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UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

ESSAYS ON INTERNATIONAL ECONOMICS

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

In partial fulfillment of the requirements for the

Degree of

Doctor of Philosophy

By
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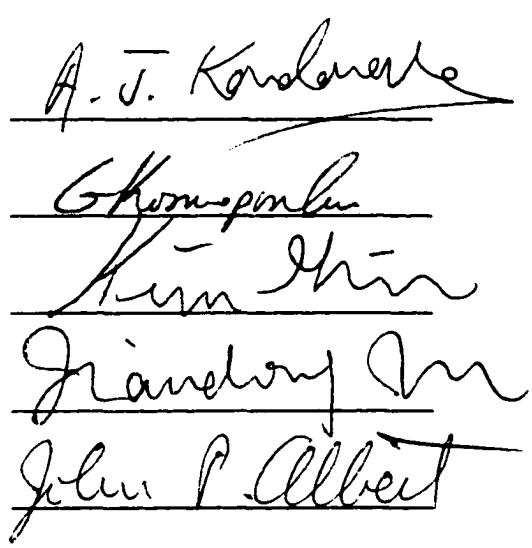
A Dissertation APPROVED FOR THE
DEPARTMENT OF ECONOMICS

BY



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INTRODUCTION

While existing studies of the contagious currency crises concentrate on the financial sector channel, this dissertation conducts studies to show that both real and financial sector channels can be important to explain the severity of a currency crisis. This dissertation presents evidence suggesting that trade patterns, common bank lending, herd behavior, and short term capital inflows play a role in transmitting currency crisis across countries. The dissertation is composed of two essays on contagious currency crises.

The first chapter, "Contagion Currency Crisis: Is Trade a Channel?," presents empirical evidence that trade linkages can explain contagion above and beyond macroeconomic fundamentals. Trade variables are found to be statistically significant in explaining crises spread in both the Asian crisis of 1997-98 and Mexican peso crisis of 1994-95. We find evidence suggesting that links of trade channels to the severity of the crisis have been the same for both crises. This paper also finds evidence that China's 50% devaluation in 1994 put competitive pressure on other Asian economies' exports and, as such, slowed down their export growth. This was especially true for Thailand, the first victim of the Asian crisis, where export growth nearly collapsed. Thus, China may have been the first domino in the Asian crisis of 1997- 1998.

The second chapter, "Contagious Asian Crisis: Bank Lending, Herd behavior, and Capital Inflows," investigates two financial channels, bank lending, and capital inflows to explain the severity of the crisis. First, crises can spread across countries through common bank lending. An offshore bank may lend to many countries. If any one those countries, especially a major borrower, is hit by a financial crisis, then it will affect the bank's balance sheet. The bank needs to rebalance its portfolio, which may require credit contraction to other borrowers, and that might result in financial crises in those countries. We find that countries that share Japanese banks as their major lender with Thailand, the first victim in the Asian crisis, tend to experience currency crisis. Second, it has been argued after the Asian crisis that one of the reasons the Asian crisis became so severe was that all of those countries received huge capital inflows. After the crisis started in Thailand, investors were moving capital out of this region. This created huge capital outflows. Subsequently many Asian tigers had to devaluate their currency heavily.

Some economists were quick to reason that the enormous capital inflows were the main reason for the crisis spread. We argue in this essay that it was short-term capital inflows, not total capital inflows, that were the main culprit in this episode. Long-term capital inflows such as foreign direct investment are beneficial, because they increase the productive capacity of the country and they are less volatile as well. On the other hand, short-term capital inflows are very volatile and are associated with consumption booms. Short-term flows also create inefficient investment. When a country enters into an economically tough period, very quickly short-term inflows become outflows and that brings countries to their knees. We find evidence that links short-term capital inflows to the severity of the Asian currency crisis. Finally, crises can spread through herd behavior. In this mechanism, there is no formal channel through which crises can spread. In the herding mechanism, investors simply follow other investors. When the crisis started in Thailand, investors considered all of East Asia as one troubled region. They thought that if Thailand was in trouble, so was Malaysia. Therefore, their mood was to get out of that region. We investigate this issue and found that investors were in fact considering the Southeast Asian countries as one troubled region rather than rationally trying to differentiate between economies. This creates herding contagion. We compare the cross-country correlations among stock returns of Thailand, Malaysia, Indonesia, Korea, and Philippines between crisis and tranquil period to test for the existence of contagion.

Chapter 1

Contagious Currency Crises:

Is Trade a Channel?

I. Introduction:

We have seen several major currency crises during the 1990's such as the European Monetary System (EMS) crisis of 1992-1993, The Tequila crisis of 1994-1995, the Asian crisis of 1997-1998, and more recently the Brazilian and the Russian currency crises. How these crises spread from the first victim to other countries has caught the attention of a growing number of economists in recent times. Eichengreen, Rose, and Wyplosz (1996) and Glick and Rose (1999) found that the strength of trade links were very useful in explaining the contagious nature of currency crises.[1] This paper also finds evidence that contagion in both the Asian currency crisis and the Mexican peso crisis can be explained through trade channels, even when controlling for macroeconomic fundamentals. We find the evidence suggesting that the link between trade channels and the severity of the crises is the same for both crises.

We study the Mexican peso crisis of 1994-95 and the Asian crisis of 1997-98 using cross-sectional data. Our sample consists of 25 emerging countries. This paper is most similar to Glick and Rose (1999). However, we differ from Glick and Rose (1999) in that we investigate whether there is a structural change in the models that explains the spread of the crisis in the Tequila crisis and in the Asian crisis, respectively.

Mexico was clearly the first domino in the Tequila crisis. On the other hand, it is not clear whether or not Thailand was the first domino in the Asian crisis. Some recent studies suggest that China was, in fact, the first domino in the Asian crisis. Therefore, the paper asks another important question, was China the first domino in the Asian crisis? Krugman (1998) concludes that the slide toward crisis began with an export slowdown in the region partly due to growing competition from China. How could Asian countries

have growing competition from China? The Chinese devaluation on January 1, 1994 made Chinese exports more competitive against neighboring countries. Radelet and Sachs (1998) reason that devaluation in the Chinese Yuan probably contributed to export slowdown in some Asian countries. Bergsten (1997) and Balla (1998) also suggest that China's devaluation was a major cause of East Asian devaluations three years later.[2] We find statistically significant results suggesting that export competition with China in a third market tends to make the 1997 currency crisis more severe among our sample countries.

The paper is organized as follows. Section II gives a brief survey of theoretical and empirical literature on currency crises and contagion. Section III provides our methodology, followed by our main empirical results in Section IV. Section V concludes the paper.

II. Literature on Currency Crises:

A.Theoretical:

Krugman's (1979) seminal work explains how macro economic imbalances can lead to a collapse of the currency peg. The model assumes that the domestic credit expansion related to monetization of a persistent fiscal deficit. This expansionary policy causes gradual loss of foreign reserves, which are exhausted in a perfectly foreseen speculative attack. Thus the fixed exchange rate system collapses. Krugman's work was later extended and modified by several authors. Some notable works are Flood and Garber (1984), Obstfeld (1984), more recently Flood, Garber and Kramer (1996).[3]

Obstfeld (1986) shows that self-fullfilling speculative attacks on currency might emerge even though fundamentals are consistent with fixed parity. This occurs if market participants believe that, after an attack on the currency, the ex-post fundamental will be inconsistent with the peg. They then will attack the currency ex-ante and the monetary authority will eventually abandon the peg. This creates possibility of the multiple equilibria.[4] In one equilibrium a country maintains the peg while in another one, a country abandons the peg. If there is no attack on the currency, then there is no change in sound fundamentals; thus, the maintenance of the peg. On the other hand, if currency is attacked with the expectation of ex-post unsound fundamentals, then that puts pressure on the fundamentals and leads to the consequent collapse of the exchange rate system. Since the attack on the currency forces the abandonment of an otherwise viable peg, these attacks are self-fulfilling. Recent papers of this type include Obstfeld (1994, 1996), Flood and Marion (1996) and Bensaid and Jeanne (1997). One of the striking differences between early and recent models is, in the earlier models such as Obstfeld (1986) government sets its objective function at random while recent literature suggests government maximizes its policy objectives. Government continuously compares the benefit of changing the exchange rate with the cost of defending the exchange rate. Cost is an increasing function of self-fulfilling attacks. If cost exceeds benefit the peg collapses. One important aspect that we need to understand is that the self-fulfilling nature of the attacks cannot completely rule out the importance of maintaining good fundamentals. Even in the models with self-fulfilling attacks, there is a range of sound fundamentals that rules out speculative attacks. Jeanne (1997) shows how fundamentals and the self-fulfilling nature of the attacks can complement each other.

B. Empirical:

There have been a large number of empirical studies on currency crises emerging since Krugman (1979) canonical work.[5] Some papers, such as Blanco and Garber (1986) and Cumby and Wijnbergen (1989) focus on a particular country in a specific time period.[6] Even though country specific studies produce some robust results, the generality of the results are always open to question, because the results are driven from a single country. Recent studies such as Eichengreen, Rose, and Wyplosz (1995), Sachs, Tornell, and Velasco (1996), Tornell (1999), Corsetti, Pasenti, and Roubini (1998), and Kaminski (1999a) are all multicountry studies. These multi-country studies generally find evidence suggesting that weak fundamentals may lead to the propagation of currency crises. These multicountry studies use non-structural models and find somewhat more general results, but are not as robust as single country studies. The currency crises of the 90's challenged the first generation hypothesis that fundamental imbalance is the only cause of speculative attacks. In their empirical studies, Jean (1997) and Jeanne and Masson (2000), find evidence that the crisis of French franc, 1992-1993, had some self-fulfilling components. Webber (1997) and Flood and Marion (1996) try to distinguish between fundamentals and speculative components of a crisis empirically. In the wake of the Asian currency crisis of 1997-98, Kaminsky (1999a) demonstrates that a banking crisis precedes a currency crisis. Glick and Hutchison (1999) also find similar results for emerging markets.

C. Contagion:

The propagation of currency crises across countries has caught the attention of a growing number of economists in recent times. In this section, we shall put together a

brief survey of such studies. Firstly, countries with similarly weak fundamentals (macroeconomic and financial) as the first victim will also face speculative attacks, as investors reduce their exposure in those economies. Thus, crises can spread across countries through economic fundamentals. Sachs, Tornell and Velasco (1996), Tornell (1999), Frankel and Rose (1996), Corsetti, Pasenti and Roubini (1998), and Kaminsky and Reinhart (1999a) find evidences suggesting that macroeconomic and financial imbalances can explain the cross country variations of crises spread.

Contagion can arise from "herd" behavior. In herding mechanism investors simply follow other investors, and that cannot be justified by their own expectation about the market based on the information they have. This behavior may occur, because a single investor knows only some partial information about the market and he/she may not know the information that other investors possess. Thus, when a group of investors start selling, a single investor follows blindly, even though his/her own expectation about the market is positive. It is costly with respect to time and money to acquire more information about the market. Therefore it creates a bandwagon effect such that small investors simply follow large investors or single investors follow a group of investors who may have superior information about the market. A large scale herding will run down a country's international reserves and pegging will collapse. Calvo and Mendoza (1997) find that globalization of financial markets lead to herd behavior. They show that the payoff of gathering and processing country specific information declines with the globalization of capital markets and that leads to herding. Kaminsky and Schmukler (1999) find evidence suggesting that large swings in market behavior in Asian crisis can be explained by herd behavior.[7]

Another type of contagion currency crises arises from multiple equilibria. A crisis in one country increases the probability of a crisis in another country. Investors are usually operating in several countries. If there is a crisis in one country, then investors may reassess their positions in other countries, which might bring other countries into the sunspot; and that might shift investors' expectation about those countries from good to bad. Thus, a crisis in one country increases the probability of a crisis in another country. Masson (1997) shows how a crisis could spread from one country to others through the mechanism of multiple eqilibria.

