Contagion Effect of Currency Crises: a Probit Approach*

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Abstract

In this paper, we analyze the role of trade contagion, financial contagion, and fundamentals in the propagation of currency crisis. For the Asian, Russian, Brazilian, and Argentinean crisis, panel probit regression applied on 30 emerging market countries shows that trade contagion plays a significant role, and financial contagion is also an effective channel in the transmission of these crises. For the Mexican crisis, cross-section probit regression on 24 developing countries shows that fundamentals can explain the occurrence of Mexican crisis mostly. Either trade contagion or financial contagion plays some role in the spread of the Mexican crisis.

Keywords: currency crises, trade contagion, financial contagion, emerging markets

1. Introduction

In the modern world, there has been a series of currency crises in developing countries: the Mexican crisis of 1994-1995, the Asian crisis of 1997-1998, the Russian crisis of 1998, the Brazilian crisis of 1999, and the Argentinean crisis of 2002. One common feature of these crises is the rapid spread of difficulties from one country to others of very different sizes and structures. This phenomenon, known as "contagion", is prominent and there has been increasing interest in the contagion effect of currency crises.

In the broad sense, contagion is defined as the transmission of shocks from one country to other countries. Among contagion channels, spillover through trade linkages and spillover through financial linkages are usually used to measure contagion effect of currency crises. Contagion through trade linkages means that currency crisis may spillover to other countries through bilateral trade or trade competition in third markets. Contagion through financial linkages is the contagion through bilateral financial linkage or common creditor. It indicates that a crisis in one country may leads investors to rebalance their portfolios for liquidity, risk management, or other reasons. Therefore, contagious crisis may take place if international investors simultaneously change their investment positions in some countries.

Numerous empirical analyses have been made on the role of trade contagion and financial contagion in the transmission of currency crises. Some studies argue that trade contagion is important determinants of how crises spread, while others find that financial contagion plays a significant role in the spread of

currency crisis.

Eichengreen, Rose and Wyploz (1996) analyze contagion using 30 years of panel data from 20 OECD countries. They find that shocks spread more easily within two countries if they have strong trade relations and conclude that trade links can explain contagion more than macroeconomic similarities. Using a large sample of countries (107 to 131), Glick and Rose (1999) focus on five currency crisis episodes between 1971 and 1997. Results show that trade measures are significant and macroeconomic controls are generally insignificant.

Empirical studies by Kaminsky and Reinhart (2000), Van Rijckeghem and Weder (2001) and Caramazza, Ricci and Salgodo (2004) analyze the significance of indirect financial lender— "common bank lender effect" and trade contagion. Kaminsky and Reinhart (2000) assess the spread of the Mexican and Asian crises, using trade channel and bank lending channel. Van Rijckeghem and Weder (2001) use cross-sectional data in the Mexican, Asian, and Russian crises to test the role of "common creditor" , trade linkages and macroeconomic variables. Caramazza, Ricci and Salgodo (2004), using a sample of 41 emerging market and industrial countries during the Mexican, Asian, and Russian crises, investigate the relevance of macroeconomic variables as well as trade and financial linkages in inducing currency crises. Results of these studies show that common bank lender plays a significant role in the transmission of currency crisis, while trade linkages are less influential.

Although there have been many empirical analyses about contagion channels, there are few literatures which analyze currency crises since the Mexican crisis (1994) until the most recently Argentinean crisis (2002). Moreover, earlier empirical literatures usually use limited indicators of contagion channel to measure the contagion effect of currency crises. This paper seeks to make one more examination on whether trade contagion and financial contagion are important determinants of countries vulnerability to the recent episodes of currency crises. To analyze contagion effect of currency crises more completely, we use many indicators of trade contagion and financial contagion and extend the sample period to the Argentinean crisis (2002).

In the probit framework, we follow the empirical method of Caramazza, Ricci and Salgodo (2004), hereafter abbreviated as CRS (2004), and extends that in CRS (2004) at several points. Firstly, in order to analyze the transmission of currency crises by trade channel and financial channel, we use a number of different methods to compute the indicators of trade contagion and financial contagion, while CRS (2004) only use two methods to compute the indicators of trade contagion and financial contagion. Secondly, we test a new measure of trade contagion. Thirdly, our sample period is extended to include the Brazilian crisis (1999) and the Argentinean crisis (2002), along with the Mexican, Asian, and Russian crises, which are also analyzed in CRS (2004).

Due to data availability problems, some adjustment of empirical method is made. For the Asian, Russian, Brazilian and Argentinean crisis, panel probit regression is used on 30 emerging market countries, while in the case of Mexican crisis, cross-section probit estimation is used on 24 developing countries[1].

This paper is organized as follows. Section 2 presents the empirical analysis about panel probit regression of the Asian, Russian, Brazilian and Argentinean crisis. Section 3 presents the empirical analysis about

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[1] Due to lack of comparable data for 6 emerging market economies within the full sample period, they are excluded from the 30 emerging market countries above.

Cross-section probit estimation of the Mexican crisis. Section 4 gives some conclusions.

2. Panel probit regression of the Asian, Russian, Brazilian and Argentinean crisis

We apply panel probit regressions to data for 30 developing countries[2] during the Asian, Russian, Brazilian, and Argentinean crisis.

2.1 Empirical estimation approach
2.1.1 Identifying crises (the dependent variable)

To analyze the spillover of currency crises, an operational definition of exchange market pressure is required to determine which countries suffered most during the Asian, Russian, Brazilian and Argentinean Crisis. Following an approach similar to that in CRS (2004), we construct an index of exchange market pressure (EMP)[3] to account for the movements in a country's exchange rate and foreign exchange reserves. It is a weighted average of monthly exchange rate changes and monthly reserve changes for 30 developing countries for the period 1990.1-2002.12. Periods when the 12-month inflation rate exceeds 100% are excluded.

$$EMP_{it} = \alpha_i(\Delta ER_{it}/ER_{it}) - \Psi_i(\Delta R_{it}/R_{it}) \qquad (1)$$

where $\Delta ER_{it}/ER_{it}$ is monthly exchange rate change for country i and period t, $\Delta R_{it}/R_{it}$ is monthly reserve change for country i and period t, α_i is the inverse of the sample standard deviation of monthly exchange rate change, and Ψ_i is the inverse of the sample standard deviation of monthly reserve change. α_i and Ψ_i are country specific.

Crisis countries during the Asian, Russian, Brazilian and Argentinean Crisis are identified as those suffering exchange market pressures exceeding a specific threshold during each crisis period. Crisis period is defined as the period of six months from the beginning of each crisis. The starts of the four crisis episodes are dated as July 1997 (Asian crisis), August 1998 (Russian crisis), January 1999 (Brazilian crisis), and January 2002 (Argentinean crisis)[4]. Therefore, the crisis period of the Asian crisis is July- December 1997, that of the Russian crisis is August 1998-January 1999, that of the Brazilian crisis is January-June 1999, and that of the Argentinean crisis is January-June 2002.

The crisis index is defined as

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[2] Emerging market countries: Latin America(10)—Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Uruguay, and Venezuela; Asia(9)—India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, and Thailand; Middle East and Africa(4)—Israel, Kenya, Morocco, and Turkey; and transition countries(7)—Bulgaria, Czech Republic, Hungary, Poland, Romania, Russia, and Slovak Republic.

[3] Similar to Kaminsky and Reinhart (1999) and Caramazza, Ricci and Salgodo(2004), interest rates changes are excluded from the exchange market pressure index, due to lack of comparable data for many emerging markets for the full sample period.

[4] To determine the start of each crisis episode, earlier empirical literatures such as CRS (2004) are referenced.

$$Crisis_{it}=1, \quad if \quad EMP_{it} > \mu_{EMP} + 1.645\sigma_{EMP} \quad (2)$$
$$=0, \quad otherwise$$

where μ_{EMP} and σ_{EMP} are the pooled mean and pooled standard deviation of the calculated EMP respectively. "The threshold is chosen so that over the whole sample 5% of the monthly index values will exceed that threshold if the values are distributed normally" (CRS 2004).

Using crisis index, we can get crisis countries during the Asian, Russian, Brazilian and Argentinean Crisis as shown in Table 1. For example, because the crisis index of Thailand during the crisis period of Asian crisis (July- December 1997) is calculated as 1, Thailand is regarded as crisis country in the Asian crisis.

In Table 1, there are 10 countries which have experienced currency crisis during the Asian crisis, 5 countries during the Russian crisis, 7 countries during the Brazilian crisis, and 6 countries during the Argentinean crisis. In terms of geographic distribution, from Figure 1, we know that the Asian crisis mostly affected Asian countries, the Russian crisis mainly the European transition countries and Latin American economies, the Brazilian crisis primarily Latin American economies and the Argentinean crisis mainly Latin American economies.

Figure 1 Incidence of Currency Crises
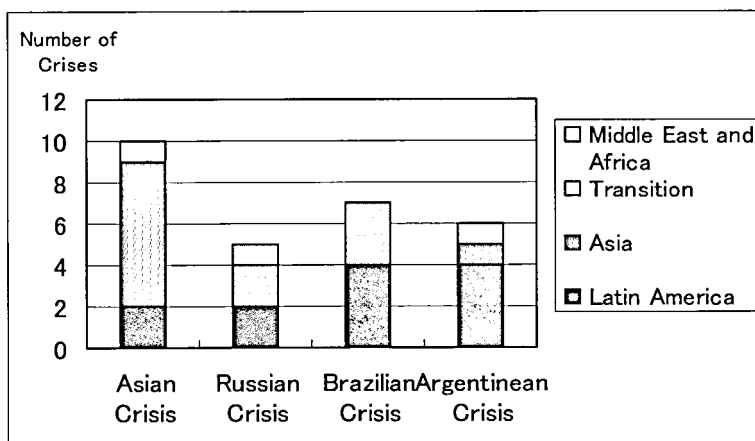
2.1.2 Panel Probit model

We use a panel probit model to analyze how the crisis index ($Crisis_{it}$) can be explained by a set of regressors (x_{it}).

