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Economic regions in Asia Pacific: An exercise in regional delimitation

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Working Paper No. 409

Economic Regions in Asia Pacific:
An Exercise in Regional Delimitation

by

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I. Introduction

The export oriented economies in East and Southeast Asia have formed one of the most vibrant regions in the world. Due to their openness they have enjoyed increasing shares in world trade. Concomitant with their integration into the world market, the countries of the region have developed closer economic relations in terms of trade links and financial interdependence among each other.¹ Especially, the governments of the ASEAN countries are pursuing a strategy of explicitly encouraging the exchange of goods and factors of production by extending regional trade preferences to each other as well as through other measures of industrial and financial cooperation (See Devan, 1987; Hiemenz, Naya, 1985; Amelung, 1989). For some ASEAN members, however, bilateral economic relations with non-member countries such as the USA, Japan, Taiwan, Hong Kong and South Korea have still remained more important than those within the ASEAN group.

This supports the assumption that the so-called "positive" liberalization through discriminatory tariff cuts or factor integration within regional integration schemes may not be of much relevance for the Asia Pacific Region. If this were true, the theory of regional economic interactions would appear in a new light. Main-stream theories on regional trade stress the importance of institutionalized integration such as Viner's theory of custom unions and Mundell's theory of monetary unions. Other concepts are required when some countries develop close economic relations without institutional integration. To identify such economic regions without institutionalized integration in a given geographical area- the Asia Pacific region - is the purpose of this paper. The approach chosen in this paper involves some degree of arbitrariness. The focus on Asia Pacific may be justified by the importance of foreign trade and capital flows for economic development in this geographical area. Furthermore, economic relations with "the rest of the world" have explicitly been included in the analysis. Concerning the formation of economic regions an other choice had to be made with respect to an appropriate proxy for inter-country economic relations. As a

first step, trade relations were employed to delimit regions. And finally, a hierarchical cluster analysis was used to measure the intensity of inter-country economic relations.

Chapter II briefly introduces the Asia Pacific region and the economic criterion through which economic regions within the geographical area are delimited from each other. Chapter III discusses major characteristics of the hierarchical cluster analysis and the underlying concept of an economic region as a functional rather than homogeneous unit. Chapter IV presents the empirical results. Finally, Chapter V provides conclusions and suggestions for further research.

II. Asia Pacific as the Host of Economic Regions

In this paper Asia Pacific is defined to include the Asian part of the Pacific Rim, South Asia and as the only non-Asian country, the United States. Latin American countries as well as Canada are excluded because of their marginal contribution to intra-Asia Pacific trade. Thus, basically, in addition to the US, the area comprises all Asian countries except the Middle East.

This area not only covers major actors in world trade such as Japan, the US or the NICs but also accounts for a substantial part of the individual countries' trade. For instance, in the period 1981-87 almost 50 per cent of the countries' total exports and about 43 per cent of their imports were destined for or originated from the area (Table A2). This average hides considerable differences among countries. For instance, the USA or Pakistan direct less than one third of their exports to this area, while the primary-commodity exporting countries like Brunei or Indonesia sell more than 90 per cent of their total exports to trading partners in this area. Import shares vary too, albeit not as considerable as export shows. It goes without saying that the heterogeneity of the countries is huge, not only with respect to trade links within the area but also as far as market size, resource endowment, outward orientation and income level is concerned. This heterogeneity helps to classify the geographical

area as a functional rather than homogeneous unit. Countries form a homogenous region, if they reveal a high degree of similarity with respect to a set of characteristics, e.g. per capita income, natural resource endowments, climate, topography etc. For this reason, trade due to differences in the resource endowment is a priori excluded in this concept to a large extent. Intra-industry type of trade, which could be typical for trade within a homogenous region is primarily a phenomenon of trade among high income countries and hence less relevant for the majority of Asian-Pacific developing countries. This concept bears two major shortcomings. Firstly, it is difficult to derive homogenous characteristics for the composition of regions and secondly there is a built-in tendency to neglect intra-regional differences in these regions. (See Cas, 1988).

Hence, it is the functional approach which underlies the methodology introduced below. Functional regions can be derived by analyzing the interactions between spatial units. These interactions are estimated by using flow variables such as migration, trade, financial flows, traffic etc. Functional regions are regarded as prevailing when the intra-regional interactions are stronger than the inter-regional interactions. If interactions within a region concentrate on a few small centres within these regions then there is a high degree of heterogeneity. This corresponds to the concept of nodal regions developed by L6sch and Christaller, which defines economic regions by analyzing the interactions between centres and their respective periphery (see Richardson, 1979, p. 227). It is especially this latter aspect of nodal regions which a priori seems to be relevant for the Asia Pacific region as it is characterized by a number of spatial units serving as centres for trade and factor flows, i.e. Hong Kong, Singapore, Macao.

As far as the economic criterion is concerned, the relative intensity of bilateral merchandise trade is used. Apart from its empirical appeal, eg. easy availability for all countries and comparability over time, it offers some further advantages. It complies with the definition of functional regions as we expect

such regions to have more intensive merchandise trade among each other than with non-members. Additionally, by its definition as a relative measure, it does not neglect trade with the rest of the world since world trade of individual countries enters the concept as a numeraire (see Chapter III). However, it has to be noted that data on bilateral trade, as they are given in the Direction of Trade Statistics of the IMF, neglects the unregistered trade between countries. This may lead to an underestimation of trade links between countries. Especially, the socialist economies like Burma, Vietnam and Laos, which maintain a highly distorted price system, are known to suffer from smuggling or unofficial border trade, as they share very long national borders with relatively developed neighbour countries.

III. The Empirical Methodology

To classify a number of countries as a functional region requires that inter-regional interdependence is found to be weaker than intra-regional interdependence. Among the various alternatives for grouping data, the hierarchical cluster analysis (HCA) was chosen, which groups the data on the basis of their interrelatedness. Hence, the method used to determine economic interdependence among the various countries of the Asia Pacific region is based on a technique for delimiting functional regions. In this paper economic interdependence is solely defined by the intensity of trade relations, since it is difficult to include more than one criterion in the HCA.² This is obviously a narrow view which will be discussed further in Section V.

The method encompasses two subsequent steps. The first step is to derive a so-called "similarity matrix" in the terminology of the cluster analysis, while the second step encompasses the grouping of the data.³

The similarity matrix is calculated from the transaction flow table which in this case is a trade matrix. Table A1 (A2) shows the direction of trade flows in the period 1974-1980 (1981-1987). Using the sum of trade flows of 7 years can help to reduce fluc-

tuations in yearly trade volumes due to changes in export and import prices. The first column of the trade matrix lists the exporting countries, while the first row gives the importers. Accordingly, the rows show the direction of exports of country i to countries j , while the columns give the imports of country j from various exporters i . The last column of the trade matrices gives the total exports of country i to the entire world. In the same vein, the last row gives the total amounts of imports for each particular country j . Hence, the last column (row) is not the sum of all elements a_{ij} in the respective row (column).