Contagion can spread across countries through the mechanism of a political channel. Drazen (1998) shows how devaluation in one country makes it politically less costly for other countries to devalue. For example, in the 1992 EMS crisis, it became less costly politically for France to devaluate after the devaluation of the British pound. In the process of economic integration, member countries try to keep fixed parity, and a devaluation would be politically costly.[8]

Another type of channel by which crises can spread across countries is through common bank lending. An offshore bank may lend to many countries. If any one of those countries, specially a major borrower, is hit by a financial crisis, then it will affect the bank's balance sheet. The bank needs to rebalance its portfolio, which may require credit contraction to other countries, and that might result in financial crises in those countries. Kaminsky and Reinhart (1999b), Van Rijkehem and Weder (1999) and Khan (2000) find evidence supporting this hypothesis.

Finally, crises can spread across countries through trade channels. The most direct form of this channel is through bilateral trade. A devaluation in one country will

negatively affect the trade balance of its trading partners in the presence of nominal rigidities.[9] Another form of trade link that can be considered is an indirect link. In the case of two countries competing for exports in a common third market, a devaluation in any one country will put competitive pressure on the other country. Eichengreen, Rose and Wyplosz (1996) and Glick and Rose (1999) find evidence suggesting that trade links are significant in explaining the contagious nature of currency crises.

III. Methodology:

We focus on two episodes of currency crises, the Asian crises of 1997-98, and the Mexican peso crisis of 1994-95. Our objective for this paper is to determine possible trade channels in explaining the contagion for those two crises. Our interest is not to determine how and when a crisis originated in a first victim, but rather how a crisis spread across emerging markets from the first victim. The benchmark regression framework is of the form:

$$Crisis_j = \alpha_0 + \sum \beta_i Trade_{ij} + \sum \delta_i Macro-controls_{ij} + \varepsilon_j$$

Where $Crisis_j$ is a continuous measure of exchange market pressure calculated as the weighted average of the percentage depreciation of nominal exchange rate with respect to US dollar and the percentage decline in foreign reserves for six months following the start of the crisis.[10] The weights are determined so as to equalize the volatility of the components. We calculate the inverse of the variances for each variable with three years of monthly data prior to each crisis. Then we compute weights of each variable as its inverse of the variance over the sum of the inverses of the variances.[11, 12]

Trade Indices:

We calculate $TMEC_j$ (Third market Export Competition) index as follows:

$$TMEC_j \text{ (share)} \equiv \sum_r \left\{ \left[(x_{0r} + x_{jr}) / (x_0 + x_j) \right] \bullet \left[1 - \left| (x_{jr} / x_j - x_{0r} / x_0 \right| / (x_{jr} / x_j + x_{0r} / x_0) \right] \right\}$$

Where 0 stands for ground zero (first victim) country and r stands for a common third market where ground zero and country j compete in exports. x_{jr} represents country j's export to a third market r. x_j denotes export from country j to world export market. The first component of the equation is a measure of overall importance of a third market to country j and 0. The second component captures the extent to which country j and the first victim compete with respect to trade share in a third market. We divide the World export market into five mutually exclusive regions: Africa and Middle East, Latin America, U.S. and Canada, Europe, and Asia and Oceania, and calculate export competition of country j with the first victim in each one of the five markets. The TMEC index for any country can be calculated by summing up the TMEC for all five markets.

We also calculate a variant measure of third market trade competition that uses absolute value of exports to a third market rather than export share.

$$TMEC \text{ (absolute)} \equiv \sum_r \left\{ \left[(x_{0r} + x_{jr}) / (x_0 + x_j) \right] \bullet \left[1 - \left| (x_{jr} - x_{0r} \right| / (x_{jr} + x_{0r}) \right] \right\}$$

Our trade data are cross-sectional and come from IMF's *Direction of Trade Statistics*.[13] We use 1994 trade data for the Mexican crisis and 1996 for the Asian crisis. We also use 1993 trade data to find trade links between China and other countries in the sample. Since China devaluated on January 1, 1994, it is reasonable to use 1993 trade data to assess trade links with China and to estimate how these links put competitive pressure on other countries.

Macro control:

A number of macro-economic and financial variables can explain the contagious nature of a crisis. Countries with macro-economic and financial imbalances may face speculative attacks. The control variables that we employ in this study are drawn from a set of variables that have been shown to be relevant in explaining currency crises in the empirical literature.[14] We use the following variables: lending boom, real exchange rate appreciation, current account balance as a percentage of GDP, the government budget as a percentage of GDP, and the level of M2 over international reserve.[15] It is evident from the empirical literature that the above macro variables can explain contagion currency crises. We are interested in determining whether trade variables can help to explain contagion when we control for the effect of the above macro controls.

The data are two cross-sections for 25 emerging market countries. The countries in the sample are: Argentina, Brazil, Mexico, Chile, Colombia, Peru, Venezuela, India, Indonesia, Korea, Malaysia, Pakistan, The Philippines, Sri Lanka, Thailand, Jordan, South Africa, Turkey, Zimbabwe, Poland, Czech Republic, Hungary, Singapore, China, and Taiwan.[16] We use 1994 macro data for the Mexican crisis and 1996 data for the Asian crisis.[17]

IV. Results:

The main results are reported in Tables 1 through 3. Equation 1 of Table 1, reports the results of regressing, the crisis index on the macro control variables and the variable TMEC. The variable TMEC has the expected sign and is significant at the 5% level. Countries that have strong trade links [18] with the first victim[19] through the export

competition in a third market have depreciated their currency or lost reserves or both in the Asian crisis. None of the macro control variables are significant except for current account. The current account is significant at the 10% level and it has the correct sign. Current account deficits tend to increase the severity of a crisis. Therefore, for the Asian crisis strong export competition between first victim and other countries in the third market can explain possible crisis severity. From Equation 2, it is evident that TMEC is significant (at the 10% level) and positively related to crisis index for the Mexican peso crisis. However, we cannot find any evidence suggesting that variations of economic fundamentals could explain the crisis spread. We stacked 48 observations for the Asian and Mexican currency crises, and estimated the pooled models in Equation 3. TMEC have correct signs and significant at the 1% level in the estimations of the pooled models. We would like to answer another question at this point; whether the same model that explains the contagion in the Asian crisis can also explain the severity of the crisis spread in the Mexican crisis. In other words, we are interested to know whether the coefficients of Equation 3 are the same in both periods. First, we perform Chow test on models involving TMEC, and the test statistic is

$$F[7, 34] = \frac{[2412.1 - 570.98 - 1531]/7}{[570.98 + 1531]/34} = .716$$

Since $F[7, 34] < F_{c,\ 5\%\ level} = 2.33$, we cannot reject the null hypothesis that the model that explains the Asian crisis can also explain the Mexican peso crisis. Coefficients of the model presented in Equation 5 are the same in both periods.

Table 2 presents the export growth of selected Asian countries. We notice that while China's export growth was flourishing between 1994-1996 in the crucial Asian & Oceania and USA & Canadian markets, most of the other Asian economies (Asia 5)

experienced a slowdown in export growth in these regions. Notably, Thailand's (first victim in the Asian crisis) export growth collapsed after China's devaluation. On the other hand, the 50% devaluation by China in 1994 had a huge impact on its imports. Chinese imports from every market collapsed after the devaluation, while most of the Asia 5 countries showed acceleration in import growth as presented in Table 3. Chinese trade surpluses continued to grow in the post-devaluation periods. The Asia 5 countries' trade deficits were worsening after Chinese devaluation as can be seen in Table 4. Beggar-thy-neighbor policies entail an increase in the trade surplus that may come not only through large gains in exports, but also through contraction in imports. Therefore, the Chinese devaluation affected its neighbors, especially Thailand.

The rankings of trade competitors of China in our sample are tabulated in Table 5. Higher rank means greater export competition with China in a third country export markets. Not surprisingly, all seven countries at the top of the list experienced currency crises in 1997-1998. Equation 1 of Table 6 presents our regression results and suggests that China was in fact the first domino in Asian crisis. TMEC is significant at the 1% level and has a positive effect on crisis index. Thus, trade links with China increases the severity of a currency crisis. Here, we choose China as a ground zero country instead of Thailand and found evidence that links trade competition to the severity of the Asian crisis. We then test whether our choice of ground zero matters to link trade variable to crisis propagation. We choose a "dummy" country Czech Republic which does not have any substantial trade link in terms of competition for exports in a third market with the crisis hit Asian countries. Equation 2 of Table 6 tests the significance of TMEC with Czech Republic as a ground zero country, and we found that TMEC is insignificant and

have wrong sign. Thus, our choice of ground zero country matters to link trade with crisis severity.

Sensitivity Analysis:

We test the robustness of our benchmark cases, presented in Tables 1 and 6, by using a different set of macro control variables, by using different measures of the dependent variable, and by using variant measures of trade variable. TMEC estimate in the pooled regressions are very robust to those tests. Again our findings in Table 6 that China is the first domino in the Asian crisis also passed different sensitivity tests. Table 7 to 9 presents these robustness tests. Various other sensitivity tests such as excluding outliers and changes in the country composition of the sample were conducted and our findings are relatively robust.

V. Conclusions:

The purpose of this paper is to find whether trade linkages, through competition for export in third markets with the first victim, tend to make balance of payments crises more severe. We find that trade links through export competition in a third market with the ground zero country are statistically significant, and increase the severity of crisis for both the Asian and Mexican currency crises. These results are also robust to different specifications. We find that the model that explains the contagion in the Mexican peso crisis can also explain the severity of the crisis spread in the Asian crisis. Clearly, trade links explain the severity of the crises in both episodes. There was no structural change in the models.

We also find evidence that China was the first domino in the Asian crisis. China's exports were growing, while its imports nearly collapsed after the devaluation of 1994. Therefore China's trade balance was increasing. We see exactly the opposite phenomenon for its export competitors or trading partners. Beggar-thy-neighbor policies entail an increase in the trade surplus that may come not only through large gains in exports, but also through contraction in imports. The Chinese devaluation affected its neighbors, especially Thailand, whose export growth nearly collapsed after the devaluation. We also find evidence, using China as a ground zero country in Glick and Rose's (1998) model, suggesting that trade links with China through export competition in a third market tend to make competitive devaluation more severe.

For future research, it will be interesting to conduct a similar study on contagion through trade channels with sector-specific trade data, if data are available. Sector-specific export competition in a third market will definitely be a better measurement of competition; thus, the competitive devaluation story will become even more vivid.

Table 1: Coefficients and absolute t statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

	Crisis 1997-1998.	Crisis 1993-1994.	Pooled regression
Variable	Eq. 1	Eq.2	Eq.3
Constant	-5.701 (1.466)	-8.005 (2.124)**	-7.233 (3.495)**
Lending Boom	.002 (.111)	-.005 (.428)	-.004 (.415)
Real Appreciation	.418 (1.712)	-.290 (1.124)	.034 (.169)
Current Account	-.504 (1.873)*	-.37 (1.435)	-.390 (2.248)**
M2/Reserve	-.081 (1.15)	.165 (1.329)	-.0278 (.498)
Budget	.096 (.204)	.084 (.295)	.012 (.049)
TMEC	.208 (2.401)**	.151 (1.988)*	.210 (4.265)**
R^2	.301	.305	.372

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 2: Export growth of Asian countries in different regions

Country	Region	Export ($ Bn)				Growth	
China		1990	1993	1994	1996	90-93	94-96
	US & Canada	15.7	18.2	22.8	28.3	6.42	9.38
	Europe	9.3	16.5	19.8	24.4	24.90	9.07
	Asia & Oceania	43.3	50.7	71.8	89.2	6.85	9.42
Indonesia	US & Canada	3.5	5.5	6.5	7.2	19.62	4.44
	Europe	3.3	5.8	6.8	8.4	24.49	9.17
	Asia & Oceania	17.8	23.2	23.5	31.4	11.5	12.58
Korea	US & Canada	21.2	19.5	21.9	22.9	-3.63	1.93
	Europe	10.9	11.7	12.9	19.1	3.07	17.04
	Asia & Oceania	25.2	39	45.8	67.1	18.96	16.58
Malaysia	US & Canada	5.2	10	13	14.8	17.31	5.63
	Europe	4.9	7.3	8.9	11.4	18.32	10.75
	Asia & Oceania	18.1	27.6	34.1	48.6	14.80	15.38
Philippines	US & Canada	3.2	4.5	5.4	7.2	14.61	12.49
	Europe	1.5	2.1	2.4	3.7	13.18	18.79
	Asia & Oceania	3.1	4.2	5.2	9.1	18.90	24.30
Thailand	US & Canada	5.5	8.5	10.1	10.6	18.90	2.98
	Europe	5.8	8.7	8.3	10	17.60	8.01
	Asia & Oceania	9.4	17.4	23.9	30.8	26.74	11.01

Source: International Monetary Fund, *Direction of Trade Statistics*

Table 3: Import Growth of Asian Countries in different markets.