Crisis index ($Crisis_{it}$) is a binary choice variable. $Crisis_{it} = 1$ if crisis happens and 0 if crisis does not happen for country i and time t. Suppose that there is an unobserved latent variable $Crisis_{it}^*$ that is linearly related to x_{it}:

$$Crisis_{it}^* = x_{it}'\beta + v_i + \mu_{it} \quad (3)$$

Then the observed dependent variable is determined by whether $Crisis_{it}^*$ exceeds a threshold value:

$$Crisis_{it} = \begin{cases} 1 & if \quad Crisis_{it}^{\bullet} > 0 \\ 0 & if \quad Crisis_{it}^{\bullet} \leq 0 \end{cases} \qquad (4)$$

So that

$$\Pr(Crisis_{it} = 1) = \Pr(Crisis_{it}^{\bullet} > 0) = \Pr(\mu_{it} > -v_i - x_{it}^{'}\beta) = F(v_i + x_{it}^{'}\beta) \qquad (5)$$

where F is normal cumulative distribution functions which is between zero and one. β is the vector of coefficients. Consider the random effect model, v_i is assumed to follow the normal distribution, that is, $v_i \sim N(0, \sigma_v^2)$.

$$\Pr(Crisis_{it}|x_{it}) = \int_{-\infty}^{+\infty} \frac{e^{-v_i^2/2\sigma_v^2}}{\sqrt{2\pi}\sigma_v} \left\{ \prod_{t=1}^{n_i} F(v_i + x_{it}^{'}\beta) \right\} dv_i \qquad (6)$$

In this panel probit model, explanatory variables x_{it} include fundamental variables[5] and indicators of trade contagion and financial contagion. Therefore, panel probit model (3) could be rewrite as follows:

$$Crisis_{it}^{\bullet} = \beta_0 + \sum_{c=1}^{8} \beta_c Z_{c,it} + \beta_{TC} TC_{it} + \beta_{FC} FC_{it} + v_i + \mu_{it} \qquad (7)$$

where Z consists of the fundamental variables, TC indicates trade contagion, and FC indicates financial contagion.

Among the fundamental variables, the external variables are real exchange rate depreciation, current account balance to GDP, and exports to GDP. Real exchange rate appreciation is a proxy for exchange rate misalignment and loss of international price competitiveness for exports merchandise. Current account deficit may indicate poor trade competitiveness in crisis countries. Negative export growth is another indicator of weak external performance.

The domestic variables are fiscal balance to GDP, M2 to GDP, and GDP growth. Large fiscal deficits or monetary expansions can fuel inflation expectations and lead to pressures on the currency. Slow GDP growth may indicate that imbalances have become increasingly untenable or that governments will be unwilling to defend exchange rate arrangements by implementing polices.

The indicators of financial weaknesses or fragility are share of short-term BIS debt and short-term debt to reserves. Share of short-term BIS debt is used to measure the maturity composition of bank liabilities. Short-term debt to reserves is a proxy for the inadequacy of international reserves to cover speculative attacks.

As to the crisis contagion, trade contagion and financial contagion are considered.

Trade contagion

In contrast to CRS (2004) which build a trade contagion variable measuring the price and income effect,

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[5] In contrast to CRS (2004), this paper adds a variable of exports to GDP to the benchmark model because negative export growth is regarded as an indicator of weak external performance.

we consider three types of trade contagion indicators, that is, direct trade measure, indirect trade measure, and total trade measure. Total trade measure is a combination of direct trade measure and indirect trade measure. It includes a weighted sum indicator and a product indicator. The direct, indirect trade measure and the weighted sum indicator of total trade are calculated by the similar formula provided by Glick and Rose (1999), while the product indicator of total trade is a new indicator comparing to the earlier empirical literature.

Direct trade contagion is through bilateral trade, so the direct trade measure is defined as

$$DirectTrade_i = 1 - \frac{|x_{i0} - x_{0i}|}{x_{i0} + x_{0i}} \qquad (8)$$

where 0 stands for the "ground zero" country, i stands for the sample country, x_{i0} denotes aggregate bilateral exports from country i to 0, and x_{0i} denotes aggregate bilateral exports from country 0 to i. The closer bilateral exports between countries 0 and i are, the higher this indicator is.

The indirect trade measure focuses on trade competition in third markets. It is calculated as follows:

$$IndirectTrade_i \equiv \sum_k \frac{x_{0k} + x_{ik}}{x_0 + x_i} \left(1 - \frac{|x_{ik} - x_{0k}|}{x_{ik} + x_{0k}} \right) \qquad (9)$$

where k stands for the common export market, x_{0k} denotes aggregate bilateral exports from country 0 to k, x_{ik} denotes aggregate bilateral exports from country i to k, and x_0, x_i represent aggregate exports from country 0 and i respectively. The first component of the equation is a measure of the overall importance of the common export market (k country) for countries i and 0. The second component captures the extent to which countries i and 0 compete in the common export market. The higher the value of *IndirectTrade* is, the more intensely the country's exports compete with the "ground zero" country in third markets.

In this paper, the "ground zero" country (0 country) is Mexico in the Mexican crisis, Thailand in the Asian crisis, Russia in the Russian crisis, Brazil in the Brazilian crisis, and Argentina in the Argentinean crisis. Similar to Hattori (2002a), the common export markets (k country) are assumed to be G7, Spain, and China. Spain and China are added to the common export markets due to consideration of the relationship within Spain and Latin American countries, and that within China and East Asian countries. Export competition countries (i country) are assumed to be the sample countries. The countries used in calculating index of trade competition are tabulated in Table 2.

Total trade measure is a composite indicator of DirectTrade*i* and IndirectTrade*i*. One measure of total trade, TotalTrade1*i*[6], is the weighted sum of DirectTrade*i* and IndirectTrade*i*, it is defined as follows:

$$TotalTrade1_i = \frac{x_{i0} + x_{0i}}{x_0 + x_i} \times DirectTrade_i + \left(1 - \frac{|x_{i0} - x_{0i}|}{x_{i0} + x_{0i}} \right) \times IndirectTrade_i \qquad (10)$$

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[6] See Glick and Rose (1999) and Santis, R.D. (2004).

i.e., DirectTrade$i$ is weighted by $(x_{i0}+x_{0i})/(x_0+x_i)$ and IndirectTrade$i$ is weighted by $(1-|x_{i0}-x_{0i}|/(x_{i0}+x_{0i}))$.

Another measure of total trade, TotalTrade2i, is the product of DirectTrade$i$ a|nd IndirectTrade$i$. This indicator means to relate the contagion effect by the direct trade linkages and that by the indirect trade linkages. This total trade contagion not only includes the influence of direct trade contagion and indirect trade contagion, but also includes each other's influence of the two terms.

$$TotalTrade2_i = \left(1 - \frac{|x_{i0} - x_{0i}|}{x_{i0} + x_{0i}}\right) \times \left(\sum_k \frac{x_{0k} + x_{ik}}{x_0 + x_i}\left(1 - \frac{|x_{ik} - x_{0k}|}{x_{ik} + x_{0k}}\right)\right) \qquad (11)$$

To calculate the indicator of trade contagion, we use the sum of precrisis monthly data from IMF-Direction of Trade Statistics. That is, the sum of December 1993-November 1994 monthly data for the Mexican crisis, the sum of July 1996-June 1997 monthly data for the Asian crisis, the sum of August 1997-July 1998 monthly data for the Russian crisis, the sum of January-December 1998 monthly data for the Brazilian crisis, and the sum of January-December 2001 monthly data for the Argentinean crisis. When calculating the indicator of DirectTrade$i$, TotalTrade1i, and TotalTrade2i[7], since the "ground zero" countries are included in the sample countries, we remove the observation corresponding to that country (Mexico in the Mexican crisis, Thailand in the Asian crisis, Russia in the Russian crisis, Brazil in the Brazilian crisis, and Argentina in the Argentinean crisis) for each crisis episode.

Financial contagion

We use two indicators to measure indirect financial linkages[8].

Following the method of CRS (2004), one indicator uses BIS data to calculate the common creditor variable. The common creditor variable tries to measure the effect on which the other countries may suffer financial contagion through portfolio adjustment by the common creditor to a country initially in crisis. Common creditor refers to the major lender to the first crisis country. The common creditor variable (BISAB) measures the financial linkages of each country with the common creditor. It is calculated as the product of two indicators, BISA and BISB. The indicator of BISA measures the importance of the common lender to the borrowers and is calculated as the precrisis share of BIS debt that each country borrows from common creditor. The indicator of BISB measures the importance of a borrower to the common lender and is calculated as the precrisis share of common creditor's BIS portfolio that is lent to a country. The larger BISA and BISB are, the stronger the effect of the portfolio adjustment by the common creditor to other countries would be. The major lenders to the first crisis country are identified as the United States in the Mexican crisis, Japan in the Asian crisis, Germany in the Russian crisis, the United States in the Brazilian crisis, and the United States in the Argentinean crisis. Taking the Asian crisis as an example, we have $BISA_i = b_{iJ}/b_i$, $BISB_i = b_{iJ}/b_J$, and $BISAB_i = BISA_i \times BISB_i$.

Another indicator of the intensity of competition for bank funds is constructed by following Van Rijckeghem and Weder (2001). Van Rijckeghem and Weder (2001) use two indicators to measure the

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[7] Due to lack of data, we remove Slovak Republic when calculating the indicator of DirectTradei, TotalTrade1i, and TotalTrade2i.

[8] Due to lack of comparable data, we don't measure the indicator of direct financial linkages.

intensity of competition for bank funds: absolute and relative competition. The indicator of absolute competition uses the absolute value of credits obtained from the common lender. The indicator of relative competition measures the degree of competition scaling countries by their size (in terms of total financing). Absolute competition considers that a larger country represents more competition for other countries, for example, if the demand for funds increases in a larger country, because of margin calls, contagion may occur if there is limited supply of funds. Relative competition implies that all countries are equally important which means a shock in large country conveys the same information to the market as a shock in small country, so contagion may occur due to information spillovers (Hernández and Valdés (2001)). In this paper, we assume that larger countries are more important, so we select the indicator of absolute competition. It is calculated as follows:

$$FundsComp_i \equiv \sum_c \frac{b_{0c} + b_{ic}}{b_0 + b_i}\left(1 - \frac{|b_{0c} - b_{ic}|}{b_{0c} + b_{ic}}\right) \qquad (12)$$

where 0 stands for the "ground zero country", c stands for the common lender, b_{ic} represents bank lending from a country c to country i, b_i represents the total borrowing of country i. The first component of the equation is a measure of the overall importance of the common lender (c country) for countries 0 and i. The second component captures the extent to which countries 0 and i compete for funding from the same creditor countries.