In order to derive the similarity matrix, all elements in the rows of the trade matrix which feature the various a_{ij} of the exporting country i are divided by total exports given in the last column. This double standardization of the trade matrix controls for the differences between areas in the total amounts of exports or imports thus making the relative weight of bilateral trade in total trade of the countries more important than the absolute volume of trade. The similarity matrices resulting from this standardization process are given in Tables A3 and A4 in the appendix.⁴

In a second step the HCA uses a single-linkage hierarchical clustering algorithm to unite, or link areas into what is called "strong components" or clusters in directed graph theory. The agglomerative technique ultimately reduces the data to a single cluster containing all entities.⁵ The resulting hierarchical classifications can be represented by inverted tree structures (dendogram), which are two-dimensional diagrams illustrating the fusions that have been made at each successive stage of the analysis.

At the beginning there are no links between the various countries in the similarity matrix. Directed links between countries are inserted in the order of decreasing magnitudes of the a_{ij} values in the similarity matrix. Starting from the largest a_{ij} value in the matrix as an initial threshold value, the threshold value (t) is gradually decreased. Thereby, additional directed links

between countries are inserted when a_{ij} is larger than t . When t is such that both a_{ij} and a_{ji} are larger than t , then countries i and j are said to be united in a "strong component". Hence the algorithm developed by Carlino and Lang (1986) for arranging the hierarchy of links between countries is

$$\min (a_{ij}, a_{ji}) = \max (t).$$

Choosing the lower value of the directed links has a major advantage. Large economies may dominate a region in the sense that smaller economies show very high values of a_{ij} vis-a-vis the large trading partner, while the a_{ji} is negligible. Hence, choosing the lower values ensures that the trade links are bilaterally strong enough to justify a strong component.

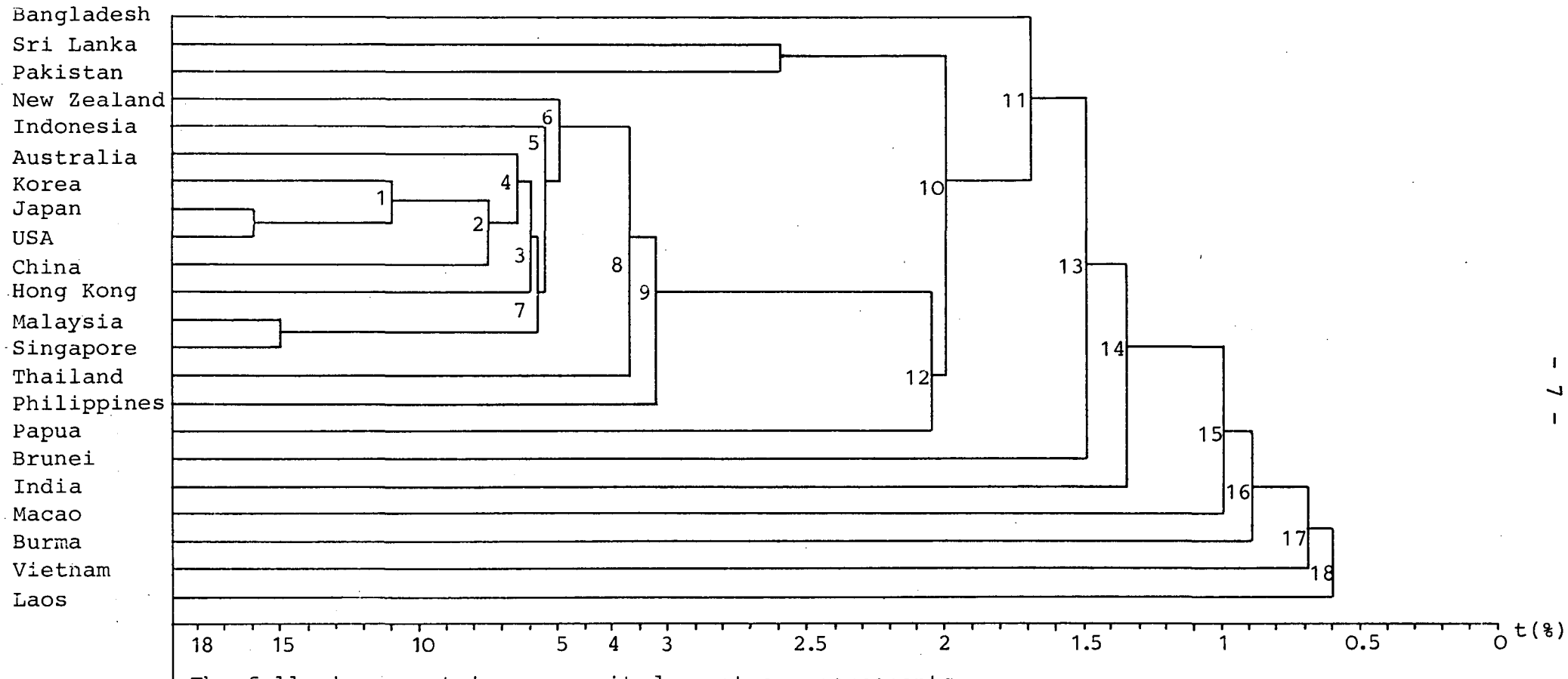
In a tree diagram, countries i and j are connected at the threshold value which makes them a strong components. Thus, t serves as a measure of functional integration between the trading partners. As the threshold value is decreasing further countries forming strong components are treated as single units when additional directed links between countries are formed. Other countries will form strong components and country i and j as a unit will be joined with other countries into larger strong components at some lower threshold value. As this procedure continues, all countries unite into clusters, so that eventually all countries form one all-encompassing strong component.⁶

IV. Functional Regions in Asia Pacific

The economic essence of clustering the sample countries in two dendograms for the periods of the seventies and eighties (Figures 1 and 2) can be summarised as follows.