Country		Import				Growth	
China	Region	1990	1993	1994	1996	90-93	94-96
	US & Canada	8.1	12	15.8	18.7	17.06	7.32
	Europe	13	24.1	25.5	27.8	26.81	3.75
	Asia & Oceania	29.7	61.7	67.9	81.7	31.75	8.03
Indonesia	US & Canada	2.9	3.7	3.9	5	10.58	10.79
	Europe	5	7.3	6.8	10.6	16.43	19.27
	Asia & Oceania	12.2	15.5	18.3	24.6	10.40	12.84
Korea	US & Canada	18.4	19.6	23.6	36	2.74	18.33
	Europe	9.9	13	16.5	25.6	11.83	19.07
	Asia & Oceania	29.4	38	46.1	63.6	11.14	13.97
Malaysia	US & Canada	5.2	7.9	10.1	12.6	18.16	9.60
	Europe	5.2	6.6	10.3	13.3	10.35	11.10
	Asia & Oceania	17.6	29.7	37.4	49	22.72	11.73
Philippines	US & Canada	2.7	3.6	4.3	6.5	12.49	17.94
	Europe	1.7	2.3	3	4.6	13.13	18.56
	Asia & Oceania	6.6	9.7	13	17.4	16.72	12.66
Thailand	US & Canada	4	5.7	6.8	9.8	15.38	15.87
	Europe	6.4	9.5	10.4	13.2	17.15	10.35
	Asia & Oceania	20.1	27.3	33.3	42.7	13.29	10.79

Source: International Monetary Fund, *Direction of Trade Statistics*

Table 4: Trade Balance (% of GDP)

Country	1993	1994	19995	1996
China	-1.92	1.39	1.68	2.10
Indonesia	1.48	.72	-.76	-1.14
Malaysia	-.11	-1.59	-3.75	.58
Korea	.06	-1.22	-1.63	-4.36
Philippines	-8.53	-8.95	-8.80	-9.44
Thailand	-4.56	-5.18	-7.09	-6.65

Source: *International Financial Statistics*

Table 5: Measure of Third Market Trade Competition With China

Rank	Country
1	Malaysia
2	Singapore
3	Indonesia
4	Thailand
5	Korea
6	Philippines
7	Taiwan
8	India
9	Chile
10	Pakistan
11	Peru
12	Brazil
13	Sri Lanka
14	Jordan
15	South Africa
16	Argentina
17	Zimbabwe
18	Columbia
19	Turkey
20	Venezuela
	Poland
22	Mexico
23	Hungary
24	Czech Republic

Table 6: Coefficients and absolute t statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.

Variable	Eq. 1	Eq. 2
Constant	-11.287 (3.474)**	10.523 (2.074)**
Lending Boom	-.016 (1.513)	.018 (1.264)
Real Appreciation	.717 (2.865)**	.598 (1.30)
Current Account	-.528 (2.0)*	-1.153 (3.313)**
M2/Reserve	-.113 (1.448)	-.038 (.637)
Budget	-.063 (.121)	.858 (1.693)
TMEC	.332 (4.604)**	-9.955 (1.024)
R^2	.504	.249

We use China as a ground zero country in this measurement to test whether China is the first domino in the Asian Crisis.
Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% level or better

Table7: (Robustness test: different macro controls)
Coefficients and absolute t statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

	Pooled regression	China (as ground zero)
Variable	Eq. 1	Eq. 2
Constant	-7.049 (2.931)**	-11.316 (2.855)**
%Δ Credit	.055 (1.025)	.116 (.521)
Δ (Budget)	.033 (.074)	1.060 (.721)
Δ (Current Account)	-.578 (1.387)	-1.016 (1.037)
Capital inflows	.181 (.887)	.558 (1.466)
%Δ M1	-.007 (.184)	.078 (.315)
TMEC	.195 (4.055)**	.255 (3.856)**
R^2	.372	.434

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 8: (Robustness test: different measures of regressand)
Coefficients and absolute t statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

	Pooled regression	China (as ground zero)
Variable	Eq. 1	Eq. 2
Constant	-3.401 (2.181)**	-8.270 (2.499)**
Lending Boom	-.002 (.2367)	-.017 (1.470)
Real Appreciation	.179 (1.546)	.512 (2.688)**
Current Account	-.1713 (1.122)	-.285 (.982)
M2/Reserve	-.05 (1.173)	.131 (1.829)*
Budget	-.133 (.614)	-.307 (.598)
TMEC	.166 (3.363)**	.299 (4.105)**
R^2	.329	.440

Heteroskedasticity consistent t-statistics are reported in parentheses.
Dependent variable measured as the percentage change in nominal exchange rate
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% level or better

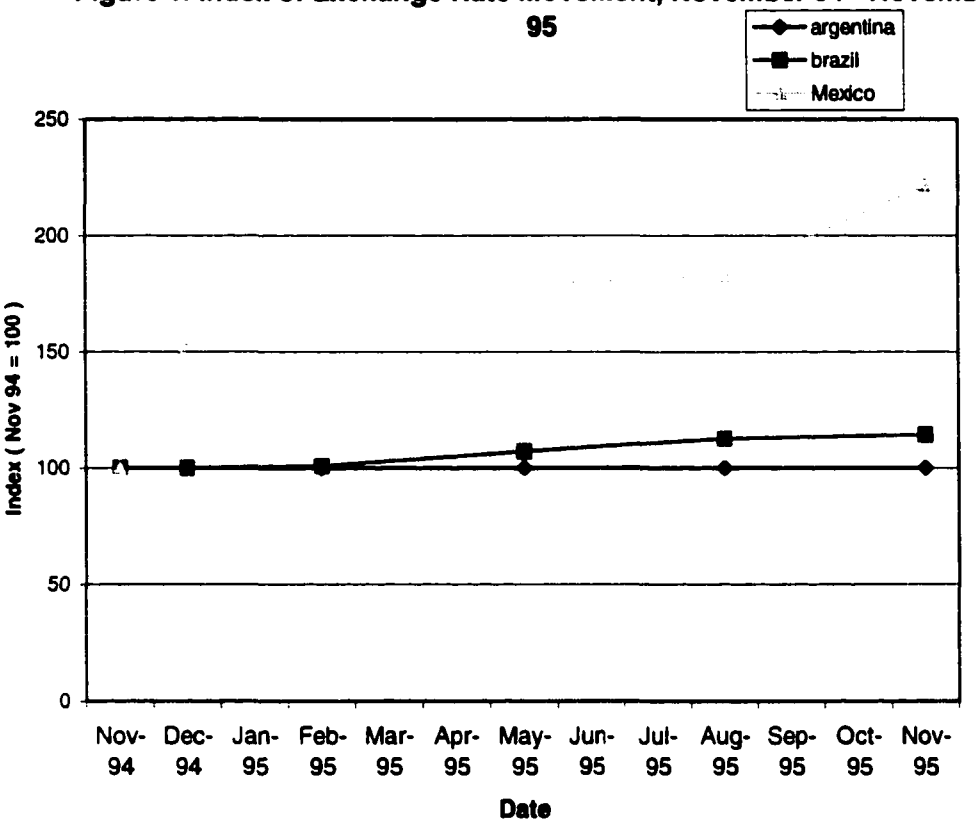
Table 9: (Robustness test: different measures of trade index)
Coefficients and absolute t statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

	Pooled regression	China (as ground zero)
Variable	Eq. 1	Eq. 2
Constant	-6.725 (2.566)**	-2.77 (.827)
Lending Boom	-.006 (.685)	-.019 (1.222)
Real Appreciation	-.089 (.389)	-.04 (.128)
Current Account	-.553 (3.131)**	-.921 (4.070)**
M2/Reserve	-.04 (.987)	.069 (1.216)
Budget	-.075 (.311)	.165 (.408)
TMEC (absolute)	.271 (4.276)**	.284 (4.161)**
R^2	.355	.419

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% level or better

Appendix 1:

