The Role of Chinese Exchange Rate Policy in the East Asian Currency Crisis of 1997-1998

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Abstract

This paper studies the role of China's exchange rate policy during the 1997 Asian currency crises. In particular, this paper examines whether a devaluation in the Chinese Yuan would set off rounds of competitive devaluation and aggravate the 1997 Asian currency crisis. This paper first uses three indices to measure the degree of trade competition between China and various countries. The index that take into account the composition of trade at a high product disaggregation level indicate that the crisis countries are all strong trade competitors of Mainland China. The paper then employs a TARCH model (Threshold ARCH model) to examine how the exchange rate policy of China affects the exchange rate movements of other countries through their trade linkages with China. It is found that there is asymmetric effect in the appreciation and depreciation of Yuan. While an appreciation of Yuan does not have significant effect on the volatility of other countries' exchange rates, a depreciation of Yuan signif-

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icantly increases the volatility of the exchange rates of China's close trade competitors. This asymmetric phenomenon is in consistent with the competitive devaluation hypothesis. This paper further examines the effect of China's exchange rate policy on the likelihood of speculative attacks on other Southeast Asian countries. On this part, this paper employs the nested logit model in Lau and Yan (2003) to estimate the effects of relative depreciation in Yuan on the probability of speculative attacks and unsuccessful defenses. The estimation results show that the depreciation in the real exchange rate of Yuan is not an important factor that triggers speculative attacks on its trade competitors. Economic fundamentals related to the external liabilities are more crucial in accounting for the incidents of speculative attacks and unsuccessful defenses of the central banks. (JEL: F31 and F33)

1 Introduction

There are two important questions with regard to the role of Chinese exchange rate policy in the East Asian currency crisis of 1997-1998. The first is whether the devaluation of the Renminbi (or Yuan), up to mid-1993, caused, or at least contributed to, the occurrence of the crisis. (Between mid-1993 and mid-1997, the Renminbi appreciated in both real and nominal terms.) The second is whether, by holding its nominal (and effectively also the real) exchange rate stable during and after the crisis, China contributed to the recovery of the rest of East Asia from the crisis. Central to whether the exchange rate policy has an impact is the degree of trade competition between the two economies.

Whether China should follow its neighbors and devalue its currency

during the peak of the 1997 East Asian currency crisis aroused heated debates among Chinese economic policy makers. On the one hand, some economists believed that a devaluation of the Yuan would be necessary to maintain the trade competitiveness of China in the midst of the drastic depreciation in the currencies of its trade competitors. For example, Tyers and Yang (2002a, 2002b) simulates the external shocks to the Chinese economy during the 1997 Asian crisis under fixed and floating currency regimes. They find that China's decision not to devalue the Renminbi (RMB) during 1997 and 1998 cost it about 4% of annual GDP. This was mainly because of (i) the post crisis deflation along with its associated real wage rise and slower employment growth, (ii) the decline in the export to the crisis-affected economies due to the loss of trade competitiveness and (iii) the drop in private investment due to the surge in the real interest rate. On the other hand, there was great concern that a devaluation of the Yuan may aggravate the crisis by setting off rounds of competitive devaluation (Dornbusch, 1999; Chen, 1999; Ni, 1999 and Tyers, 2000). In this case, a Chinese devaluation may not bring any benefit to China itself. In addition, some economists even blame the gradual depreciation in China's real exchange rate in the early 1990's to be a culprit that led to the Asian crisis (Makin (1997))[1]. Figure 1 shows the real exchange rate indices of selected Asian economies. Note that the swap rate of Mainland China is used for the period before 1993Q4 when China had a dual exchange rate system. Under the dual exchange rate

[1] Makin (1997) wrote that "China's preemptive devaluation in 1994 was the first of a number of events leading to acute problems in Asian countries that surfaced this year"(p.2). According to the 22 November 1997 Economist, the Chinese devaluation of 1994 created an export boom that *may have laid the ground for some of South-Asia's woes*" (p.41). (Noland et. al. (1998))

3

system, an official exchange rate was applied to the state enterprises while a more depreciated swap rate was applied to export and other selected new industries. Compared to the official rate (set at RMB 5.7 to 1 USD), the swap rate was closer to the "market rate" because the swap rate was principally determined by the market demand and supply conditions through a bidding process. According to the IMF, 80 percent of foreign exchange transactions were carried out at the swap rate by 1993 (Noland et. al. (1998) and Zhang (1999)). The real exchange rate index shows that the real exchange rate[2] of China actually slightly appreciated in 1995-1998. During the 1997 Asian crisis, the real exchange rate of the crisis economies (namely, Indonesia, Malaysia, Philippines, South Korea and Thailand) tumbled while China stayed put. It was believed that China's decision to not devaluating at the peak of the crisis plays a stabilizing role in Asia. This paper examines more closely how China's exchange rate policy affects the exchange rate volatilities of other Asian economies. In addition, this paper investigates how a devaluation of the Yuan would have affected the probabilities of speculative attacks for other Southeast Asian economies.

The paper is organized as follows: section 1 gives the introduction and 2 provides a literature review. Section 3 reports three measures of trade competition between China and various economies. Section 4 presents the TARCH model that is employed to investigate the effects of China's exchange rate policy on the volatilities of the exchanges rate

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[2]The producer price index (PPI) is used in calculating the real exchange rate for most of the Southeast Asian countries as it consists of less nontradable component compared with the consumer price index (CPI). For the Mainland China, since PPI is not available, GDP deflator is used.

of China's trade competitors. Section 5 reports the estimation results of the nested logit model developed in Lau and Yan (2003) that studies the relationship between a relative Yuan depreciation and the probability of speculative attacks for China's close trade competitors. Section 6 concludes.
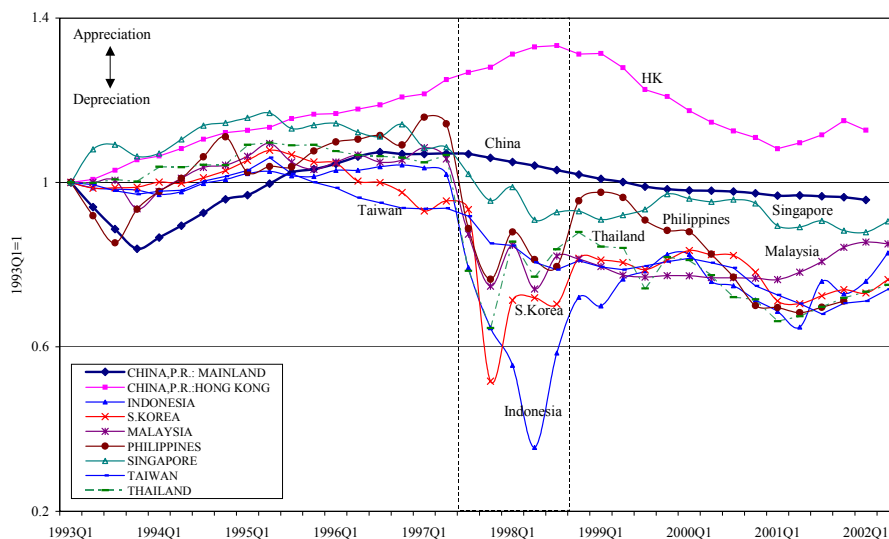

Figure 1: Real Exchange Rate Index of Selected East Asian Economies

2   Literature Review

Tyers (2000) employs comparative static simulations of an aggregate demand and supply model (AS-AD model) to assess the choice of China's exchange rate regime in the aftermath of a crisis. He compares the simulation results under a fixed and flexible exchange rate regime when there is an external crisis. He finds that the maintenance of fixed parity with the US dollar since the onset of the crisis has brought about post-crisis deflation, real wage rise and slower output growth. Based on the simulation result, a managed float with higher flexibility appears to be able to reduce this domestic cost as it allows the use of monetary policy

5

to combat deflation. Nevertheless, this model does not take into account the possible reactions of the other affected East Asian economies.

Similarly, Noland et. al. (1998) uses a computable general equilibrium (CGE) model to simulate the series of devaluations which have occurred throughout Asia and generate estimates of the impact of these exchange rate changes on the trade volume with partner economies and the sectorial composition of world trade. Their numerical analysis indicates that the changes in the trade flow are expected to increase US bilateral trade deficits substantially with a number of Asian trade partners including China.

3 The Measures of Trade Competition with China

To understand to what extent a devaluation of the Yuan will cause competitive devaluation in other East Asia economies, we need first of all to examine the degree of trade competition between Mainland China and the individual East Asian economies. Glick and Rose (1998) employ an absolute trade competition index that measures the similarity between the export destinations of Mainland China and any given economy i. This index is defined as follows:

$$AbsTradeCompete_i^{GlickRose} = \sum_m \{[\frac{(Exp_{CHINA,m} + Exp_{i,m})}{(Exp_{CHINA} + Exp_i)}][1 - \frac{|(Exp_{CHINA,m} - Exp_{i,m})|}{(Exp_{CHINA,m} + Exp_{i,m})}]\}$$

where $Exp_{i,m}$ is the export from economy i to destination m and Exp_i is the total export of economy i. The Glick-Rose absolute trade competition index has been computed for the years 1994, 1996, 1998 and 2001 and are reported in Figures 2(a) through 2(d). Figure 2(d), for ex-

6

ample, suggests that South Korea, Japan, Hong Kong, UK, Singapore[3], Malaysia and Taiwan[4] are the top trade competitors of China in 2000. Nevertheless, a closer examination of the composition of exports of these economies indicates that the product mixes are very different among them. While the exports of these other economies consist largely of machinery and transport equipment that are more capital intensive, the exports of China are dominated by miscellaneous manufactured products that are more labor intensive (see Appendix B for a detail breakdown of the export composition of various countries). A closer examination of the export pattern of Mainland China in SITC two-digit level is provided in Appendix C. Tables 5(i)-(iii) in Appendix C indicate that China's export concentrates mainly in the apparel & clothing accessories sector (SITC-84), the textile yarn & fabrics sector (SITC-65) and the electrical machinery sector (SITC-77). They account for 24.47 percent, 9.64 percent and 6.47 percent of China's total export in 2000 respectively. Given the composition of Chinese exports, economies such as Malaysia, Thailand and Indonesia are much stronger trade competitors of China. These three sectors together accounted for 28.16 percent of Malaysian exports, 23.98 percent of Thai exports and 17.33 percent of Indonesian exports respectively in 2000. In contrast, the three sectors identified

[3]Since the re-export of Hong Kong and Singapore are very high, we use the domestic export instead of the total export for these two economies. See Fung (1996), Fernald et. al. (1998) and Feenstra et. al. (1998) for a detail discussion of the re-export of Hong Kong.

[4]Since a high percentage of the export of Taiwan and China to Hong Kong is for re-export purpose, we subtract the part of the export of Taiwan and China to Hong Kong that is for re-export. Fail to eliminate this effect will result in an overstatement of the degree of competition between Taiwan and China as it appears that Hong Kong is a large common destination of both Taiwan and China even though Hong Kong is only an entrepot but not the final destination.

7

above accounted for only about one-tenth of Japanese exports and less than 7 percent of UK's exports in the same year. Instead, Japanese exports are concentrated in the road vehicles sector (SITC-78) which alone accounts for nearly 20 percent of Japanese exports. UK's exports are concentrated in the office machinery & automatic data processing machinery sector (SITC-75) and the road vehicles sector (SITC-78) which together account for nearly 15 percent of UK's total exports.

In view of the findings above, it is clear that a useful measure of trade competition with China should take into account the composition of exports by product. Forbes (2001) develops a trade competition index that takes into account the composition of trade. It is defined as follows[5]:

$$TradeCompete_i^{Forbes} = 100 \times \sum_k [\frac{Exp_{CHINA,W,k}}{Exp_{W,W,k}} * \frac{Exp_{i,W,k}}{GDP_i}]$$

where $Exp_{CHINA,W,k}$ is the exports from China in sector k to every other economy in the world (W); $Exp_{i,W,k}$ is the export from economy i in sector k to every other economy in the world (W); $Exp_{W,W,k}$ is the export from every economy in the world in sector k to every other economy in the world (W); and GDP_i is the gross domestic product of economy i. The Forbes trade competition indices have been computed for the years 1994, 1996, 1998 and 2000 and are reported in Figures 3(a) through 3(d). The Forbes indices reveal a very different pattern of trade competition from the Glick-Rose indices. The Forbes indices suggest that, for example, in 2000, East Asian economies such as Malaysia,

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[5]Forbes's original measure is slightly different as it is normalized by the maximum competition index in the sample. Nevertheless, using such normalization makes the comparison over time difficult as the country that has the maximum competition index can be different in different years.

Thailand, Singapore[6], Taiwan, Philippines, Indonesia and South Korea are the strongest trade competitors of China while the US, Japan and the UK are only very moderately competitive with China.

To fine tune the measurement of trade competition with China, we develop indices that takes into account both export destinations and composition. Such indices can be defined in terms of export value or export share. The indices in value and share are defined respectively as follows:

$TradeCompete_i^{LauYan}$ (in value)

$$= \sum_m \sum_k [\frac{(Exp_{CHINA,m,k} + Exp_{i,m,k})}{(Exp_{CHINA} + Exp_i)}][1 - \frac{(Exp_{CHINA,m,k} - Exp_{i,m,k})^2}{(Exp_{CHINA,m,k} + Exp_{i,m,k})^2}]$$

$TradeCompete_i^{LauYan}$ (in share)

$$= \sum_m \sum_k [\frac{(Exp_{CHINA,m,k}/Exp_{CHINA} + Exp_{i,m,k}/Exp_i)}{\sum_m \sum_k (Exp_{CHINA,m,k}/Exp_{CHINA} + Exp_{i,m,k}/Exp_i)}]$$

$$[1 - \frac{(Exp_{CHINA,m,k}/Exp_{CHINA} - Exp_{i,m,k}/Exp_i)^2}{(Exp_{CHINA,m,k}/Exp_{CHINA} + Exp_{i,m,k}/Exp_i)^2}]$$

$$= \sum_m \sum_k [\frac{(w_{CHINA,m,k} + w_{i,m,k})}{\sum_m \sum_k (w_{CHINA,m,k} + w_{i,m,k})}]$$

$$[1 - \frac{(w_{CHINA,m,k} - w_{i,m,k})^2}{(w_{CHINA,m,k} + w_{i,m,k})^2}]$$

where subscript i denotes economy i; subscript k denotes sector k and subscript m denotes export destination m. Hence, $Exp_{i,m,k}$ is economy i's export in sector k to destination m whereas $w_{i,m,k} = \frac{Exp_{i,m,k}}{Exp_{i,k}}$ is the share of economy i's export in sector k to destination m . The

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[6]For Hong Kong and Singapore, the domestic export data (total export net of re-export) is used.

first term $\frac{(Exp_{CHINA,m,k}+Exp_{i,m,k})}{(Exp_{CHINA}+Exp_i)}$ in the value measure captures the importance of exports in sector k relative to the total exports of economy i and China. The second term $1 - \frac{(Exp_{CHINA,m,k}-Exp_{i,m,k})^2}{(Exp_{CHINA,m,k}+Exp_{i,m,k})^2}$ measures the degree of similarity between economy i and China's export destinations and composition. The products of these two terms are then summed over all sectors and destinations. Similar interpretation can be given to the index defined in terms of share. Relatively large values of the Lau-Yan index indicates that a given economy is a strong trade competitor of Mainland China. The Lau-Yan indices, at the SITC one to four-digit product disaggregation level, have been computed for the years 1994, 1996, 1998 and 2000 and are reported in Figures 4 through 11 (Figure 4-7 are the value measure of the index in one to four digit product disaggregation levels whereas Figure 8-11 are the share measure of the index in one to four digit product disaggregation level). The Lau-Yan indices based on the four-digit disaggregation levels (which considers both trade destinations and composition) reveal a pattern similar to that of the Forbes index (which considers only trade composition but not destinations). The Lau-Yan indices measured in value and share indicate that the East Asian economies such as Thailand, Malaysia and Indonesia are the strongest trade competitors of Mainland China, similar to the group of economies identified by the Forbes index. This result suggests that export competition is mostly in products rather than in destinations. Hence once the composition by product is taken into account, the composition by destination does not have much additional impact on the degree of export competition.

While it is generally recognized that Mainland China and the devel-

10

oping economies of Southeast Asia – Thailand, Indonesia and Malaysia – are significant trade competitors, the exports of South Korea, Singapore (excluding re-exports) and Taiwan are generally considered to be complementary to those of China–these economies and China occupy different positions in the global supply chain. If the indices are measured in one-digit disaggregation levels only, Taiwan surprisingly turned out to be the strongest trade competitor of China. It is conjectured that the coarseness of the degree of disaggregation is the major reason accounting for this. Two economies both exporting products in the same one-digit SITC category may well be exporting totally different products that are entirely non-competing. Because of this, a high level of product disaggregation (mainly at four-digit level) is used in the later analysis of this paper. In addition, since the bulk of the exports from Taiwan to Mainland China is trans-shipped through Hong Kong, and most of these exports are in turn processed in Mainland China and re-exported to other destinations through Hong Kong, it may appear, if the re-exports are not properly excluded from the domestic imports of Hong Kong, that Mainland China and Taiwan are important trade competitors in the same SITC sector (one-digit) in Hong Kong, whereas in fact that is just an artifact of the treatment of the re-export data. For this reason, we have excluded from the Taiwan data the export to Hong Kong that is for re-export purpose.

