Why are Currency Crises Contagious?

Reuven Glick and Andrew K. Rose*

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Executive Summary

Currency crises tend to be regional. Since macroeconomic and financial phenomena are not regional, these phenomena are unimportant in understanding why crises spread. But international trade is regional, as countries tend to trade with their neighbors. This suggests that trade links are important in understanding how currency crises spread, above and beyond any macroeconomic phenomena. We provide empirical support for these hypotheses. Using data for five different currency crises (in 1971, 1973, 1992, 1994, and 1997) we show that currency crises affect clusters of countries tied together by international trade. By way of contrast, macroeconomic and financial influences are not closely associated with the cross-country incidence of speculative attacks.

Keywords: speculative; attack; exchange rate; international; macroeconomic; empirical; trade.

Reuven Glick
Federal Reserve Bank of San Francisco
101 Market St.,
San Francisco CA 94105
Tel: (415) 974-3184
Fax: (415) 974-2168
E-mail: reuven.glick@sf.frb.org

Andrew K. Rose
Haas School of Business
University of California
Berkeley, CA USA 94720-1900
Tel: (510) 642-6609
Fax: (510) 642-4700
E-mail: arose@haas.berkeley.edu

* Glick is Vice President and Director of the Center for Pacific Basin Studies, Economic Research Department, Federal Reserve Bank of San Francisco. Rose is B.T. Rocca Jr. Professor of International Trade and Economic Analysis and Policy in the Haas School of Business at the University of California, Berkeley, NBER research associate and CEPR Research Fellow. We thank Priya Ghosh and Laura Haworth for research assistance and a large number of colleagues for comments. The views expressed below do not represent those of the Federal Reserve Bank of San Francisco or the Board of Governors of the Federal Reserve System, or their staffs. This is a condensed version of a paper with the same title, which is available as NBER Working Paper #6806 and CEPR DP No. 1947. A current (PDF) version of this paper and the (Excel 97 spreadsheet) data set used in the paper are available at http://haas.berkeley.edu/~arose.

1: Introduction

Currency crises tend to be regional. In this paper, we attempt to document this fact, and to understand its implications.

Economists tend to think about currency crises using two models of speculative attacks (we use the expression synonymously with currency crises). One model points to inconsistencies between an exchange rate commitment and domestic economic fundamentals such as an underlying excess creation of domestic credit prompted by a fiscal imbalance which generates inflation, an over-valued exchange rate and a current account deficit. Another views speculative attacks as being self-fulfilling duels between speculators and the government over inflation, unemployment and growth. What is common to both models is their emphasis on macroeconomic and financial fundamentals as determinants of currency crises. But macroeconomic phenomena do not tend to be regional. Thus from the traditional perspective, it is hard to understand why currency crises tend to be either regional or contagious.

On the other hand, trade patterns *are* regional; countries tend to export and import with their neighbors. Trade linkages seem like an obvious place to look for a regional explanation of currency crises. It is easy to imagine why the trade channel might potentially be important. If prices tend to be sticky, a nominal devaluation delivers a real exchange rate pricing advantage, at least in the short run. That is, countries lose competitiveness when their trading partners devalue. They are therefore more likely to be attacked — and to devalue — themselves. So trade provides a reason why currency crises are both regional and contagious.

Of course, this channel may not be important in practice. Nominal devaluations need not result in real exchange rate changes for any long period of time. Devaluations are costly and can be resisted. Making the case for the trade channel is primarily an empirical exercise.

This paper argues that trade is an important channel for currency contagion, above and beyond macroeconomic influences. Countries who trade and compete with the targets of speculative attacks are themselves likely to be attacked.

Our point is modest and intuitive. We ignore a number of related issues. For instance, in trying to model "contagion" in currency crises, we do not rule out the possibility of (regional) shocks common to a number of countries. Moreover, we do not attempt to study the timing, order, or intensity of currency crises.[1] Also, we do not ask why some crises become contagious and spread while others do not. We *do* intend to show that, given the occurrence of a currency crisis, the incidence of speculative attacks across countries is linked to the importance of international trade linkages. That is, currency crises spread along the lines of trade linkages, after accounting for the effects of macroeconomic and financial factors.[2] This linkage is intuitive, statistically robust, and important in understanding the regional nature of speculative attacks.

Section II motivates the analysis by discussing the regional nature of three recent waves of speculative attacks. A section that provides a framework for our analysis follows. Our methodology and data are discussed in section IV; the actual empirical results follow. The paper ends with a brief conclusion.

2: Have Currency Crises Been Regional?

Substantially. But not exclusively.

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[1] We study the intensity of currency crises in the working paper version of this paper.

[2] Of course, currency crises may spread through other channels as well, such as international asset and debt relationships. However, these non-trade linkages tend to be correlated with trade flows. Data constraints prevent us from explicitly comparing these channels to our trade and macro channels for contagion.

The last decade has witnessed three important currency crises. In the autumn of 1992, a wave of speculative attacks hit the European Monetary System and its periphery. Before the end of the year, five countries (Finland, the UK, Italy, Sweden and Norway) had floated their currencies. Despite attempts by a number of countries to remain in the EMS with the assistance of devaluations (by Spain, Portugal and Ireland), the system was unsalvageable.