Figure 1: Index of Exchange Rate Movement, November 94 - November 95



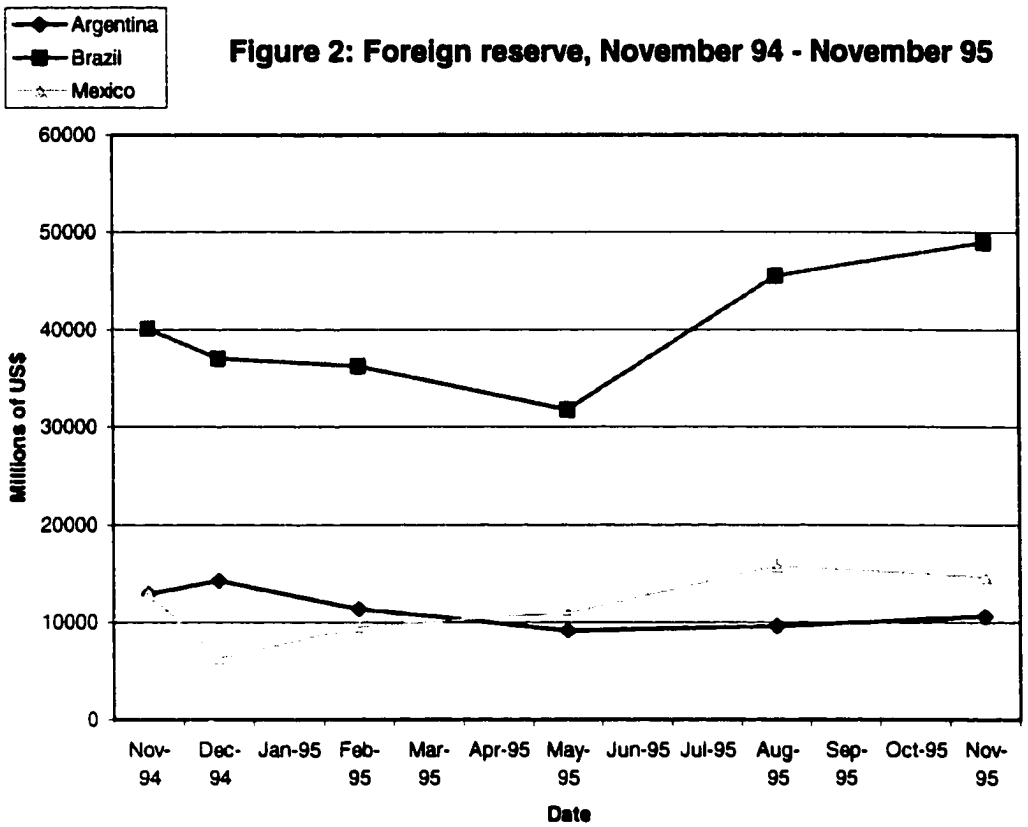


Figure 2: Foreign reserve, November 94 - November 95

Figure 3: Index of exchanage rate movement, June 97 - June

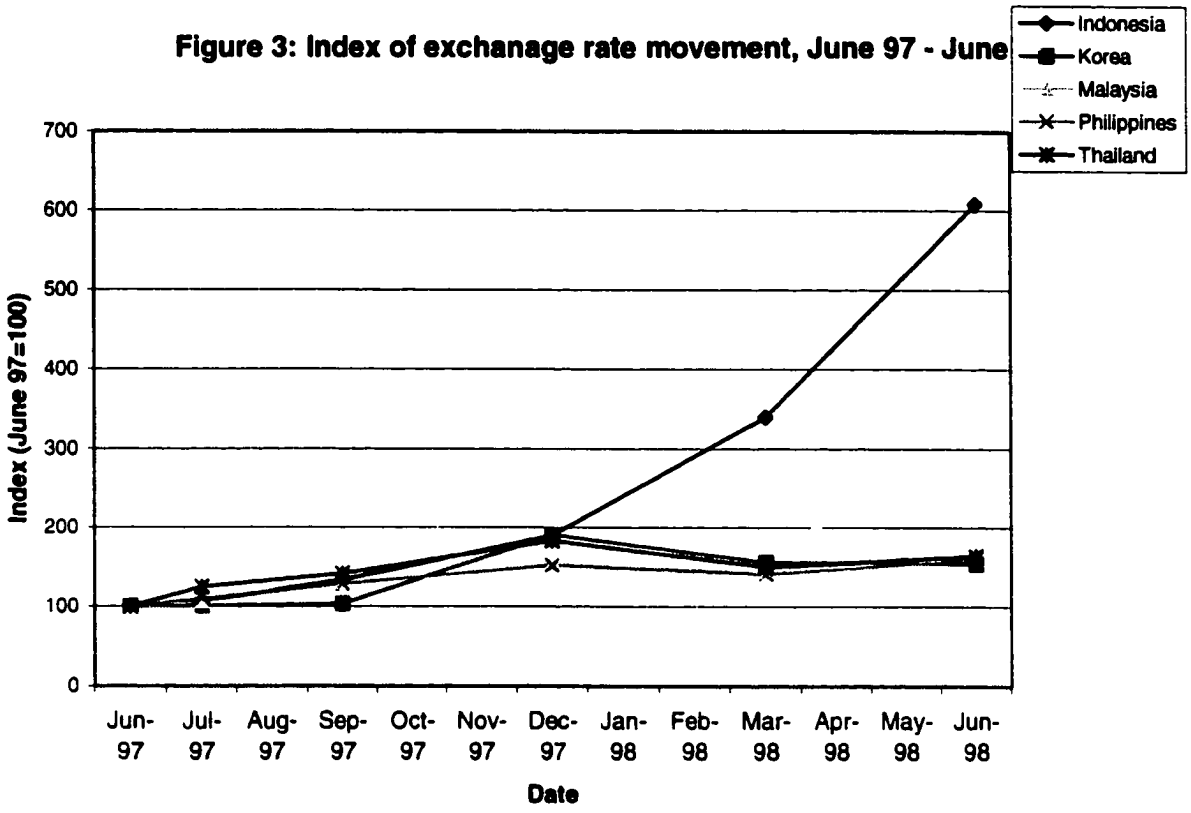


Figure 4: Foreign reserve, June 97 - June 98

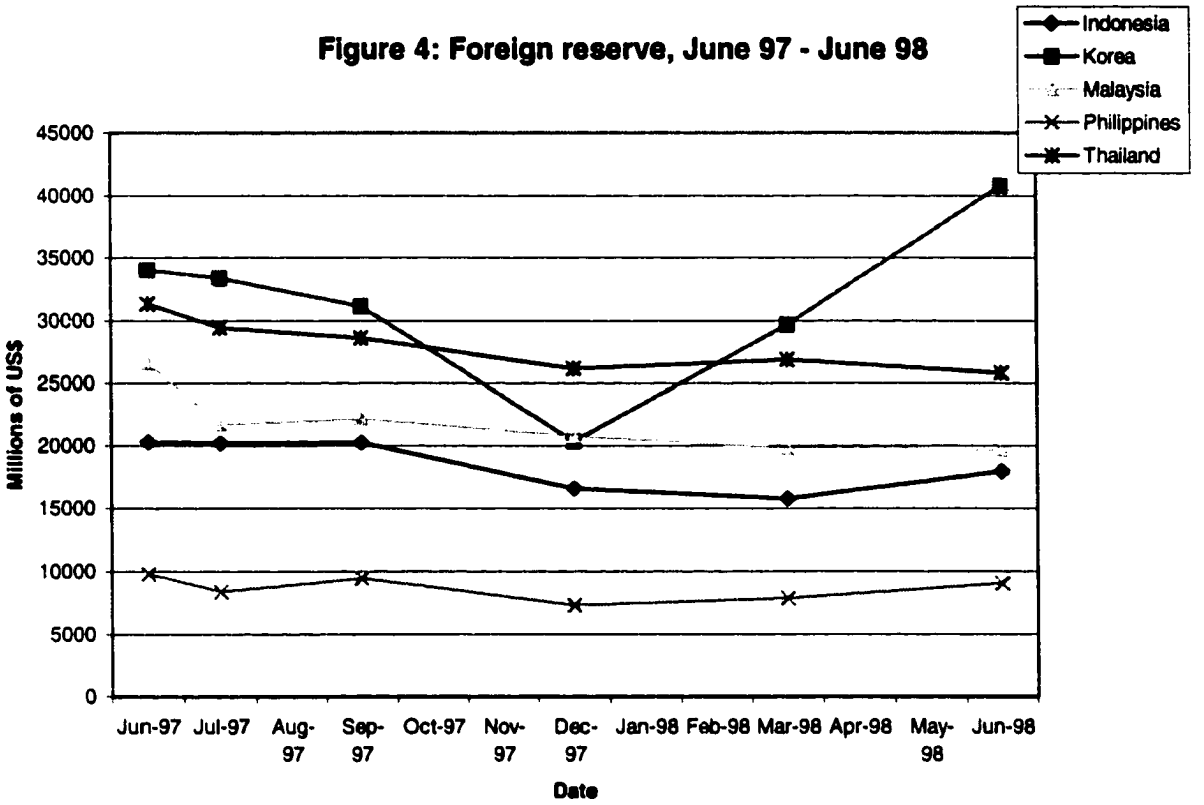


Figure 5: Crisis index (Asian currency crisis)

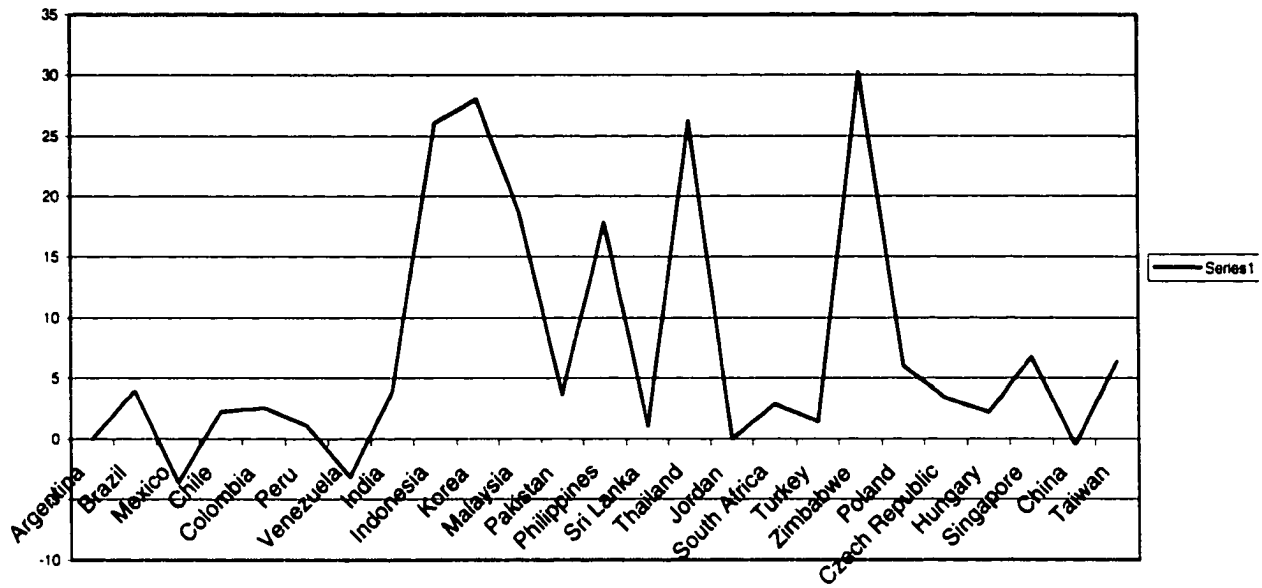
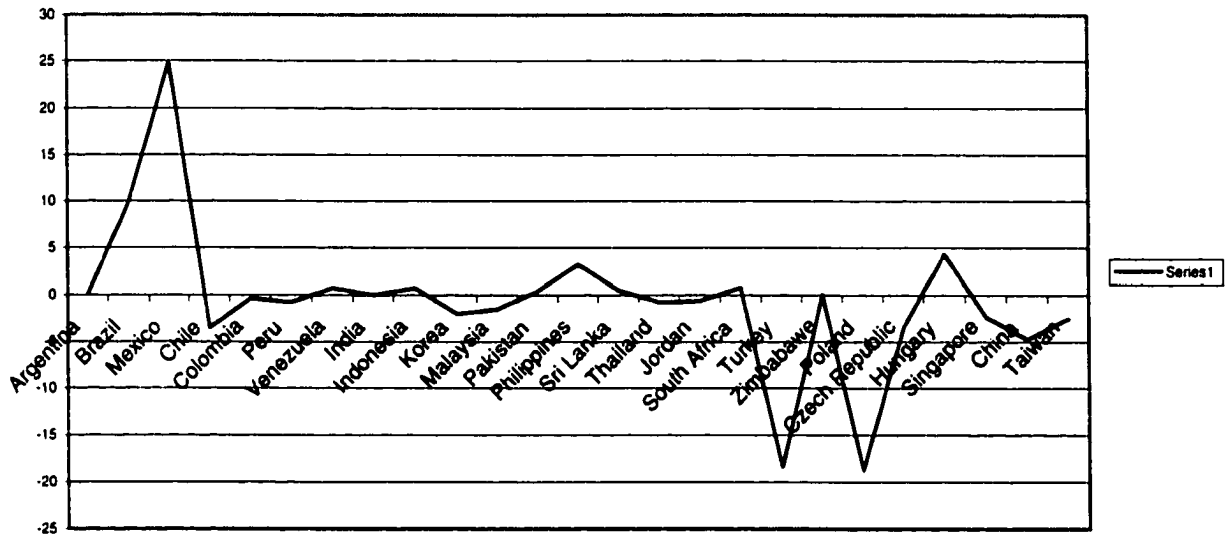


Figure 6: Crisis index (Mexican crisis)



Summary Statistics: Mexican Peso Crisis 1994-1995

Variable	Mean	Standard Deviation
Lending Boom	18.262	60.401
Real Appreciation	-1.577	5.765
Current Account	-1.824	5.169
Budget	-1.756	4.842
M2/ Reserve	5.784	7.602
Crisis Index	-1.629	5.979
TMEC	29.80	15.59

Summary Statistics: Asian Crisis 1997-1998

Variable	Mean	Standard Deviation
Lending Boom	11.289	66.836
Real Appreciation	.176	5.04
Current Account	-1.869	5.591
Budget	-1.279	4.816
M2/ Reserve	8.874	17.539
Crisis Index	6.702	9.76
TMEC	58.614	24.224

Data Appendix:

This Appendix describes the construction of the data. Most of the data come from IMF's *International Financial Statistics.* Taiwanese data are from the Financial Statistics (IMF) of Central Bank of China (www.cbc.gov.tw) and from various issues of *Monthly Bulletin of Statistics of the Republic of China.*

Real Exchange Rate Appreciation:

As in Glick and Rose (1999), the real exchange rate appreciation was calculated as the percentage change in the real exchange rate between the average of the three previous years and the crisis year. Most of the real exchange rate data are from J.P. Morgan & Co. The data for Jordan, Hungary, Checzh Republic, Sri Lanka, Zimbabwe, Poland, and China were not available from J.P. Morgan & Co. We calculated the real exchange rates for these countries as the weighted sum of the bilateral real exchange rates (using CPI's) with respect to the Dollar, Yen, and DM. Average nominal exchange rates and CPI data for this purpose were obtained from IMF's *International Financial Statistics.*

Lending Boom:

First, we got the ratio of the claims on the private sector of the deposit money banks (IFS line 32d) to nominal GDP (IFS line 99b). We then used the growth rate of this ratio between 1990 and 1994 for the Mexican crisis and 1992 and 1996 for the Asian crisis.