There are pairs of countries like Japan and the USA, Malaysia and Singapore, China and Hong Kong, or Australia and New Zealand which have formed strong economic entities, particularly in the eighties and to a lesser extent also in the seventies. In the latter period the strongest link can be observed between the USA

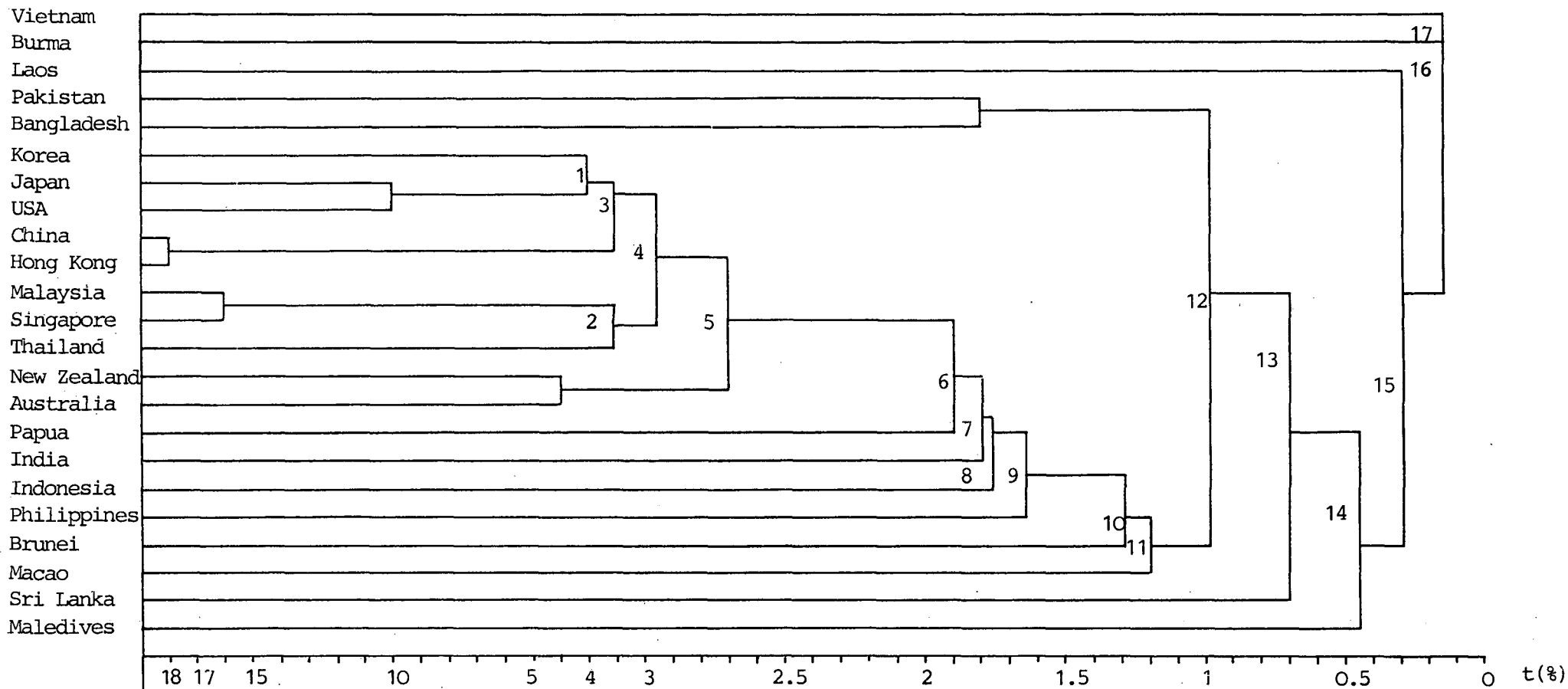
Figure 1: Dendrogram: Functional Regions in Asia Pacific, 1974-1980 Period



The following countries are united as strong components:

- | | | |
|-------------------------|------------------------|----------------------|
| 1 Korea-Japan | 7 Singapore-Japan | 13 Brunei-Singapore |
| 2 China-Japan | 8 Thailand-Singapore | 14 India-USA |
| 3 Hong Kong-Japan | 9 Philippines-Japan | 15 Macao-Hong Kong |
| 4 Australia-Japan | 10 China-Pakistan | 16 Burma-Bangladesh |
| 5 Indonesia Japan | 11 Pakistan-Bangladesh | 17 Vietnam-Singapore |
| 6 New Zealand-Australia | 12 Papua-Australia | 18 Laos-Thailand |

Figure 2: Dendrogram: Functional Regions in Asia Pacific, 1981-1987 Period



The following countries are united as strong components:

- | | | |
|-----------------------|-------------------------|------------------------|
| 1 Korea-Japan | 7 India-Singapore | 13 Singapore-Sri Lanka |
| 2 Singapore-Thailand | 8 Indonesia-Japan | 14 Sri Lanka-Maldives |
| 3 China-Japan | 9 Philippines-Malaysia | 15 Thailand-Laos |
| 4 Singapore-Hong Kong | 10 Singapore-Brunei | 16 Burma-Singapore |
| 5 Japan-Australia | 11 Macao-Hong Kong | 17 Singapore-Vietnam |
| 6 Papua-Australia | 12 Singapore-Bangladesh | |

and Japan. Due to their size and their high per capita income these countries maintain a leading role in world trade in general and in regional trade in particular. In the seventies (eighties) the trade volumes between these countries reached 25.2 (27.9) per cent of the trade within the Asia Pacific Area. Figure 2 shows that the functional relationship between Japan and the USA is weaker (in terms of t-values) in the 1981-1987 than in the 1974-1980 period. The reason is that the bilateral trade between these countries increased at a lower rate than the total exports of these countries.

Furthermore, Australia and New Zealand form a functional region in the eighties which can be attributed to the formation of an institutional trade integration scheme, the Australia-New Zealand Free Trade Agreement. Unlike the ASEAN PTA, the institutional arrangement between Australia and New Zealand is much more advanced and thus encourages strong bilateral relations.

Functional relationships are also prevailing between pairs of countries which are clearly complementary in terms of resource endowment. Singapore as an entrepot trader and service center for Malaysia is a case in point both in the seventies and in the eighties. Hongkong and China, after opening up in the eighties, fall into the same pattern in the 1981-1987 period. These pairs have in common that one partner is a country at a lower stage of development. Typically, the more advanced trading partner acts as an intermediary in marketing and other distribution functions for the neighbouring backward partner thus encouraging trade flows in both directions. With increasing level of development, such strong bilateral relations may become weaker and can be replaced by a broader geographical range of trade relations.

Moreover, there are other pairs of countries such as Pakistan and Sri Lanka in the 1974-1980 period or Pakistan and Bangladesh in the 1981-1987 period. However, given the relatively low t-values these pairs can only be viewed as loose functional entities.

Any extension of functional regions beyond pairs of countries makes the picture more diffuse as it is demonstrated by the decrease of the units on the horizontal axis of the dendogram moving from the left to the right. Yet, two groups can be identified comprising of clusters with more than two countries in Figure 2. The first group encompasses South East Asian countries like Malaysia, Singapore and Thailand, while the second group comprises North East Asian trading partners, namely Korea, Japan, the USA, China and Hong Kong. This division between the South East Asian and the North East Asian countries (including the USA as a non-Asian nation) is less distinct in the seventies. In this period both functional regions are united at relatively high t-values, while the South East Asian "region" consists only of Singapore and Malaysia. Apparently this has changed in the eighties, as Singapore intensified its trade relations with Thailand, while Singapore's trade with Japan became less important, thus leading to a division into two functional regions.