The Lau-Yan indices disaggregated at the four-digit SITC level reveal that the measured trade competition between China and the newly industrialized economies of East Asia (South Korea, Singapore and Taiwan) is considerably reduced. The principal trade competitors of Main-

land China are the developing economies of Southeast Asia – Thailand, Indonesia and Malaysia. Our findings therefore suggest that the spillover effect of a devaluation of the Yuan on the exchange rates of these developing economies can be substantial. Any significant devaluation of the Yuan can trigger rounds of competitive devaluation in these strong trade competitors. In section 5, we examine the impact of a devaluation of the Yuan on the probabilities of occurrence of speculative attacks against the currencies of the major Southeast Asian economies.
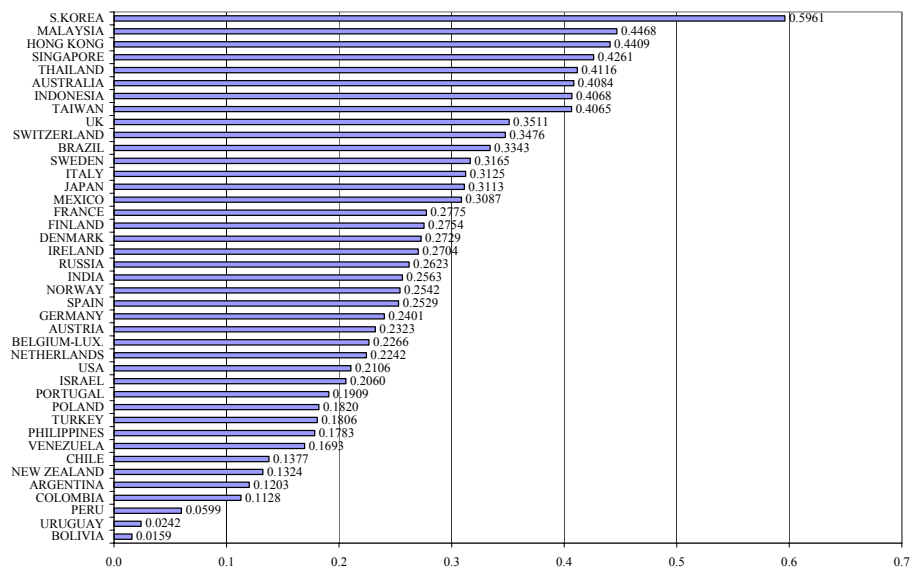
Country	Value
S.KOREA	0.5961
MALAYSIA	0.4468
HONG KONG	0.4409
SINGAPORE	0.4261
THAILAND	0.4116
AUSTRALIA	0.4084
INDONESIA	0.4068
TAIWAN	0.4065
UK	0.3511
SWITZERLAND	0.3476
BRAZIL	0.3343
SWEDEN	0.3165
ITALY	0.3125
JAPAN	0.3113
MEXICO	0.3087
FRANCE	0.2775
FINLAND	0.2754
DENMARK	0.2729
IRELAND	0.2704
RUSSIA	0.2623
INDIA	0.2563
NORWAY	0.2542
SPAIN	0.2529
GERMANY	0.2401
AUSTRIA	0.2323
BELGIUM-LUX.	0.2266
NETHERLANDS	0.2242
USA	0.2106
ISRAEL	0.2060
PORTUGAL	0.1909
POLAND	0.1820
TURKEY	0.1806
PHILIPPINES	0.1783
VENEZUELA	0.1693
CHILE	0.1377
NEW ZEALAND	0.1324
ARGENTINA	0.1203
COLOMBIA	0.1128
PERU	0.0599
URUGUAY	0.0242
BOLIVIA	0.0159

Figure 2(a): Glick & Rose's Measure of Trade Competition with Mainland China,

classified by destinations – 1994

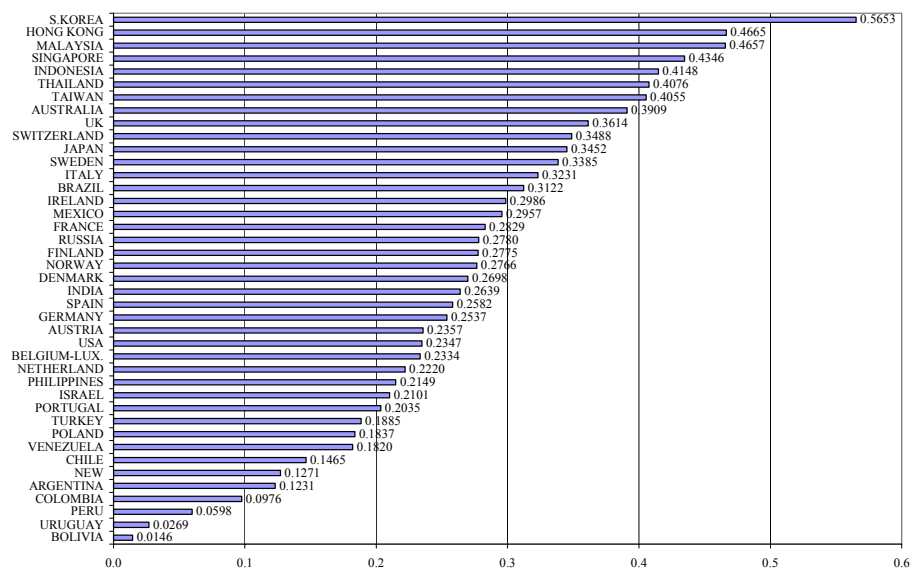| Country	Value
S.KOREA	0.5653
HONG KONG	0.4665
MALAYSIA	0.4657
SINGAPORE	0.4346
INDONESIA	0.4148
THAILAND	0.4076
TAIWAN	0.4055
AUSTRALIA	0.3909
UK	0.3614
SWITZERLAND	0.3488
JAPAN	0.3452
SWEDEN	0.3385
ITALY	0.3231
BRAZIL	0.3122
IRELAND	0.2986
MEXICO	0.2957
FRANCE	0.2829
RUSSIA	0.2780
FINLAND	0.2775
NORWAY	0.2766
DENMARK	0.2698
INDIA	0.2639
SPAIN	0.2582
GERMANY	0.2537
AUSTRIA	0.2357
USA	0.2347
BELGIUM-LUX.	0.2334
NETHERLAND	0.2220
PHILIPPINES	0.2149
ISRAEL	0.2101
PORTUGAL	0.2035
TURKEY	0.1885
POLAND	0.1837
VENEZUELA	0.1820
CHILE	0.1465
NEW	0.1271
ARGENTINA	0.1231
COLOMBIA	0.0976
PERU	0.0598
URUGUAY	0.0269
BOLIVIA	0.0146

Figure 2(b): Glick & Rose's Measure of Trade Competition with Mainland China,
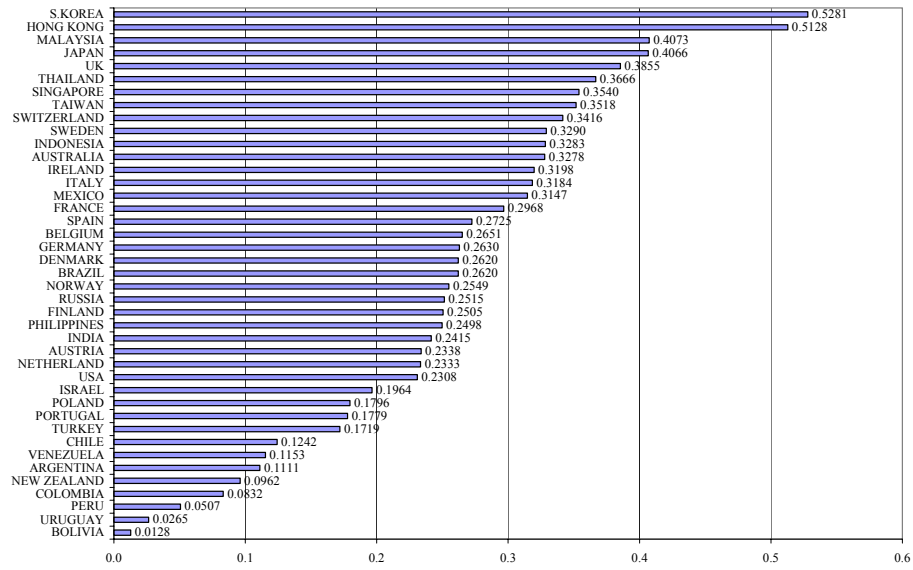
classified by destinations – 1996

13

Figure 2(c): Glick & Rose's Measure of Trade Competition with Mainland China,
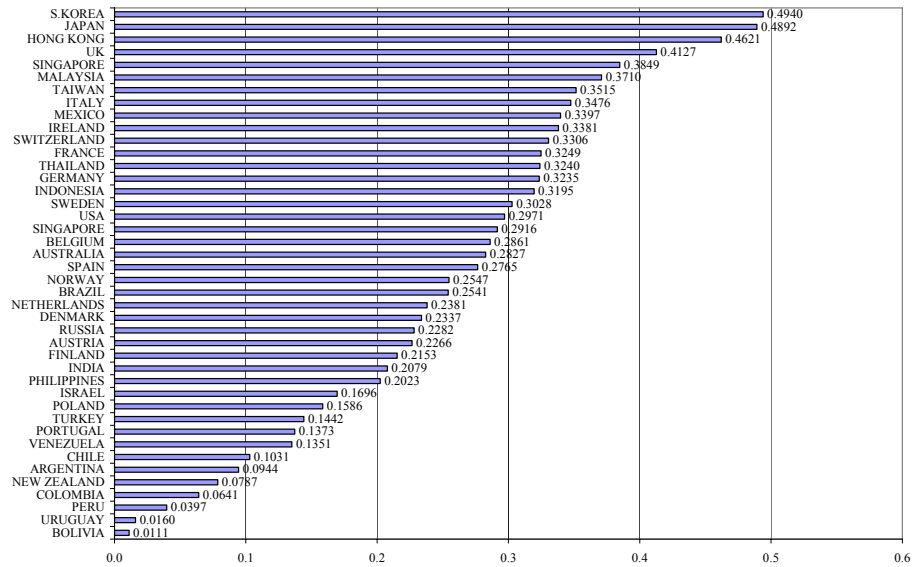
classified by destinations – 1998

Figure 2(d): Glick & Rose's Measure of Trade Competition with Mainland China,

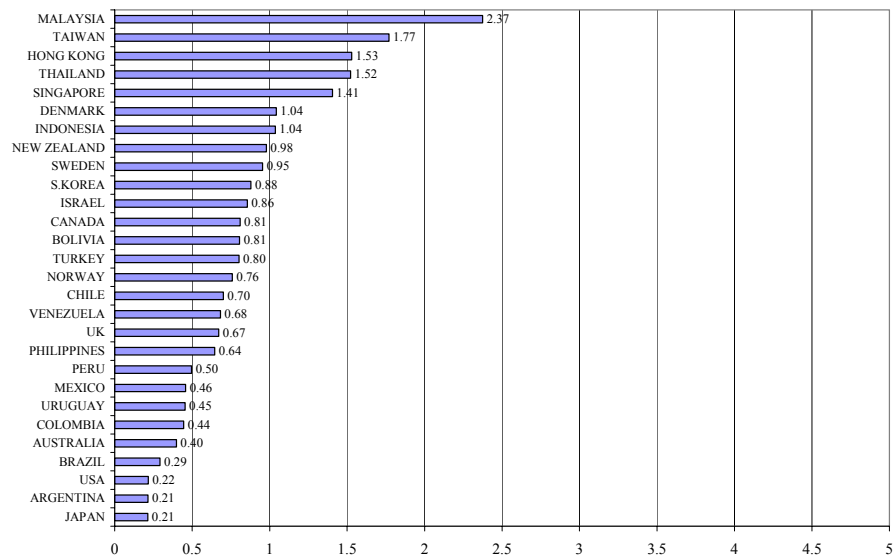classified by destinations – 2000

14

Figure 3(a):

Country	Value
MALAYSIA	2.37
TAIWAN	1.77
HONG KONG	1.53
THAILAND	1.52
SINGAPORE	1.41
DENMARK	1.04
INDONESIA	1.04
NEW ZEALAND	0.98
SWEDEN	0.95
S.KOREA	0.88
ISRAEL	0.86
CANADA	0.81
BOLIVIA	0.81
TURKEY	0.80
NORWAY	0.76
CHILE	0.70
VENEZUELA	0.68
UK	0.67
PHILIPPINES	0.64
PERU	0.50
MEXICO	0.46
URUGUAY	0.45
COLOMBIA	0.44
AUSTRALIA	0.40
BRAZIL	0.29
USA	0.22
ARGENTINA	0.21
JAPAN	0.21

Figure 3(a): Forbes' Measure of Trade Competition with Mainland China

which considers the composition of trade – 1994

Figure 3(b):

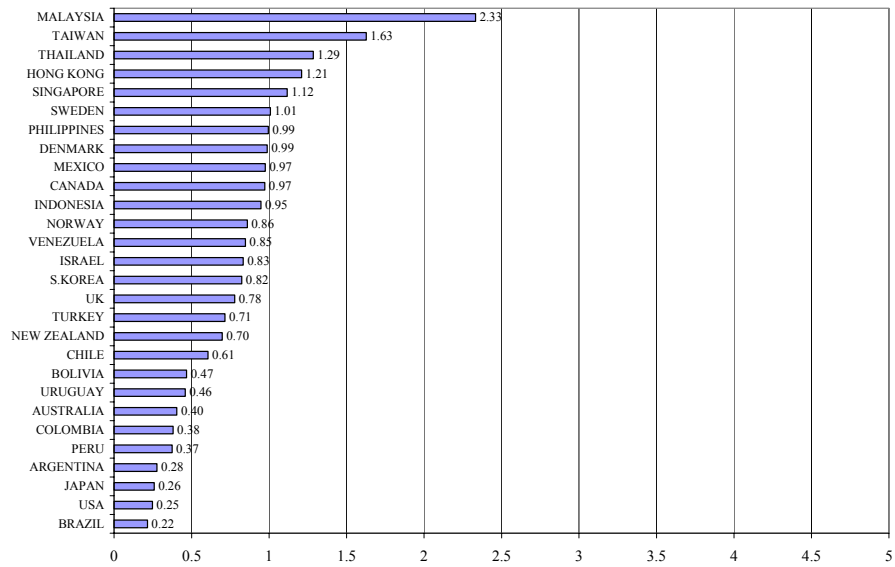| Country	Value
MALAYSIA	2.33
TAIWAN	1.63
THAILAND	1.29
HONG KONG	1.21
SINGAPORE	1.12
SWEDEN	1.01
PHILIPPINES	0.99
DENMARK	0.99
MEXICO	0.97
CANADA	0.97
INDONESIA	0.95
NORWAY	0.86
VENEZUELA	0.85
ISRAEL	0.83
S.KOREA	0.82
UK	0.78
TURKEY	0.71
NEW ZEALAND	0.70
CHILE	0.61
BOLIVIA	0.47
URUGUAY	0.46
AUSTRALIA	0.40
COLOMBIA	0.38
PERU	0.37
ARGENTINA	0.28
JAPAN	0.26
USA	0.25
BRAZIL	0.22

Figure 3(b): Forbes' Measure of Trade Competition with Mainland China

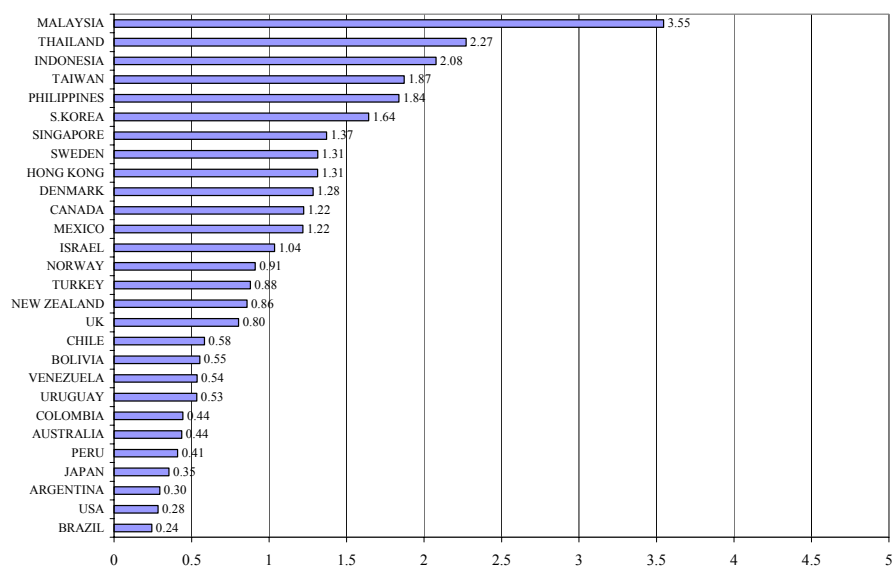which considers the composition of trade – 1996

15

Figure 3(c): Forbes' Measure of Trade Competition with Mainland China

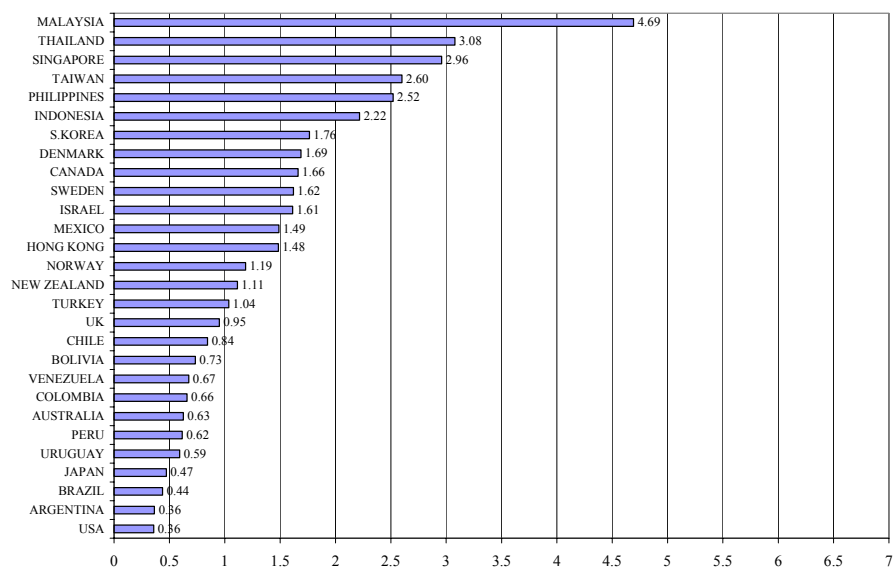which considers the composition of trade – 1998

Figure 3(d): Forbes' Measure of Trade Competition with Mainland China

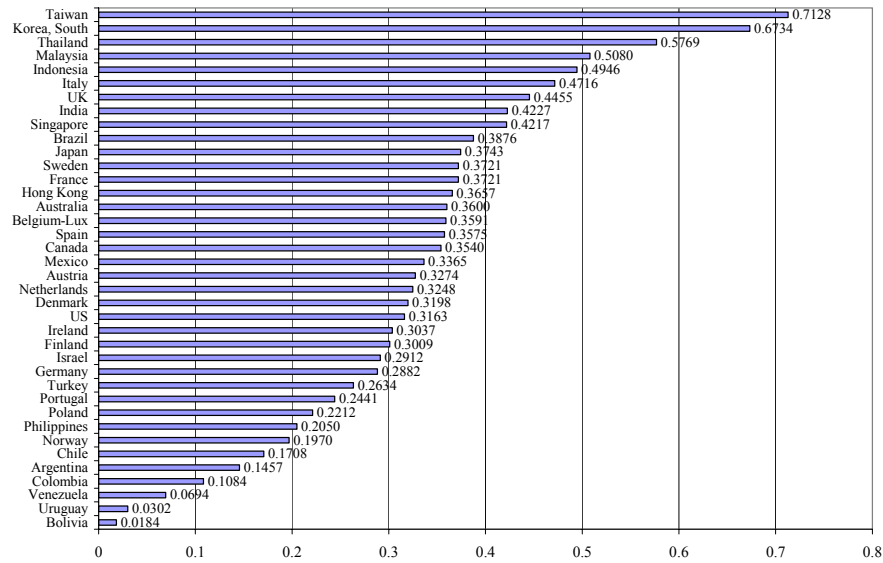which considers the composition of trade – 2000

16

Figure 4(a): Lau and Yan index (in value) on trade competition with China at 1-digit product disaggregation levels – 1994

Country	Index
Taiwan	0.7128
Korea, South	0.6734
Thailand	0.5769
Malaysia	0.5080
Indonesia	0.4946
Italy	0.4716
UK	0.4455
India	0.4227
Singapore	0.4217
Brazil	0.3876
Japan	0.3743
Sweden	0.3721
France	0.3721
Hong Kong	0.3657
Australia	0.3600
Belgium-Lux	0.3591
Spain	0.3575
Canada	0.3540
Mexico	0.3365
Austria	0.3274
Netherlands	0.3248
Denmark	0.3198
US	0.3163
Ireland	0.3037
Finland	0.3009
Israel	0.2912
Germany	0.2882
Turkey	0.2634
Portugal	0.2441
Poland	0.2212
Philippines	0.2050
Norway	0.1970
Chile	0.1708
Argentina	0.1457
Colombia	0.1084
Venezuela	0.0694
Uruguay	0.0302
Bolivia	0.0184