Current Account:

The current account (IFS line 78al) has been converted to national currency using the annual average exchange rate (IFS line rf). We used the converted current account in 1996 as a percentage of 1996 GDP for the Asian crisis and the ratio of current account in

94 to GDP of 1994 for the Latin crisis. A positive sign on this variable denotes current account surplus, while a negative sign denotes a current account deficit.

Budget:

The variable Budget is constructed as government budget (IFS line 80) as a percentage of nominal GDP. A budget surplus shows a positive sign, and deficit shows a negative sign. We then used the ratio of 1996 for the Asian crisis and 1994 for the Mexican crisis.

M2 / Reserves:

We converted total reserves minus gold (IFS line 1l) to national currency, using average exchange rate. We calculated M2 as the sum of money (IFS line 34) and quasi money (IFS line 35). The ratio of M2 to total reserve (minus gold) of 1996 was used as a reserve adequacy for the Asian crisis and the ratio of 1994 was used for the Mexican peso crisis.

Credit Growth:

We used the annual growth rate of domestic credit (IFS line 32) between the years of 1995 and 1996 for the Asian crisis and 1993 and 1994 for the tequila crisis.

% ΔM1:

We used the log difference of M1 between the years of 1993 and 1994 for the Mexican crisis and 1995 and 1996 for the Asian crisis.

Capital Inflow:

We constructed this variable by summing the capital account (IFS line 78bc), the financial account (IFS line 78bj), and net errors and omissions (IFS 78ca), then the sum was converted to national currency by multiplying it with annual average exchange rate;

then we obtained a ratio of that converted sum to nominal GDP. The ratio in 1996 was used for Asian crisis and the ratio in 1994 is used for the peso crisis.

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Footnotes

1. In this study we consider only fundamental-based contagion. We define fundamental-based contagion as the spread of crises from the first victim to the other countries through macroeconomic, financial or trade channels.
2. Articles in the *Financial Times* (September 17, 1997, p29), *The Economist* (November 22, 1997, P41), *The Washington Post* (February 4, 1998, pA18), *The New York Times* (February 3, 1998, pA31) *Barron's* (October 27, 1997, p17) also link China's devaluation in 1994 to the Asian Crisis.
3. For an excellent survey on first generation models see Agenor, Bhandari and Flood (1992), and for more detailed discussion of first generation models see Krugman (1998).
4. Morris and Shin (1998) demonstrated that a small amount of uncertainty in investors' signals about the fundamentals can eliminate multiple equilibria even in the presence of self-fulfilling attacks. With uncertainty in a unique equilibrium currency is attacked.
5. For a detailed survey on empirical literature on currency crises see Kaminsky, Lizondo and Reinhart (1998).
6. For more recent single country studies see Goldberg (1994) and Otkan and Pazarbazioglu (1997).
7. For further works on herding based contagion see Forbes and Rigobon (1998), Calvo and Mendoza (1996), and Frankel and Schmukler (1998).
8. The European Monetary Union is an example of this type of cooperative organization.
9. Both through losses in competitiveness and through fall in demand.
10. For the Mexican peso crisis, change is measured from end of November 1994, while for the Asian crisis it is measured from end of June 1997.
11. Sachs, Tornell and Velasco (1996), Tornell (1999), and Eichengreen, Rose and Wyplosz (1996) calculated their crisis index in a similar fashion.
12. Raising the interest rate may fend off speculative attack. So it would be reasonable to incorporate percentage change in domestic interest rate in our crisis index, but lack of data on interest rates of emerging market economies limits us in doing so.

13. Taiwanese Trade data from *Monthly Statistics for Exports and Imports, Taiwan Area* , Department of Statistics, Ministry of Finance, Taiwan.
14. See Kaminsky, Lizondo and Reinhart (1998), which gives a survey of 28 empirical papers.
15. The variables Lending Boom, percentage change in real exchange rates, and M2 over international reserves have been emphasized in most of the recent literature; see Sachs, Tornell and Velasco (1996), Tornell (1999), Grier and Grier (2001), and Corsetti, Passenti and Roubini (1998). The variable government budget as a percentage of GDP has also been used widely: see Dornbusch, Goldfajn and Valdes (1995), Eichengreen, Rose and Wyplosz (1995), Frankel and Rose (1996), Eichengreen, Rose and Wyplosz (1996), and Glick and Rose (1999). Finally, Current Account as a percentage of GDP is used in Sach, Tornrell and Velasco (1996), Glick and Rose (1999), Corsetti, Pasenti and Roubini (1998), Frankel and Rose (1999), Radelet and Sachs (1998), Eichengreen, Rose and Wyplosz (1996), Kaminsky, Lizondo and Reinhart (1998), Tornell (1999), and Grier and Grier (1999).
16. Lack of availability of Macro and Financial Control Variables for many emerging market countries limits our sample size.
17. See Appendix I for detailed discussion of our data set.
18. Through bilateral trading or export competition in the third market.
19. Thailand was the first victim of the Asian crisis, 1997-98, while Mexico was the first victim of the Latin Crisis, 1994-95.

Chapter 2

Contagious Asian Crisis:

Bank Lending, Herd Behavior, and Capital Inflows

Introduction:

The recent Asian crisis of 1997 has once again raised the question of contagion effects. An appreciating real exchange rate and current account deficit, as well as financial sector problems due to excessive risky lending, which caused inflation in assets prices in boom time and collapsed in later times, may be traced to the cause of currency crisis in Thailand, the first victim in the Asian crisis. On July 2, 1997, the Thai authorities were forced to abandon the dollar exchange rate peg, subsequently, crises spread to all of East Asia. How this crisis spread so rapidly from the first victim to the other East Asian economies has caught the attention of a growing number of economists in recent times. This paper examines the role of the international bank lending, herd behavior, and short-term capital inflow in the propagation of the East Asian crisis.

Though much has been written on contagion effect, contagion has been understood to be different things in different studies. According to Calvo and Reinhart (1996) contagion can be divided into two main categories: fundamental based contagion and herding contagion. Fundamental based contagion arises when the infected country is linked to others via trade or finance, and thus economic shocks can be transmitted across countries through these channels. Herding contagion results from the factors independent of fundamentals. This kind of contagion occurs when common shocks or all channels of interdependence are not present or controlled for. The paper addresses both types of contagion for the Asian crisis.

The paper investigates two financial channels, bank lending, and capital inflows to explain contagion. First, crises can spread across countries through international bank lending. An offshore bank may lend to many countries. If any of those countries,

especially a major borrower, is hit by financial crisis, it will affect the bank's balance sheet. The bank needs to rebalance its portfolio, which may require credit contraction to other countries, and that might result in financial crises in those countries. We find evidence that contagion in the Asian crisis can be explained through the bank-lending channel.

Second, excessive capital inflows lead to a currency crisis eventually. However, the composition of flows matter for various reasons. Long-term capital inflows such as foreign direct investment are beneficial, because they increase the productive capacity of the country and they are less volatile as well. On the other hand, short-term capital inflows are very volatile and are associated with consumption boom or inefficient investment, thus weaken countries fundamentals and bring balance of payment crisis eventually. We argue in this paper that short-term capital inflows, not long-term capital inflows such as FDI, could be a channel to the propagation of the Asian crisis.

Finally, contagion can arise from herd behavior. In this mechanism, investors simply follow other investors. Sachs and Radelet (1998) point out that foreign creditors made little effort to distinguish among Southeast Asian countries. They assumed that if Thailand was in trouble, then other countries in the region could be next. Therefore, their mood was to get out of the region as soon as possible. We test this hypothesis that investors considered all of Southeast Asia as one troubled region rather than rationally trying to differentiate between economies in the region. This creates herding contagion. We compare the cross-country correlations among stocks of Thailand, Malaysia, Indonesia, Korea, and Philippines between crisis and tranquil period to test for the existence of contagion. If correlations increases in the crisis period compared to tranquil

period, then we may conclude that herding contagion exits in the Asian market. This approach is relatively common in the existing literature on contagion.[1] However we differ from them, because most of the literature use high frequency data, thus cannot control for macroeconomic fundamentals and global shocks. We use monthly data that allow us to control for them. If we are interested in herding contagion, it is important that we control for macroeconomic fundamentals and global shocks.[2]

The paper is organized as follows: Section II gives a brief survey of the literature on capital inflows, herd behavior, and international bank lending as possible channels to contagion; Section III provides our methodology, followed by our main empirical results in Section IV; and Section V concludes the paper.

II. Literature:

A. Common Bank Lending:

An international bank may be exposed to many countries through its loan portfolio. If a crisis hits any one of those countries, especially a major borrower, then the bank needs to rebalance its portfolio following the losses in the ground zero country,[3] which may require credit contraction in other countries in which they hold positions. Not only may banks be unwiiling to extend new credits to other borrowers, but they may also refuse to roll over existing short-term loans; this policy will lead to capital outflows from those countries. A large-scale capital outflow runs down their international reserves, and thus creates financial crises in those countries.

Kaminsky and Reinhart (1999a) test the significance of common bank lending channel in propagation of currency crisis. They use the "signals" approach to assess the

probability of a contagion currency crisis.[4] They formed clusters of countries based on a bank lending channel, a liquidity channel, and a trade channel and show that these clusters tend to be regional.[5] They find two bank lending clusters in their sample, namely the Japanese bank cluster, comprises Indonesia, Malaysia, and Thailand and the US bank cluster, includes Argentina, Brazil, Chile, Colombia, Mexico, the Philippines, Uruguay, and Venezuela. They show that the probability of a crisis in Indonesia, Malaysia, and Thailand, conditional on the knowledge that one or two of these countries already had a crisis, tends to be higher than the unconditional probability of a crisis. Similar results were found in the Latin American countries. The probability of a crisis in a Latin American country increases with the knowledge that one or more other Latin countries is already having a currency crisis.

Van Rijckeghem and Weder (1999) test the bank lending in transmitting currency crisis using a panel data on capital flows to 30 emerging markets. They developed a Fund composition index which measures the intensity of competition of bank funds between ground zero and another country in the sample analog to the trade competition in the third market by Glick and Rose (1999). They find that the degree to which countries compete for funds from the common bank lender is a fairly robust predictor of the incidence of the contagion currency crises.

Even though we also test the significance of the common bank-lending channel in transmitting currency crises from the first victim to other emerging markets, we differ from Kaminsky and Reinhart (1999) and Van Rijckeghem and Weder (1999) in approach and methodology.

B. Capital Inflows:

Capital inflows to emerging markets have been sustained at a relatively high level throughout the 1990's even though a slight decline is observed after the Mexican Peso crisis of 1994. Even though capital inflows can increase welfare by consumption smoothing and may also increase the productive capacity of a country, it has bitter consequences as well. Excessive capital inflows can also have less desirable macroeconomic effects, such as rapid monetary expansion, inflationary pressure, real exchange rate appreciation, and widening current account deficits, which may eventually lead to a currency crisis.

Calvo, Leiderman, and Reinhart (1996) point out few causes to capital inflows in emerging markets. Firstly, lower interest rates in the developed nations attracted investors to Asia and Latin American economies where interest rates were relatively higher. Second, the early 1990's recessions in the United States, Japan, and many countries of Europe made profit opportunities in developing countries appear relatively more attractive. Third, there has been a trend toward international diversification of investment. Fourth, several emerging market economies adopt policies that liberalize the capital and financial markets. Finally, a large capital inflow to one or two large countries in a region may generate externalities for the smaller neighboring countries.