Furthermore, the dendograms show that Singapore has increased its relevance as a trade and service center. The numbers in the dendogram indicate the countries forming a strong component. Hence, a country enters the dendogram with its most important trading partner. Obviously, Singapore's role as a nodal point in regional trade has become stronger. In the seventies Singapore formed strong components with 4 countries (Japan, Thailand, Brunei, Vietnam). In the eighties this numbers increased to 8, as Singapore developed strong linkages towards some South Asian countries (India, Sri Lanka, Burma, Bangladesh) and Hong Kong. Nevertheless, the bulk of trade in the Asia Pacific area still concentrated on Japan, though the number of its strong components decreased from 8 in the seventies to 5 in the eighties. According to Table A2 the share of Japanese exports to countries of the Asia Pacific area accounted for 35 per cent of the total trade within that area in the 1981-1987 period, while Singapore had a share of 6 per cent. Japan's important role as regional trading partner is due to its dominant position in the North East Asian group. In addition, Japan forms strong components with Australia

and Indonesia, the latter being an important supplier of raw materials. Besides the North East Asian and South East Asian group, there is no indication for other functional regions in the Asia Pacific area. Neither in the seventies nor in the eighties ASEAN countries (excluding Brunei) can be classified as a functional region. Indonesia and the Philippines, which both show comparatively weak functional links with countries of the Asia Pacific area, are closer related to Japan than their ASEAN trading partners. A functional region including all major ASEAN members would also encompass 7 other non-ASEAN countries (Japan, Korea, China, Hong Kong, Australia, New Zealand, USA), as Figure 2 shows. However, this does not mean that institutional integration is a failure per se. The South Pacific Free Trade Agreement illustrates that given a minimum degree of institutional deepening, regional integration may overlap with functional regions. Obviously, ASEAN has not yet reached this minimum level.

Apart from that the cluster analysis labels some countries as permanent "outsiders" in the geographical area, that is Sri Lanka, Maldives, Burma, Vietnam and Laos. In the case of the Socialist countries, socio-economic isolation and economic backwardness add to the relative low degree of functional integration, whereas India has no intensive neighbouring trade with the other South Asian countries for political reasons and is rather engaging in trade (and factor flows) with the Middle East. Finally, Bangladesh and Sri Lanka would be part of a loose functional entity (not to say region) with Pakistan; two countries which themselves do not form "strong components" with Asia Pacific trading partners.

On the whole, hierarchical rankings described above are fairly robust over time. Changes are mainly introduced through China's open door policy which led the country into a functional region with its "natural" trading partner with Hong Kong. Furthermore, functional relationships seem to be generally stronger in the seventies than in the eighties, since the trade within the Asia

Pacific area increased at a lower rate than the world exports of all countries of this area. According to Tables A1 and A2 the trade within the Asia Pacific area increased from 937 billion US\$ in the 1974-80 period to 2076 billion US\$ in the 1981-87 period, while the total exports of all countries in the Asia Pacific area almost tripled from 1479 billion to 4213 billion US\$. This leads to the hypothesis that the countries of that area increasingly establish trade links with Europe, Africa, Latin America and Middle Eastern countries, thus reducing the relevance of functional regions within the Asia Pacific area.

V. Issues for Further Research Using Cluster Analyses

In this paper economic regions in a pre-selected geographical unit, Asia and the Pacific, have been derived "from the laboratory". The analytical power of this approach mainly hinges upon the quality of the concept, that is the hierarchical cluster analysis. The HCA delivered plausible results for trade among neighbouring countries and pairs of small economies, while the test for larger groups of countries and large individual economies, yielded more diffuse findings. In one case (ASEAN) institutional integration failed to overlap with functional regions while in a second case (Australia/New Zealand) such an overlap could be confirmed. Apart from the fact that there is arbitrariness in the choice of the sample (eg Taiwan had to be excluded because of data inavailability), there is the problem of a one-dimensional concept. Trade shares were used as the sole criterion, and the HCA does not allow to adjust them by measures of the size of the internal market in order to take account of differences between countries in the relative weight of trade versus domestic production. Thus, to broaden the basis of assessment beyond a single criterion, there is need for opening the concept to additional factors of regional interactions. This would serve as a yardstick for the sensitivity of the HCA to changes in the transaction variables. Capital flows between sample countries as far as they are available could fulfill this role. Furthermore, tests could be run with respect to the

sensitivity of the HCA to a changing sample of countries, that is enlarging the geographical unit or disregarding very small economies in the unit.

Finally, merits and limits of the concept should be weighed. As many other statistical measures, it offers a tool to sort and structure data for a specific purpose. The method allows group countries into clusters of varying degrees of bilateral trade intensity. The analysis provides a tool for identifying functional regions and thus a convenient starting point for an assessment of determinants for regional integration via market forces as opposed to regional integration via institutional arrangements.

Footnotes

- 1 See Langhammer (1989), Campbell (1986) and Lee (1989).
- 2 See Fischer (1982), p.35.
- 3 This two stage approach has been proposed by Everitt (1980).
- 4 It has to be noted that the standardization of the transaction flow matrix is often done by using an iterative proportional fitting procedure adjusting row and column sums to unity. However, the standardization procedure used in this paper can be justified on the grounds that the set of spatial units is not given in the sense that all states in the world enter the initial data set. In order to adjust for the omission of countries located outside the Asia Pacific area one has to divide the elements of the similarity matrix by the import and exports from/to the world in order to yield a measure of regional interdependence. For simplicity all elements of the similarity matrices as they are given in the appendix have been multiplied by 1000000, as the double standardization process yields very small numbers.
- 5 By contrast, the divisive techniques will finally split the entire set of data into groups each containing a single entity. A broad assessment of the various clustering procedures is given in Everitt (1980, pp.24-40).
- 6 Yet this method bears a fundamental shortcoming. The standardization procedure corrects only for the differences in absolute trade volumes. However, the intensity of trade integration cannot be measured on the basis of mere measures of relative trade intensity without assessing the relative openness of trading partners. It cannot be doubted that trade has a larger impact on the allocation process of an economy when its export/GNP ratio is higher. For instance this ratio was about 7 percent for Vietnam in 1982, 7 percent for Burma in 1984/85, 5 percent for India in 1985 and 8 per cent for The USA in 1985, while other countries show relatively high ratios, i.e. Laos (1985) 30 percent, Thailand (1985) 22 per cent and South Korea (1985) 33 percent (See U.S. State Department, Countries of the World, 1989 edition). However, it is not possible to correct the standardized values for these differences, as one has to take into account that large economies and less developed countries tend to show lower ratios. Hence, reference system for the "normal" level of outward orientation correction for the differences in developmental status and size would be required. However, looking for countries of an equal size and similar and stage of development is a complicated procedure that goes beyond the scope of this paper and bears additional serious shortcomings.