Figure 4(b): Lau and Yan index (in value) on trade competition with China at 1-digit product disaggregation levels – 1996

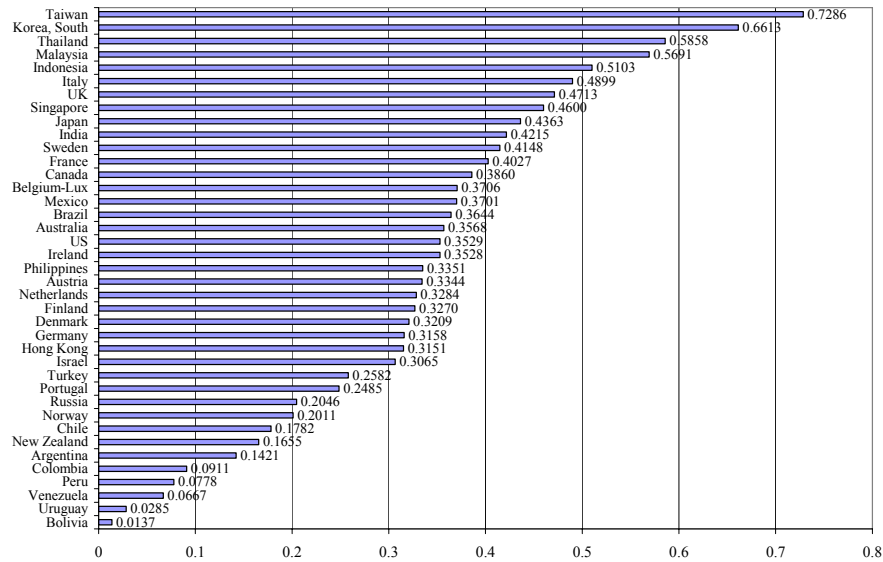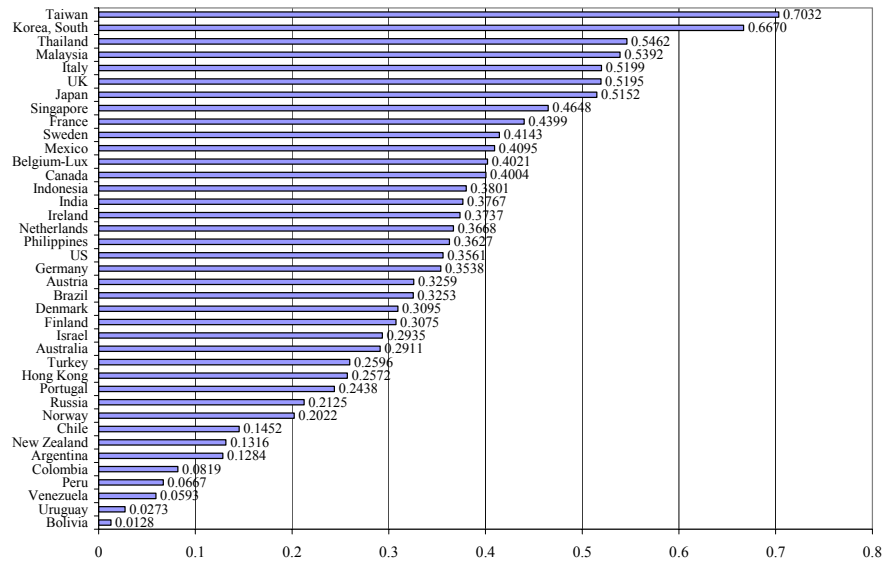| Country	Index
Taiwan	0.7286
Korea, South	0.6613
Thailand	0.5858
Malaysia	0.5691
Indonesia	0.5103
Italy	0.4899
UK	0.4713
Singapore	0.4600
Japan	0.4363
India	0.4215
Sweden	0.4148
France	0.4027
Canada	0.3860
Belgium-Lux	0.3706
Mexico	0.3701
Brazil	0.3644
Australia	0.3568
US	0.3529
Ireland	0.3528
Philippines	0.3351
Austria	0.3344
Netherlands	0.3284
Finland	0.3270
Denmark	0.3209
Germany	0.3158
Hong Kong	0.3151
Israel	0.3065
Turkey	0.2582
Portugal	0.2485
Russia	0.2046
Norway	0.2011
Chile	0.1782
New Zealand	0.1655
Argentina	0.1421
Colombia	0.0911
Peru	0.0778
Venezuela	0.0667
Uruguay	0.0285
Bolivia	0.0137

Figure 4(c): Lau and Yan index (in value) on trade competition with China

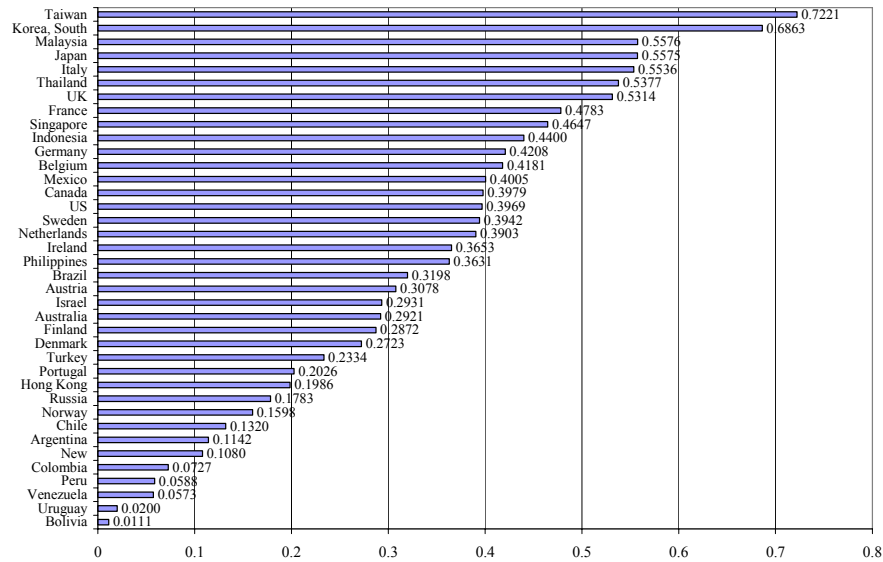at 1-digit product disaggregation levels – 1998

Figure 4(d): Lau and Yan index (in value) on trade competition with China

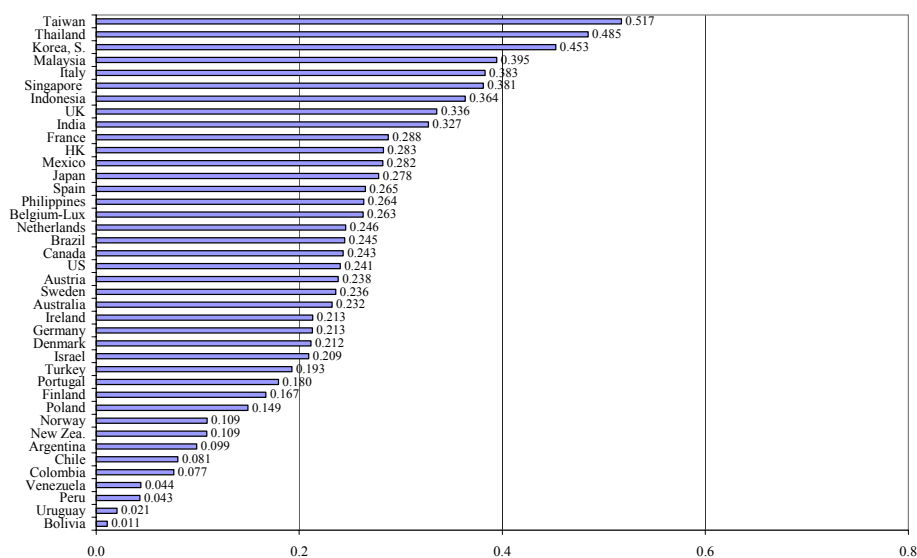at 1-digit product disaggregation levels – 2000

Figure 5(a): Lau and Yan index (in value) on trade competition with China

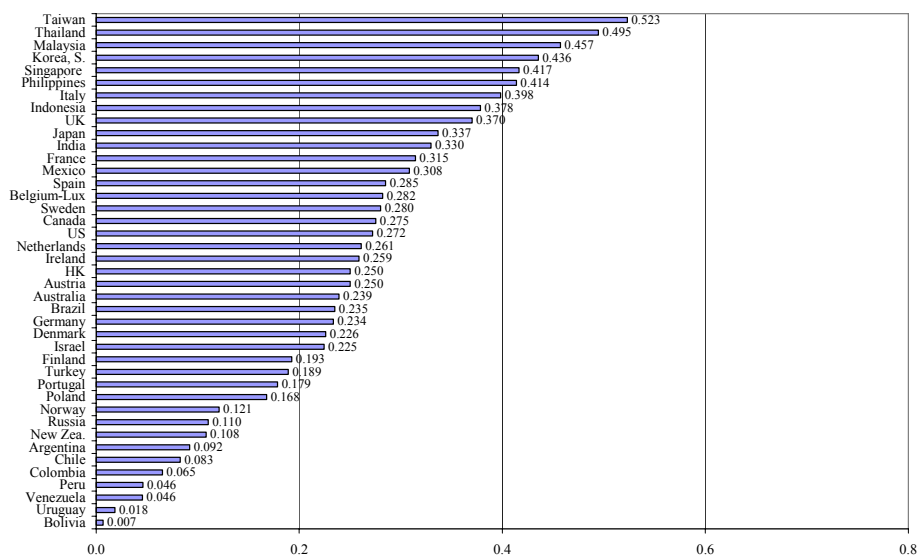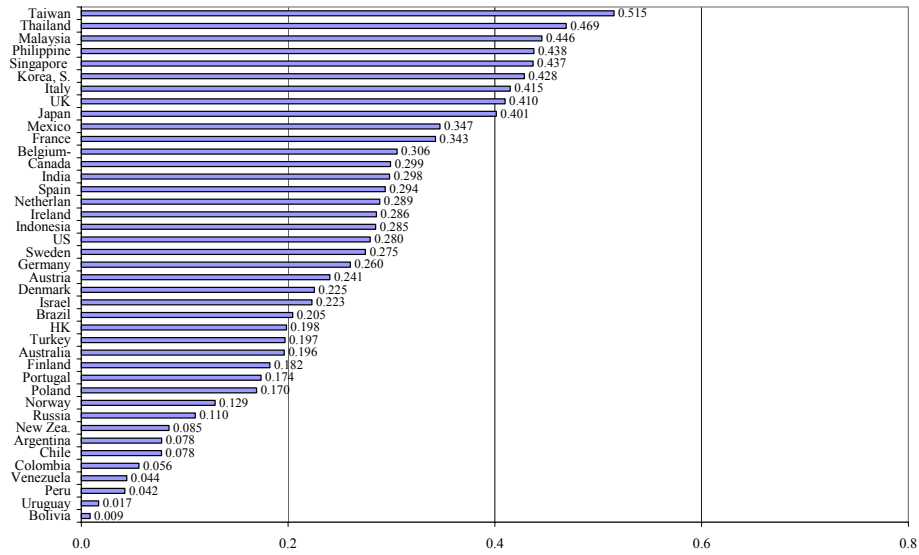at 2-digit product disaggregation levels – 1994

Figure 5(b): Lau and Yan index (in value) on trade competition with China

at 2-digit product disaggregation levels – 1996

Figure 5(c): Lau and Yan index (in value) on trade competition with China

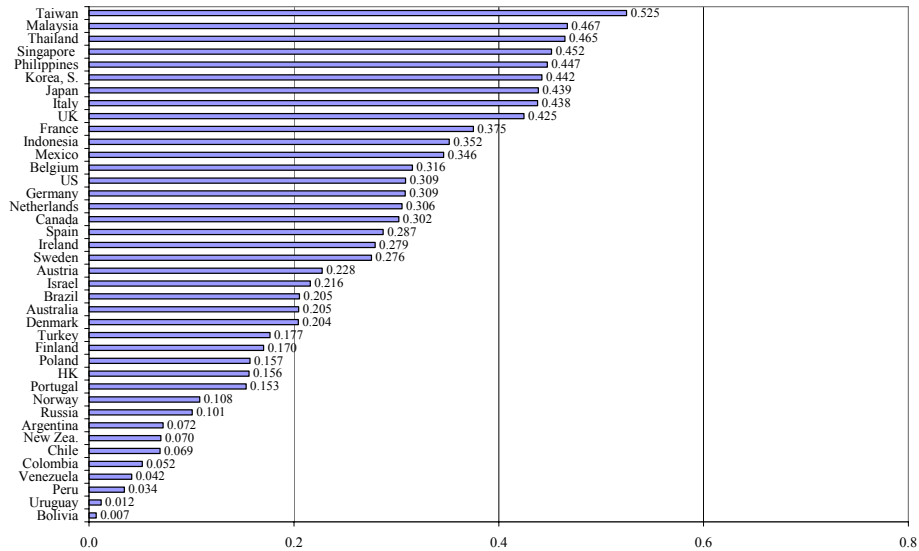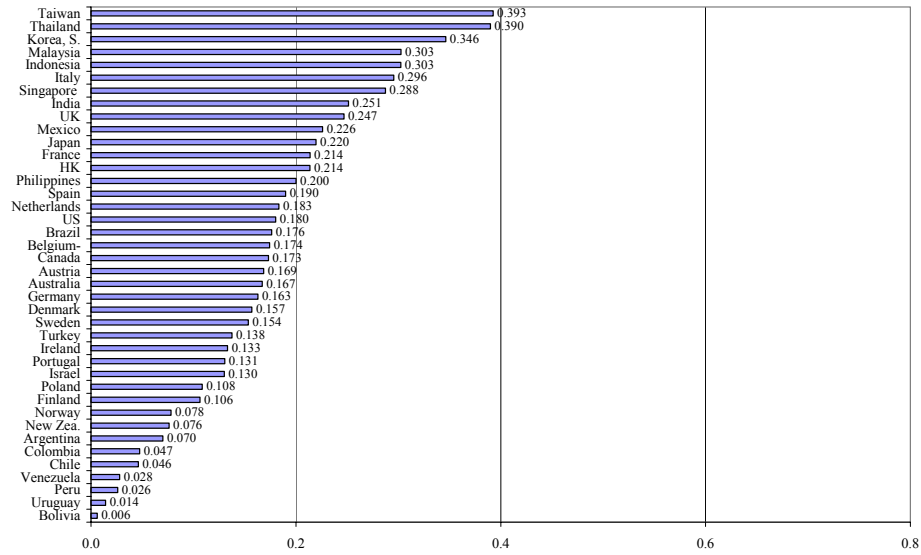at 2-digit product disaggregation levels – 1998

Figure 5(d): Lau and Yan index (in value) on trade competition with China

at 2-digit product disaggregation levels – 2000

Figure 6(a): Lau and Yan index (in value) on trade competition with China
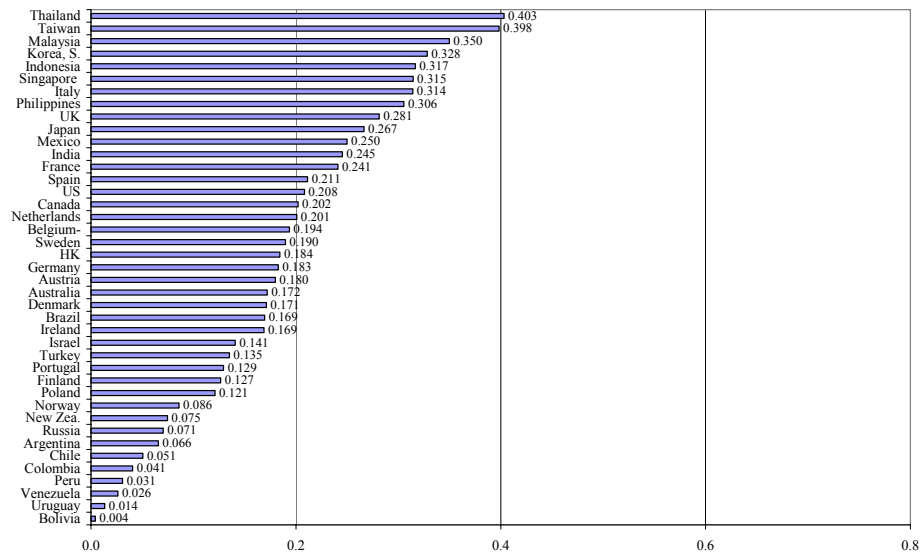
at 3-digit product disaggregation levels – 1994

Figure 6(b): Lau and Yan index (in value) on trade competition with China

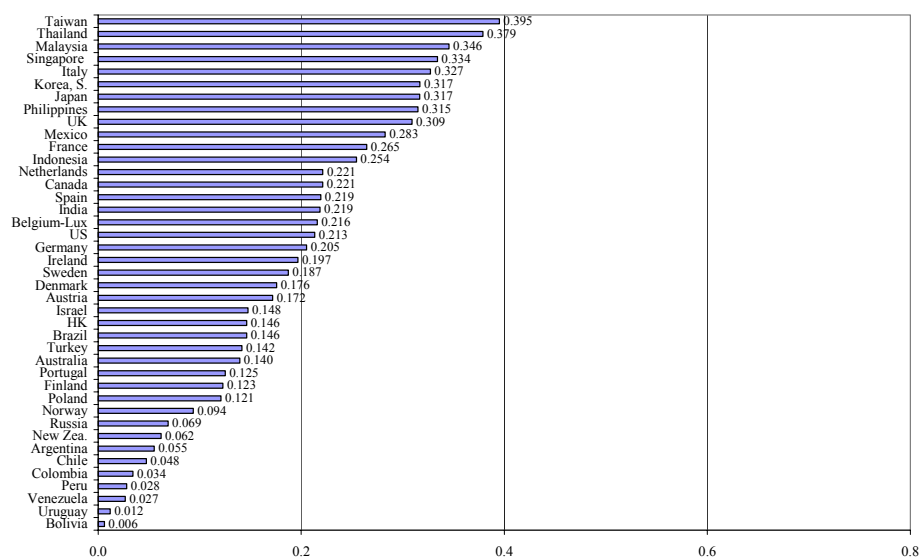at 3-digit product disaggregation levels – 1996