Chuhan, Claessens, and Mamingi (1993) find, using monthly bond and equity flows from the U.S. to nine Latin American countries, that bond flows respond strongly to the countries credit rating, while price-earning ratios were uniformly unimportant. On the other hand, the US interest rate was important for both bond and equity flows.[6] The

World Bank (1997) has suggested that idiosyncratic country factors may have played a much larger role in recent years inflow episodes to the emerging markets.

Even though large capital inflows eventually cause a currency crisis, it is the short – term capital inflows, rather than long term capital inflows, is the main culprit in the episodes of contagion currency crises. Sach, Tornell, and Velasco (1999) cannot find evidence supporting the hypothesis that high capital inflows (which contains FDI flows and long maturity bonds and loans) make a currency crisis more severe, however they find that short term capital inflows do seem to matter in explaining propagation of the Mexican currency crisis.

C. Herd Behavior:

Contagion can arise from "herd" behavior. In herding mechanism investors simply follow other investors, and that cannot be justified by their own expectations about the market based on the information they have. This behavior may occur, because a single investor may know only some partial information about the market and he/she may not know the information that other investors possess. With this kind of information asymmetry present in the market, when a group of investors start selling, a single investor follows blindly, even though his or her expectation about the market is positive. A large scale herding will run down a country's international reserves and the exchange rate peg will collapse.

Calvo and Mendoza (1998) show that the fixed cost of gathering and processing country specific information making it rational for small investors to follow large investors who may have better information, thus create herding. This behavior could be individually rational even though the investors' behavior as a group could be irrational,

which may create self-fulfilling, costly and fundamentally unnecessary panicked reversals in capital flows. Calvo and Mendoza (1998) also show that the payoff of gathering and processing country specific information decline with the globalization of the capital market. This might be the case of increase in herd behavior over time as the capital market gets increasingly globalized. Banerjee (1992) and Shiller (1995) also argue that herd behavior may not be irrational.

Kodres and Pritsker (1998) show that information asymmetries and the ability to engage in cross-market macroeconomic risk may lead to financial contagion. A negative shock in one country may lead the investors to sell that countries assets and buy assets in a second country. Again, investors can hedge this new position by selling in a third country. In this process uninformed investors may start following the informed investors.

Rigobon (1998) explains that overreaction in the financial market is the direct result from a learning problem. The author assumed that during the period of boom agents take positive action and that fuels the economy. In this situation, good signals are expected and are less informative; on the other hand, bad signals are not expected and become more informative. Thus, unexpected bad signals may lead to over reaction in the financial market. A bad signal was not expected in the "paper tigers" in the wake of crisis; but a realization in the middle of June1997 may lead investors to over react.

Dornbusch, Park, and Classens (2000) point out that as the financial market grow with more diverse investors over time, establishing reputation becomes relatively more costly. Investors may find it less costly to follow the herd when they face high reputation cost. Investors, in particular, fund managers' reputation depends on the performance of

their portfolios relative to that of market portfolio. Surely, they have far more to loose from staying in a currently unpopular market and it turns out to be wrong.

A significant increase in cross-country correlation is considered as evidence of contagion. A large number of studies of this type have been conducted after the US. stock market crash of 1987. King & Wadhwani (1990) test for an increase in cross-country correlations between U.S.A, UK, and Japan and find evidence that correlations increase significantly after the crash. Lee and Kim (1993) also find similar results. Calvo and Reinhart (1996) find evidence that correlation of weekly returns on equities and Brady bonds for Asian and Latin American emerging markets increases after the Mexican crisis. Baig and Goldfajn (1998) investigate whether cross-country correlations among currencies, stock returns, interest rates, and sovereign spreads in emerging markets increase during the Asian crisis. They find evidence suggesting that cross-market correlations increased significantly for many of these countries.

III. Methodology:

Our objective for this paper is to determine the effect of common bank lender, herd behavior, and the accumulation of short-term capital inflows to explain the contagion effect of the Asian crisis of 1997-98. Our interest is not to determine how and when the Asian crisis originated from, Thailand, the first victim, rather than how the crisis spread across other emerging markets in Asia.

We run the benchmark regression of the form:

$$Crisis_i = \alpha_0 + \beta\, Macro - Controls_i + \varphi\, Banklending + \varepsilon$$

Where we measured bank lending as a dummy variable, by assigning the value of 1 to those countries in our sample, which like Thailand, share Japanese banks as their major lender. Our objective is to investigate whether countries that share Japanese banks as their major lender suffer more than other countries in the sample. We use the Bank for International Settlements' semi-annual consolidated data for June 1997.[7, 8] The data include international claims of affiliates and branches which have their head-offices outside the BIS reporting area. We also computed two different perturbations of our benchmark measure, and find that common bank lending measures are robust to the exact way we compute them. The first is a continuous measure that calculates percentage share of total lending from the Japanese banks. The second measure calculates the intensity of competition for funds from the Japanese banks. This variable is calculated in the similar fashion as the trade competition in the third market is calculated in Glick and Rose(1999). The Fund Competition from Japanese Banks (FCJB) is calculated as follows:

$$\mathrm{FCJB_j\,(share)} \equiv \left\{\left[(b_{0j}+b_{ij})/(b_0+b_i)\right]\bullet\left[1-\left|(b_{ij}/b_i-b_{0j}/b_0)\right|/(b_{ij}/b_i+b_{0j}/b_0)\right]\right\}$$

Where 0 stands for ground zero (first victim) country and j stands for a common lender (Japanese Banks). Here we consider Japanese banks as the common lender. Ground zero (Thailand) and country i compete for funds from Japanese banks. b_{ij} represents country i's borrowing from Japanese banks. b_i denotes total amount of funds country i borrow from the world banking system. The first component of the equation is a measure of overall importance of Japanese banks to country i and 0. The second component captures the extent to which country i and the first victim compete for funds from the Japanese banks.

Here, $Crisis_i$ is a continuous measure of exchange market pressure calculated as the weighted average of the percentage depreciation of nominal exchange rate with respect to U.S. dollar and the percentage decline in foreign reserve for six months following the start of the crisis.[9] The weights are determined so as to equalize the volatility of the components. We calculate the inverse of the variances for each variable with years of monthly data prior to the crisis. Then we compute weight for each variable as its inverse of variance over sum of the inverse of the variances.[10, 11]

Does large capital inflows make currency crisis more severe?

A popular view is that large capital inflows today may lead to outflows tomorrow, and thus lead to a currency crisis. However, we know short-term capital inflows are more volatile and a sudden reversal may lead to a currency crisis in a country.[12] We like to investigate whether the effect of large short-term capital inflows can explain severity of a crisis above and beyond the effect of macro-controls. The basic equation regresses the crisis index on the variable capital inflows (short term inflows or inflow series that contains both short term and long term inflows) taking account the state of the economic fundamentals and the adequacy of foreign reserves. We estimate our benchmark regressions of the following form using ordinary least squares:

$$Crisis_i = \beta_0 + \beta_2 (Inflows) + \beta_4 (D^{LR} \times Inflows) + \beta_6 (D^{LR} \times D^{WF} \times Inflows) + \varepsilon$$

We classify, like Tornell (1999), a country has high reserves if its M2/ Reserves rate is below 1.8, and a country has strong fundamentals if lending boom is negative and its real exchange rate appreciation is lower than 5%. We create a dummy variable for weak fundamentals, such that we assign D^{WF} equals to one if a country has weak

fundamentals, and assign 0 for strong fundamentals. Similarly, we assign D^{LR} equals to one if a country has low reserves and assign 0 for high reserves.

The existence of herding contagion:

Asian currency crisis was started in Thailand and transmitted through the East Asian region. This transmission process was so quick that, within a couple of months most of the East Asian countries were faced with a financial crisis. Was the Asian currency crisis contagious in nature? We will empirically investigate this issue here. First, we define contagion as the substantial increase in cross-market linkages after a shock to an individual country (or group of countries) [13]. Rigobon and Forbes (1999) pointed out that cross-market linkages can be measured by correlation in asset returns. We tests for evidence of contagion in the stock markets of Indonesia, Korea, Malaysia, the Philippines, and Thailand. If the correlations among markets increase significantly during the crisis period as compared to tranquil period, then we may conclude the existence of contagion in the market.[14]

We estimate two different correlation measures of stock returns. First, we calculate the cross-market correlations of stock returns of five most crisis hit Asian countries, Thailand, Malaysia, Indonesia, Korea, and Philippines between crisis and tranquil period. A potentially important shortcoming of this measure is that macroeconomics fundamentals and global shocks are not controlled for. Thus, it creates an upward bias in the correlation. A high correlation of stock returns may result of similarities of economic fundamentals and common global shocks. To correct for this bias, a second measure has been calculated. We regress stock returns on nominal exchange rate, change in interest rate, inflation, and US. stock returns for each one of the five countries.[15, 16] US stock

returns serve as the proxy variable to control for global shock. We carefully choose this measure, as US stock return has impact on emerging markets. We then calculate the correlations of residuals from five regressions that we ran.

We employ the methodology developed by Rigobon and Forbes (1998) and Baig and Goldfajan (1998). We apply a two-sample t-test to check whether correlations are significantly different (statistically) in two periods. The test hypotheses are the following:

$$H_0 : \rho^0_{i,j} \geq \rho^1_{i,j}$$

$$H_1 : \rho^0_{i,j} < \rho^1_{i,j}$$

Where $\rho^t_{i,j}$ is the correlation coefficient between country i and country j over period t. The tranquil and crisis period is denoted by "0" and "1" respectively. Baig and Goldfajan (1998) derived following test statistic:

$$T = \frac{\bar{x}_0 - \bar{x}_1}{\left(\frac{{s_0}^2}{n_0} + \frac{{s_1}^2}{n_1} \right)^{\frac{1}{2}}}$$

The test statistics follows the t-distribution, and degrees of freedom is calculated as follows:

$$df = \frac{\left(\frac{{s_0}^2}{n_0} + \frac{{s_1}^2}{n_1} \right)^2}{\frac{\left(\frac{{s_0}^2}{n_0} \right)^2}{n_0 - 1} + \frac{\left(\frac{{s_1}^2}{n_1} \right)^2}{n_1 - 1}}$$

$\bar{x}_t$ and s_t^2 are the estimated sample mean and variance. n_t is the sample size. The correlation coefficients are transformed through a Fisher transformation. They are approximately normally distributed with mean and variance as follows:

$$\mu_t = \frac{1}{2}\ln\left(\frac{1+\rho'_{i,j}}{1-\rho_{i,j}{}'}\right)$$

$$\sigma_t^2 = \frac{1}{n_t - 3}$$

We also apply the likelihood ratio test for the significance of the groupwise correlations. Following the work of Valdes (1997) and Pindyck and Rotemberg (1990) the hypotheses are as follows:

H_0: No groupwise correlations

H_1 : The null is not true

The test statistic: $LR = -N\log|R|$ is χ^2 distributed with $\frac{1}{2}q(1-q)$ degrees of freedom. Where, $|R|$ is the determinant of the correlation matrix, N is the number of observation in the pooled sample, and q is the number of series being tested.

Macro control:

A number of macroeconomic and financial variables can explain the severity of a crisis. Countries with macroeconomic and financial imbalances may face speculative attacks. The control variables that we employ in this study are drawn from a set of variables that have been shown to be relevant in explaining currency crises in the empirical literature.[18] We use the following variables: lending boom, real exchange rate appreciation, current account balance as a percentage of GDP, the government budget as a percentage of GDP, and the level of M2 over international reserves. We are interested

in determining whether bank lending channels, capital inflows, and change in market sentiment independent of macroeconomic imbalances can explain the severity of a crisis.