Table A1: Trade Matrix, 1974 - 1980 period (Millions of US Dollar)

Exporter i	Importer j	1	2	3	4	5	6	7	8	9	10	11	13
		USA	Austra.	Japan	N-Zeal.	Bangl.	Brunei	Burma	China	HK	India	Indonesia	Korea
USA	1	0.0	20133.0	92169.0	3211.0	1558.0	227.0	127.0	7720.0	10490.0	7768.0	6417.0	19730.0
Austra.	2	11132.0	0.0	31005.0	5335.0	381.0	16.0	49.0	3429.0	1730.0	1052.0	1721.0	2094.0
Japan	3	143880.0	17109.0	0.0	3427.0	1113.0	363.0	956.0	19719.0	18467.0	4381.0	14452.0	29492.0
N-Zeal.	4	3254.0	2994.3	3197.6	0.0	11.2	1.5	1.1	420.6	313.2	44.0	214.6	259.3
Bangl.	5	490.1	97.6	142.4	22.5	0.0	0.0	32.9	87.5	11.0	41.9	13.2	4.1
Brunei	6	1069.2	0.4	9916.4	16.4	0.0	0.0	0.1	0.2	3.3	0.0	0.5	0.2
Burma	7	51.0	7.9	260.9	0.4	85.6	0.0	0.0	25.1	135.5	7.0	269.8	12.1
China	8	2651.0	980.0	13719.0	165.0	207.0	52.0	114.0	0.0	14148.0	10.0	939.0	23.0
HK	9	21531.0	2457.0	4797.0	386.0	87.0	49.0	40.0	1861.0	0.0	164.0	2091.0	943.0
India	10	5210.0	644.0	4523.0	148.0	390.0	4.0	78.0	7.0	559.0	0.0	584.0	244.0
Indonesia	11	19647.0	844.0	37818.0	167.0	39.0	0.0	25.0	0.0	377.0	154.0	0.0	1609.0
Korea	13	24741.0	889.0	15642.0	125.0	203.0	0.0	58.0	16.0	2714.0	382.0	888.0	0.0
Lao	14	5.9	0.1	24.4	0.0	0.0	0.0	0.0	0.0	10.6	0.0	0.1	0.1
Macao	15	346.9	13.3	47.1	0.1	0.0	0.0	0.0	0.8	247.5	0.0	0.2	0.0
Malay.	16	8547.0	898.0	10785.0	249.0	90.0	180.0	76.0	812.0	786.0	1020.0	164.0	942.0
Maldi.	17	0.0	0.0	14.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
Pakistan	18	582.5	87.8	835.2	12.4	177.3	0.2	14.7	336.2	767.8	161.1	169.2	38.4
Papua	19	381.5	551.8	1646.5	28.0	0.0	0.0	0.0	75.1	10.2	0.3	2.0	27.1
Philip.	20	7961.1	433.0	6695.6	25.5	26.7	10.6	0.3	327.3	585.4	36.8	304.9	486.8
Singa.	21	9870.0	3011.0	6496.0	939.0	581.0	1050.0	234.0	725.0	5066.0	1206.0	10.0	1003.0
Sri Lanka	22	438.6	111.9	254.6	46.1	19.7	0.0	0.3	376.3	79.5	56.4	3.8	1.6
Thail.	23	2916.6	259.2	5646.3	25.7	118.8	43.7	14.8	469.6	1389.2	110.5	1071.2	269.4
Vietnam	24	18.9	1.2	292.8	3.3	0.0	0.0	0.0	0.0	120.3	0.0	16.8	20.8
Total imports	25	1153552	95510.0	584143.0	26929.7	10458.0	2315.3	2719.1	53419.0	85860.0	56614.0	46811.0	91330.0

Exporter i	Importer j	14	15	16	17	18	19	20	21	22	23	24	Total exports
		Lao	Macao	Malay.	Maldi.	Pakistan	Papua	Philip.	Singa.	Sri Lanka	Thail.	Vietnam	
USA	1	25.0	4.0	4864.0	0.0	3124.0	171.0	7883.0	10945.0	333.0	4436.0	893.0	575783.0
Austra.	2	1.0	3.0	2192.0	2.0	396.0	2087.0	1072.0	2159.0	254.0	680.0	193.0	104640.0
Japan	3	63.0	55.0	7583.0	16.0	2676.0	717.0	9021.0	15108.0	787.0	9518.0	979.0	262957.0
N-Zeal.	4	0.2	1.6	293.8	3.7	51.0	128.0	313.3	410.7	21.3	118.3	2.6	16994.4
Bangl.	5	0.0	0.0	6.6	0.1	193.1	2.7	7.6	79.3	27.4	14.0	0.0	3600.8
Brunei	6	0.0	0.0	323.1	0.0	0.1	0.0	93.0	519.4	0.0	192.3	0.0	13298.5
Burma	7	0.0	0.0	74.8	3.7	37.3	0.0	0.9	226.9	145.1	29.2	26.7	1981.9
China	8	0.0	405.0	1215.0	0.0	546.0	21.0	622.0	2250.0	302.0	806.0	0.0	28024.0
HK	9	12.0	727.0	828.0	0.0	161.0	118.0	1117.0	3420.0	152.0	891.0	213.0	76512.0
India	10	0.0	0.0	380.0	7.0	65.0	6.0	90.0	516.0	453.0	193.0	75.0	43139.0
Indonesia	11	0.0	0.0	347.0	0.0	231.0	0.0	805.0	8739.0	15.0	111.0	1.0	83705.0
Korea	13	1.0	0.0	390.0	0.0	283.0	13.0	438.0	891.0	83.0	494.0	41.0	72585.0
Lao	14	0.0	0.0	9.1	0.0	0.1	0.0	0.0	10.4	0.0	24.5	0.0	104.3
Macao	15	0.0	0.0	1.8	0.0	0.0	0.0	0.1	10.4	0.0	0.7	0.0	1888.6
Malay.	16	0.0	0.0	0.0	0.0	327.0	10.0	630.0	9232.0	37.0	687.0	3.0	50918.0
Maldi.	17	0.0	0.0	0.1	0.0	2.4	0.0	0.0	0.0	8.0	0.0	0.0	39.2
Pakistan	18	0.7	0.1	24.2	6.4	0.0	0.1	22.0	170.4	278.7	27.5	1.3	10666.4
Papua	19	0.0	0.0	0.4	0.0	0.1	0.0	24.7	28.0	0.0	0.1	0.0	5098.7
Philip.	20	0.4	0.0	231.3	0.0	14.6	9.9	0.0	418.3	7.9	144.6	11.5	24383.4
Singa.	21	63.0	0.0	10430.0	0.0	560.0	500.0	934.0	0.0	473.0	2605.0	472.0	69778.0
Sri Lanka	22	0.0	0.0	7.4	6.0	312.9	0.0	6.2	81.4	0.0	4.8	0.0	5300.3
Thail.	23	162.1	0.3	1257.6	1.6	54.9	2.3	152.3	2090.0	138.1	0.0	72.6	26913.9
Vietnam	24	0.3	0.0	8.9	0.0	2.9	0.0	6.9	99.1	0.0	5.1	0.0	415.6
Total imports	25	462.0	1657.4	40671.0	83.8	21149.0	4240.7	35174.4	90760.0	7103.2	36419.0	3964.6	0.0