In this paper, we assume that emerging market countries borrow from the developed countries. The common lender countries (c country) are assumed to be France, Germany, Japan, Netherlands, Switzerland, the United Kingdom and the United States[9]. "Ground zero" countries (0 country) are the countries initially in crises. Borrowing countries (i country) are assumed to be the sample countries. The countries used in calculating indicator of FundsComp$i$ are tabulated in Table 3[10].

To calculate the indicator of funds competition, we use the precrisis annual data from "BIS-Consolidated International Banking Statistics". That is, we use 1994 data for the Mexican crisis, 1996 data for the Asian crisis, 1997 data for the Russian crisis, 1998 data for the Brazilian crisis, and 2001 data for the Argentinean crisis.

2.2 Empirical results of panel probit regression

In this section we use panel probit regression on 30 countries to analyze the role of contagion channel and fundamentals in the spread of currency crises. To test various indicators of trade contagion and financial contagion, we made two kinds of combination of variables. The first one is that we combine fundamentals, various trade contagion indicators with the financial contagion of common creditor indicator (BISAB). The panel probit model of the first combination can be expressed as follows:

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[9] The common lender countries are those data available countries that report bank lending by nationality of lender from BIS.

[10] Due to lack of data, we remove the country of Bulgaria, Czech Republic and Slovak Republic when calculating the indicator of FundsComp..

$$Crisis_{it}^{\bullet} = \beta_0 + \sum_{c=1}^{8} \beta_c Z_{c,it} + \beta_{TC} TC_{it} + \beta_{FC} BISAB_{it} + v_i + \mu_{it} \qquad (13)$$

where financial contagion variable is measured by the indicator of common creditor (BISAB), trade contagion variable is measured by the indicator of direct trade contagion (*DirectTrade*), indirect trade contagion (*IndirectTrade*), and total trade contagion (*TotalTrade1,TotalTrade2*) respectively.

The second one is that we combine fundamentals, various trade contagion indicators with the financial contagion of funds competition indicator (FundsComp). The panel probit model of the second combination can be expressed as follows:

$$Crisis_{it}^{\bullet} = \beta_0 + \sum_{c=1}^{8} \beta_c Z_{c,it} + \beta_{TC} TC_{it} + \beta_{FC} FundsComp_{it} + v_i + \mu_{it} \qquad (14)$$

where financial contagion variable is measured by the indicator of funds competition (FundsComp), trade contagion variable is measured by the indicator of direct trade contagion (*DirectTrade*), indirect trade contagion (*IndirectTrade*), and total trade contagion (*TotalTrade1,TotalTrade2*) respectively.

Results of the first combination

When financial contagion is measured by the common creditor indicator (BISAB), using panel probit model of (13), we test the role of various trade contagion indicators, common creditor indicator, and fundamentals in the transmission of currency crises. Panel probit regression results of the first combination are shown in Table 4 and Table 5.Correlation coefficients of trade contagion indicators and financial contagion indicators in the panel data are shown in Table 8.

In Table 4, when trade contagion is calculated by the indicator of indirect trade contagion, results show that when indirect trade contagion and common creditor variable are entered alone in the regression, each of them is significant. However, when both of them are entered in the regression, indirect trade contagion is still significant while common creditor variable becomes insignificant. Results suggest that both indirect trade linkage and the common creditor linkage are effective channels in the spreading of crisis.

Results in Table 5 show that direct trade contagion, total trade1 contagion and total trade2 contagion are significant while common creditor variable is not significant statistically.

From Table 8, we know that the correlation coefficients of trade contagion indicators and common creditor indicator seem not high.

In Table 4 and Table 5, among the fundamentals, regressions show significant effects from current account balance to GDP and exports to GDP. This suggests that the occurrence of currency crisis in a country always accompany with large current account deficit and deterioration in the trade balance before the crisis.

Results of the second combination

In the second combination, financial contagion is measured by the funds competition indicator (FundsComp*i*). Using panel probit model of (14), we get the regression results of the second combination as shown in Table 6 and Table7.

Similar to results of the first combination, results in Table 6 show that if trade contagion is calculated by the indicator of indirect trade contagion, when indirect trade contagion and funds competition variable are entered alone in the regression, each of them is significant, suggesting trade competition in third markets and competition for funds are associated with a higher probability of contagion. When both of them are entered in the regression, indirect trade contagion is still significant while funds competition variable is insignificant. Part of the explanation lies in the relatively high correlation between indirect trade contagion and funds competition variable (the correlation coefficient of them is 0.6182 shown in Table 8).

Results in Table 7 show that total trade1 contagion and total trade2 contagion are significant while funds competition variable is not significant statistically.

In Table 6 and Table 7, similar to results of the first combination, among the fundamentals, regressions show significant effects from current account balance to GDP and exports to GDP.

Table 8 Correlation Coefficient of Trade Contagion and Financial Contagion in the Panel Data

Contagion Variable	Direct Trade Contagion	Indirect Trade acontagion	Total trade1 contagion	Total trade2 contagion
Common Creditor	0.262	0.396	0.383	0.294
Funds Competition	0.293	0.618	0.475	0.451

To summarize, results of panel probit regression on 30 countries show that trade linkages play significant role in the spread of Asian, Russian, Brazilian, and Argentinean crises. When currency crisis occurred in one country, it may spread to other countries through channels of bilateral and indirect trade linkages, owing to the improved price competitiveness and compression of imports in the crisis country. A strong trade links with the "ground zero" country would increase one country's vulnerability to crisis.

Among the fundamental variables, external variables of current account balance to GDP and exports to GDP are significant. Current account deficits and trade deficits are indicators of weak external performance. The cause of current account deficits and trade deficits may be the gap between investment required and availability of savings which leads to greater imports than exports during periods of rapid economic growth or the overvaluation of real exchange rate. If large current account deficits are financed by foreign loans, the government debt will increase. If government tightens domestic economy to improve current account balance to GDP, this leads to negative GDP growth.These factors will deteriorate the macroeconomic environment of a country.

Results of panel probit analysis show that financial contagion variable is significant when it is entered alone in the regression in two cases. This indicates that financial contagion is an effective channel to spread currency crisis. When a crisis breaks out in one country, it may transmit to other countries because foreign investors possibly rebalance their portfolios for risk management, liquidity, or other reasons. Results also show that when trade contagion variable and financial contagion variable are entered together in the regression, financial contagion becomes insignificant statistically. One possible reason may be the relatively high correlation between some trade contagion indicator and financial contagion indicator. The high correlation between the explanatory variables will lead to multicollinearity in a model. However, Table 8 also shows that only two contagion indicators have relatively high correlation. This indicates that multicollinearity could not explain the results of all of cases. Another possible reason is that the Brazilian

crisis and Argentinean crisis are considered as of different type from the Asian crisis. The earlier empirical literature of CRS (2004) uses panel probit regression on 41 emerging market countries to examine the role of fundamentals, trade linkages and financial linkages. They find that financial linkages play a significant role in the spread of the Mexican, Asian, and Russian crises. In this paper, we use the panel probit model to analyze contagion effect during the Asian, Russian, Brazilian and Argentinean crises. The different result may be due to the different characters between the Brazilian, Argentinean crisis and the Asian crisis. The Brazilian and Argentinean crisis are considered to be current account crisis which is always featured of large current account deficits and fiscal deficits, while the Asian crisis is usually deemed to be capital account crisis. To examine this opinion, we did the cross-section probit analyses of Asian crisis, Brazilian crisis, and Argentinean crisis. Detailed explanation of the model and results are described in the Appendix 1. Cross-section probit results of Asian crisis show that financial contagion plays a significant role in the spread of the Asian crisis. However, cross-section probit results of the Brazilian and Argentinean crisis show that financial contagion is not significant or is significant while not correctly signed.

3. Cross-section probit estimation of the Mexican crisis

This section uses cross-section probit regression for 24 emerging market[11] countries in the Mexican crisis to investigate the cause of currency crisis.

3.1 Empirical estimation approach
3.1.1 Identifying crisis (the dependent variable)

Our approach to build crisis index is similar to that in section 2.1.1. However, the sample period used to construct the index of exchange market pressure (EMP) is 1990.1-1995.6. The crisis period of Mexican crisis used to calculate the crisis index is December 1994-June 1995. The start of the Mexican crisis episode is dated as December 1994.

Equation (1) and (2) are used to calculate crisis index, by which Colombia, Kenya, and Mexico are found to be crisis countries during the Mexican crisis.

3.1.2 Probit model

To analyze Mexican crisis, using cross section data, we apply probit model to estimate how the crisis index ($Crisis_i$) can be explained by a set of regressors (x_i).

$$Crisis_i^* = x_i'\beta + \mu_i \qquad (15)$$

$$\Pr(Crisis_i = 1) = \Pr(Crisis_i^* > 0) = \Pr(\mu_i > -x_i'\beta) = F(x_i'\beta) \qquad (16)$$

where F is the cumulative distribution function of the standard normal distribution. β is the vector of

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[11] Emerging market countries: Latin America(9)—Argentina, Chile, Colombia, Costa Rica, Ecuador, Mexico, Peru, Uruguay, and Venezuela; Asia(9)—India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Sri Lanka, and Thailand; Middle East and Africa(4)—Israel, Kenya, Morocco, and Turkey; and transition countries(2)—Hungary and Romania.

coefficients.

Explanatory variables x_i of benchmark model include current account balance to GDP, exports to GDP, fiscal balance to GDP, M2 to GDP, GDP growth, share of short-term BIS debt, short-term debt to reserves, trade contagion, and financial contagion. The measurement of explanatory variables is the same as that of panel probit model in section 2.1.2.