The data are two cross-sections for 25 emerging market countries. The countries in the sample are: Argentina, Brazil, Mexico, Chile, Colombia, Peru, Venezuela, India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, Sri Lanka, Thailand, Jordan, South Africa, Turkey, Zimbabwe, Poland, Czech Republic, Hungary, Singapore, China, and Taiwan.[19] We use 1996 macro data for the Asian crisis.[20]

To test for the existence of contagion we use monthly data of nominal exchange rate, interest rate, consumer price index, and stock return. Our sample is from January 1995 to December 1998. All the data are from IFS CD ROM except stock return. Stock return data come from the Bloomberg.

IV. Results:

Equation 1 of Table 1, reports the results of regressing the crisis index on the macro control variables and the common bank-lending dummy. Bank lending dummy is significant at the 1% level. Its coefficient (10.758) suggest that the severity of the crisis increases by around 11 additional percentage point in countries that share the Japanese banks as their major lender like the first victim, Thailand. Among the macro-control variables, the current account is significant. The current account is significant at the 1% level and has the correct sign. Current account deficits tend to increase the severity of a crisis. Equation 2 and Equation 3 leaves macro-controls unchanged and substitute two different continuous measures of common bank lending variables. In Equation 2 we use percentage share of borrowing from Japanese banks and in Equation 3 we use fund

competition from Japanese banks. Both of these variables are significant at the 1% level. Our finding of a positive statistically significant role for common bank lending channel is robust to the variant measures of common bank lending variable.

Table 2 presents the same regressions as Table 1, but also controls for TMEC (Third Market Trade Competition). Common bank lending channel lost its significance in all three equations and TMEC also turn out to be insignificant. There exist a high correlation between trade linkages and competition for funds. The historical expansion of bank lending started with financing trade.[21] This high collinearity may be the reason behind the insignificance of both TMEC and common bank lending channel when we include both variables in the same regression.

Equation 1 of Table 3 reports the results of regressing crisis index on capital inflows (a series that consist of short term and long term flows). We also interact capital inflows with dummy variable representing economic fundamentals and reserve adequacy. We would like to explore the view that excessive capital inflows must lead eventually to a currency crisis. To explore whether this view is supported by the data, we estimate this regression imposing two restrictions: $\beta_6 + \beta_7 = 0$ and $\beta_6 + \beta_7 + \beta_8 = 0$. The ρ values for the above two null hypotheses are .598 and .016 respectively. Thus, we reject the null hypotheses. Therefore, we find evidence suggesting that high capital inflows make a currency crisis more severe when a country has weak fundamentals and low reserves. Equation 2 of Table 3 presents the estimates of a regression that includes capital inflows and macro-control. The ρ values for the null hypotheses $\beta_6 + \beta_7 = 0$ and $\beta_6 + \beta_7 + \beta_8 = 0$ are .322 and .356 respectively. Thus capital inflows cannot explain the severity of a currency crisis above and beyond the effect of macro-controls.

Similarly, Equation 1 of Table 4 presents the results of the regressing crisis index on short-term capital inflows. We reject the null hypothesis $\beta_6 + \beta_7 + \beta_8 = 0$ with a ρ value of .048. Therefore we may conclude that high short-term capital inflows make a currency crisis more severe when a country has weak fundamentals and low reserves. In Equation 2, we control for macroeconomic fundamentals. The null hypothesis $\beta_6 + \beta_7 + \beta_8 = 0$ is still rejected with a ρ value of .06. Thus, short-term capital inflows can have an extra effect to the propagation of a currency crisis above and beyond the effect of macroeconomic fundamentals. Table 5 presents the regression results that test for the effect of FDI (the most stable component of capital inflows) to explain the severity of a currency crisis. We cannot find any evidence that links FDI to the severity of currency crisis.

Table 6 and Table 7 report the cross-market correlation of stock returns for both tranquil and crisis period. The two-sample t-test reveals that eight of the ten pairs of cross-market correlations are significantly greater in the crisis period. Stock returns correlations between Indonesia-Thailand, Indonesia-Korea, Korea-Malaysia, Korea-Philippines, Philippines-Thailand change from strong negative to strong positive value between tranquil and crisis period. Thus, there exists strong volatility in the stock market in the Asian region. LR test statistics are 258.48 and 202.35 for the tranquil and crisis period respectively. χ^2 value with 10 degrees of freedom and 1% level of significance is 23.209. Thus, we reject the null hypothesis of no groupwise correlation for both tranquil and crisis period.

Table 8 and Table 9 present residuals correlations controlling for macroeconomic fundamentals and global shock. The two-sample t-test reveals that seven of the ten pairs

of residual correlations are significantly greater in the crisis period. Therefore, even after controlling for fundamentals and a global shock, there exist contagion effect in the financial market and it increases in the crisis period. LR test reveals statistically significant groupwise correlations of residuals for both tranquil and crisis period.

Sensitivity Analysis:

We test the robustness of the regression results presented in Table 1 through Table 5, by using different set of macro control variables and different measures of dependent variable. Our finding that common bank lending and short-term capital inflows can explain the severity of Asian crisis is in fact a robust result to the above tests. We also test the sensitivity of the results presented in Table 6 through 9 by changing the sample size. Our finding that correlation coefficients increase significantly in the crisis period compared to tranquil period is relatively robust to this test. Various other sensitivity tests such as excluding outliers and changes in the country composition of the sample were conducted and our findings are relatively robust.

V. Conclusions:

The purpose of this paper is to investigate whether common bank lending, herd behavior, and short-term capital inflows can explain the severity of the Asian crisis. We find that the "common bank lender" channel was important in the propagation of the Asian crisis above and beyond the effect of macro-controls. Japanese banks were the major lender to Thailand, the first victim of the Asian crisis. After the Thai devaluation in 1997, the Japanese banks contracted their credits to the other Asian economies, and subsequently other Asian economies such as Indonesia, Malaysia, and South Korea

experienced currency crises. Thus, the lending of Japanese banks seems to play a role in explaining the severity of the Asian crisis. We also computed two different perturbations of our benchmark measure, and find that common bank lending measures are robust to the exact way we compute them. However, links between common bank lending channel to severity of currency crisis disappear with the inclusion of trade link variable in the regression. Trade and bank lending are highly correlated. Thus, we cannot differentiate their effects when we regress them together.

We find that the composition of capital inflows matters in explaining the contagion currency crisis. Short-term flows are very volatile and easily become outflow when the going gets tough. On the other hand, long-term flows such as FDI are relatively stable. We find evidence that short-term flows explain the severity of the Asian crisis, while no such evidence can be found for total capital-inflows. Both total capital inflows and short-term capital inflows increase the severity of the Asian currency crisis in countries with low reserves and weak fundamentals when macroeconomic fundamentals are not controlled for. However, only short-term capital inflows can explain the severity of a crisis above and beyond the effect of macroeconomic fundamentals. FDI, the most stable component of the capital inflows does not seem to have any effect in explaining the crisis even when country has weak fundamentals and low reserves.

We also find evidence of herding contagion in the Asian market during the crisis, and that can partly explains the severity of the crisis. When the crisis erupted in Thailand, investors were very quick to pull out from Asian economies without any substantial effort to differentiate between the economies. The general consensus among the investors was, if Thailand was in trouble, so would be other Asian "tigers". We find

evidence that cross-country correlations of stock returns increase in the crisis period as compared to tranquil period. An important shortcoming with this analysis was that macroeconomic fundamentals and global shocks are not controlled for. Thus, we calculate residual correlations of stock returns where the effect of them are controlled for. We also find evidence of significant increase of residual correlations in the crisis period as compared to tranquil period. Therefore, we may conclude that herding contagion exists in the financial market in the Asian crisis.

Table 1: Coefficients and absolute t-statistics of multivariate OLS estimates
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.			
Variable	Eq. 1	Eq. 2	Eq. 3
Constant	2.471 (1.295)	1.1 (.417)	.745 (.245)
Lending Boom	.006 (.264)	-.001 (.006)	.024 (1.402)
Real Appreciation	.103 (.406)	.109 (.418)	.161 (.642)
Current Account	-.758 (2.935)**	-.680 (2.720)**	-.573 (2.311)
M2/Reserve	-.027 (.474)	-.055 (.950)	.064 (1.138)
Budget	.134 (.289)	.106 (.256)	.156 (.371)
Lending Dummy	10.758 (2.384)**	--------	--------
Lending Share (Japanese Bank)	-------	.359 (2.296)**	--------
Fund Competition (Japanese Bank)	--------	--------	.361 (2.375)**
R^2	.311	.374	.261

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 2: Coefficients and absolute t-statistics of multivariate OLS estimates
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.			
Variable	Eq. 1	Eq. 2	Eq. 3
Constant	-1.928 (.415)	-4.295 (1.074)	-4.765 (1.179)
Lending Boom	.003 (.122)	-.000 (.004)	.008 (.309)
Real Appreciation	.247 (.759)	.318 (.894)	.347 (1.003)
Current Account	-.643 (2.134)**	-.556 (1.997)*	-.510 (1.970)*
M2/Reserve	-.054 (.668)	-.077 (1.023)	-.082 (1.16)
Budget	.075 (.158)	.054 (.123)	.063 (.143)
Lending Dummy	€.586 (.921)	--------	--------
Lending Share (Japanese Bank)	-------	.141 (.519)	--------
Fund Competition (Japanese Bank)	--------	--------	.138 (.494)
TMEC	.102 (.796)	.148 (1.094)	.155 (1.090))
R^2	.328	.311	..311

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 3: Coefficients and absolute t-statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.			
Estimated Coefficient	*Variable*	Eq. 1	Eq. 2
β_0	Constant	4.241 (1.602)	5.204 (1.277)
β_1	Lending Boom		.02 (.562)
β_2	Real Appreciation		.207 (.588)
β_3	Current Account		-.459 (.515)
β_4	M2/ Reserve		-.06 (.443)
β_5	Budget		.357 (.582)
β_6	Capital Inflows	.156 (.279)	-.196 (.159)
β_7	Capital Inflows × D^{LR}	-1.165 (.620)	.226 (.099)
β_8	Capital Inflows × D^{LR} × D^{WF}	2.550 (1.40)	1.605 (.716)
Addendum: Wald tests *Null Hypothesis*		ρ values	ρ values
$\beta_6 + \beta_7 = 0$		.598	.868
$\beta_6 + \beta_7 + \beta_8 = 0$		.016	.322
R^2		.287	.356

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 4: Coefficients and absolute t-statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.			
Estimated Coefficient	*Variable*	Eq. 1	Eq. 2
β_0	Constant	7.398 (3.651)**	5.015 (1.903)*
β_1	Lending Boom		.039 (1.245)
β_2	Real Appreciation		.263 (.838)
β_3	Current Account		-1.29 (2.717)**
β_4	M2/ Reserve		-.092 (.816)
β_5	Budget		.145 (.250)
β_6	Short term Inflows	-.238 (.511)	-1.355 (1.854)
β_7	Short term Inflows $\times D^{LR}$	-1.659 (.562)	-1.642 (.565)
β_8	Short term Inflows $\times D^{LR} \times D^{WF}$	4.231 (1.363)	5.201 (1.83)
Addendum: Wald tests *Null Hypothesis*		ρ values	ρ values
$\beta_6 + \beta_7 = 0$		.520	.29
$\beta_6 + \beta_7 + \beta_8 = 0$		.048	.06
R^2		.195	.529

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 5: Coefficients and absolute t-statistics of multivariate OLS estimates.
Dependent variable: Crisis index: six months horizon.

Asian Crisis 1997-1998.			
Estimated Coefficient	*Variable*	Eq. 1	Eq. 2
β_0	Constant	8.961 (2.433)**	11.099 (2.241)**
β_1	Lending Boom		-.001 (.043)
β_2	Real Appreciation		.333 (784)
β_3	Current Account		-.680 (-1.339)
β_4	M2/ Reserve		-.028 (.208)
β_5	Budget		1.115 (1.619)
β_6	FDI	-.132 (.919)	.218 (.182)
β_7	FDI $\times D^{LR}$	-.14 (.567)	.057 (.182)
β_8	FDI $\times D^{LR} \times D^{WF}$	.387 (.888)	.012 (.022)
Addendum: Wald tests *Null Hypothesis*		ρ values	ρ values
$\beta_6 + \beta_7 = 0$		.80	.653
$\beta_6 + \beta_7 + \beta_8 = 0$		.283	.768
R^2		.11	.288

Heteroskedasticity consistent t-statistics are reported in parentheses.
(*) Indicates statistical significance at 10% level
(**) Indicates statistical significance at 5% or better.