Source: IMF, Direction of Trade Statistics, various issues; own calculation.

Table A2: Trade Matrix, 1981 - 1987 period (Millions of US Dollar)

Exporter i	Importer j	1	2	3	4	5	6	7	8	9	10	11	13
		USA	Austra.	Japan	N-Zeal.	Bangl.	Brunei	Burma	China	HK	India	Indonesia	Korea
USA	1	0	35009	166020	5575	1455	562	133	22151	20513	11387	8518	42963
Austra.	2	17179	0	42836	8369	334	48	36	5607	3992	1686	2599	5996
Japan	3	412824	34684	0	7292	2042	586	1417	51556	44562	10906	22875	54786
N-Zeal.	4	5803.1	6064.7	5913.5	0	11.6	4.3	2.6	998.4	568	238.3	435.1	691.6
Bangl.	5	1105.6	130	393.4	22	0	0.2	31.3	136.3	62.3	124	15.3	12.6
Brunei	6	1699.3	62.6	13865.3	10.5	0	0	0	0.7	2.1	0	32.5	904.2
Burma	7	82.36	7.88	261.61	1.27	36.22	0.46	0	226.07	191.69	75.82	123.69	63.96
China	8	15295	1487	36787	221	623	26	271	0	53515	538	674	0
HK	9	62490	4489	9580	622	416	82	63	38129	0	773	3900	4125
India	10	13735	858	7317	157	356	6	14	251	1200	0	428	1296
Indonesia	11	26439	2228	63045	1070	127	9	19	665	1735	188	0	3745
Korea	13	73855	2846	33310	427	738	81	114	0	9618	3567	1876	0
Lao	14	8.642	0.935	11.164	0.303	0.198	0	0	50.02	2.598	0	0.041	0
Macao	15	1896.96	113.1	109.88	2.61	0.05	0.04	0	277.58	1197.82	0.01	0.79	0.08
Malay.	16	14271	1829	22035	197	245	377	68	1123	1972	2756	523	4940
Maldi.	17	0	0	12	0	0	0	0	0.1	0.4	0	0	0
Pakistan	18	1924	217.8	2011.9	34.3	409.7	4.2	3.6	698.7	618.8	251.4	140.1	304.4
Papua	19	198	677.3	1917.3	53.5	0	0.1	0	153.8	24	4.1	1	452
Philip.	20	12611.4	613.7	7127.6	63.8	24.6	17.1	0.1	535.9	1495.8	83.6	358	882.8
Singa.	21	31243	5354	15325	1516	1814	2271	401	2516	11289	3724	0	2527
Sri Lanka	22	1718.5	88.9	404.6	31.5	53.9	0	7.6	150.3	78.6	118.2	5.4	20
Thail.	23	9139.7	867.4	7749.8	85.8	452.9	83.3	72.9	1714.3	2401.2	383.6	645.7	974.5
Vietnam	24	0.3	37.1	414.9	0.9	0	0	0	0	538.3	2.2	19.9	7.5
Total imports	25	2312047	165101	946198	42213	17860.7	5222.1	5075.58	216766	214299	121489	91532	210894

Exporter i	Importer j	14	15	16	17	18	19	20	21	22	23	24	Total exports
		Lao	Macao	Malay.	Maldi.	Pakistan	Papua	Philip.	Singa.	Sri Lanka	Thail.	Vietnam	
USA	1	0	27	11979	0	5702	401	11555	24560	671	7590	158	1545257
Austra.	2	0	6	3071	4	469	3160	1075	4419	273	1116	25	160061
Japan	3	80	145	16648	54	5658	1044	10012	32429	1821	16148	960	1226929
N-Zeal.	4	0	0.6	526.5	0.4	119.4	349.2	355.8	598.8	72.9	197.8	5.7	40965.8
Bangl.	5	0	0	23.4	0.2	304	1.2	0.2	292.2	5	30.2	2.3	6179.5
Brunei	6	0	0	102.5	0	0.1	0	386.9	1441.4	0	1265.6	0	20865
Burma	7	0	0.46	129.9	31.49	32.59	3.44	3.18	389.82	86.41	167.23	14.77	3597.68
China	8	2	2111	1398	1	1591	41	1583	7685	308	1418	0	188421
HK	9	4	2779	1621	19	263	174	2660	6858	615	1847	398	207047
India	10	0	0	560	7	62	7	50	1360	552	332	91	70206
Indonesia	11	2	1	505	0	210	3	1494	14275	45	448	45	135365
Korea	13	0	11	1845	7	85.2	47	1299	3627	505	1285	0	209139
Lao	14	0	0	22.967	0	0.368	0	0	3.867	0	11.873	0	137.032
Macao	15	0	0	2.58	0.42	0	0.06	0.5	9.87	2.09	0.55	0	6424.06
Malay.	16	0	0	0	6	1085	29	1779	20870	309	3079	7	101827
Maldi.	17	0	0	1.9	0	3	0	0	11.1	19.2	62.2	0	127.1
Pakistan	18	0.2	0	77.6	2.9	0	0	45.8	297.4	217.7	142.8	1.8	21205.8
Papua	19	0	0	21.3	0	6.5	0	49.2	77.9	1.5	2.3	0	6465.5
Philip.	20	0.1	0	1011.7	0	22.2	26.3	0	1301.2	72.2	343.1	10.9	36131.8
Singa.	21	52	16	25622	221	999	858	2109	0	1338	6765	352	161564
Sri Lanka	22	0	0	67.7	45.6	248	0.1	2.3	215.1	0	23.7	0	8300.5
Thail.	23	197.4	0.5	2417	8.2	182.5	12.7	299.9	4569.1	174.3	0	16.1	55030.8
Vietnam	24	0	0.6	57.4	0	2	0	0.3	162.5	12.1	6.8	0	1947.4
Total imports	25	540.591	5708.44	87118	492.5	39343	6526.1	48364.1	196820	13104.1	70611.4	4169.1	

Source: IMF, Direction of Trade Statistics, various issues; own calculation.