Figure 2 Fundamental Variables before the Mexican Crisis
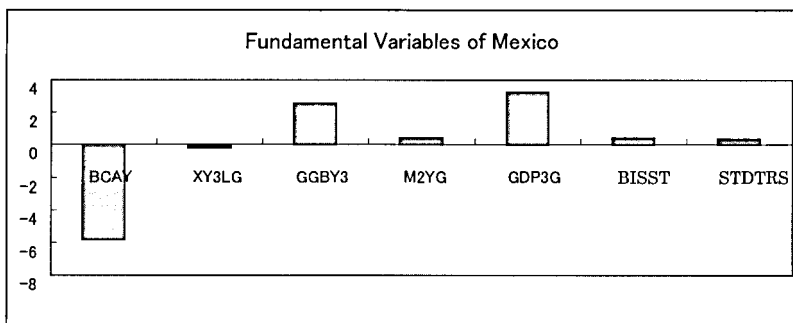
Note: BCAY is current account balance to GDP, XY3LG is exports to GDP, GGBY3 is fiscal balance to GDP, M2YG is M2 to GDP, GDP3G is GDP growth, BISST is share of short-term BIS debt, and STDTRS is short-term debt to reserves.

Figure 2 shows fundamental variables of Mexico before the Mexican crisis. Fiscal surplus and GDP growth averaged 3% for the preceding three years indicate the favorable side of Mexico's macroeconomic situation. However, unfavorable macroeconomic indicators of large current account deficit, trade deficits, expansionary monetary policy and large short-term debt also exist.

3.2 Empirical results

Just as in section 2.2, we made two kinds of combination of variables to test various indicators of trade contagion and financial contagion. The first one is that we combine fundamentals, various trade contagion indicators with the financial contagion of common creditor indicator (BISAB). The probit model of the first combination can be expressed as follows:

$$Crisis_i^* = \beta_0 + \sum_{c=1}^{7} \beta_c Z_{c,i} + \beta_{TC}TC_i + \beta_{FC}BISAB_i + \mu_i \qquad (17)$$

where financial contagion variable is measured by the indicator of common creditor (BISAB), trade contagion variable is measured by the indicator of direct trade contagion (*DirectTrade*), indirect trade contagion (*IndirectTrade*), and total trade contagion (*TotalTrade*1,*TotalTrade*2) respectively.

The second one is that we combine fundamentals, various trade contagion indicators with the financial contagion of funds competition indicator (FundsComp*i*). The probit model of the second combination can be expressed as follows:

$$Crisis_i^{\bullet} = \beta_0 + \sum_{c=1}^{7} \beta_c Z_{c,i} + \beta_{TC} TC_i + \beta_{FC} FundsComp_i + \mu_i \qquad (18)$$

where financial contagion variable is measured by the indicator of funds competition (FundsComp), trade contagion variable is measured by the indicator of direct trade contagion (*DirectTrade*), indirect trade contagion (*IndirectTrade*), and total trade contagion (*TotalTrade1,TotalTrade2*) respectively.

When calculating the indicator of DirectTrade$_i$, TotalTrade1$_i$, and TotalTrade2$_i$, we remove the country of Mexico because it is included in the "ground zero" country and the sample country simultaneously.

Results of the first combination

When financial contagion is measured by the common creditor indicator (BISAB), using probit model of (17), we test the role of various trade contagion indicators, common creditor indicator, and fundamentals in the transmission of Mexican crisis. Probit regression results of the first combination are shown in Table 9-12.

In the case that trade contagion is calculated by the indicator of direct trade contagion, Table 9 shows that when common creditor is entered alone in the regression, exports to GDP, fiscal balance to GDP, M2 to GDP, GDP growth, share of short-term BIS debt, and short-term debt to reserves are significant. Common creditor variable is significant while not correctly signed. When direct trade contagion is entered alone in the regression, direct trade contagion is correctly signed, while it is not significant.

In the case that trade contagion is calculated by the indicator of indirect trade contagion, Table 10 shows that when indirect trade contagion and common creditor variable are entered alone in the regression, each of them has a significant effect, suggesting that each of them could be a sufficient channel in the transmission of Mexican crisis. However, when both of them are entered in the regression, indirect trade contagion becomes insignificant and common creditor variable is still significant. Part of the explanation lies in the high correlation between indirect trade contagion and common creditor variable (see Table 11, correlation coefficient of them is 0.8163). Among the fundamentals, exports to GDP, fiscal balance to GDP, M2 to GDP, GDP growth, and short-term debt to reserves are significant in some regression results.

The regression result calculated by the indicator of TotalTrade1 contagion is similar to that by TotalTrade2 contagion (see Table12). In the two cases, when total trade contagion is entered alone in the regression, total trade contagion and most fundamental variables are significant. When common creditor is entered alone in the regression, most fundamental variables are significant, common creditor is significant while not correctly signed.

Results of the second combination[12]

Table 13 shows probit regression results of the second combination which is calculated by probit model (18). In this combination, financial contagion is measured by the funds competition indicator (FundsComp$_i$).

Results show that indirect trade contagion, total trade1 contagion and total trade2 contagion are

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[12] Due to lack of data, when calculating the variable of FundsComp, we remove the country of Costa Rica and Romania.

significant at 1%. Funds competition indicator is significant while not correctly signed in two regression results. Most fundamental variables are significant.

Probit estimation results of the two combinations indicate that the occurrence of Mexican crisis can be explained by fundamental variables primarily. Before the Mexican crisis, expansionary monetary policy leads to the oversupply of money which resulted in a loss of reserves and a high current account deficit. Government of Mexico finances the current account deficit by using capital inflows. In the inflowing capital, short-term debt accounts for nearly half proportion. Decreasing foreign reserves is not adequate to cover foreign debt which makes Mexico was vulnerable to speculative attacks. Therefore, when foreign investors were afraid that Mexico could not repay its significant foreign debt and lost their confidence in the economy, they began to withdraw funds which hasten the foreign reserve losses. The devaluation of peso became inevitable in December 1994.

Estimation results suggest that Mexican crisis spread to other countries through trade contagion channel and financial contagion channel. Via trade competition in the common export markets and competition for funds in the common creditor, contagion makes other countries to experience a crisis too. Moreover, our results show that indirect trade contagion variable and one of the indirect financial contagion variable—common creditor—has relatively high correlation relationship. This may be a possible reason for that indirect trade contagion becomes insignificant when common creditor is also included in the model.

4. Conclusion

In this paper, using some indicators of trade contagion and financial contagion calculated by various methods, we test the role of trade contagion, financial contagion, and fundamentals in the propagation of currency crisis. For the Asian, Russian, Brazilian and Argentinean crisis, panel probit regression is used on 30 emerging market countries. For the Mexican crisis, cross-section probit regression is used on 24 developing countries.

Results of the panel probit regression for the Asian, Russian, Brazilian and Argentinean crisis show that trade contagion plays a significant role in the spread of these four crises. Crisis in one country may spread to other countries through channels of bilateral and indirect trade linkages. Close trade linkages with the country initially in crisis would increase one country's vulnerability to crisis. Financial contagion is also shown to be an effective channel in the transmission of these crises because it is significant when it is entered in the model excluding the variable of trade contagion in two cases. Crisis in one country may transmit to other countries because foreign investors possibly adjust their portfolios for risk management or liquidity. Results also show that when trade contagion variable and financial contagion variable are entered together in the regression, financial contagion becomes insignificant statistically. We consider that one possible reason may be the relatively high correlation between some trade contagion indicator and financial contagion indicator, and another possible reason is that the Brazilian crisis and Argentinean crisis are of different type from the Asian crisis. Among the fundamental variables, external variables of current account balance to GDP and exports to GDP are significant. These fundamental indicators could help to explain the

occurrence of crises.

The cross-section probit estimation for the Mexican crisis indicates that the fundamental variables play a significant role in the occurrence of currency crisis. Either trade contagion or financial contagion could explain the transmission of Mexican crisis. Through trade competition in the common export markets and competition for funds in the major lender, crisis in one country may spillover to other countries.

This paper provides some empirical evidence about the occurrence and propagation of currency crises. However, we have not considered financial contagion in the bond market and the stock market. On the other hand, we have not included all of the probable fundamental factors, while, for example, the fourth generation currency crises theories consider the institutional factors important in the occurrence of currency crises. Adding the institutional factors to the model may be useful in the empirical analyses. These research topics remain for future study.

Table 1 Crisis Countries in the Panel Probit Analysis (Crisis Index = 1)

	Asian Crisis	Russian Crisis	Brazilian Crisis	Argentinean Crisis
Latin America	Chile Colombia	Brazil Colombia	Brazil Chile Costa Rica Ecuador	Argentina Costa Rica Uruguay Venezuela
Asia	Indonesia Korea Malaysia Pakistan Philippines Singapore Thailand			Sri Lanka
Transition		Poland Russia	Czech Republic Hungary Slovak	
Middle East and Africa	Kenya	Israel		Israel
the sum	10	5	7	6

Table 2
Countries Used in Calculating Trade Contagion

Ground Zero Country (0 country)	
the Mexican crisis	Mexico
the Asian crisis	Thailand
the Russian crisis	Russia
the Brazilian crisis	Brazil
the Argentinean crisis	Argentina

Common Export Markets (k country)	
the United States	Canada
the United Kingdom	Japan
France	Spain
Germany	China
Italy	

Export competition countries (i country)	
Argentina	Mexico
Brazil	Morocco
Bulgaria	Pakistan
Chile	Peru
Colombia	Philippines
Costa Rica	Poland
Czech Republic	Romania
Ecuador	Russia
Hungary	Singapore
India	Slovak Republic
Indonesia	Sri Lanka
Israel	Thailand
Kenya	Turkey
Korea	Uruguay
Malaysia	Venezuela

Table 3
Countries Used in Calculating FundsComp

Ground Zero Country (0 country)	
the Mexican crisis	Mexico
the Asian crisis	Thailand
the Russian crisis	Russia
the Brazilian crisis	Brazil
the Argentinean crisis	Argentina

the common lender (c country)	
France	Switzerland
Germany	the United Kingdom
Japan	the United States
Netherlands	

Borrowing countries (i country)	
Argentina	Morocco
Brazil	Pakistan
Chile	Peru
Colombia	Philippines
Costa Rica	Poland
Ecuador	Romania
Hungary	Russia
India	Singapore
Indonesia	Sri Lanka
Israel	Thailand
Kenya	Turkey
Korea	Uruguay
Malaysia	Venezuela
Mexico	

Table 4 Panel Probit Results (the first combination, trade contagion is indirect trade contagion)

Dependent Variable:CRIIND	Expected sign	Estimated Coefficient	Indirect Trade contagion	
			Estimated Coefficient	Estimated Coefficient
C		−2.467***	−1.324	−2.336**
		(0.009)	(0.109)	(0.015)
Real exchange rate depreciation	−	−0.015	−0.023	0.072
		(0.97)	(0.957)	(0.864)
Current account balance to GDP	−	−0.093**	−0.074**	−0.098**
		(0.015)	(0.045)	(0.016)
Exports to GDP	−	−1.518*	−1.313	−1.543*
		(0.083)	(0.117)	(0.078)
Fiscal balance to GDP	−	0.038	0.015	0.025
		(0.461)	(0.778)	(0.641)
M2 to GDP	+	0.078	0.166	0.160
		(0.933)	(0.852)	(0.866)
GDP growth	−	−0.036	−0.008	−0.042
		(0.539)	(0.895)	(0.484)
Share of short-term BIS debt	+	1.841	0.839	1.570
		(0.188)	(0.525)	(0.269)
Short-term debt to reserves	+	0.027	0.067	0.035
		(0.881)	(0.708)	(0.847)
Indirect trade contagion	+	4.874***		4.296***
		(0.001)		(0.008)
Common creditor	+		39.536**	25.622
			(0.023)	(0.203)
Diagnostic Test				
Number of observation		120	120	120
Number of groups		30	30	30
Log Likelihood		−52.398	−55.352	−51.582
		Wald chi2(9) = 18.97	Wald chi2(9) = 14.99	Wald chi2(10) = 18.44
Prob＞chi2		0.025	0.0911	0.0479

Note: Probability levels of z-statistics in parentheses.