21

Figure 6(c): Lau and Yan index (in value) on trade competition with China

at 3-digit product disaggregation levels – 1998

Figure 6(d): Lau and Yan index (in value) on trade competition with China

at 3-digit product disaggregation levels – 2000

22

Figure 7(a): Lau and Yan index (in value) on trade competition with China

at 4-digit product disaggregation levels – 1994

Figure 7(b): Lau and Yan index (in value) on trade competition with China

at 4-digit product disaggregation levels – 1996

Figure 7(c): Lau and Yan index (in value) on trade competition with China
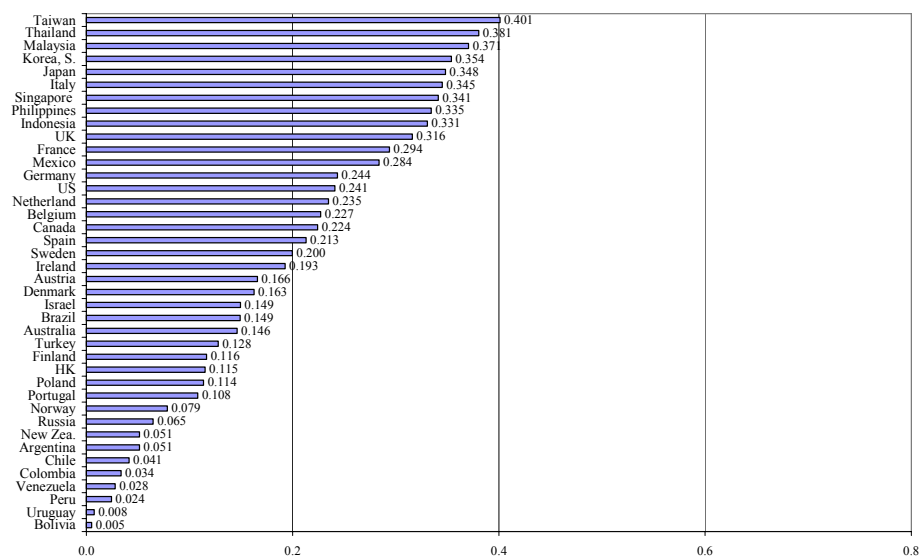
at 4-digit product disaggregation levels – 1998

Figure 7(d): Lau and Yan index (in value) on trade competition with China

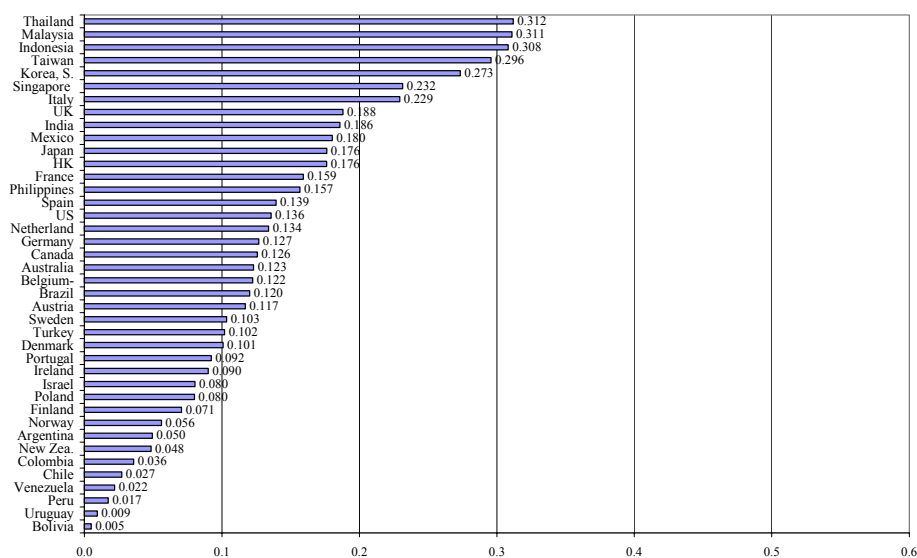at 4-digit product disaggregation levels – 2000

24

Figure 8(a): Lau and Yan index (in share) on trade competition with China

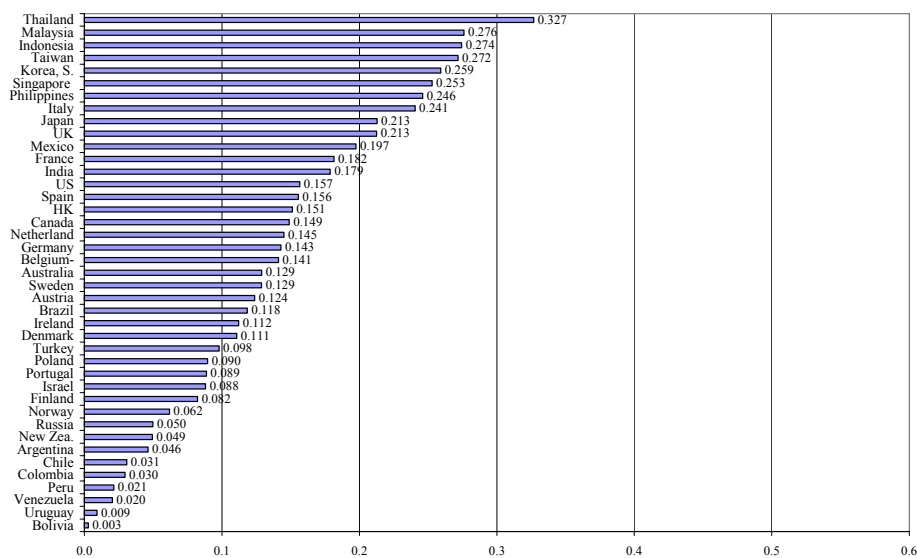at 1-digit product disaggregation levels – 1994

Figure 8(b): Lau and Yan index (in share) on trade competition with China

at 1-digit product disaggregation levels – 1996

Figure 8(c): Lau and Yan index (in share) on trade competition with China

at 1-digit product disaggregation levels – 1998

Figure 8(d): Lau and Yan index (in share) on trade competition with China

at 1-digit product disaggregation levels – 2000

26

Figure 9(a): Lau and Yan index (in share) on trade competition with China

at 2-digit product disaggregation levels – 1994

Figure 9(b): Lau and Yan index (in share) on trade competition with China

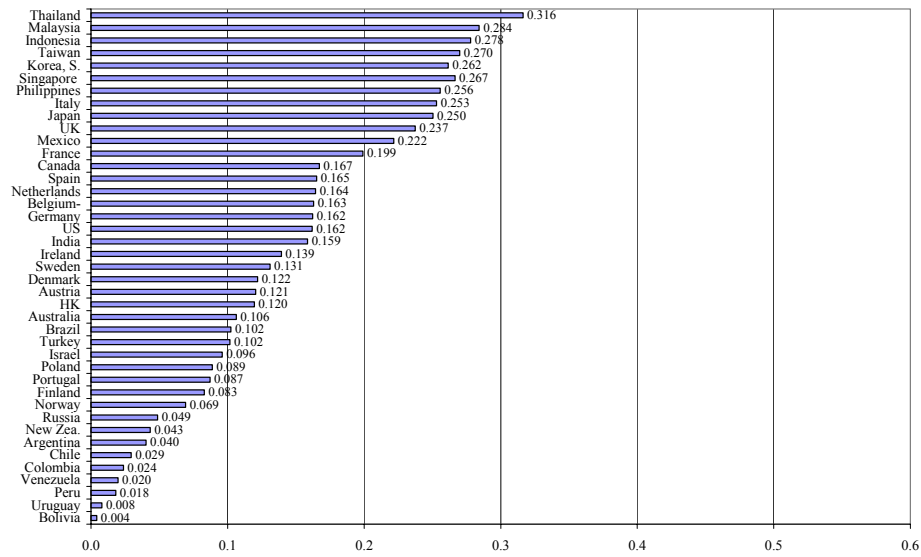at 2-digit product disaggregation levels – 1996

Figure 9(c): Lau and Yan index (in share) on trade competition with China

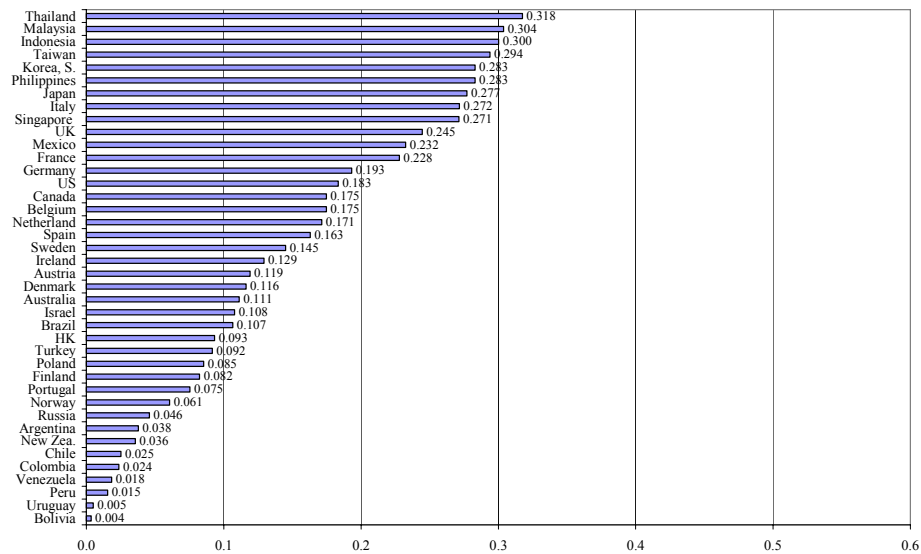at 2-digit product disaggregation levels – 1998

Figure 9(d): Lau and Yan index (in share) on trade competition with China

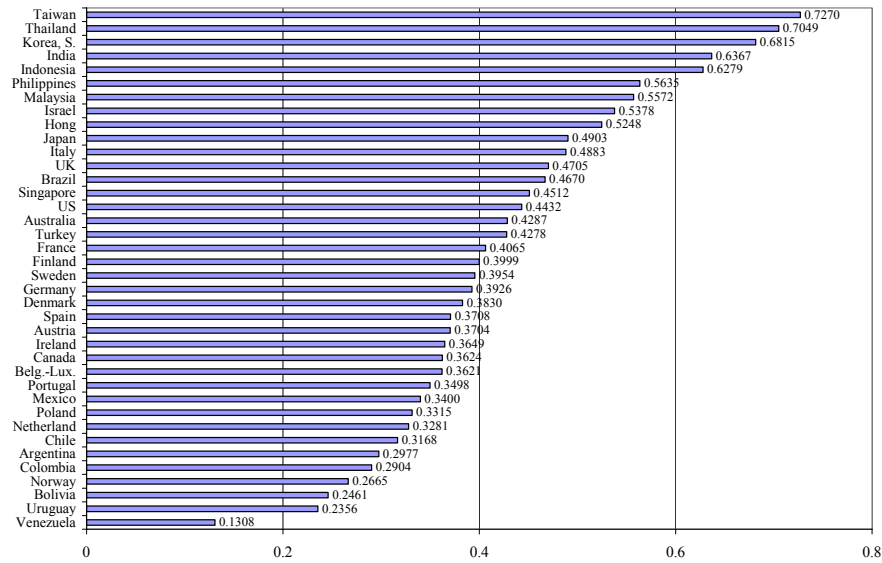at 2-digit product disaggregation levels – 2000

28

Figure 10(a): Lau and Yan index (in share) on trade competition with China

at 3-digit product disaggregation levels – 1994
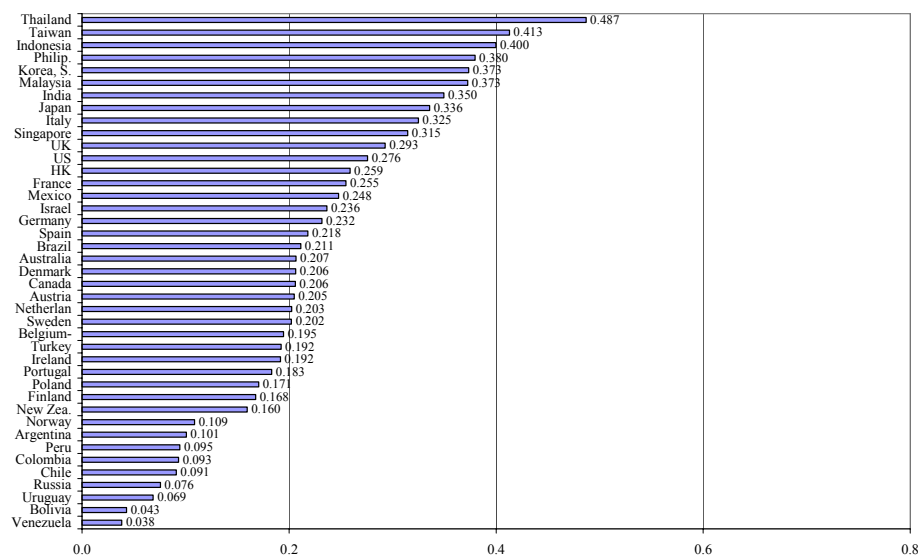
Figure 10(b): Lau and Yan index (in share) on trade competition with China

at 3-digit product disaggregation levels – 1996
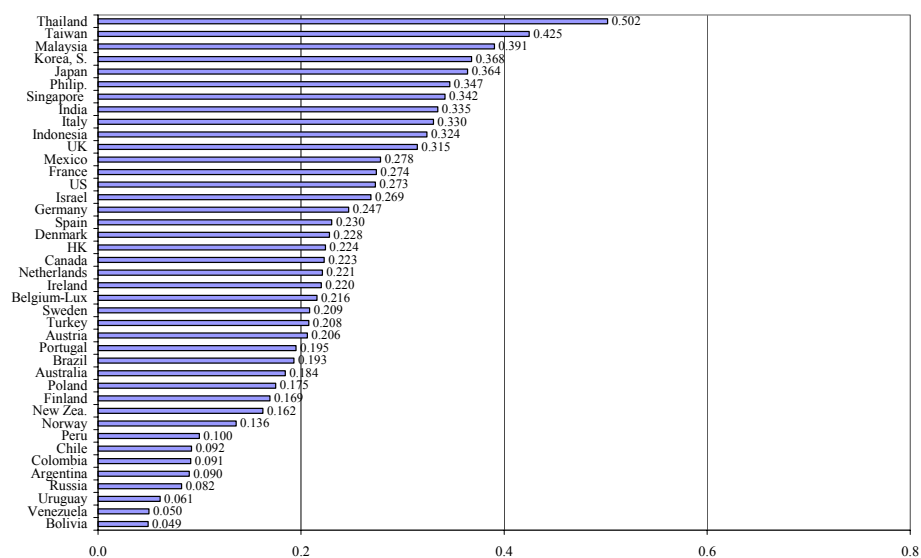
Figure 10(c): Lau and Yan index (in share) on trade competition with China

at 3-digit product disaggregation levels – 1998
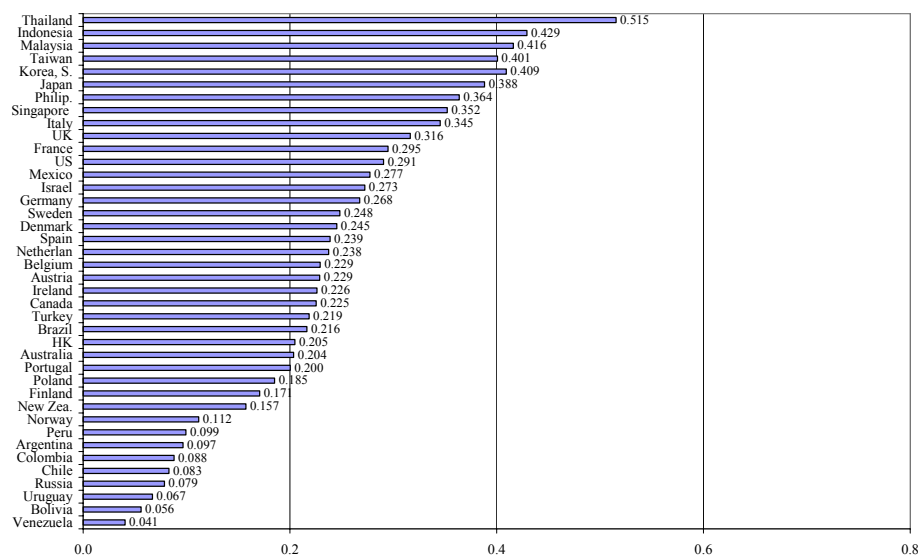
Figure 10(d): Lau and Yan index (in share) on trade competition with China