Table A3: Similarity Matrix, 1974 - 1980 period

		1	2	3	4	5	6	7	8	9	10	11	12
Exporter i	Importer j	USA	Austra.	Japan	N-Zeal.	Bangl.	Brunei	Burma	China	HK	India	Indonesia	Korea
	USA	1	0.00	3.50	16.01	0.56	0.27	0.04	0.02	1.34	1.82	1.35	1.11
Austra.	2	10.64	0.00	29.63	5.10	0.36	0.02	0.05	3.28	1.65	1.01	1.64	2.00
Japan	3	54.72	6.51	0.00	1.30	0.42	0.14	0.36	7.50	7.02	1.67	5.50	11.22
N-Zeal.	4	19.15	17.62	18.82	0.00	0.07	0.01	0.01	2.47	1.84	0.26	1.26	1.53
Bangl.	5	13.61	2.71	3.95	0.62	0.00	0.00	0.91	2.43	0.31	1.16	0.37	0.11
Brunei	6	8.04	0.00	74.57	0.12	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Burma	7	2.57	0.40	13.17	0.02	4.32	0.00	0.00	1.27	6.84	0.35	13.61	0.61
China	8	9.46	3.50	48.95	0.59	0.74	0.19	0.41	0.00	50.49	0.04	3.35	0.08
HK	9	28.14	3.21	6.27	0.50	0.11	0.06	0.05	2.43	0.00	0.21	2.73	1.23
India	10	12.08	1.49	10.48	0.34	0.90	0.01	0.18	0.02	1.30	0.00	1.35	0.57
Indonesia	11	23.47	1.01	45.18	0.20	0.05	0.00	0.03	0.00	0.45	0.18	0.00	1.92
Korea	12	34.09	1.22	21.55	0.17	0.28	0.00	0.08	0.02	3.74	0.53	1.22	0.00
Lao	13	5.67	0.09	23.44	0.00	0.02	0.00	0.00	0.00	10.13	0.00	0.11	0.09
Macao	14	18.37	0.70	2.49	0.00	0.00	0.00	0.00	0.04	13.11	0.00	0.01	0.00
Malay.	15	16.79	1.76	21.18	0.49	0.18	0.35	0.15	1.59	1.54	2.00	0.32	1.85
Maldi.	16	0.00	0.00	37.76	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.51
Pakistan	17	5.46	0.82	7.83	0.12	1.66	0.00	0.14	3.15	7.20	1.51	1.59	0.36
Papua	18	7.48	10.82	32.29	0.55	0.00	0.00	0.00	1.47	0.20	0.01	0.04	0.53
Philip.	19	32.65	1.78	27.46	0.10	0.11	0.04	0.00	1.34	2.40	0.15	1.25	2.00
Singa.	20	14.14	4.32	9.31	1.35	0.83	1.50	0.34	1.04	7.26	1.73	0.01	1.44
Sri Lanka	21	8.28	2.11	4.80	0.87	0.37	0.00	0.01	7.10	1.50	1.06	0.07	0.03
Thail.	22	10.84	0.96	20.98	0.10	0.44	0.16	0.05	1.74	5.16	0.41	3.98	1.00
Vietnam	23	4.55	0.29	70.45	0.79	0.00	0.00	0.00	0.00	28.95	0.00	4.04	5.00

		13	14	15	16	17	18	19	20	21	22	23
Importer j		Lao	Macao	Malay.	Maldi.	Pakistan	Papua	Philip.	Singa.	Sri Lanka	Thail.	Vietnam
Exporter i												
USA	1	0.00	0.00	0.84	0.00	0.54	0.03	1.37	1.90	0.06	0.77	0.16
Austra.	2	0.00	0.00	2.09	0.00	0.38	1.99	1.02	2.06	0.24	0.65	0.18
Japan	3	0.02	0.02	2.88	0.01	1.02	0.27	3.43	5.75	0.30	3.62	0.37
N-Zeal.	4	0.00	0.01	1.73	0.02	0.30	0.75	1.84	2.42	0.13	0.70	0.02
Bangl.	5	0.00	0.00	0.18	0.00	5.36	0.07	0.21	2.20	0.76	0.39	0.00
Brunei	6	0.00	0.00	2.43	0.00	0.00	0.00	0.70	3.91	0.00	1.45	0.00
Burma	7	0.00	0.00	3.77	0.19	1.88	0.00	0.05	11.45	7.32	1.47	1.34
China	8	0.00	1.45	4.34	0.00	1.95	0.07	2.22	8.03	1.08	2.88	0.00
HK	9	0.02	0.95	1.08	0.00	0.21	0.15	1.46	4.47	0.20	1.16	0.28
India	10	0.00	0.00	0.88	0.02	0.15	0.01	0.21	1.20	1.05	0.45	0.17
Indonesia	11	0.00	0.00	0.41	0.00	0.28	0.00	0.96	10.44	0.02	0.13	0.00
Korea	12	0.00	0.00	0.54	0.00	0.39	0.02	0.60	1.23	0.11	0.68	0.06
Lao	13	0.00	0.00	8.74	0.00	0.12	0.00	0.00	9.97	0.00	23.53	0.00
Macao	14	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.55	0.00	0.04	0.00
Malay.	15	0.00	0.00	0.00	0.00	0.64	0.02	1.24	18.13	0.07	1.35	0.01
Maldi.	16	0.00	0.00	0.26	0.00	6.12	0.00	0.00	0.00	20.41	0.00	0.00
Pakistan	17	0.01	0.00	0.23	0.06	0.00	0.00	0.21	1.60	2.61	0.26	0.01
Papua	18	0.00	0.00	0.01	0.00	0.00	0.00	0.48	0.55	0.00	0.00	0.00
Philip.	19	0.00	0.00	0.95	0.00	0.06	0.04	0.00	1.72	0.03	0.59	0.05
Singa.	20	0.09	0.00	14.95	0.00	0.80	0.72	1.34	0.00	0.68	3.73	0.68
Sri Lanka	21	0.00	0.00	0.14	0.11	5.90	0.00	0.12	1.54	0.00	0.09	0.00
Thail.	22	0.60	0.00	4.67	0.01	0.20	0.01	0.57	7.77	0.51	0.00	0.27
Vietnam	23	0.07	0.00	2.14	0.00	0.70	0.00	1.66	23.85	0.00	1.23	0.00

Source: IMF, Direction of Trade Statistics, various issues; own calculation.