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Table 5 Panel Probit Results (the first combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	Total trade 1 contagion	Total trade 1 contagion
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		−2.040**	−1.919**	−2.019**
		(0.034)	(0.036)	(0.03)
Real exchange rate depreciation	−	−0.233	−0.150	−0.144
		(0.621)	(0.742)	(0.752)
Current account balance to GDP	−	−0.083**	−0.086**	−0.091**
		(0.045)	(0.036)	(0.03)
Exports to GDP	−	−1.247	−1.393	−1.359
		(0.152)	(0.113)	(0.123)
Fiscal balance to GDP	−	0.039	0.042	0.039
		(0.488)	(0.454)	(0.489)
M2 to GDP	+	−0.126	0.002	0.109
		(0.894)	(0.998)	(0.911)
GDP growth	−	0.019	−0.008	−0.015
		(0.771)	(0.902)	(0.82)
Share of short-term BIS debt	+	1.238	1.352	1.457
		(0.379)	(0.345)	(0.312)
Short-term debt to reserves	+	0.066	0.060	0.055
		(0.724)	(0.749)	(0.771)
Trade contagion	+	0.911*	3.952**	4.408**
		(0.096)	(0.022)	(0.017)
Common creditor	+	8.389	−1.723	6.179
		(0.714)	(0.946)	(0.799)
Diagnostic Test				
Number of observation		112	112	112
Number of groups		29	29	29
Log Likelihood		−48.387	−47.086	−46.866
Wald chi2(10)		12.79	15.22	15.26
Prob>chi2		0.2355	0.1244	0.1228

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Table 6 Panel Probit Results (the second combination, trade contagion is indirect trade contagion)

Dependent Variable:CRIIND	Expected sign	Estimated Coefficient	Indirect Trade contagion	
			Estimated Coefficient	Estimated Coefficient
C		-2.171** (0.024)	-1.644* (0.068)	-2.179** (0.024)
Real exchange rate depreciation	−	-0.063 (0.877)	-0.016 (0.97)	-0.008 (0.984)
Current account balance to GDP	−	-0.106** (0.011)	-0.108*** (0.009)	-0.110*** (0.009)
Exports to GDP	−	-1.515* (0.087)	-1.568* (0.06)	-1.580* (0.072)
Fiscal balance to GDP	−	0.053 (0.327)	0.045 (0.396)	0.050 (0.353)
M2 to GDP	+	0.271 (0.791)	0.009 (0.993)	0.237 (0.815)
GDP growth	−	-0.03 (0.615)	-0.025 (0.691)	-0.036 (0.557)
Share of short-term BIS debt	+	1.356 (0.341)	0.948 (0.491)	1.319 (0.356)
Short-term debt to reserves	+	0.004 (0.984)	-0.035 (0.851)	-0.014 (0.939)
Indirect trade contagion	+	4.477*** (0.003)		3.727* (0.051)
Funds competition	+		2.008** (0.019)	0.729 (0.505)
Diagnostic Test				
Number of observation		108	108	108
Number of groups		27	27	27
Log Likelihood		-47.702	-49.406	-47.478
		Wald chi2(9) = 18.05	Wald chi2(9) = 15.77	Wald chi2(10) = 18.12
Prob＞chi2		0.035	0.072	0.053

Note: Probability levels of z-statistics in parentheses.

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Table 7 Panel Probit Results (the second combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion Estimated Coefficient	Total trade1 contagion Estimated Coefficient	Total trade2 contagion Estimated Coefficient
C		-1.753* (0.083)	-1.577* (0.098)	-1.691* (0.08)
Real exchange rate depreciation	−	-0.239 (0.622)	-0.228 (0.633)	-0.228 (0.632)
Current account balance to GDP	−	-0.091** (0.04)	-0.088** (0.048)	-0.091** (0.041)
Exports to GDP	−	-1.258 (0.156)	-1.313 (0.15)	-1.280 (0.161)
Fiscal balance to GDP	−	0.056 (0.336)	0.056 (0.336)	0.057 (0.327)
M2 to GDP	+	-0.093 (0.927)	0.134 (0.898)	0.199 (0.849)
GDP growth	−	0.029 (0.692)	0.014 (0.85)	0.009 (0.902)
Share of short-term BIS debt	+	0.853 (0.555)	0.851 (0.556)	1.005 (0.491)
Short-term debt to reserves	+	0.047 (0.808)	0.072 (0.712)	0.064 (0.742)
Trade contagion	+	0.703 (0.214)	3.868** (0.034)	4.280** (0.031)
Funds competition	+	0.156 (0.894)	-0.672 (0.601)	-0.561 (0.658)
Diagnostic Test				
Number of observation		104	104	104
Number of groups		27	27	27
Log Likelihood		-45.949	-44.420	-44.362
Wald chi2(10)		11.82	14.49	14.57
Prob>chi2		0.2974	0.1519	0.1485

Note: Probability levels of z-statistics in parentheses.
***,** and * indicate significant at 1%, 5% and 10%, respectively.

Table 9 Cross Section Probit Results of the Mexican Crisis
(the first combination, trade contagion is direct trade contagion)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	
		Estimated Coefficient	Estimated Coefficient
C		−2.795* (0.078)	−16.415 (0.406)
Current account balance to GDP	−	17.421*** (0.004)	8.566 (0.329)
Exports to GDP	−	−228.318*** (0.004)	−93.782 (0.337)
Fiscal balance to GDP	−	−11.670*** (0.004)	−6.607 (0.353)
M2 to GDP	+	45.327*** (0.003)	13.359 (0.292)
GDP growth	−	−6.430*** (0.004)	−3.836 (0.316)
Share of short-term BIS debt	+	41.106*** (0.007)	35.940 (0.374)
Short-term debt to reserves	+	2.893** (0.012)	−2.514 (0.496)
Direct trade contagion	+		10.621 (0.386)
Common creditor	+	−1457.313*** (0.004)	
Diagnostic Test			
Number of observation		23	23
Wald chi2(8)		35.83	26.97
Prob＞chi2		0	0.0007
Log pseudo-likelihood		−2.971	−3.02
Pseudo R2		0.563	0.556

Note: Probability levels of z-statistics in parentheses.
***,** and * indicate significant at 1%, 5% and 10%, respectively.

Table 10 Cross Section Probit Results of the Mexican Crisis (the first combination, trade contagion is indirect trade contagion)

Dependent Variable:CRIIND	Expected sign	Estimated Coefficient	Indirect Trade contagion	
			Estimated Coefficient	Estimated Coefficient
C		0.350 (0.812)	-0.177 (0.901)	-0.098 (0.945)
Current account balance to GDP	−	0.599*** (0.004)	0.851*** (0.004)	0.784*** (0.003)
Exports to GDP	−	-4.579 (0.103)	-7.028** (0.041)	-6.383** (0.038)
Fiscal balance to GDP	−	-0.207 (0.295)	-0.393* (0.081)	-0.350* (0.091)
M2 to GDP	+	2.279** (0.027)	0.737 (0.346)	1.004 (0.149)
GDP growth	−	-0.427*** (0.001)	-0.631*** (0.002)	-0.582*** (0.002)
Share of short-term BIS debt	+	-0.653 (0.809)	2.144 (0.465)	1.544 (0.582)
Short-term debt to reserves	+	0.434* (0.08)	0.274 (0.239)	0.310 (0.185)
Indirect trade contagion	+	5.318*** (0.003)		1.476 (0.515)
Common creditor	+		154.284*** (0.001)	117.060* (0.067)
Diagnostic Test				
Number of observation		24	24	24
		Wald chi2(8)=23.43	Wald chi2(8)=19.39	Wald chi2(9)=23.25
Prob>chi2		0.0029	0.0129	0.0057
Log pseudo-likelihood		-4.3397	-4.1745	-4.1449
Pseudo R2		0.5201	0.5383	0.5416

Note: Probability levels of z-statistics in parentheses.

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Table 11 Correlation Coefficient of Variables (the Mexican Crisis)

Variable	CRIIND	BCAY	XY3LG	GGBY3	M2YG	GDP3G	BISST	STDTRS	Indirect TC	BISAB
CRIIND	1									
BCAY	0.133	1								
XY3LG	0.1256	0.2225	1							
GGBY3	0.0535	0.4709	−0.3186	1						
M2YG	0.206	0.0135	−0.3379	−0.0361	1					
GDP3G	−0.1807	0.2477	−0.3056	0.3249	0.4043	1				
BISST	−0.0982	0.462	0.0196	0.4719	0.0037	0.545	1			
STDTRS	0.1629	−0.2599	0.0524	−0.3463	0.0142	−0.1228	−0.0157	1		
Indirect TC	0.3998	0.0119	−0.1896	0.3754	0.2144	0.2075	0.0235	0.0274	1	
BISAB	0.403	-0.1375	−0.391	0.2815	0.401	0.231	−0.1576	0.0705	0.8163	1

Note: CRIIND is crisis index, BCAY is current account balance to GDP, XY3LG is exports to GDP, GGBY3 is fiscal balance to GDP, M2YG is M2 to GDP, GDP3G is GDP growth, BISST is share of short-term BIS debt, STDTRS is short-term debt to reserves, Indirect TC is indirect trade contagion, and BISAB is common creditor.

