	2.75%	0.00%	1.50%	3.48%
S1-S3	--	--	--	--	0.11%	0.78%
S2-N	--	6.51%	9.18%	0.00%	19.30%	13.91%
S2-S1	--	0.00%	1.10%	0.00%	1.68%	4.49%
S2-S2	--	0.64%	0.77%	0.15%	12.65%	10.46%
S2-S3	--	--	--	0.00%	0.10%	0.58%
S3-N	--	--	--	--	0.81%	1.05%
S3-S1	--	--	--	--	8.55%	2.51%
S3-S2	--	--	--	--	0.10%	0.58%
S3-S3	--	--	--	--	--	--

Source: Author's Calculation

Table 6. Geographic Orientation for VS1

		North	South1	South2	South3
China	75	--	--	--	--
	85	39.99%	0.00%	9.22%	--
	00	26.92%	33.71%	26.59%	--
Indonesia	75	51.07%	11.66%	1.18%	--
	85	56.55%	17.47%	2.85%	0.54%
	00	24.57%	32.43%	23.76%	8.22%
Japan	75	9.37%	48.36%	20.70%	--
	85	4.96%	59.16%	14.00%	2.95%
	00	3.88%	39.47%	31.78%	9.25%
Korea	75	87.64%	6.08%		
	85	63.52%	7.65%	15.99%	0.00%
	00	22.09%	21.49%	26.61%	22.31%
Malaysia	75	30.07%	30.11%	2.00%	--
	85	22.60%	26.22%	6.06%	0.19%
	00	16.67%	25.82%	15.88%	5.53%
Taiwan	75	--	--	--	--
	85	43.16%	12.61%	8.50%	4.70%
	00	25.58%	10.61%	13.09%	25.26%
Philippines	75	88.64%	8.58%	1.06%	--
	85	45.55%	18.84%	20.96%	0.87%
	00	26.47%	36.33%	29.75%	4.68%
Singapore	75	31.52%	2.53%	65.95%	--
	85	25.25%	48.77%	57.06%	0.53%
	00	9.13%	56.14%	66.50%	4.60%
Thailand	75	56.53%	9.30%	16.74%	--
	85	36.78%	18.21%	19.43%	2.26%
	00	18.71%	19.53%	39.46%	6.69%
United States	75	52.22%	27.84%	9.36%	--
	85	33.80%	40.60%	11.90%	1.37%
	00	15.33%	35.28%	32.00%	5.97%

Source: Author's Calculation