Table A4: Similarity Matrix, 1981 - 1987 period

Importer j.		1	2	3	4	5	6	7	8	9	10	11	13
Exporter i		USA	Austra.	Japan	N-Zeal.	Bangl.	Brunei	Burma	China	HK	India	Indonesia	Korea
USA	1	0.00	2.27	10.74	0.36	0.09	0.04	0.01	1.43	1.33	0.74	0.55	2.78
Austra.	2	10.73	0.00	26.76	5.23	0.21	0.03	0.02	3.50	2.49	1.05	1.62	3.75
Japan	3	33.65	2.83	0.00	0.59	0.17	0.05	0.12	4.20	3.63	0.89	1.86	4.47
N-Zeal.	4	14.17	14.80	14.44	0.00	0.03	0.01	0.01	2.44	1.39	0.58	1.06	1.69
Bangl.	5	17.89	2.10	6.37	0.36	0.00	0.00	0.51	2.21	1.01	2.01	0.25	0.20
Brunei	6	8.14	0.30	66.45	0.05	0.00	0.00	0.00	0.00	0.01	0.00	0.16	4.33
Burma	7	2.29	0.22	7.27	0.04	1.01	0.01	0.00	6.28	5.33	2.11	3.44	1.78
China	8	8.12	0.79	19.52	0.12	0.33	0.01	0.14	0.00	28.40	0.29	0.36	0.00
HK	9	30.18	2.17	4.63	0.30	0.20	0.04	0.03	18.42	0.00	0.37	1.88	1.99
India	10	19.56	1.22	10.42	0.22	0.51	0.01	0.02	0.36	1.71	0.00	0.61	1.85
Indonesia	11	19.53	1.65	46.57	0.79	0.09	0.01	0.01	0.49	1.28	0.14	0.00	2.77
Korea	13	35.31	1.36	15.93	0.20	0.35	0.04	0.05	0.00	4.60	1.71	0.90	0.00
Lao	14	6.31	0.68	8.15	0.22	0.14	0.00	0.00	36.50	1.90	0.00	0.03	0.00
Macao	15	29.53	1.76	1.71	0.04	0.00	0.00	0.00	4.32	18.65	0.00	0.01	0.00
Malay.	16	14.01	1.80	21.64	0.19	0.24	0.37	0.07	1.10	1.94	2.71	0.51	4.85
Maldi.	17	0.00	0.00	9.44	0.00	0.00	0.00	0.00	0.08	0.31	0.00	0.00	0.00
Pakistan	18	9.07	1.03	9.49	0.16	1.93	0.02	0.02	3.29	2.92	1.19	0.66	1.44
Papua	19	3.06	10.48	29.65	0.83	0.00	0.00	0.00	2.38	0.37	0.06	0.02	6.99
Philip.	20	34.90	1.70	19.73	0.18	0.07	0.05	0.00	1.48	4.14	0.23	0.99	2.44
Singa.	21	19.34	3.31	9.49	0.94	1.12	1.41	0.25	1.56	6.99	2.30	0.00	1.56
Sri Lanka	22	20.70	1.07	4.87	0.38	0.65	0.00	0.09	1.81	0.95	1.42	0.07	0.24
Thail.	23	16.61	1.58	14.08	0.16	0.82	0.15	0.13	3.12	4.36	0.70	1.17	1.77
Vietnam	24	0.02	1.91	21.31	0.05	0.00	0.00	0.00	0.00	27.64	0.11	1.02	0.39

		14	15	16	17	18	19	20	21	22	23	24
Importer	Exporter	Lao	Macao	Malay.	Maldi.	Pakistan	Papua	Philip.	Singa.	Sri Lanka	Thail.	Vietnam
	i											
USA	1	0.00	0.00	0.78	0.00	0.37	0.03	0.75	1.59	0.04	0.49	0.01
Austra.	2	0.00	0.00	1.92	0.00	0.29	1.97	0.67	2.76	0.17	0.70	0.02
Japan	3	0.01	0.01	1.36	0.00	0.46	0.09	0.82	2.64	0.15	1.32	0.08
N-Zeal.	4	0.00	0.00	1.29	0.00	0.29	0.85	0.87	1.46	0.18	0.48	0.01
Bangl.	5	0.00	0.00	0.38	0.00	4.92	0.02	0.00	4.73	0.08	0.49	0.04
Brunei	6	0.00	0.00	0.49	0.00	0.00	0.00	1.85	6.91	0.00	6.07	0.00
Burma	7	0.00	0.01	3.61	0.88	0.91	0.10	0.09	10.84	2.40	4.65	0.41
China	8	0.00	1.12	0.74	0.00	0.84	0.02	0.84	4.08	0.16	0.75	0.00
HK	9	0.00	1.34	0.78	0.01	0.13	0.08	1.28	3.31	0.30	0.89	0.19
India	10	0.00	0.00	0.80	0.01	0.09	0.01	0.07	1.94	0.79	0.47	0.13
Indonesia	11	0.00	0.00	0.37	0.00	0.16	0.00	1.10	10.55	0.03	0.33	0.03
Korea	13	0.00	0.01	0.88	0.00	0.41	0.02	0.62	1.73	0.24	0.61	0.00
Lao	14	0.00	0.00	16.76	0.00	0.27	0.00	0.00	2.82	0.00	8.66	0.00
Macao	15	0.00	0.00	0.04	0.01	0.00	0.00	0.01	0.15	0.03	0.01	0.00
Malay.	16	0.00	0.00	0.00	0.01	1.07	0.03	1.75	20.50	0.30	3.02	0.01
Maldi.	17	0.00	0.00	1.49	0.00	2.36	0.00	0.00	8.73	15.11	48.94	0.00
Pakistan	18	0.00	0.00	0.37	0.01	0.00	0.00	0.22	1.40	1.03	0.67	0.01
Papua	19	0.00	0.00	0.33	0.00	0.10	0.00	0.76	1.20	0.02	0.04	0.00
Philip.	20	0.00	0.00	2.80	0.00	0.06	0.07	0.00	3.60	0.20	0.95	0.03
Singa.	21	0.03	0.01	15.86	0.14	0.62	0.53	1.31	0.00	0.83	4.19	0.22
Sri Lanka	22	0.00	0.00	0.82	0.55	2.99	0.00	0.03	2.59	0.00	0.29	0.00
Thail.	23	0.36	0.00	4.39	0.01	0.33	0.02	0.54	8.30	0.32	0.00	0.03
Vietnam	24	0.00	0.03	2.95	0.00	0.10	0.00	0.02	8.34	0.62	0.35	0.00

Source: IMF, Direction of Trade Statistics, various issues; own calculation.

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