Table 12 Cross Section Probit Results of the Mexican Crisis (the first combination, trade Contagion is total trade Contagion)

Dependent Variable:CRIIND	Expected sign	Total trade1 contagion		Total trade2 contagion	
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		-3.788***	-2.719*	-3.309**	-2.795*
		(0.003)	(0.086)	(0.012)	(0.078)
Current account balance to GDP	−	2.497***	20.157***	2.426***	17.421***
		(0)	(0.001)	(0)	(0.004)
Exports to GDP	−	-27.932***	-264.921***	-27.107***	-228.318***
		(0.001)	(0.001)	(0.002)	(0.004)
Fiscal balance to GDP	−	-1.706***	-13.520***	-1.640***	-11.670***
		(0)	(0.001)	(0.001)	(0.004)
M2 to GDP	+	4.777***	52.569***	4.604***	45.327***
		(0)	(0)	(0)	(0.003)
GDP growth	−	-1.328***	-7.411***	-1.272***	-6.430***
		(0)	(0.001)	(0)	(0.004)
Share of short-term BIS debt	+	11.276***	46.593***	10.360***	41.106***
		(0.001)	(0.002)	(0.004)	(0.007)
Short-term debt to reserves	+	0.246	3.471***	0.238	2.893**
		(0.231)	(0.002)	(0.241)	(0.012)
Total trade contagion	+	14.253**		12.573**	
		(0.012)		(0.029)	
Common creditor	+		-1707.472***		-1457.313***
			(0.001)		(0.004)
Diagnostic Test					
Number of observation		23	23	23	23
Wald chi2(8)		33.42	45.18	29.15	35.83
Prob>chi2		0.0001	0	0.0003	0
Log pseudo-likelihood		-3.206	-2.9381	-3.2788	-2.9709
Pseudo R2		0.5281	0.5676	0.5175	0.5628

Note: Probability levels of z-statistics in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Table 13 Cross Section Probit Results of the Mexican Crisis (the second combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion Estimated Coefficient	Indirect Trade contagion Estimated Coefficient	Total trade1contagion Estimated Coefficient	Total trade2 contagion Estimated Coefficient
C		-1.137 (0.271)	-0.126 (0.919)	-4.671*** (0.002)	-4.341*** (0.004)
Current account balance to GDP	−	0.242** (0.03)	0.676*** (0.003)	3.435*** (0)	3.346*** (0)
Exports to GDP	−		-5.901** (0.038)	-40.651*** (0.001)	-39.637*** (0.001)
Fiscal balance to GDP	−	-0.067 (0.364)	-0.324* (0.083)	-2.385*** (0)	-2.314*** (0)
M2 to GDP	+	2.326*** (0.009)	3.098** (0.015)	7.605*** (0)	7.371*** (0)
GDP growth	−	-0.330*** (0)	-0.432*** (0.002)	-1.706*** (0)	-1.650*** (0)
Share of short-term BIS debt	+	1.245 (0.443)	0.346 (0.867)	15.979*** (0.001)	15.204*** (0.002)
Short-term debt to reserves	+	0.046 (0.855)	0.347 (0.128)	0.190 (0.376)	0.187 (0.377)
Trade contagion	+	1.357 (0.164)	8.349*** (0.001)	16.239*** (0.004)	15.015*** (0.009)
Funds competition	+	-0.745 (0.636)	-3.317 (0.159)	-5.112** (0.027)	-4.902** (0.039)
Diagnostic Test					
Number of observation		21	22	21	21
		Wald chi2(8)=19.33	Wald chi2(9)=28.2	Wald chi2(9)=56.53	Wald chi2(9)=49.69
Prob＞chi2		0.0132	0.0009	0	0
Log pseudo-likelihood		-3.9029	-4.2345	-3.0388	-3.101
Pseudo R2		0.409	0.5168	0.5399	0.5305

Note: Probability levels of z-statistics in parentheses. ***, ** and * indicate significant at 1%, 5% and 10%, respectively.

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Data Appendix

Construction of the Variables and Data Notes[13]
Dependent Variable:

Exchange market pressure (EMP, sources only, see paper for construction)—exchange rates (IFS) and foreign reserves (IFS).

Independent Variables of probit approach:

1. Real exchange rate depreciation (RERG)—3-year log change of 12-month precrisis average of real exchange rate. Real exchange rate is calculated by the author. The calculation method is shown in the paper. National currency per US dollar and consumer prices used in calculating real exchange rate are from IFS.

2. Current account balance to GDP (BCAY)—ratio of precrisis current account balance to GDP ratio (WEO).

3. Exports to GDP (XY3LG)—3-year log change of precrisis exports to GDP (WDI). However, Singapore's data is calculated by the data from IFS.

4. Fiscal balance to GDP (GGBY3)—3-year precrisis average of the general government balance (IFS)-to-

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[13] BIS is the Bank for International Settlements; IFS is the International Financial Statistics; WEO is the World Economic Outlook; WDI is the World Development Indicators; GDF is Global Development Finance; DOTS is Direction of Trade Statistics.

GDP(IFS) ratio.

5. M2 to GDP (M2YG)—3-year log change of ratio of precrisis M2 to GDP (WDI).

6. GDP growth (GDP3G)—average 3-year precrisis real GDP growth (WDI).

7. Share of short-term BIS debt (BISST)—precrisis short-term share of debt to BIS banks (BIS).

8. Short-term debt to reserves (STDTRS)—log of ratio of precrisis short-term debt (GDF) to reserves(IFS) ratio. Due to data availability problems, the data of Israel, Korea, and Singapore are from Deutsche Bank Research.

9. Trade contagion (DirectTrade, IndirectTrade, TotalTrade1, TotalTrade2)—the calculation methods are shown in the paper. The original data is from the IMF Direction of Trade Statistics.

10. Financial contagion (BISAB, FundsComp)—the calculation methods are shown in the paper. The original data is from BIS.

Appendix 1 Cross-section Probit Estimation of the Asian Crisis, Brazilian Crisis, and Argentinean Crisis

We apply cross-section probit regression for 30 emerging market countries which is same as in the panel probit model during the Asian Crisis, Brazilian Crisis, and Argentinean Crisis to investigate the cause and transmission of currency crisis.

1. Empirical estimation approach

1.1 Identifying crisis (the dependent variable)

The approach to build crisis index is similar to that in section 2.1.1. However, the sample period used to construct the index of exchange market pressure (EMP) is ten years of monthly data just before each crisis period[14]. The crisis period of the Asian crisis is July- December 1997, that of the Brazilian crisis is January-June 1999, and that of the Argentinean crisis is January-June 2002. Therefore, the sample period used to construct the index of EMP is July 1987-June 1997 in the Asian crisis, January 1989-December 1998 in the Brazilian crisis, January 1992-December 2001 in the Argentinean crisis.

Equation (1) and (2) are used to calculate crisis index. Crisis countries during these crises are shown in Appended Chart 1.

1.2 Probit model

Probit model is same as model of (15) and (16) in section 3.1.2. Explanatory variables x_i include real exchange rate depreciation, current account balance to GDP, exports to GDP, fiscal balance to GDP, M2 to GDP, GDP growth, share of short-term BIS debt, short-term debt to reserves, trade contagion, and financial contagion. The measurement of explanatory variables is same as that of panel probit model in section 2.1.2.

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[14] The choice of the sample period is following Sachs, Tornell, and Velasco (1996) and Hatori (2002a). The opinion of "ten years of monthly data" is from Sachs, Tornell, and Velasco (1996), the opinion of "just before each crisis period" is from Hatori (2002a).

2. Comparison of the Asian Crisis, Brazilian Crisis, and Argentinean Crisis

To compare the Asian Crisis and Brazilian Crisis, Argentinean Crisis, firstly, we will compare the difference of fundamental variables before these crises. Then we will compare the cross-section probit estimation results of these crises.

Appended Chart 1 Crisis Countries in the Cross-section Probit Analysis (Crisis Index=1)

	Asian Crisis	Brazilian Crisis	Argentinean Crisis
Latin America	Chile Colombia	Brazil Chile Costa Rica Ecuador	Argentina Costa Rica Uruguay Venezuela
Asia	Indonesia Korea Malaysia Pakistan Philippines Singapore Thailand	Pakistan	Sri Lanka
Transition	Czech Republic	Czech Republic Hungary Slovak	
Middle East and Africa	Kenya		
the sum	11	8	6

2.1 Difference of precrisis fundamental variables

In the Asian crisis, crisis countries of Indonesia, Korea, Malaysia, Philippines, Singapore and Thailand are chosen because severe crises occurred in these countries. Fundamental variables of these countries before the Asian crisis are shown in Appendix Figure 1. From these fundamental variables, we could have two conclusions. The first one is that economic situations of these countries were well before the Asian crisis. Increasing exports relative to GDP during the three years prior to the onset of crisis, precrisis general government fiscal surplus, and rapid GDP growth in the three years prior to the crisis show that fundamentals of these Asian countries were nicer. The second one is that there were some hidden troubles of these economies. Before the Asian crisis, high GDP growth rate were accompanied by large current account deficits which were mainly financed by short-term foreign capital inflows. Large inflows of foreign funds resulted in a growth in money supply. In Appendix Figure 1, current account deficit, the growth of M2 relative to GDP, and high short-term share of debt to BIS banks before the crisis confirm the hidden troubles.

In the Brazilian crisis, we select the country of Brazil. Fundamental variables before the Brazilian crisis are shown in Appendix Figure 2. There were large current account deficits and general government fiscal deficits before the crisis. The large current account deficits and fiscal deficits were financed by inflowing of foreign capital, resulted in rising external indebtedness. These fundamental variables indicate the

deterioration of Brazilian economy before the Brazilian crisis.

Appendix Figure 3 shows fundamental variables before the Argentinean crisis. Overvaluation of the currency, Current account deficits, government fiscal deficits, and stagnant economic growth show the weak fundamentals before the crisis. Capital inflows resulted in growing external debt. Weak fundamentals and the growing foreign debt liabilities led to fears of debt default on the part of investors.