Table 6: Stock Returns Correlation (Tranquil Period: 1/95-12/96)

	Indonesia	Korea	Malaysia	Philippines
Korea	-.532			
Malaysia	.899	-.669		
Philippines	.870	-.629	.887	
Thailand	-.346	.822	-.496	-.358

(**) indicates statistical significance at the 1% level
LR Test statistic = 258.48**

Table 7: Stock Returns Correlation (Crisis period: 1/97-12/98)

	Indonesia	Korea	Malaysia	Philippines
Korea	.809**			
Malaysia	.909	.897**		
Philippines	.873	.816**	.947**	
Thailand	.846**	.908**	.956**	.913**

(**) indicates statistical significance at the 1% level
LR Test statistic = 202.35**

Table 8: Residuals Correlation (Stock Returns)
Tranquil Period: 1/95-12/96)

	Indonesia	Korea	Malaysia	Philippines
Korea	.077			
Malaysia	.598	-.066		
Philippines	.289	-.085	.453	
Thailand	.549	.05	.019	.189

(**) indicates statistical significance at the 1% level
Macroeconomic fundamentals and global shock is controlled for
LR Test statistic = 65.748**

Table 9: Residuals Correlation (Stock Returns)
Crisis period: 1/95-12/96)

	Indonesia	Korea	Malaysia	Philippines
Korea	.217*			
Malaysia	.368	.219**		
Philippines	.290	.436**	.576**	
Thailand	.456	.505**	.408**	.780**

(**) indicates statistical significance at the 1% level
(*) indicates statistical significance at the 5% level
Macroeconomic fundamentals and global shock is controlled for
LR Test statistic = 95.908**

Appendix1:
Liabilities as percentage of borrower's total liabilities:(as of December '97)

Borrower	Liabilities to Japan($bn)	Percentage
Argentina	1.6	3.6
Brazil	4.9	6.9
Mexico	4.9	7.4
Chile	1.3	7.6
Colombia	1.3	7.8
Peru	.09	1.2
Venezuela	.366	3.0
India	3.8	20.4
Indonesia	23.2	39.4
Korea	23.7	22.9
Malaysia	10.5	36.4
Pakistan	.678	11.2
Philippines	2.1	14.94
Sri Lanka	.04	5.02
Thailand	37.7	54.4
Jordan	.015	1.6
South Africa	2.2	9.5
Turkey	2.1	8.4
Zimbabwe	.001	.10
Poland	.140	1.5
Czech Republic	.981	8.62

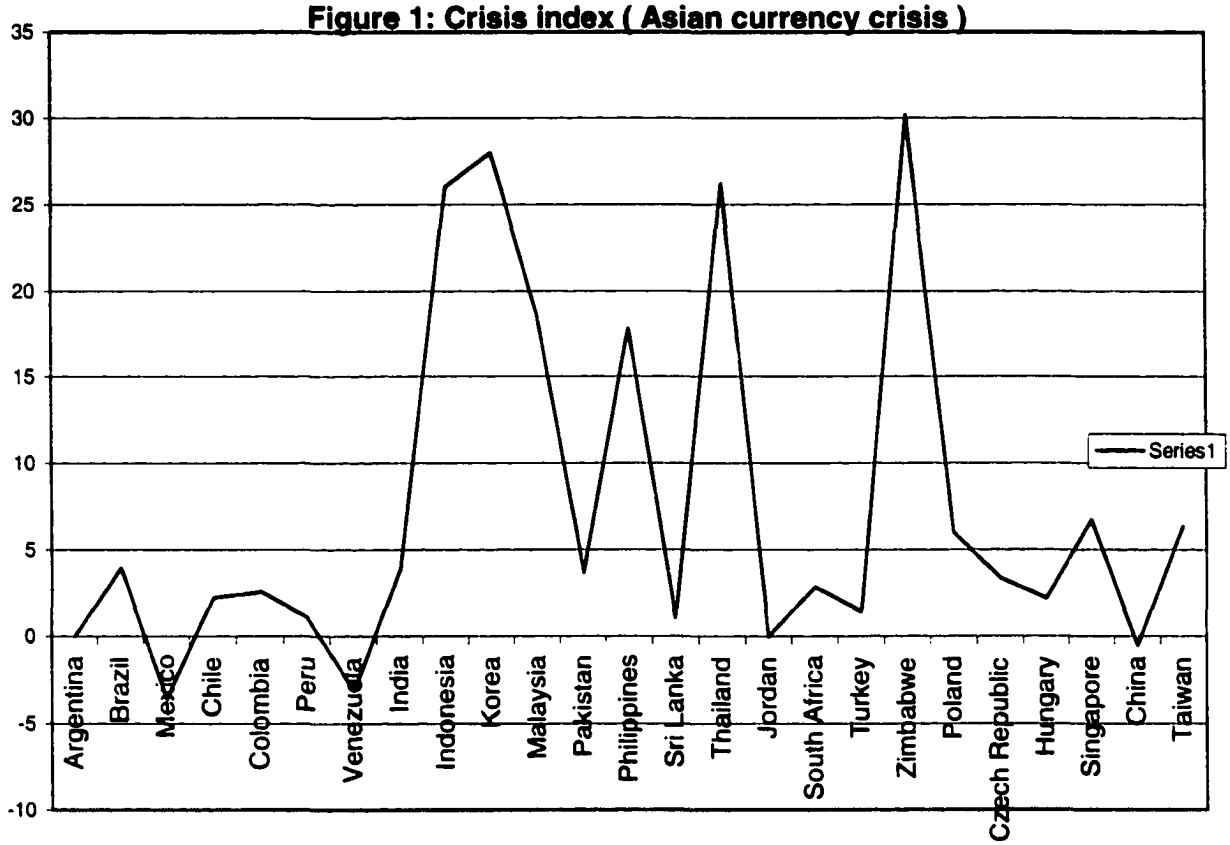
Borrower	Liabilities to Japan($bn)	Percentage
Hungary	1.1	10.2
Singapore	65.0	30.8
China	18.7	32.3
Taiwan	3.0	11.9

Source: Bank of International Settlements

Summary Statistics: Asian Crisis 1997-1998

Variable	Mean	Standard Deviation
Lending Boom	11.402	65.431
Real Appreciation	-1.325	6.991
Current Account	-2.273	4.456
Budget	-1.567	4.579
M2/ Reserve	7.319	10.223
Capital Inflows	4.089	4.106
Short-term flows	1.543	5.278

Figure 1: Crisis index (Asian currency crisis)



Data Appendix:

This Appendix describes the construction of the data. Most of the data come from IMF's *International Financial Statistics*. Taiwanese data are from the Financial Statistics (IMF) of Central Bank of China (www.cbc.gov.tw) and from various issues of *Monthly Bulletin of Statistics of the Republic of China.*

Real Exchange Rate Appreciation:

As in Glick and Rose (1999), the real exchange rate appreciation was calculated as the percentage change in the real exchange rate between the average of the three previous years and the crisis year. Most of the real exchange rate data are from J.P. Morgan & Co. The data for Jordan, Hungary, Checzh Republic, Sri Lanka, Zimbabwe, Poland, and China were not available from J.P. Morgan & Co. We calculated the real exchange rates for these countries as the weighted sum of the bilateral real exchange rates (using CPI's) with respect to the Dollar, Yen, and DM. Average nominal exchange rates and CPI data for this purpose were obtained from IMF's *International Financial Statistics.*

Lending Boom:

First, we got the ratio of the claims on the private sector of the deposit money banks (IFS line 32d) to nominal GDP (IFS line 99b). We then used the growth rate of this ratio between 1992 and 1996.

Current Account:

The current account (IFS line 78al) has been converted to national currency using the annual average exchange rate (IFS line rf). We used the converted current account in 1996 as a percentage of 1996 GDP. A positive sign on this variable denotes current account surplus, while a negative sign denotes a current account deficit.

Budget:

The variable Budget is constructed as government budget (IFS line 80) as a percentage of nominal GDP. A budget surplus shows a positive sign, and deficit shows a negative sign. We then used the ratio of 1996.

M2 / Reserves:

We converted total reserves minus gold (IFS line 11) to national currency, using average exchange rate. We calculated M2 as the sum of money (IFS line 34) and quasi money (IFS line 35). The ratio of M2 to total reserve (minus gold) of 1996 was used as a reserve adequacy for the Asian crisis.

Capital Inflow:

We constructed this variable by summing the capital account (IFS line 78bc), the financial account (IFS line 78bj), and net errors and omissions (IFS 78ca), then the sum was converted to national currency by multiplying it with annual average exchange rate; then we obtained a ratio of that converted sum to nominal GDP. Share of Capital inflows to GDP of 1996 were used in this study.

Short-term Capital Inflows:

The source for this variable is the IMF's *Balance of Payments Statistics*. This variable is constructed by summing portfolio investment (line 4600), errors and omissions (line 4998), and other short-term flows within the category of "other investments"(line 4727, 4733, 4734, 4768, 4777, 4789, and 4792). Share of Short-term Capital Inflows to GDP of 1996 were used.

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Footnotes

1. See King & Wadhwani (1990), Lee and Kim (1993), Calvo and Mendoza (1996), and Baig and Goldfajn (1998).
2. Dornbusch, Park, and Claessens (2000) define pure contagion as comovement that cannot be explained on the basis of fundamentals or global shocks.
3. See Agenor and Aizenman (1998)
4. The "Signal" approach is described in more details in Kaminsky and Reinhart (1999b), Kaminsky, Lizondo, and Reinhart (1998), and Kaminsky (1998).
5. This may explain the regional nature of contagion currency crises. Glick and Rose (1999) find that trade channel is useful to explain the propagation of a crisis.
6. More systematic evidence supporting a role for domestic factors in attracting capital inflows was provided in Hernandez and Rudolf (1994)
7. Consolidated cross-border claims in all currencies and local claim in non-local currencies.
8. We use the BIS Data for June 1997 to measure the borrowing position of every country in our sample on the eve of the Asian crisis of 1997.
9. The Asian crisis is measured from end of June 1997.
10. Sachs, Tornell and Velasco (1996), Tornell (1999), and Eichengreen, Rose and Wyplosz (1996) calculated their crisis index in a similar fashion.
11. Raising the interest rate may fend off speculative attack. So, it would be reasonable to incorporate percentage change in domestic interest rate in our crisis index, but lack of data on interest rates of emerging market economies limits us in doing so.
12. World Bank (1997) investigation finds that quarterly volatility of FDI and portfolio flows for eight major capital recipient countries during the 1990's (measured by the coefficient of variation of series) yielded higher volatility estimates for portfolio flows in six of eight countries examined.
13. Rigobon and Forbes (1999) and Dornbusch, Park, and Claessens (2000) also defined contagion in similar fashion.
14. For Tranquil period, we sampled from January 1995 to December 1996. For the crisis period, our sample is from January 1997 to December 1997.
15. All variables are in logs except for interest rate.

16. The model is similar to Fratzscher (1998) and Baig and Goldfajn (1998)
17. The variables Lending Boom, percentage change in real exchange rates, and M2 over international reserves have been emphasized in explaining the variation of nominal exchange rate in most of the recent literature; see Sachs, Tornell and Velasco (1996), Tornell (1999), Grier and Grier (2001), and Corsetti, Passenti and Roubini (1998).
18. See Kaminsky, Lizondo, and Reinhart (1998), which gives a survey of 28 empirical papers.
19. Lack of availability of Macro and Financial Control Variables for many emerging market countries limits our sample size.
20. See Appendix I for detailed discussion of our data set.
21. See Van Rijckeghem and Weder (1999) for details discussion of this issue.