at 3-digit product disaggregation levels – 2000
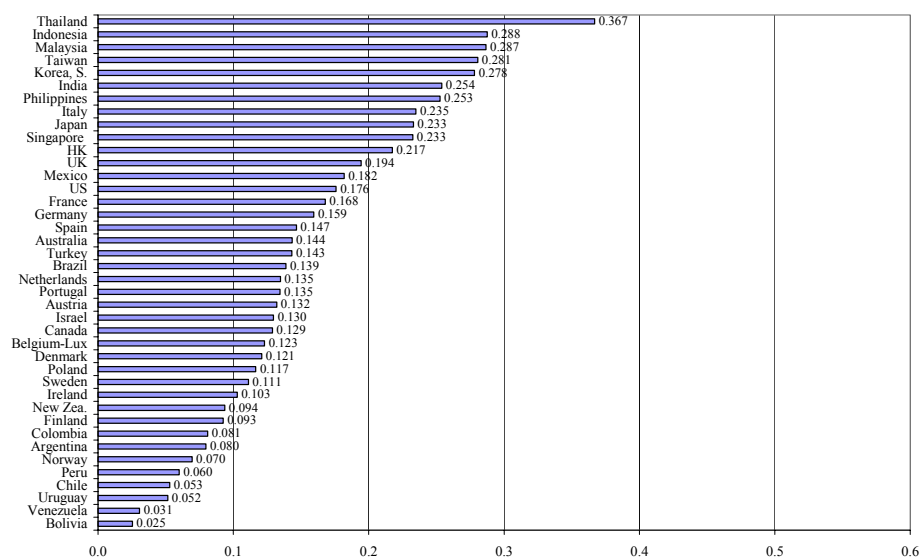
Figure 11(a): Lau and Yan index (in share) on trade competition with China
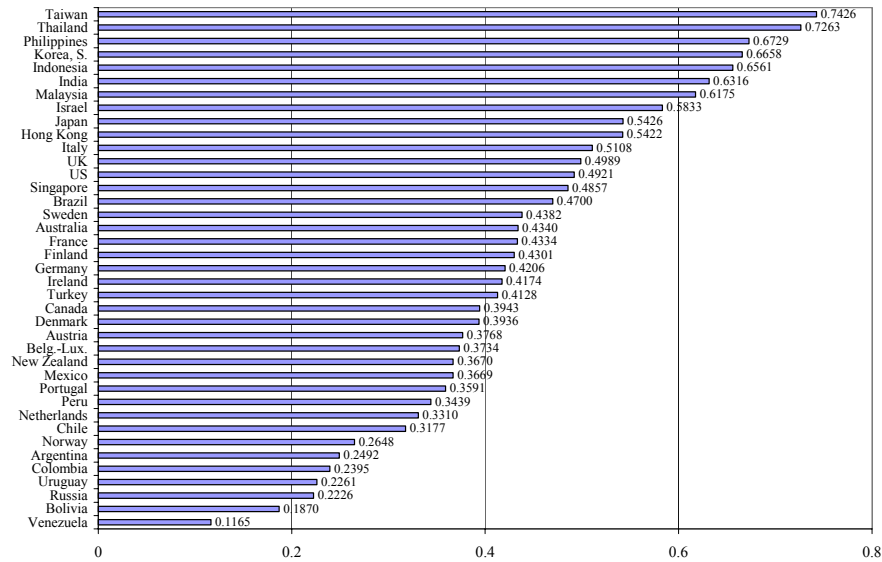
at 4-digit product disaggregation levels – 1994
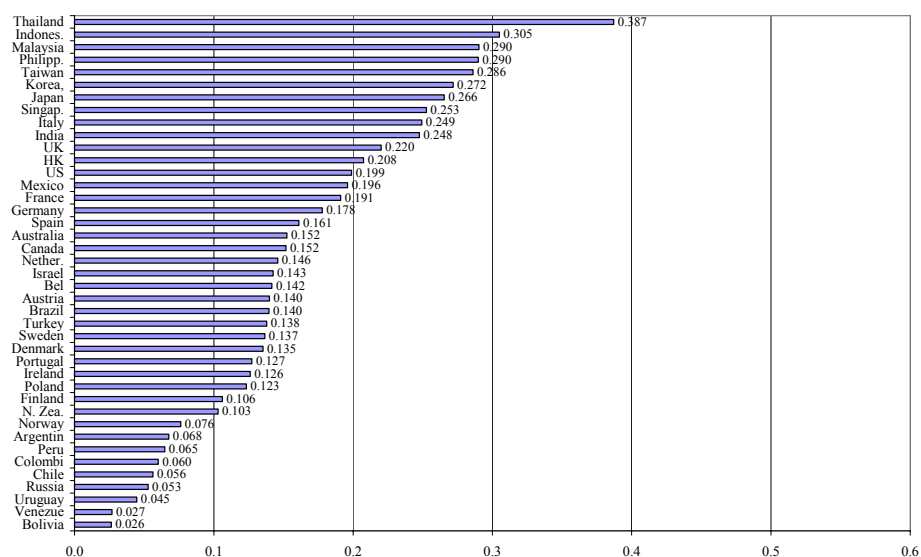
Figure 11(b): Lau and Yan index (in share) on trade competition with China
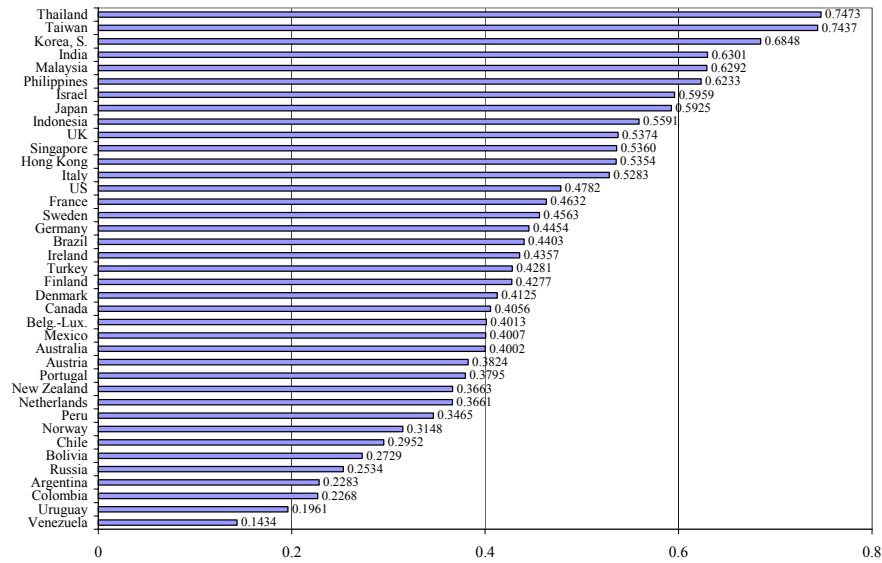
at 4-digit product disaggregation levels – 1996
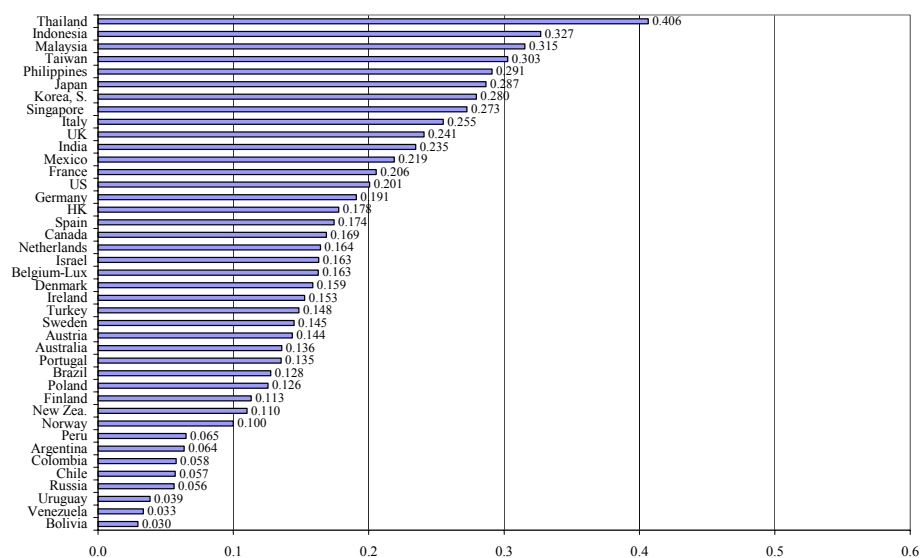
Figure 11(c): Lau and Yan index (in share) on trade competition with China

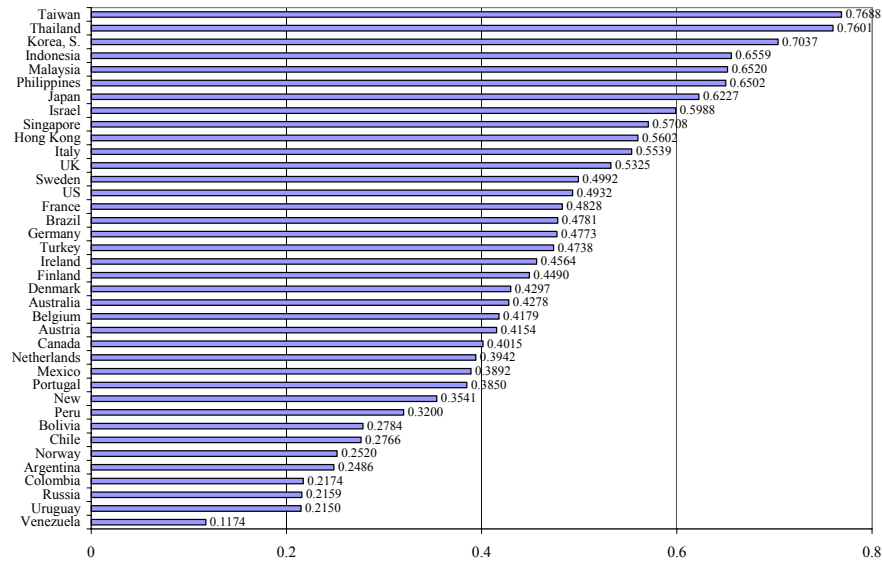at 4-digit product disaggregation levels – 1998
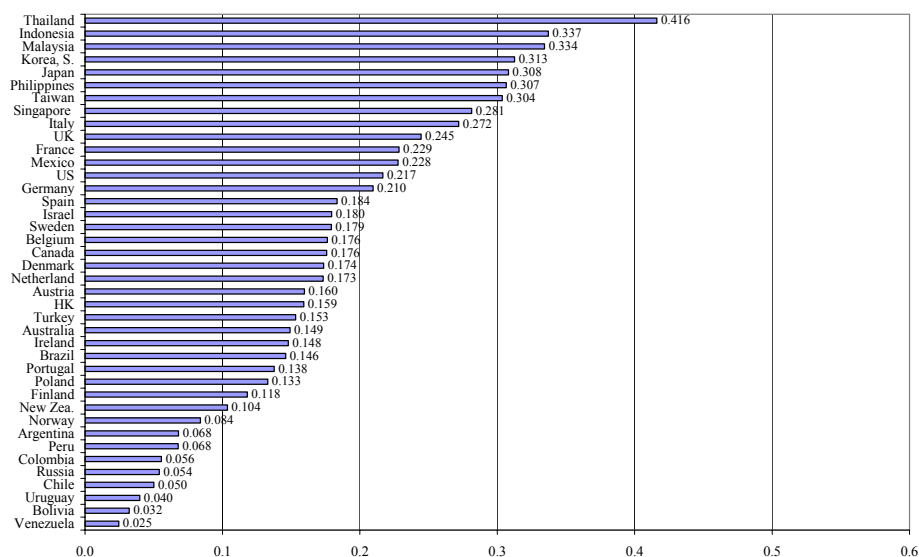
Figure 11(d): Lau and Yan index (in share) on trade competition with China

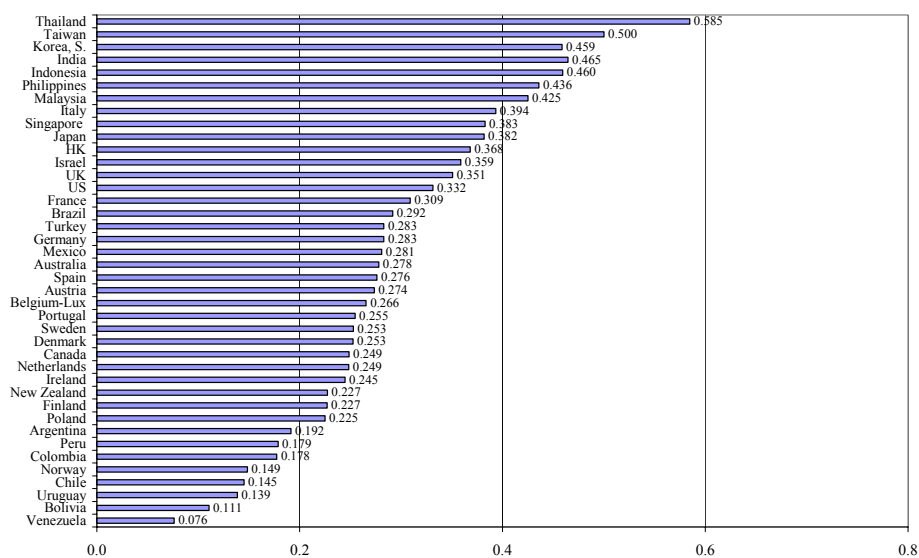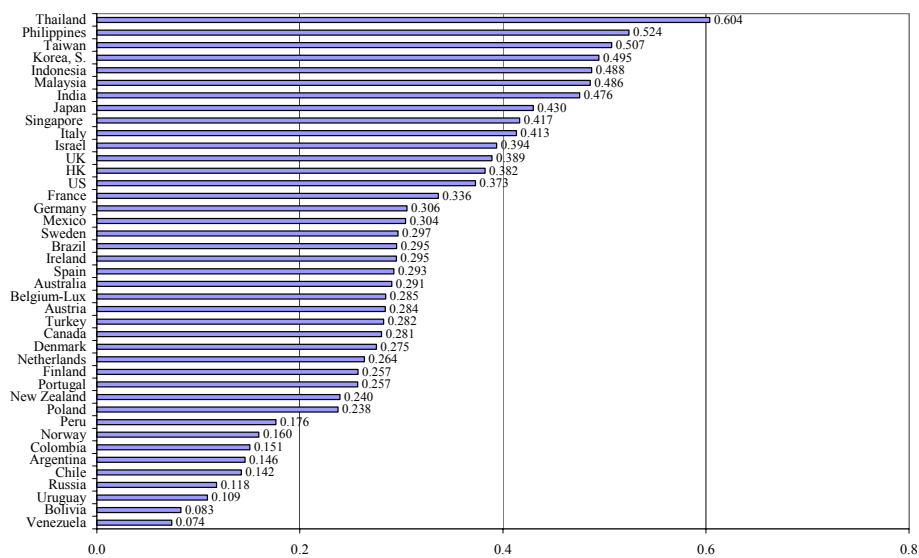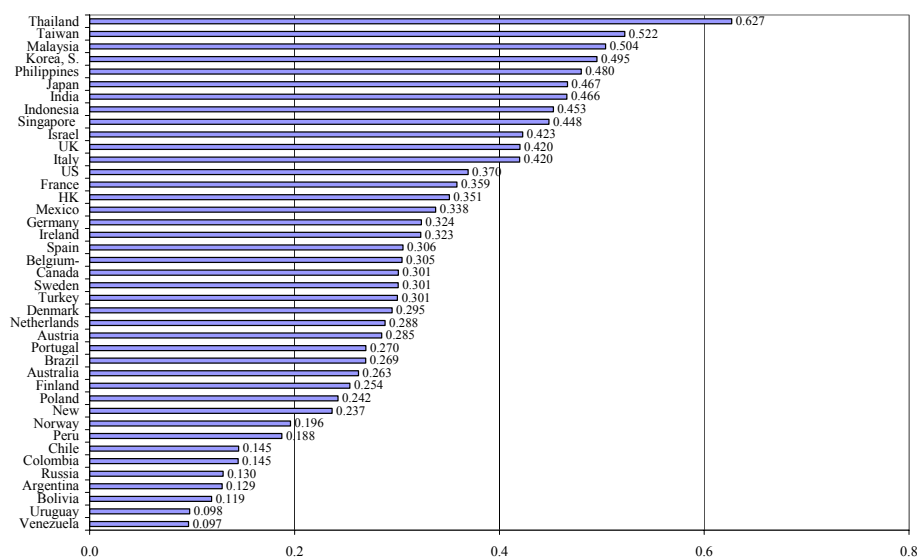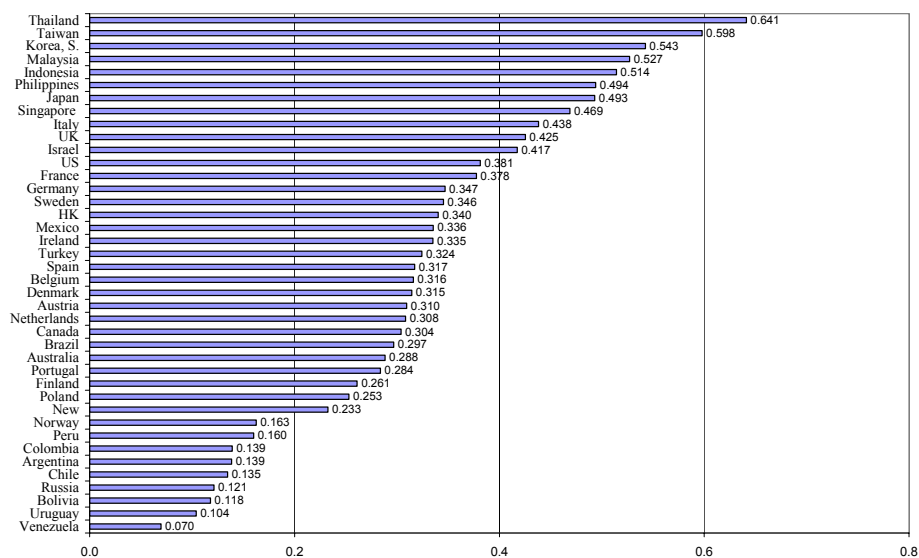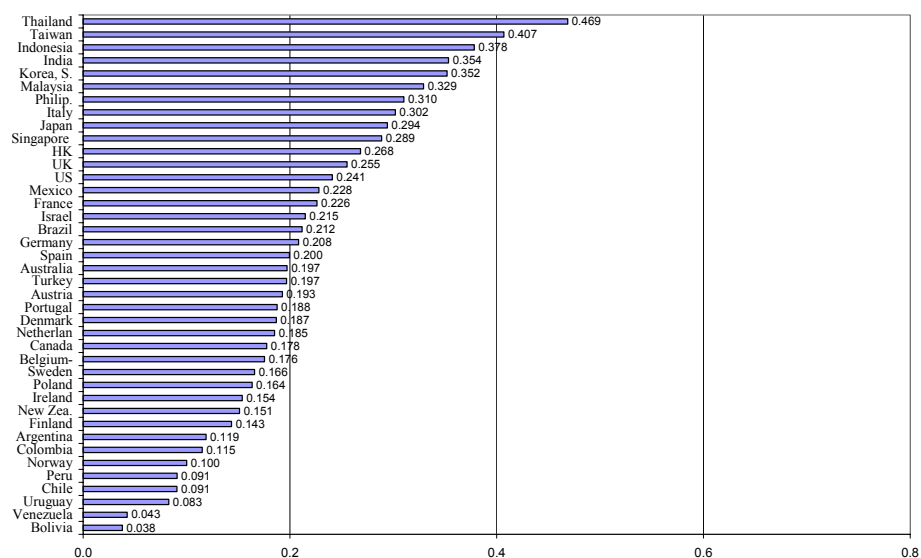at 4-digit product disaggregation levels – 2000

4 Asymmetric Spillover of Real Exchange Rate Volatility

Exchange rate reaction functions are asymmetric. If an economy devalues its currency, it can expect its trade competitors to match its devaluation, thus negating any pricing advantage for its exports. If an economy revalues its currency, it can expect its competitors not to match its revaluation and thereby to gain market shares at its expense. Consequently, no economy has an incentive to change its (real) exchange rate unilaterally, either upwards or downwards. Thus, the status quo exchange rates, in real terms, constitute a stable Nash equilibrium. Real relative exchange rates are likely to appear "sticky" – there is everything to lose with a revaluation and nothing to gain with a devaluation–and moreover are probably more "sticky" upwards than downwards. However, if there is a devaluation of the Yuan, it is likely to set off rounds of competitive devaluation, whereas a revaluation of the Yuan is not likely to be followed by its trade competitors. For this reason, downward movements of the Yuan are more likely to generate greater volatilities in the exchange rates of the trade competitors than upward movements of the same magnitude. To examine the asymmetric effects of real appreciation and depreciation of the Yuan on the real exchange rate movements of the strong trade competitors of China, we employ an Threshold ARCH model (TARCH) introduced independently by Glosten, Jaganathan and Runkle (1993). Compared to the simple ARCH model, the TARCH model provides a better description of the stylized fact that downward movements (devaluations/crashes) in the foreign exchange market are followed by higher

volatilities that upward movements of the same magnitude. Equation (1a) is the mean equation while equation (2) is the conditional variance equation. The mean equation is specified as follows:

$$e_{i,t} = \beta_0 + \sum_{h=1}^{H} \beta_h e_{i,t-h} + \delta t + \varphi_m \sum_{\tau=1}^{t} CRISIS_\tau + \varepsilon_{i,t} \qquad (1(a))$$

which implies:

$$\Delta e_{i,t} = \delta + \sum_{h=1}^{H} \beta_h \Delta e_{i,t-h} + \varphi_m CRISIS_t + \varepsilon_{i,t}^*$$

where $\varepsilon_{i,t}^* \equiv \varepsilon_{i,t} - \varepsilon_{i,t-1} \sim iid(0, \sigma_{i,t}^2)$. The conditional variance equation is specified as follows:

$$\sigma_{i,t}^2 = \omega + \sum_{j=1}^{J} \alpha_j \sigma_{i,t-j}^2 + \sum_{k=1}^{K} \gamma_k \varepsilon_{i,t-k}^{*2} d(\varepsilon_{i,t-k}^* < 0) + \sum_{p=1}^{P} \lambda_p \varepsilon_{i,t-p}^{*2} + \varphi_v CRISIS_t$$

$$+ \sum_{q=1}^{Q} \theta_q^+ (TradeCompete_{i,t-q}^{LauYan})(x_{CHINA,t-q}^+)$$

$$+ \sum_{r=1}^{R} \theta_r^- (TradeCompete_{i,t-r}^{LauYan})(x_{CHINA,t-r}^-) \qquad (2)$$

where $d(\varepsilon_{i,t}^* < 0) = 1$ if $\varepsilon_{i,t}^* < 0$ (negative shocks), and 0 otherwise.