Via Comparison the fundamental variables before the Asian Crisis and Brazilian Crisis, Argentinean Crisis, we conclude that though there were some hidden troubles in Asian countries, the macroeconomic situations were well before the Asian Crisis. On the contrary, the domestic fundamentals were weak in Brazil and Argentina before the Brazilian Crisis and Argentinean Crisis.

## Appendix Figure 1 Fundamental Variables before the Asian Crisis
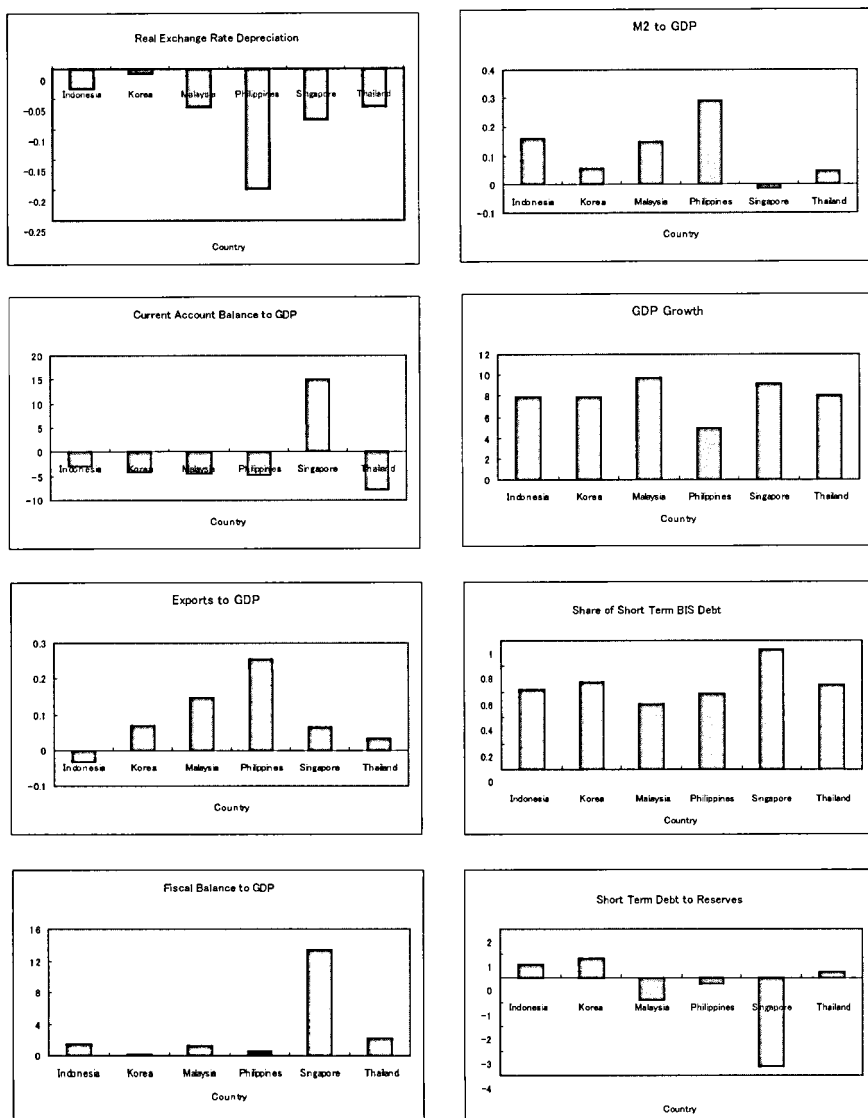
Appendix Figure 2 Fundamental Variables before the Brazilian Crisis
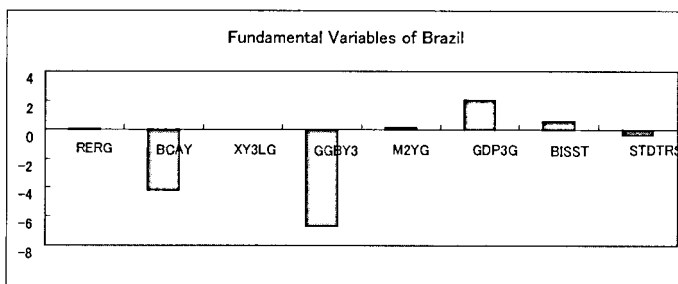
Note: RERG is real exchange rate depreciation, BCAY is current account balance to GDP,
XY3LG is exports to GDP, GGBY3 is fiscal balance to GDP, M2YG is M2 to GDP,
GDP3G is GDP growth, BISST is share of short-term BIS debt, and STDTRS is short-term
debt to reserves.

Appendix Figure 3 Fundamental Variables before the Argentinean Crisis
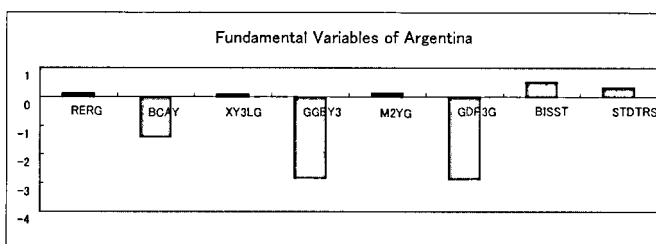
Note: RERG is real exchange rate depreciation, BCAY is current account balance to
GDP, XY3LG is exports to GDP, GGBY3 is fiscal balance to GDP, M2YG is M2 to
GDP, GDP3G is GDP growth, BISST is share of short-term BIS debt, and STDTRS is
short-term debt to reserves.

2.2 Difference of cross-section probit estimation results

Cross-section probit estimation results are shown in Appended Chart 2-7.
As in section 3.2 of the text, we made two kinds of combination of variables to test various indicators of trade contagion and financial contagion. The probit model of the first combination is same to equation (17). The probit model of the second combination is same to equation (18).

From the probit results of the Asian crisis shown in Appended Chart 2-3, we find that financial contagion play a significant role in the spillover of crisis. One indicator of financial fragility—short term debt to reserves—is also significant in one case. These may indicate that the Asian crisis is capital account crisis basically. Before the Asian crisis, there were large capital inflows in the Asian countries from the financial institutions of developed countries. Among these developed countries, the loans from Japan account for very large share for the Asian crisis countries before the Asian crisis. According to Ogawa and Kumamoto (2000), before the Asian crisis, the share of loans from Japan to its total loans outstanding is about 60% in Thailand. The same share is about 40% in Indonesia, 40% in Malaysia, 30% in Korea, 10~20% in Philippines. Southeast Asian countries concentrating on the same common creditor increased financial fragility of them. Moreover, large short-term debts make these countries vulnerable to the reversal of capital flows. Therefore, when crisis occurred in Thailand, the other Southeast Asian countries may suffer financial

contagion through the portfolio adjustment by Japan to Thailand through financial contagion channel. Probit results of the Asian crisis show that trade contagion is not significant. This may be due to those exports to Thailand constituting small fraction of total exports from other East Asian crisis countries. The trade connections between East Asian countries were not strong. This may be the reason that trade contagion channel did not play significant role in the spread of the Asian crisis. Otherwise, fundamental variable of exports to GDP is significant. Therefore, although trade contagion channel play limited role in the transmission of Asian crisis, the change of precrisis exports to GDP could explain the occurrence of crisis.

Probit results of the Brazilian crisis shown in Appended Chart 4-5 suggest that trade contagion could explain the spread of crisis. Financial contagion is not significant in some cases and significant while not correctly signed in some cases. Fundamental variables of current account balance to GDP and short-term debt to reserves play some role in the occurrence of crisis.

Probit results of the Argentinean crisis shown in Appended Chart 6-7 also suggest that trade contagion is significant, financial contagion is not significant in some cases and significant while not correctly signed in some cases. Most fundamental variables of current account balance to GDP, exports to GDP, fiscal balance to GDP, M2 to GDP, GDP growth and short-term debt to reserves are significant.

Empirical results of the Brazilian crisis and Argentinean crisis indicate that weak fundamentals before the crises play significant role in the occurrence of crises. During the Brazilian crisis and Argentinean crisis, crisis countries have relatively high trade linkages. This may result in crises spread to other countries by trade contagion channel.

During the Brazilian crisis and Argentinean crisis, financial contagion channel did not play any role in the spread of these crises. There are several possible explanations for this. Firstly, the Latin American crisis countries did not concentrate their loans to the same common creditor so much as those East Asian countries did before the Asian crisis. This weakened the role of indirect financial linkages, that is, competition for funds in the common creditor. Secondly, after experiencing the Mexican crisis, Asian crisis, and Russian crisis, the international investment environment had changed much before the Brazilian crisis and the Argentinean crisis. In the late 1990s, investors retrenched funds from many emerging markets and commercial banks reduced the volume of short-term loans to emerging countries. This makes the risks were reduced from banks withdrawing their credit during the Brazilian crisis and Argentinean crisis. Comparing the short-term debts to BIS banks and short-term debt to reserves as shown in Appendix Figure 1 and Appendix Figure 2-3, we can see that the volume of short-term debts before the Brazilian crisis and Argentinean crisis were smaller than that before the Asian crisis. Thirdly, international investors have improved their approach to risk analysis. Improved information makes it possible for investors to discriminate between emerging countries, instead of treating all countries in one region as a group.

Via comparison of the Asian crisis and the Brazilian crisis, Argentinean crisis, we know that the Asian crisis could be considered as a capital account crisis, while the Brazilian crisis and Argentinean crisis are current account crises essentially, the occurrence of these two crises are due to weak domestic fundamental mostly.