In the mean equation, $e_t = \log(S_t)$ is the log real exchange rate of an economy and $\Delta e_t = \log(S_t/S_{t-1})$ is the quarterly rate of change of the log real exchange rate. In equation (1a), the log real exchange rate is assumed to follow an autoregressive process with a time trend determined by the fundamentals. If the relative productivity growth in the tradable and nontradable sectors is the same in the domestic economy

and in the US in the long run, the log real exchange rate will converge to a constant and remain stable over time, as implied by the Balassa-Samuelson Theorem. This means that the conditional expectation of the error term in equation (1b) is zero in the long run. The conditional variance equation (equation (2)) is augmented with three regressors: $x^+_{CHINA,t}$ is the real exchange rate appreciation of the Yuan ($x^+_{CHINA,t} = Max\{\log(S_{CHINA,t}/S_{CHINA,t-1}), 0\}$), $x^-_{CHINA,t}$ is the real exchange rate depreciation of the Yuan ($x^-_{CHINA,t} = |Min\{\log(S_{CHINA,t}/S_{CHINA,t-1}), 0\}|$) and $CRISIS_t$ is a dummy variable that takes the value 1 if t is within the 1997 East Asian crisis period (1997Q3 to 1998Q3) and 0 otherwise. Since the impact of the real exchange rate movements of the Yuan on another economy's real exchange rate movements is expected to be stronger if the trade competition between the two economies are stronger, the variables that measure the exchange rate movements of the Yuan ($x^+_{CHINA,t}$ and $x^-_{CHINA,t}$) are weighted by the trade competition index of Lau and Yan (measured in share) at the four-digit disaggregation levels as described in Section 3. The impact of the real exchange rate movements of the Yuan on the volatilities of the real exchange rates of other Southeast Asian economies is asymmetric if $\sum_q \theta^+_q \neq \sum_r \theta^-_r$. The lag length in the mean equation is selected so that the Q-statistics of the correlogram (autocorrelations and partial correlations) of the standardized residuals are all insignificant, which indicates that the hypothesis that the residuals of the mean equation are white noise cannot be rejected. The lag length in the variance equation are selected so that the Q-statistics of the correlogram of the squared standardized residuals are all insignificant, which indicates that there is no remaining ARCH in the variance equa-

tion. The sample period used in the estimation is 1986Q1 to 2002Q4. The estimates of the TARCH model are reported in Table 2(a)-(b). In addition, Table 3 reports the F statistics for the hypothesis of symmetry between the effects of real appreciation (revaluation) and real depreciation (devaluation) of the Yuan.

Table 2 shows that θ_q^- is significantly positive for most economies which are strong trade competitors of the Mainland China, including Indonesia, Malaysia and Thailand. This indicates that a depreciation in the real exchange rate of the Yuan has a significantly positive impact on the volatilities of the real exchange rate of these economies. This provides an evidence that supports the competitive devaluation hypothesis. However, the effect is not symmetric for the appreciation of the Yuan. The coefficients associate with the Yuan appreciation, θ_q^+, are not statistically significant for all of these economies. This implies that most economies do not follow suit when China revaluates its currency and hence the volatilities of their currencies do not increase. These results support the asymmetry hypothesis on the appreciation and depreciation of the Yuan. Table 3 formally tests for the asymmetric effect by testing $H_0 : \sum_q \theta_q^+ = \sum_r \theta_r^-$ against $H_1 : \sum_q \theta_q^+ \neq \sum_r \theta_r^-$. The null hypothesis of symmetry is rejected at the 5 percent significance level for all economies in the sample except for Singapore and Hong Kong.

Mean equation	Indonesia	S.Korea	Malaysia	Philipp.	Singapore
β_0	0.0015	0.0091	0.0001	0.0016	0.0010
	(0.0403)	(0.0927)	(0.0172)	(0.1945)	(0.2018)
Δe_{t-1}	0.6337	0.6343	0.1636	0.1629	0.2837
	(0.9302)	(0.2826)	(1.1213)	(0.7472)	(1.6483)
Δe_{t-2}	0.1908	0.6334	0.1141	0.4218	-0.3775
	(0.7015)	(1.6504)	(0.8957)	(2.3663)**	(-2.1940)**
Δe_{t-3}	0.0083	0.5543	0.2493	0.0844	
	(0.0240)	(0.1628)	(1.7337)	(0.4647)	
Δe_{t-4}		0.0691	0.0556	-0.2909	
		(0.1135)	(0.5331)	(-1.8553)	
$CRISIS_t$	-0.6410	-0.8462	-0.2067	-0.1273	-0.0592
	(-5.9254)**	(-2.8078)**	(-2.4524)**	(-3.888)**	(-2.4298)**

Var. equation	Indonesia	S.Korea	Malaysia	Philipp.	Singapore
ω	0.0103	0.0224	0.0008	0.0025	0.0006
	(3.0523)**	(5.7814)**	(2.4713)**	(9.6324)**	(3.5774)**
σ^2_{t-1}	0.5478	0.5172	0.3466	0.4822	0.4497
	(1.7790)	(2.0409)*	(0.4469)	(1.5440)	(1.4115)
$\varepsilon^{*2}_{i,t-1}$	0.1644	0.1400	0.0769	-0.0176	0.0029
	(0.0966)	(0.1145)	(0.2184)	(-0.0399)	(0.0124)
$\varepsilon^{*2}_{i,t-1}d(\varepsilon^*_{i,t-1}<0)$	0.1202	0.2584	0.0078	0.0210	-0.0930
	(0.0349)	(0.3633)	(0.0094)	(0.0500)	(-0.3388)
$(TradeCompete^{LauYan}_{t-1})$ $\times(x^+_{CHINA,t-1})$	-0.1816	-0.3996	-0.0032	-0.0375	-0.0110
	(-1.9246)	(-1.2941)	(-0.2185)	(-0.4420)	(-0.3089)
$(TradeCompete^{LauYan}_{t-1})$ $\times(x^-_{CHINA,t-1})$	0.1178	0.0752	0.0049	0.0327	0.0161
	(3.4037)**	(1.4059)	(1.9634)*	(0.4029)	(2.9916)**
$CRISIS_t$	0.0092	0.0101	0.0139	0.0013	0.0003
	(0.5176)	(0.0720)*	(0.5419)	(0.4191)	(0.2120)

Note: The numbers in the parentheses are the t-statistics. "*" and "**" means
the z-statistic is significant at the 5% and 1% level respectively.

Table 2: (a) Estimates of the TARCH model

Mean equation	Taiwan	Thailand	Hong Kong
β_0	0.0016	0.0090	0.0033
	(1.8249)	(0.7316)	(1.2982)
Δe_{t-1}	0.2987	0.2840	0.3484
	(6.1281)**	(0.6046)	(2.2305)*
Δe_{t-2}	0.2961	0.1724	0.0130
	(4.3616)**	(0.6710)	(0.0879)
Δe_{t-3}	0.0577	0.2726	0.4000
	(0.9041)	(1.1099)	(3.0139)**
Δe_{t-4}	-0.4587	-0.3590	
	(-5.0325)**	(-1.0096)	
$CRISIS_t$	-0.0193	-0.2652	-0.0028
	(-2.3917)**	(-2.3845)**	(-0.7487)

Var. equation	Taiwan	Thailand	Hong Kong
ω	0.0418	0.0023	0.0001
	(2.7727)**	(1.6025)	(2.0403)*
σ^2_{t-1}	0.3033	0.3579	0.4412
	(1.4084)	(0.5708)	(1.0974)
$\varepsilon^{*2}_{i,t-1}$	-0.1614	0.0450	0.1515
	(-2.8241)**	(0.0601)	(0.5808)
$\varepsilon^{*2}_{i,t-1}d(\varepsilon^{*}_{i,t-1} < 0)$	0.1095	0.2758	0.0578
	(0.3996)	(0.3462)	(0.1865)
$(TradeCompete^{LauYan}_{t-1})$ $\times (x^{+}_{CHINA,t-1})$	-0.3342	-0.0320	-0.0043
	(-0.2145)	(-1.0160)	(-1.0990)
$(TradeCompete^{LauYan}_{t-1})$ $\times (x^{-}_{CHINA,t-1})$	0.3342	0.0085	0.0017
	(3.8513)**	(13.7875)**	(2.0870)*
$CRISIS_t$	0.3235	0.0225	0.0001
	(1.3656)	(0.4675)	(1.5109)

Note: The numbers in the parentheses are the t-statistics. "*" and
"**" means the t-stat. is significant at the 5% and 1% level respectively.

Table 2: (b) Estimates of the TARCH model (Continue)

Testing the asymmetric effect of Yuan Revaluation/Devaluation on Other Countries' Exchange Rate Volatilities: $H_0: \sum_q \theta_q^+ = \sum_r \theta_r^-$ $H_1: \sum_q \theta_q^+ \neq \sum_r \theta_q^-$					
	Indonesia	S.Korea	Malaysia	Philipp.	Singapore
F stat.	4.8184	3.8800	4.2544	6.1777	3.5958
p-value	(0.0332)*	(0.0549)*	(0.0448)*	(0.0166)*	(0.0642)
	Taiwan	Thailand	Hong Kong		
F stat.	4.4068	3.8779	2.3963		
p-value	(0.0413)*	(0.0549)*	(0.1291)		
Note: The numbers in the parentheses are the p-values. "*" and "**" means the F-statistic is significant at the 5% and 1% level respectively.					

Table 3: F test on the asymmetric effect of the appreciation and depreciation of yuan

5 A Nested Logit Model on the Contagion Effect of the Yuan Devaluation

A nested logit model is employed in Lau and Yan (2003) to predict speculative attacks and unsuccessful defenses. In this paper, we augment the model with variables that measure the exchange rate policy of the Mainland China and China's trade linkages with various economies in our sample[7]. Through this, we aim at examining how a real exchange rate depreciation of the Yuan affects the likelihood of currency attacks of various economies through their trade linkages with China.

The structure of the model is described in the diagram below. The top branch represents the choice by the speculators of whether or not to launch speculative attacks given the economic fundamentals of the

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[7]See Lau and Yan (2003) for a detail description of the sample.

target economy. The two choices lead to two different outcomes: the "no speculative attack" state (state 0) and the speculative attack branch. The speculative attack branch further initiates two states based on the outcomes of responses by the central banks. The two states are the states of successful defenses (state 1) and unsuccessful defenses (state 2).
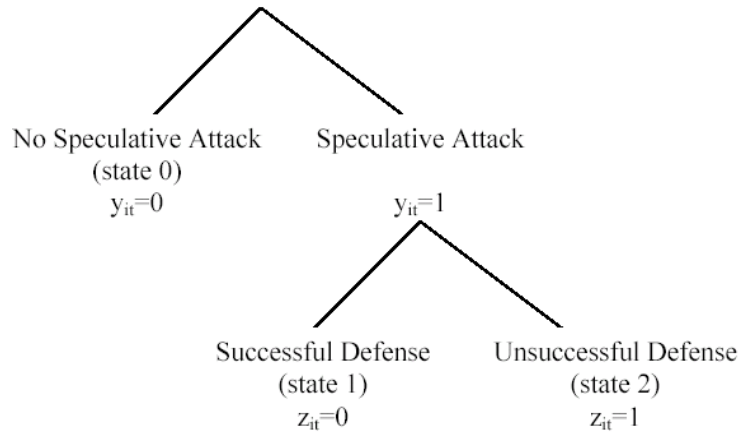
Based on the nested logit model, the probabilities of speculative attacks/no speculative attack and the conditional probabilities of successful defenses/unsuccessful defenses given an attack are specified as follows:

Let X_{it} be the vector of predictive variables for economy i in period t.

Let γ^{NA} and γ^{A} be the vectors of coefficients associated with the no speculative attack state (state 0) and the speculative attack branch (state 1 and 2) respectively.

Let β^{SD} and β^{UD} be the vectors of coefficients associated with the successful defense state (state 1) and the unsuccessful defense state (state 2) respectively.

P(Speculative Attacks)$\equiv P(A)_{it} = P(1, 2)_{it}$

$$= \frac{e^{\alpha_i^A + X_{it}'\gamma^A}}{e^{\alpha_i^A + X_{it}'\gamma^A} + e^{\alpha_i^A + X_{it}'\gamma^{NA}}} \tag{1}$$

P(No Speculative Attacks)$\equiv 1 - P(A)_{it} = 1 - P(1, 2)_{it} = P(0)_{it}$

$$= \frac{e^{\alpha_i^A + X_{it}'\gamma^{NA}}}{e^{\alpha_i^A + X_{it}'\gamma^A} + e^{\alpha_i^A + X_{it}'\gamma^{NA}}} \tag{2}$$

P(Successful Defenses|Attacks)$\equiv P(SD|A)_{it} = P(1|1, 2)_{it}$

$$= \frac{e^{\alpha_i^{UD} + X_{it}'\beta^{SD}}}{e^{\alpha_i^{UD} + X_{it}'\beta^{SD}} + e^{\alpha_i^{UD} + X_{it}'\beta^{UD}}} \tag{3}$$

P(Unsuccessful Defenses|Attacks)$\equiv 1 - P(SD|A)_{it} = P(2|1, 2)_{it}$

$$= \frac{e^{\alpha_i^{UD} + X_{it}'\beta^{UD}}}{e^{\alpha_i^{UD} + X_{it}'\beta^{SD}} + e^{\alpha_i^{UD} + X_{it}'\beta^{UD}}} \tag{4}$$

In the estimation of the coefficients, two normalizations are necessary for identification purposes: in the top branch of the model, the probabilities of speculative attack and no speculative attack always sum up to 1. As a result, only the odd of attack and no attack ($\frac{e^{X_{it}'\gamma^A}}{e^{X_{it}'\gamma^{NA}}}$) can be identified. This implies that only $e^{X_{it}'(\gamma^A - \gamma^{NA})}$ can be identified. In view of this, γ^{NA} is normalized to 0 in the estimation. Similarly, only the odd of successful and unsuccessful defenses can be identified in the lower branch of the model. Hence, β^{SD} is normalized to 0. After normalization, γ^A measures the effect of changes in X_{it} on the odd of attack versus no attack. β^{UD} measures the effect of changes in X_{it} on the odd of unsuccessful defenses versus successful defenses. All predictive variables are lagged one-quarter[8].

Let Y_{it} be a zero-one dummy that equals to 1 when the state of

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[8]A number of alternative specification have also been tried. In the short spectrum, we tried to examine the contemporary influences of the indicators on the probability of currency crises. However, this specification is not chosen as the final specification because it may be subject to the endogeneity problem. We have also allowed for predictive variables lagged up to two, three, four quarters. In addition, to conserve degrees of freedom, we have tried to model the lags using moving averages instead of including different lags into the estimation separately. The results reported in this paper correspond to one-quarter lag of the predictive variables.

speculative attack is realized and Z_{it} be a zero-one dummy that equals to 1 when the state of unsuccessful defense given a speculative attack is realized. That is,

$$Y_{it} \begin{cases} = 1 \text{ if there is speculative attack in economy i at time t} \\ = 0 \text{ otherwise} \end{cases}$$

$$Z_{it} \begin{cases} = 1 \text{ if there is unsuccessful defence in economy i at time t} \\ = 0 \text{ otherwise} \end{cases}$$

The likelihood function is:

$$L = \Pi_{i=1}^{N} f_i(\{y_{it}\}_{t=1}^{T}, \{z_{it}\}_{t=1}^{T})$$

where the density function $f_i(\{y_{it}\}_{t=1}^{T}, \{z_{it}\}_{t=1}^{T})$ is defined as follows:

$$
\begin{aligned}
f_i(\{y_{it}\}_{t=1}^{T}, \{z_{it}\}_{t=1}^{T}) = & \Pi_{t=1}^{T}[1 - \Lambda(\alpha_i^A + \mathbf{X}_{it}'\boldsymbol{\gamma}^A)]^{1-y_{it}} \quad\quad (5) \\
& [\Lambda(\alpha_i^A + \mathbf{X}_{it}'\boldsymbol{\gamma}^A)\Lambda(\alpha_i^{UD}+\mathbf{X_{it}}'\boldsymbol{\beta}^{\mathbf{UD}})]^{y_{it}z_{it}} \\
& [\Lambda(\alpha_i^A + \mathbf{X}_{it}'\boldsymbol{\gamma}^A)(\mathbf{1}-\Lambda(\alpha_i^{UD}+\mathbf{X_{it}}'\boldsymbol{\beta}^{\mathbf{UD}}))]^{y_{it}(1-z_{it})} \\
= & \Pi_{t=1}^{T}[1 - \Lambda(\alpha_i^A + \mathbf{X}_{it}'\boldsymbol{\gamma}^A)]^{1-y_{it}} \\
& [\Lambda(\alpha_i^A + \mathbf{X}_{it}'\boldsymbol{\gamma}^A)]^{y_{it}}[\Lambda(\alpha_i^{UD}+\mathbf{X_{it}}'\boldsymbol{\beta}^{\mathbf{UD}})]^{y_{it}z_{it}} \\
& [\mathbf{1}-\Lambda(\alpha_i^{UD}+\mathbf{X_{it}}'\boldsymbol{\beta}^{\mathbf{UD}})]^{y_{it}(1-z_{it})}
\end{aligned}
$$

where $\Lambda(\alpha_i^A+\mathbf{X}_{it}'\boldsymbol{\gamma}^A) = \frac{e^{\alpha_i^A+\mathbf{x}_{it}'\gamma^A}}{1+e^{\alpha_i^A+\mathbf{x}_{it}'\gamma^A}}$ and $\Lambda(\alpha_i^{UD}+\mathbf{X}_{it}'\boldsymbol{\beta}^{UD}) = \frac{e^{\alpha_i^{UD}+\mathbf{x}_{it}'\beta^{UD}}}{1+e^{\alpha_i^{UD}+\mathbf{x}_{it}'\beta^{UD}}}$.