—96—

Appended Chart 2 Cross Section Probit Results of the Asian Crisis (the first combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion Estimated Coefficient	Indirect Trade contagion Estimated Coefficient	Total trade1 contagion Estimated Coefficient	Total trade2 contagion Estimated Coefficient
C		0.882 (0.545)	-0.156 (0.889)	0.618 (0.592)	0.635 (0.583)
Real exchange rate depreciation	−		0.101 (0.925)		
Current account balance to GDP	−	-0.684 (0.125)		-0.685 (0.119)	-0.688 (0.119)
Exports to GDP	−	-4.029* (0.071)	-3.237* (0.073)	-3.908* (0.06)	-3.900* (0.06)
Fiscal balance to GDP	−	0.681 (0.111)	0.352** (0.015)	0.654 (0.104)	0.656 (0.104)
M2 to GDP	+	-3.721 (0.164)	-0.351 (0.879)	-3.647 (0.147)	-3.692 (0.146)
GDP growth	−	-0.362 (0.209)	0.071 (0.77)	-0.367 (0.195)	-0.369 (0.195)
Share of short-term BIS debt	+				
Short-term debt to reserves	+	0.931 (0.189)	0.889* (0.078)	0.871 (0.199)	0.87 (0.197)
Trade contagion	+	-0.594 (0.697)	2.18 (0.533)	-1.057 (0.781)	-1.251 (0.75)
Common creditor	+	522.351*** (0.003)	256.105 (0.286)	533.191** (0.02)	538.148** (0.015)
Diagnostic Test					
Number of observation		28	30	28	28
Wald chi2(8)		20.94	21.65	19.96	19.77
Prob>chi2		0.0073	0.0056	0.0105	0.011
Log pseudo-likelihood		-6.958	-9.835	-6.981	-6.971
Pseudo R2		0.6187	0.5011	0.6175	0.618

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Appended Chart 3 Cross Section Probit Results of the Asian Crisis (the second combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	Indirect Trade contagion	Total trade1 contagion	Total trade2 contagion
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		−1.479	−1.543	−1.598	−1.575
		(0.371)	(0.306)	(0.273)	(0.282)
Real exchange rate depreciation	−	1.473**	1.402***	1.364**	1.425**
		(0.038)	(0.009)	(0.024)	(0.019)
Current account balance to GDP	−	0.031	0.026	0.03	0.03
		(0.75)	(0.789)	(0.758)	(0.759)
Exports to GDP	−	−6.158**	−6.058**	−5.886**	−6.048**
		(0.019)	(0.018)	(0.024)	(0.019)
Fiscal balance to GDP	−				
M2 to GDP	+	5.646*	5.463*	5.386*	5.502*
		(0.067)	(0.07)	(0.08)	(0.071)
GDP growth	−				
Share of short-term BIS debt	+	−0.453	−0.459	−0.407	−0.447
		(0.851)	(0.85)	(0.867)	(0.854)
Short-term debt to reserves	+	0.156	0.158	0.176	0.163
		(0.727)	(0.73)	(0.702)	(0.721)
Trade contagion	+	−0.285	−0.652	0.358	−0.425
		(0.855)	(0.876)	(0.916)	(0.91)
Funds competition	+	7.153***	7.238**	6.631**	7.081**
		(0.004)	(0.031)	(0.022)	(0.014)
Diagnostic Test					
Number of observation		26	27	26	26
Wald chi2(8)		13.67	13.85	14.24	13.82
Prob>chi2		0.091	0.086	0.0758	0.0865
Log pseudo-likelihood		−10.433	−10.436	−10.442	−10.441
Pseudo R2		0.378	0.414	0.377	0.377

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Appended Chart 4 Cross Section Probit Results of the Brazilian Crisis (the first combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion Estimated Coefficient	Indirect Trade contagion Estimated Coefficient	Total trade1 contagion Estimated Coefficient	Total trade2 contagion Estimated Coefficient
C		−5.368 (0.122)	−4.834** (0.046)	−1.921 (0.313)	−2.078 (0.214)
Real exchange rate depreciation	−	4.542* (0.083)		2.196 (0.319)	1.306 (0.572)
Current account balance to GDP	−	−0.608** (0.02)	−0.448** (0.012)	−0.387** (0.019)	−0.416*** (0.001)
Exports to GDP	−				1.303 (0.552)
Fiscal balance to GDP	−	−0.139 (0.492)	−0.091 (0.487)	−0.017 (0.895)	
M2 to GDP	+	−3.281* (0.075)	−3.845* (0.091)		
GDP growth	−		0.252 (0.114)	0.119 (0.421)	0.113 (0.419)
Share of short-term BIS debt	+	2.546 (0.557)	2.799 (0.38)	−1.022 (0.712)	−0.999 (0.763)
Short-term debt to reserves	+	0.081 (0.895)	0.514 (0.283)	0.395 (0.406)	0.475 (0.372)
Trade contagion	+	1.897* (0.07)	5.152* (0.065)	3.074 (0.383)	4.173 (0.262)
Common creditor	+	−45.092 (0.356)	−48.633 (0.163)	−95.055* (0.086)	−81.776* (0.062)
Diagnostic Test					
Number of observation		28	30	28	28
Wald chi2(8)		8.73	9.76	15.19	16.77
Prob>chi2		0.3652	0.2821	0.0556	0.0326
Log pseudo-likelihood		−8.007	−9.613	−8.983	−8.751
Pseudo R2		0.450	0.447	0.383	0.399

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Appended Chart 5 Cross Section Probit Results of the Brazilian Crisis (the second combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	Indirect Trade contagion	Total trade1contagion	Total trade2 contagion
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		-9.63** (0.015)	-8.83** (0.018)	0.822 (0.697)	0.026 (0.99)
Real exchange rate depreciation	−	29.778** (0.012)	13.771*** (0.006)		
Current account balance to GDP	−	-3.423** (0.015)	-1.524*** (0.001)	-0.663*** (0.008)	-0.67*** (0.004)
Exports to GDP	−		-2.219 (0.618)	5.692 (0.154)	5.349 (0.12)
Fiscal balance to GDP	−			0.032 (0.851)	0.027 (0.865)
M2 to GDP	+	-10.642* (0.053)		-0.879 (0.731)	-1.095 (0.64)
GDP growth	−		0.473** (0.015)		
Share of short-term BIS debt	+	-12.824* (0.064)	-4.37 (0.351)	-7.573 (0.188)	-6.321 (0.209)
Short-term debt to reserves	+	1.11** (0.024)	0.971** (0.019)	0.566 (0.25)	0.627 (0.229)
Trade contagion	+	2.948* (0.084)	15.468** (0.028)	7.078 (0.315)	7.371 (0.186)
Funds competition	+	-7.306*** (0.009)	-4.596 (0.151)	-7.672 (0.175)	-5.64** (0.027)
Diagnostic Test					
Number of observation		26	27	26	26
		Wald chi2(7) = 14.38	Wald chi2(8) = 25.63	Wald chi2(8) = 26.82	Wald chi2(8) = 28.03
Prob>chi2		0.0448	0.0012	0.0008	0.0005
Log pseudo-likelihood		-3.843	-5.462	-6.268	-6.208
Pseudo R2		0.698	0.618	0.508	0.512

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Appended Chart 6 Cross Section Probit Results of the Argentina Crisis (the first combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	Indirect Trade contagion	Total trade1 contagion	Total trade2 contagion
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		6.609 (0.215)	0.238 (0.936)	-0.173 (0.875)	-0.161 (0.883)
Real exchange rate depreciation	−			-3.376 (0.315)	-3.354 (0.316)
Current account balance to GDP	−	-0.184 (0.136)	-1.071** (0.015)	-0.261* (0.066)	-0.267* (0.07)
Exports to GDP	−	-8.487** (0.045)	-30.732*** (0.008)	-5.809* (0.071)	-5.925* (0.069)
Fiscal balance to GDP	−	-0.29* (0.096)	-0.196* (0.082)	-0.127 (0.201)	-0.125 (0.211)
M2 to GDP	+	0.893 (0.689)			
GDP growth	−		-1.956** (0.025)	-0.402** (0.013)	-0.416** (0.013)
Share of short-term BIS debt	+	-10.167 (0.212)	-7.814 (0.143)		
Short-term debt to reserves	+	2.228* (0.055)	0.797 (0.334)	0.391 (0.504)	0.393 (0.503)
Trade contagion	+	-2.073 (0.195)	48.13*** (0.009)	6.14 (0.343)	6.381 (0.354)
Common creditor	+	-2094.783 (0.117)	-1413.171 (0.126)	-356.777 (0.763)	-327.272 (0.785)
Diagnostic Test					
Number of observation		28	30	28	28
Wald chi2(8)		19.69	11.29	35.35	34.45
Prob>chi2		0.0116	0.186	0	0
Log pseudo-likelihood		-7.415	-6.032	-7.368	-7.372
Pseudo R2		0.436	0.598	0.439	0.439

Note: Probability levels of z-statistics in parentheses
***, ** and * indicate significant at 1%, 5% and 10%, respectively.

Appended Chart 7 Cross Section Probit Results of the Argentina Crisis (the second combination)

Dependent Variable:CRIIND	Expected sign	Direct Trade Contagion	Indirect Trade contagion	Total trade1contagion	Total trade2 contagion
		Estimated Coefficient	Estimated Coefficient	Estimated Coefficient	Estimated Coefficient
C		1.866* (0.072)	−4.199 (0.109)	6.156* (0.08)	2.144* (0.056)
Real exchange rate depreciation	−		−4.717 (0.173)		
Current account balance to GDP	−		−0.261 (0.114)		0.028 (0.812)
Exports to GDP	−	−8.283** (0.024)	−4.617 (0.138)	−28.288** (0.042)	−10.438** (0.023)
Fiscal balance to GDP	−	0.015 (0.905)	−0.183*** (0.007)	0.606 (0.194)	
M2 to GDP	+	7.534* (0.091)		30.685* (0.07)	8.186** (0.017)
GDP growth	−	−0.611 (0.23)		−3.365 (0.103)	−0.792 (0.141)
Share of short-term BIS debt	+		3.916 (0.238)		
Short-term debt to reserves	+	−0.178 (0.825)		−3.704 (0.148)	−0.45 (0.582)
Trade contagion	+	1.244 (0.378)	14.234** (0.047)	42.309* (0.068)	9.253* (0.084)
Funds competition	+	−11.889*** (0.006)	−3.62 (0.168)	−33.047** (0.023)	−13.71*** (0.001)
Diagnostic Test					
Number of observation		26	27	26	26
Wald chi2(7)		14.03	14.79	22.75	13.92
Prob>chi2		0.051	0.0387	0.0019	0.0526
Log pseudo-likelihood		−5.631	−9.128	−4.980	−5.425
Pseudo R2		0.558	0.362	0.609	0.574

Note: Probability levels of z-statistics in parentheses

***, ** and * indicate significant at 1%, 5% and 10%, respectively.