To get around the incidental parameter problem (Neyman and Scott(1948), Lancaster(2000)), Chamberlain (1980) suggests maximizing the *conditional* likelihood function to obtain the consistent logit estimates for $\boldsymbol{\gamma}^A$:

$$fc_i^A = f_i^A(y_{i1}, y_{i2}, \dots y_{iT} | \Sigma_{t=1}^T y_{it}) \qquad (6)$$

The conditional likelihood for the T observations of y_{it} conditional on the number of ones in the set $\{y_{it}\}_{t=1}^T$ as derived in Greene(2000) is:

$$fc_i^A = \frac{\exp(\Sigma_{t=1}^T y_{it} \mathbf{X'_{it}} \boldsymbol{\gamma}^A)}{\Sigma_{\Sigma_t d_{it}^A = S_i^A} \exp(\Sigma_{t=1}^T d_{it}^A \mathbf{X'_{it}} \boldsymbol{\gamma}^A)} \qquad (7)$$

where the function in the denominator is summed over the set of all $\begin{pmatrix} T \\ S_i^A \end{pmatrix}$ different sequences of T zeros and ones that have the same sum as $S_i^A = \Sigma_{t=1}^T y_{it}$[9]. Since we know that the distribution of z_{it} given $y_{it} = 1$ is the same as that of y_{it}, a set of sufficient statistics for α_i^{UD} is the sum of z_{it} and the set of y_{it} which equals to 1 $(\Sigma_{t=1}^T z_{it}, \{y_{it} = 1\}_{t=1}^T)$. That means we can obtain consistent estimates for $\boldsymbol{\beta}^{UD}$ by estimating the following conditional density function:

$$fc_i^{UD} = f_i^{UD}(z_{i1,} z_{i2,} \dots z_{iT} | \Sigma_{t=1}^T z_{it}, \{y_{it} = 1\}_{t=1}^T) \qquad (8)$$

$$fc_i^{UD} = \frac{\exp(\Sigma_{t=1}^T y_{it} z_{it} \mathbf{X'_{it}} \boldsymbol{\beta}^{UD})}{\Sigma_{\Sigma_t d_{it}^{UD} = S_i^{UD}} \exp(\Sigma_{t=1}^T y_{it} d_{it}^{UD} \mathbf{X'_{it}} \boldsymbol{\beta}^{UD})} \qquad (9)$$

5.1 Indices of Speculative Attacks and Successful Defenses/Unsuccessful Defenses

The next step is to identify the episodes of speculative attacks, successful defenses and unsuccessful defenses in the data. As the instruments most

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[9]Refer to Lau and Yan(2003) for a detail discussion of the estimation method.

widely used by the central banks to defend against speculative attacks are foreign exchange reserves and discount rates (the interest rate at which banks borrow from the central banks), our model uses the following measures to define instances of speculative attacks with successful and unsuccessful defenses:

An unsuccessful defense of a speculative attack ($Z_{it} = 1$) (that is, a currency crisis) is defined as an event in which the exchange rate depreciates by more than two standard deviations in a quarter compared to the mean in the preceding five years of the economy:

$$
Z_{it} \begin{cases} = 1 \text{ if } (\Delta EX_{it} > \overline{\Delta EX}_{it}) \\ = 0 \text{ otherwise} \end{cases}
$$

A successful defense of a speculative attack $Y_{it}(1 - Z_{it})$ is defined as an event in which either the decline in reserves ($\Delta \operatorname{Re} s_{it}$) or the increase in discount rate ($\Delta DisRate_{it}$) crosses the corresponding thresholds and there is no currency crisis in the current quarter ($Z_{it} = 0$):

$$
Y_{it}(1-Z_{it}) \begin{cases} = 1 \text{ if } (\Delta \operatorname{Re} s_{it} < -\overline{\Delta \operatorname{Re} s}_i \text{ or } \Delta DisRate_{it} > \overline{DisRate}_i) \\ \quad \text{ and } Z_{it} = 0 \\ = 0 \text{ otherwise} \end{cases}
$$

The threshold for quarterly reserves loss ($-\overline{\Delta \operatorname{Re} s}_i$) and the threshold for percentage increase in the discount rate ($\overline{DisRate}_i$) are two standard deviations from the means of the economy.

The threshold for the depreciation rate of domestic currency ($\overline{\Delta EX}_i$) is two standard deviations in a quarter compared to the mean quarterly depreciation in the economy in the preceding five years.

A state in which there is no speculative attack ($Y_{it} = 0$) is a state in which both $Y_{it}(1 - Z_{it})$ and Z_{it} equal 0. In addition, in order to avoid measuring the same crisis twice (or more), in cases where there are a number of crisis observations in close succession, we accept only the first observation. The window we use in this paper is four quarters.

5.2 Estimation of the Spillover Effect of the Devaluation (Depreciation) of the Yuan

The vector of predictors ($\mathbf{X}_{it}$) used in the nested logit model includes the one period lag of the lending rate differential, the ratio of fiscal deficits to GDP, the ratio of short-term external liquefiable liabilities to foreign exchange reserves, the ratio of quasi-money to foreign exchange reserves, the ratio of domestic credit to GDP, the ratio of public debt to GDP, the real exchange rate appreciation index, the deviations of unemployment rates from historical means and the real GDP growth[10]. The variable used to measure the spillover effect of the real exchange rate depreciation of the Yuan through trade linkages is the product of the index that measures the trade competition between China and various economies i and the real exchange rate deprecation of the Yuan relative to economy i's domestic currency (($e_{CHINA,t} - e_{i,t}$)<0). The trade competition index is the Lau and Yan index (measured in share and disaggregated at four-digit product disaggregation levels) developed in section 3. Hence, the variable that measures the spillover effect, which we denote as $Spill_{CHINA,i,t}$, is specified as $Spill_{CHINA,i,t} =$

---

[10]Refer to Lau and Yan(2003) for a detail discussion of each predictor and a data description.

$\left| TradeComp_{i,t}^{LauYan} \times (e_{CHINA,t} - e_{i,t})^- \right|$ where $e_{i,t} = \log(S_{i,t}/S_{i,t-1})$ is the quarterly rate of changes of the real exchange rate S of economy i and $(e_{CHINA,t} - e_{i,t})^- = Min\{e_{CHINA,t} - e_{i,t}, 0\}$ is the relative real exchange rate depreciation of the Yuan against economy i's domestic currency. A significant positive coefficient for this variable in the estimation of the speculative attack equation (γ^A in equation 7) indicates that a relative real exchange rate depreciation of the Yuan significantly raises the likelihood of speculative attacks of the closest trade competitors of China. Similarly, a significant positive coefficient for this variable in the estimation of the unsuccessful defense equation (β^{UD} in equation 9) indicates that a relative real exchange rate depreciation of the Yuan significantly increases the likelihood of unsuccessful defenses by the central banks.

The estimation results are presented in Table 4. Holding the fundamentals including the external liabilities, fiscal deficits, lending rate differentials etc. constant, there is no evidence that a relative depreciation in the real exchange rate of China significantly raise the likelihood of speculative attacks for its trade competitors, neither does the Yuan depreciation has any significant effect on the likelihood of unsuccessful defenses by the central banks.

Predictors (X)	γ^A	β^{UD}
Lending Rate	0.1675	0.1938
Differentials	(0.9904)	(0.3983)
Ratio of short external	0.4088	0.6357
liabilities to FX reserves	(2.8581)**	(2.0587)*
Real Exchange Rate	0.3018	0.0995
Appreciation Index (86Q1=1)	(1.9766)*	(0.2899)
Ratio of Quasi-money	0.0577	0.3284
to FX reserves	(0.3154)	(0.8421)
Ratio of fiscal deficits	0.3235	0.7401
to GDP	(1.9618)*	(1.3479)
Ratio of domestic	0.2208	0.8552
credit to GDP	(1.1163)	(2.1880)*
Unemployment rate	0.0337	0.2061
(deviations from historical	(0.2836)	(0.7803)
historical mean)		
Real GDP growth	-0.0827	-0.3635
	(-0.5370)	(-0.9192)
Ratio of public debts	0.1041	0.1475
to GDP	(0.7985)	(0.3768)
Spillover from China	6.2075	2.7763
	(0.9625)	(0.2055)

Note:

1. The numbers in parentheses are the t-statistics

2. "*" and "**" indicate the t-statistic is significant at the 5% and
1% significance level respectively.

Table 4: Nested Logit Estimates

6   Conclusions

When the trade composition is taken into consideration, the trade competition indices suggest that the Asian Crisis affected economies Malaysia, Indonesia and Thailand are strong trade competitors of the Mainland China. Based on the results of the TARCH model, a devaluation in the Yuan significantly raises the volatilities of real exchange rates of all of these economies while a revaluation in the Yuan does not have any significant effect. This is in consistent with the competitive devaluation hypothesis. It also suggests that China's decision of not devaluating the Yuan serves a stabilizing role in Asia by not further setting off rounds of competitive devaluation.

This paper further employs the nested logit model of Lau and Yan (2003) to estimate the effect of Yuan deprecation on the likelihood of speculative attacks for China's trade competitors. This issue is important as there was a great debate on whether the Asian crisis would be aggravated were China devaluate the Yuan during the crisis period. The estimation results indicate that once the economic fundamentals including the external liquidity, fiscal deficits and lending rate differentials are controlled for, a devaluation of the Yuan does not significantly raise the probabilities of speculative attack incidents for the Southeast Asian economies. Thus weak economic fundamentals rather than the lack of trade competitiveness relative to China lays at the root of the Asian Currency Crisis.

Appendix A: Data Description

The total export data is mainly obtained from the "Trade Analysis System (PC-TAS)" database of the United Nations. The total export data of Taiwan is from the web-site of the Bureau of Foreign Trade of Taiwan (http://www.trade.gov.tw). The domestic export data of Hong Kong is from the "Hong Kong Trade Statistics, Domestic Exports and Re-Exports" published by the Hong Kong Census and Statistics Department. The re-export data of Hong Kong classified by source and destination economies is from the "World Trade Atlas" database. The domestic export data of Singapore is from the "Singapore Trade Connection" CD-ROM issued by the Singapore Trade Development Board. The sample data for the nested logit estimation consists of quarterly data from 1982 Q1 through 2001 Q4. The primary data source is International Financial Statistics (IFS), supplemented by the World Development Indicator CD-ROM and the web-sites of the Asian Development Bank (ADB) and the Bank of International Settlements (BIS). The following table shows the sources and definitions of the variables:

Predictors	Sources and Definitions
1. Lending rate differential	The lending rate differential is constructed as the difference between the 3-month lending interest rate in the domestic economy and the US. The lending interest rate is taken from IFS line 60P.
2. Ratio of short-term international liquefiable liabilities to foreign exchange reserves	The short-term external debt data is obtained from the Asian Development Bank (ADB) web page and the Bank of International Settlements (BIS) web-site. The cumulative portfolio liabilities data is constructed as the cumulative sum of the portfolio liabilities flow data obtained from IFS line 78BGD. The import data is from IFS line 98C. The foreign exchange reserves data is from IFS line 1L.
3. Real exchange rate appreciation index	The exchange rate data is obtained from IFS line ..AE..ZF. The exchange rate for China before 1994 Q1 is the swap rate obtained from Global Financial Data. The exchange rate is deflated by PPI (IFS line 63..ZF) and then the real exchange rate is normalized to 1986 Q1=1.
4. Ratio of quasi-money (M2-M1) to foreign exchange reserves	M2 is calculated as IFS line 34 plus 35. M1 is from IFS line 34. The foreign exchange reserves data is from IFS line 1L.
5. Ratio of fiscal deficits to GDP	Fiscal deficit is from IFS line 80 and GDP is from IFS line 99B.
6. Unemployment rate	Historical unemployment rate is from the World Development Indicator CD-ROM. Recent data are from the official web-sites of various countries.
7. Public Debt	The total public debt is from IFS line 88ZF. The public debt in domestic currency is from IFS line 88AZF. The public debt in foreign currency is from IFS line 89AZF.

Appendix B: Export Composition of Selected economies

Share of Various Sectors in China's Export -- 1994

- MANUFACTURED GOODS 19.19%
- MACHINES,TRANSPORT EQUIP 18.09%
- CHEMICALS,RELTD.PROD. 5.15%
- ANIMAL,VEG. OILS, FATS, WAX 0.41%
- FUELS, LUBRICANTS, ETC. 3.36%
- CRUDE MATERIALS,INEDIBLE 3.40%
- BEVERAGES AND TOBACCO 0.83%
- FOOD AND LIVE ANIMALS 8.28%
- GOODS NOT CLASSD BY KIND 0.27%
- MISC MANUFACTURED ARTCLS 41.03%

Share of Various Sectors in China's Export -- 2000

- MANUFACTURED GOODS 17.07%
- MACHINES,TRANSPORT EQUIP 33.15%
- CHEMICALS,RELTD.PROD. 4.85%
- ANIMAL,VEG. OILS, FATS, WAX 0.05%
- FUELS, LUBRICANTS, ETC. 3.15%
- CRUDE MATERIALS,INEDIBLE 1.79%
- BEVERAGES AND TOBACCO 0.30%
- FOOD AND LIVE ANIMALS 4.93%
- GOODS NOT CLASSD BY KIND 0.21%
- MISC MANUFACTURED ARTCLS 34.51%

Fig. (i) Composition of China's Export

Share of Various Sectors in Hong Kong's Export -- 1994

■ MACHINES,TRANSPORT
EQUIP
28.01%

■ MANUFACTURED GOODS
11.91%

■ CHEMICALS,RELTD.PROD.
3.79%

■ ANIMAL,VEG. OILS, FATS,
WAX
0.06%

□ FUELS, LUBRICANTS, ETC.
0.38%

□ CRUDE
MATERIALS,INEDIBLE
0.82%

■ BEVERAGES AND
TOBACCO
1.34%

■ FOOD AND LIVE ANIMALS
1.30%

■ MISC MANUFACTURED
ARTCLS
50.64%

■ GOODS NOT CLASSD BY
KIND
1.76%

Share of Various Sectors in Hong Kong's Export -- 2000

■ MACHINES,TRANSPORT
EQUIP
24.45%

■ MANUFACTURED GOODS
8.66%

■ CHEMICALS,RELTD.PROD.
3.44%

■ ANIMAL,VEG. OILS, FATS,
WAX
0.04%

□ FUELS, LUBRICANTS, ETC.
0.46%

CRUDE
MATERIALS,INEDIBLE
1.04%

■ BEVERAGES AND
TOBACCO
0.56%

■ FOOD AND LIVE ANIMALS
0.94%

■ MISC MANUFACTURED
ARTCLS
58.76%

■ GOODS NOT CLASSD BY
KIND
1.65%

Fig. (ii) Composition of Hong Kong's Export

Share of Various Sectors in Indonesia's Export -- 1994

FUELS, LUBRICANTS, ETC.
26.27%

ANIMAL,VEG. OILS, FATS, WAX
3.43%

CHEMICALS,RELTD.PROD.
2.52%

CRUDE MATERIALS,INEDIBLE
8.08%

MANUFACTURED GOODS
23.65%

BEVERAGES AND TOBACCO
0.34%

FOOD AND LIVE ANIMALS
8.87%

MACHINES,TRANSPORT EQUIP
7.61%

GOODS NOT CLASSD BY KIND
0.37%

MISC MANUFACTURED ARTCLS
18.85%

Share of Various Sectors in Indonesia's Export -- 2000

ANIMAL,VEG. OILS, FATS, WAX
2.85%

FUELS, LUBRICANTS, ETC.
25.24%

CHEMICALS,RELTD.PROD.
5.10%

MANUFACTURED GOODS
19.86%

CRUDE MATERIALS,INEDIBLE
6.95%

BEVERAGES AND TOBACCO
0.38%

FOOD AND LIVE ANIMALS
5.64%

GOODS NOT CLASSD BY KIND
0.63%

MACHINES,TRANSPORT EQUIP
17.33%

MISC MANUFACTURED ARTCLS
16.01%

Fig. (iii) Composition of Indonesia's Export

Share of Various Sectors in Japan's Export -- 1994

MACHINES,TRANSPORT EQUIP
71.95%

MANUFACTURED GOODS
10.69%

CHEMICALS,RELTD.PROD.
5.96%

ANIMAL,VEG. OILS, FATS, WAX
0.02%

FUELS, LUBRICANTS, ETC.
0.58%

CRUDE MATERIALS,INEDIBLE
0.65%

BEVERAGES AND TOBACCO
0.09%

FOOD AND LIVE ANIMALS
0.42%

GOODS NOT CLASSD BY KIND
1.92%

MISC MANUFACTURED ARTCLS
7.72%

Share of Various Sectors in Japan's Export -- 2000

MACHINES,TRANSPORT EQUIP
68.79%

MANUFACTURED GOODS
9.74%

CHEMICALS,RELTD.PROD.
7.34%

ANIMAL,VEG. OILS, FATS, WAX
0.02%

FUELS, LUBRICANTS, ETC.
0.32%

CRUDE MATERIALS,INEDIBLE
0.69%

BEVERAGES AND TOBACCO
0.07%

FOOD AND LIVE ANIMALS
0.37%

GOODS NOT CLASSD BY KIND
3.65%

MISC MANUFACTURED ARTCLS
9.03%

Fig. (iv) Composition of Japan's Export

Share of Various Sectors in S.Korea's Export -- 1994

MANUFACTURED GOODS
23.90%

CHEMICALS,RELTD.PROD.
6.60%

ANIMAL,VEG. OILS, FATS, WAX
0.01%

FUELS, LUBRICANTS, ETC.
1.82%

CRUDE MATERIALS,INEDIBLE
1.49%

BEVERAGES AND TOBACCO
0.11%

FOOD AND LIVE ANIMALS
2.39%

GOODS NOT CLASSD BY KIND
0.59%

MACHINES,TRANSPORT EQUIP
49.01%

MISC MANUFACTURED ARTCLS
14.08%

Share of Various Sectors in S.Korea's Export -- 2000

MANUFACTURED GOODS
17.64%

CHEMICALS,RELTD.PROD.
8.00%

ANIMAL,VEG. OILS, FATS, WAX
0.01%

FUELS, LUBRICANTS, ETC.
5.44%

CRUDE MATERIALS,INEDIBLE
1.06%

BEVERAGES AND TOBACCO
0.14%

FOOD AND LIVE ANIMALS
1.39%

GOODS NOT CLASSD BY KIND
0.89%

MACHINES,TRANSPORT EQUIP
58.21%

MISC MANUFACTURED ARTCLS
7.22%

Fig. (v) Composition of S.Korea's Export

Share of Various Sectors in Malaysia's Export -- 1994

CHEMICALS,RELTD.PROD.
2.65%

MANUFACTURED GOODS
9.03%

ANIMAL,VEG. OILS, FATS,
WAX
6.81%

FUELS, LUBRICANTS, ETC.
7.37%

MACHINES,TRANSPORT
EQUIP
53.40%

CRUDE
MATERIALS,INEDIBLE
7.49%

BEVERAGES AND TOBACCO
0.14%

FOOD AND LIVE ANIMALS
2.91%

GOODS NOT CLASSD BY
KIND
0.71%

MISC MANUFACTURED
ARTCLS
9.49%

Share of Various Sectors in Malaysia's Export -- 2000

MANUFACTURED GOODS
6.91%

CHEMICALS,RELTD.PROD.
3.83%

MACHINES,TRANSPORT
EQUIP
62.52%

ANIMAL,VEG. OILS, FATS,
WAX
3.47%

FUELS, LUBRICANTS, ETC.
9.62%

CRUDE
MATERIALS,INEDIBLE
2.76%

BEVERAGES AND
TOBACCO
0.33%

FOOD AND LIVE ANIMALS
1.73%

GOODS NOT CLASSD BY
KIND
0.83%

MISC MANUFACTURED
ARTCLS
8.02%

Fig. (vi) Composition of Malaysia's Export

Share of Various Sectors in Philippines' Export -- 1994

MACHINES,TRANSPORT
EQUIP
21.64%

MANUFACTURED GOODS
6.57%

CHEMICALS,RELTD.PROD.
2.30%

MISC MANUFACTURED
ARTCLS
14.90%

ANIMAL,VEG. OILS, FATS,
WAX
3.69%

FUELS, LUBRICANTS, ETC.
1.62%

CRUDE
MATERIALS,INEDIBLE
3.09%

BEVERAGES AND
TOBACCO
0.34%

FOOD AND LIVE ANIMALS
10.02%

GOODS NOT CLASSD BY
KIND
35.84%

Share of Various Sectors in Philippines' Export -- 2000

MACHINES,TRANSPORT
EQUIP
76.13%

CHEMICALS,RELTD.PROD
.
0.89%

MANUFACTURED GOODS
3.70%

ANIMAL,VEG. OILS, FATS,
WAX
1.25%

FUELS, LUBRICANTS,
ETC.
1.33%

CRUDE
MATERIALS,INEDIBLE
1.32%

BEVERAGES AND
TOBACCO
0.13%

MISC MANUFACTURED
ARTCLS
11.47%

FOOD AND LIVE
ANIMALS
3.38%

GOODS NOT CLASSD BY
KIND
0.40%

Fig. (vii) Composition of Philippines' Export

Share of Various Sectors in Singapore's Domestic Export -- 1994

- MANUFACTURED GOODS 3.67%
- CHEMICALS,RELTD.PROD. 7.06%
- ANIMAL,VEG. OILS, FATS, WAX 0.51%
- FUELS, LUBRICANTS, ETC. 12.24%
- CRUDE MATERIALS,INEDIBLE 1.32%
- BEVERAGES AND TOBACCO 0.30%
- FOOD AND LIVE ANIMALS 1.63%
- GOODS NOT CLASSD BY KIND 0.00%
- MISC MANUFACTURED ARTCLS 6.78%
- MACHINES,TRANSPORT EQUIP 66.49%

Share of Various Sectors in Singapore's Domestic Export -- 2000

- MANUFACTURED GOODS 2.60%
- CHEMICALS,RELTD.PROD. 8.68%
- ANIMAL,VEG. OILS, FATS, WAX 0.24%
- FUELS, LUBRICANTS, ETC. 12.73%
- CRUDE MATERIALS,INEDIBLE 0.71%
- BEVERAGES AND TOBACCO 0.15%
- FOOD AND LIVE ANIMALS 0.95%
- GOODS NOT CLASSD BY KIND 0.00%
- MISC MANUFACTURED ARTCLS 8.26%
- MACHINES,TRANSPORT EQUIP 65.68%

Fig. (viii) Composition of Singapore's Export

Share of Various Sectors in Taiwan(POC)'s Export -- 1994

MANUFACTURED GOODS
23.22%

MACHINES,TRANSPORT
EQUIP
48.10%

CHEMICALS,RELTD.PROD.
6.76%

ANIMAL,VEG. OILS, FATS,
WAX
0.03%

FUELS, LUBRICANTS, ETC.
0.70%

CRUDE
MATERIALS,INEDIBLE
1.81%

BEVERAGES AND
TOBACCO
0.06%

FOOD AND LIVE ANIMALS
3.36%

GOODS NOT CLASSD BY
KIND
0.08%

MISC MANUFACTURED
ARTCLS
15.89%

Share of Various Sectors in Taiwan(POC)'s Export -- 2000

MANUFACTURED GOODS
19.38%

MACHINES,TRANSPORT
EQUIP
58.20%

CHEMICALS,RELTD.PROD.
6.22%

ANIMAL,VEG. OILS, FATS,
WAX
0.02%

FUELS, LUBRICANTS, ETC.
1.11%

CRUDE
MATERIALS,INEDIBLE
1.26%

BEVERAGES AND
TOBACCO
0.34%

FOOD AND LIVE ANIMALS
1.19%

GOODS NOT CLASSD BY
KIND
0.19%

MISC MANUFACTURED
ARTCLS
12.09%

Fig. (ix) Composition of Taiwan(POC)'s Export

Share of Various Sectors in Thailand's Export -- 1994

ANIMAL,VEG. OILS, FATS, WAX
0.06%

CHEMICALS,RELTD.PROD.
2.83%

MANUFACTURED GOODS
11.90%

FUELS, LUBRICANTS, ETC.
0.77%

MACHINES,TRANSPORT EQUIP
33.31%

CRUDE MATERIALS,INEDIBLE
4.98%

BEVERAGES AND TOBACCO
0.36%

FOOD AND LIVE ANIMALS
20.61%

GOODS NOT CLASSD BY KIND
0.76%

MISC MANUFACTURED ARTCLS
24.41%

Share of Various Sectors in Thailand's Export -- 2000

CHEMICALS,RELTD.PROD.
5.93%

MANUFACTURED GOODS
11.72%

ANIMAL,VEG. OILS, FATS, WAX
0.11%

MACHINES,TRANSPORT EQUIP
43.66%

FUELS, LUBRICANTS, ETC.
3.22%

CRUDE MATERIALS,INEDIBLE
4.08%

BEVERAGES AND TOBACCO
0.25%

FOOD AND LIVE ANIMALS
14.08%

GOODS NOT CLASSD BY KIND
2.43%

MISC MANUFACTURED ARTCLS
14.52%

Fig. (x) Composition of Thailand's Export

Share of Various Sectors in UK's Export -- 1994

CHEMICALS,RELTD.PROD.
14.03%

MANUFACTURED GOODS
14.52%

ANIMAL,VEG. OILS, FATS,
WAX
0.14%

MACHINES,TRANSPORT
EQUIP
41.41%

FUELS, LUBRICANTS, ETC.
6.68%

CRUDE
MATERIALS,INEDIBLE
1.78%

BEVERAGES AND
TOBACCO
2.81%

FOOD AND LIVE ANIMALS
4.61%

GOODS NOT CLASSD BY
KIND
0.85%

MISC MANUFACTURED
ARTCLS
13.17%

Share of Various Sectors in UK's Export -- 2000

MANUFACTURED GOODS
12.10%

CHEMICALS,RELTD.PROD.
12.56%

ANIMAL,VEG. OILS, FATS,
WAX
0.08%

MACHINES,TRANSPORT
EQUIP
47.76%

FUELS, LUBRICANTS, ETC.
8.62%

CRUDE
MATERIALS,INEDIBLE
1.15%

BEVERAGES AND
TOBACCO
2.23%

FOOD AND LIVE ANIMALS
3.14%

GOODS NOT CLASSD BY
KIND
0.67%

MISC MANUFACTURED
ARTCLS
11.68%
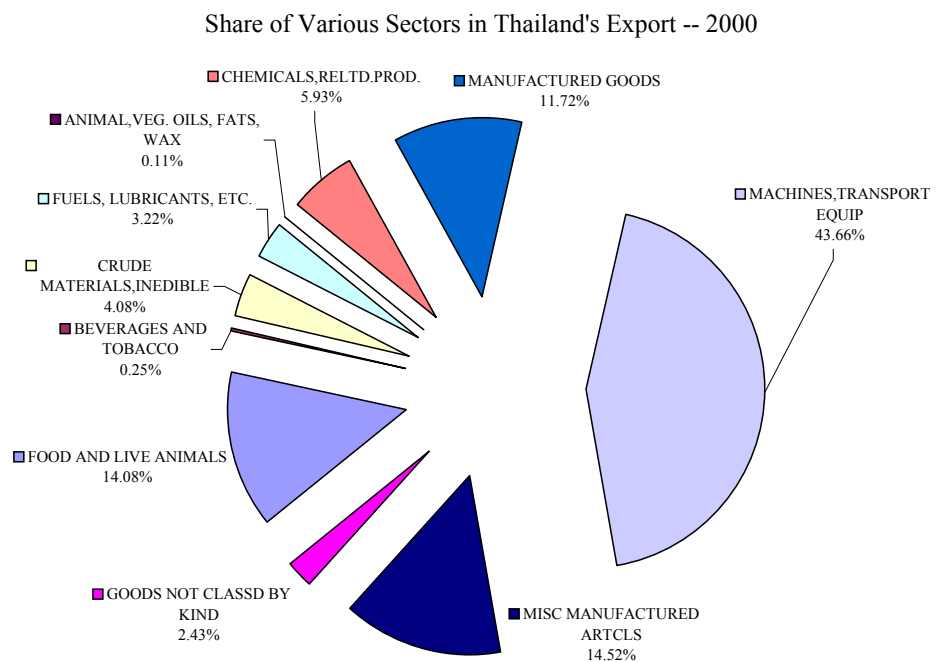
Fig. (xi) Composition of UK's Export

61

Share of Various Sectors in USA's Export -- 1994

MANUFACTURED GOODS
8.48%

CHEMICALS,RELTD.PROD.
10.71%

ANIMAL,VEG. OILS, FATS,
WAX
0.39%

FUELS, LUBRICANTS, ETC.
1.85%

CRUDE
MATERIALS,INEDIBLE
5.60%

BEVERAGES AND
TOBACCO
1.64%

FOOD AND LIVE ANIMALS
7.13%

GOODS NOT CLASSD BY
KIND
4.34%

MISC MANUFACTURED
ARTCLS
11.61%

MACHINES,TRANSPORT
EQUIP
48.26%

Share of Various Sectors in USA's Export -- 2000

MANUFACTURED GOODS
9.17%

CHEMICALS,RELTD.PROD.
11.22%

ANIMAL,VEG. OILS, FATS,
WAX
0.20%

FUELS, LUBRICANTS, ETC.
1.84%

CRUDE
MATERIALS,INEDIBLE
3.98%

BEVERAGES AND
TOBACCO
0.94%

FOOD AND LIVE ANIMALS
5.44%

GOODS NOT CLASSD BY
KIND
3.88%

MISC MANUFACTURED
ARTCLS
11.94%

MACHINES,TRANSPORT
EQUIP
51.39%

Fig. (xii) Composition of USA's Export

Appendix C: Composition of Mainland China's Export

SITC	Sectors	1996	1998	2000
0	Food and Live Animals	6.77%	5.77%	4.93%
00	Live animals	0.32%	0.24%	0.15%
01	Meat and meat preparations	0.95%	0.62%	0.50%
02	Dairy products & birds' eggs	0.05%	0.04%	0.03%
03	Fish, crustaceans, etc.	1.89%	1.44%	1.47%
04	Cereals & cereal preparations	0.35%	0.90%	0.73%
05	Vegetables & fruit	2.06%	1.63%	1.32%
06	Sugars, sugar preparations etc.	0.32%	0.17%	0.13%
07	Coffee, tea etc. & manuf. thereof	0.37%	0.32%	0.22%
08	Feeding stuff for animals	0.24%	0.12%	0.12%
09	Misc. edible products	0.22%	0.28%	0.25%
1	Beverages and Tobacco	0.89%	0.53%	0.30%
11	Beverages	0.24%	0.22%	0.18%
12	Tobacco & tobacco manuf.	0.65%	0.31%	0.12%
2	Crude Materials, inedible	2.67%	1.91%	1.79%
21	Hides, skins & furskins, raw	0.02%	0.01%	0.00%
22	Oil seeds & oleaginous fruits	0.32%	0.16%	0.17%
23	Crude rubber	0.04%	0.02%	0.02%
24	Cork & wood	0.31%	0.17%	0.18%
25	Pulp & waste paper	0.01%	0.01%	0.00%
26	Textile fibres & their wastes	0.47%	0.33%	0.44%
27	Crude fertilizers	0.63%	0.54%	0.44%
28	Metalliferous ores & metal scrap	0.06%	0.06%	0.05%
29	Crude animal & vegetable materials	0.82%	0.61%	0.49%
3	Fuels, Lubricants, etc.	3.93%	2.82%	3.15%
32	Coal, coke & briquettes	1.14%	1.02%	0.95%
33	Petroleum & related products	2.59%	1.45%	1.87%
34	Gas, natural & manufactured	0.04%	0.11%	0.09%
35	Electric current	0.16%	0.24%	0.24%

Table 5: (i) Share of Various Sectors in China's Export (in SITC 2-Digit Level)

SITC	Sectors	1996	1998	2000
4	Animals,Veg.Oils,Fats,Wax	0.25%	0.17%	0.05%
41	Animal oils & fats	0.00%	0.00%	0.00%
42	Fixed vegetables fats & oils	0.23%	0.15%	0.04%
43	Processed animals or veg. fats & oils	0.02%	0.02%	0.00%
5	Chemicals Reltd. Prod. Nes.	5.88%	5.61%	4.85%
51	Organic chemicals	1.50%	1.42%	1.25%
52	Inorganic chemicals	1.39%	1.27%	1.05%
53	Dyeing, tanning & coloring materials	0.49%	0.53%	0.46%
54	Medicinal & pharmaceutical prod.	1.00%	0.92%	0.72%
55	Essential oils & resinoids & perfume materials; toilet & cleaning preparations	0.24%	0.23%	0.19%
56	Fertilizers	0.12%	0.08%	0.13%
57	Plastics in primary forms	0.24%	0.29%	0.24%
58	Plastics in non-primary forms	0.19%	0.24%	0.21%
59	Chemical materials & products	0.69%	0.64%	0.62%
6	Manufactured Goods	18.87%	17.67%	17.07%
61	Leather, leather manuf. & dressed furskins	0.29%	0.30%	0.34%
62	Rubber manuf.	0.48%	0.49%	0.58%
63	Cork & wood manuf.	0.63%	0.57%	0.66%
64	Paper, paperboard & articles of paper pulp	0.52%	0.52%	0.54%
65	Textile yarn, fabrics, made up articles	**8.02%**	**6.97%**	**6.47%**
66	Non metallic mineral manuf.	2.18%	2.06%	1.89%
67	Iron & steel	2.41%	1.79%	1.76%
68	Non ferrous metals	1.10%	1.41%	1.35%
69	Manufactures of metals	3.25%	3.56%	3.48%

Table 5: (ii) Share of Various Sectors in China's Export (in SITC 2-Digit Level)

SITC	Sectors	1996	1998	2000
7	Machines, Transport Equip.	23.38%	27.32%	33.15%
71	Power generating machinery & equip.	1.02%	1.07%	1.20%
72	Specialized industrial machines	0.79%	0.68%	0.78%
73	Metalworking machinery	0.27%	0.24%	0.29%
74	General industrial machinery & equip.	1.94%	1.96%	2.35%
75	Office machines & automatic data processing machines	**4.45**%	**6.44**%	**7.48**%
76	Telecom. & sound recording & reproducing apparatus & equip.	**5.96**%	**6.04**%	**7.83**%
77	Electrical mach., apparatus & appli.	**6.32**%	**7.55**%	**9.64**%
78	Road vehicles	1.70%	1.95%	2.63%
79	Other transport equipment	0.93%	1.38%	0.94%
8	Misc Manufactured Articles	37.25%	38.19%	34.51%
81	Prefabricated buildings; sanitary, plumbing, heating & lighting fixtures	0.67%	0.72%	0.88%
82	Furniture & parts thereof	1.25%	1.53%	1.84%
83	Travel goods, handbags	1.80%	1.77%	1.56%
84	Articles of apparel & clothing accessories	**16.57**%	**16.35**%	**14.47**%
85	Footwear	4.70%	4.56%	3.95%
87	Professional, sci. & controlling instruments	0.66%	0.85%	1.05%
88	Photographic apparatus, equip. & supplies	2.16%	2.07%	1.85%
89	Miscellaneous manufactured articles	9.42%	10.33%	8.90%
9	Goods Not Classified	0.12%	0.00%	0.21%
91	Postal packages not classified	0.12%	0.00%	0.21%
93	Special transactions & commod not classified	0.00%	0.00%	0.00%
96	Coin, not being legal tender	0.00%	0.00%	0.00%
97	Gold, non monetary	0.00%	0.00%	0.00%

Table 5: (iii) Share of Various Sectors in China's Export (in SITC 2-Digit Level)

References

[1] Bu, Y. and R. Tyers (2001), "China's Equilibrium Real Effective exchange Rate: An Aggregated General Equilibrium Approach", Working Papers in Economics and Econometrics No.390, Australian National University. (http://ecocomm.anu.edu.au/departments/economics/staff/tyers.html).

[2] Chamberlain, G., (1980), "Analysis of Covariance with Qualitative Data", Review of Economic Studies, Vol. 47 pp.225-238.

[3] Chen, X.B., (1999), "An Analysis of the Real Exchange Rate of the RMB", The Economic Research Journal, 1:22-28 (written in Chinese).

[4] Dornbusch, R. (1999), "Don't devalue the Renminbi", the 5th Column, Far Eastern Economic Review, August 26, pp.30.

[5] Feenstra, Robert, Hai, Wen, Woo, Wing T. and Yao, Shunli (1998), "The U.S.-China Bilateral Trade Balance: Its Size and Determinants", Paper presented at the UNDP-HIID Conference on China's Integration into the Global Economy.

[6] Fernald, John G., Edison, Hali J., Loungani, Prakash (1998), "Was China the First Domino?: Assessing Links Between China and the Rest of Emerging Asia", Federal Reserve Board International Finance Discussion Paper No. 604.

[7] Forbes, Kristin (2001) "Are Trade Linkages Important Determinants of Country Vulnerability to Crises", NBER w8194.

[8] Fung K.C. (1996), "Accounting for Chinese Trade: Some National and Regional Considerations", NBER Working Paper 5595.

[9] Fung, K.C. and Lawrence J. Lau (1996), "U.S.-China Bilateral Trade balance: How Big is it Really", University of California, Santa Cruz, and Stanford University, mimeo.

[10] Glick, Reuven and Rose, Andrew (1998) "Contagion and Trade: Why are Currency Crises Regional", NBER w6806.

[11] Glosten, L.R., Jaganathan, R., and Runkle, D. (1991), "On the Relation between the Expected Value and the Volatility of the Normal Excess Return on Stocks", Journal of Finance, 48, p.1779-1801.

[12] Greene, W.H., 2000, "Econometric Analysis", *Prentice Hall, New Jersey.*

[13] Lancaster T., 1991, "The Incidential Parameter Problem since 1948", *Journal of Econometrics, Vol. 95 pp.391-413.*

[14] Lau, Lawrence J. and Yan, Isabel K. (2003), "Predicting Currency Crises with a Nested Logit Model", manuscript, Stanford University.

[15] Makin, John, (1997), "Two New Paradigms", Washington: American Enterprise Institute, October.

[16] Mckinnon, Ronald (2001) "After the Crisis, the East Asia Dollar Standard Resurrected", in Stiglitz, Joseph and Shahid, Yusuf (eds),: "Rethinking the East Asian Miracle", New York, p.197-244.

[17] McKinnon, Ronald (2003), "China's Exchange Rate", Asian Wall Street Journal, 27 June 2003.

[18] Neyman, J. and E.L.Scott, 1948, "Consistent Estimation from Partially Consistent Observations", *Econometrica, Vol. 16 pp.1-32.*

[19] Ni, W. (1999), "An Analysis of the Effect of Currency Depreciation in a Non-equilibrium Environment", Economic Research, No.4 (written in Chinese).

[20] Noland, Marcus, Robinson, Sherman, Wang, Zhi and Liu, Li-Gang (1998), "Asian Competitive Devaluations", Institute For International Economics, Working Paper 98-2.

[21] Roberts, Ivan and Tyers, Rod, (2003), "China's Exchange Rate Policy: The Case For Greater Flexibility", Asian Economic Journal, Volume 17 Issue 2, June 2003, pp. 155.

[22] Tyers, Rod, (2000), "China after the Crisis: the Elemental Macroeconomics", Asia Pacific School of Economics and Management, Working Papers 00-2.

[23] Tyers, R. and Yang Y., (2000a), "The Crisis and the Economic Change in China", Working Papers in Economics and Econometrics, Australian National University, April 2000.

[24] Tyers, R. and Yang Y., (2000b), "Weathering the Crisis: The Role of China", Pacific Economic Papers No. 308, Asia-Pacific School of Economics and Management, Australian National University, November 2000. (http://ecocomm.anu.edu.au/departments/economics/staff/tyers.html)

[25] Zhang, Zhaoyong (1999), "Foreign Exchange Rate Reform, the Balance of Trade and Economic Growth: An Empirical Analysis for China", Journal of Economic Development, Vol. 24(2), Dec 1999.