The Mexican peso was attacked in late 1994 and floated shortly after an unsuccessful devaluation. The most prominent targets of the "Tequila Hangover" attacks that followed were Latin American countries, especially Argentina and Brazil, but also including Peru and Venezuela. Not all Latin countries were attacked — Chile being the most visible exception — and not all economies attacked were in Latin America (Thailand, Hong Kong, the Philippines and Hungary also suffered speculative attacks). While there were few devaluations, the attacks were not without effect. Argentine macroeconomic policy in particular tightened dramatically, precipitating a sharp recession.

The "Asian Flu" began with continued attacks on Thailand in the late spring of 1997 and continuing with flotation of the baht in early July 1997. Within days speculators had attacked Malaysia, the Philippines, and Indonesia. Hong Kong and Korea were attacked somewhat later on; the crisis then spread across the Pacific to Chile and Brazil. The effects of "Bhatulism" lingered on until at least the flotation of the Brazilian real in January 1999.

All three waves of attacks were largely regional phenomena. Once a country had suffered a speculative attack – Thailand in 1997, Mexico in 1994, Finland in 1992 – its trading partners and competitors were disproportionately likely to be attacked themselves. Not all major trading partners devalued – indeed, not all major trading partners were even attacked. Macroeconomic and financial influences are certainly not irrelevant. But neither, as we shall

see, is the trade channel irrelevant as a means of transmitting speculative pressures across international borders.

3: The Framework

Contagion in currency crises has come to be studied by economists only recently. Eichengreen, Rose and Wyplosz (1996) provide a critical survey and some early evidence.

For the purposes of this study, we think of a currency crisis as being contagious if it spreads from the initial target(s), for whatever reason. There are at least two different types of explanations for why contagion spreads, transmission mechanisms that are not mutually exclusive. The first relies on macroeconomic or financial similarity. A crisis may spread from the initial target to another if the two countries share various economic features such as weak banking systems, over-valued exchange rates or inadequate reserves. Currency crises may be regional if macroeconomic features of economies tend to be regional.

The alternative view is that devaluation gives a country a temporary boost in its competitiveness, in the presence of nominal rigidities. Its trade competitors are then at a competitive disadvantage; those most adversely affected by the devaluation are likely to be attacked next. In this way, a currency crisis that hits one country (for whatever reason) may be expected to spread to its trading partners. Since trade patterns are strongly negatively affected by distance, currency crises will tend to be regional.

In our analysis we account for both macroeconomic and trade linkages and let the data decide which is most important.

4: Methodology

Our objective in this paper is to demonstrate that trade provides an important channel for contagion above and beyond macroeconomic and financial similarities. As a result, we focus on the incidence of currency crises *across countries*. We ask why some countries are hit during certain episodes of currency instability, while others are not.

4.1 Empirical Strategy

Our strategy keys off the "first victim" of a speculative attack. A country is attacked for some reason. We do not take a stance one way or another on whether this initial attack is warranted by bad fundamentals or is the result of a self-fulfilling attack. Instead, we ask: "Given the incidence of the initial attack, how does the crisis spread from "ground zero?" Do they share common macroeconomic similarities? Or are the subsequent targets closely linked by international trade to the first victim? We interpret evidence in favor of the latter hypothesis as indicating the importance of the trade channel of contagion.

We use a simple regression methodology, estimating:

$$Crisis_i = \varphi Trade_i + \lambda M_i + \varepsilon_i$$

where: $Crisis_i$ is an indicator variable which is initially defined as unity if country i was attacked in a given episode, and zero if the country was not attacked; $Trade_i$ is a measure of trade linkage between country i and ground 0; M_i is a set of macroeconomic control regressors; λ is the corresponding vector of nuisance coefficients; and ε is a normally distributed disturbance representing a host of omitted influences which affect the probability of a currency crisis.

We estimate this binary probit equation across countries via maximum likelihood. The null hypothesis of interest is Ho: $\varphi=0$. We interpret evidence against the null as being consistent with a trade contagion effect.

4.2 The Data Set

We use cross-sectional data from five different episodes of important and widespread currency instability. These are: 1) the breakdown of the Bretton Woods system in the Spring of 1971; 2) the collapse of the Smithsonian Agreement in the late Winter of 1973; 3) the EMS Crisis of 1992-93; 4) the Mexican meltdown and the Tequila Effect of 1994-95; and 5) the Asian Flu of 1997-98. Our data set includes data from 161 countries, many of which were directly involved in *none* of the five episodes.

Making our work operational entails: a) measuring currency crises; b) measuring the importance of trade between the "first victim" and country i; and c) measuring the relevant macroeconomic and financial control variables. We now deal with these tasks in order.

4.3 Currency Crises

To construct our simple binary indicator regressand, it is relatively easy to determine crisis victims from journalistic and academic histories of the various episodes (we rely on *The Financial Times*). We have five different dummy variables, one for each episode, with crisis countries entered as one, non-crisis countries as zero. Our list of crisis countries is tabulated in the appendix. All five waves of currency crises we examine have a strongly regional nature.

The appendix also tabulates the "first victim" or "ground zero" countries first attacked. For some periods the "first victim" is relatively straightforward (Mexico in 1994, Thailand in

1997). For others, it is more arguable. In 1971 and 1973 we consider Germany to be ground zero (though using the U.S. for ground 0 makes little difference). The 1992 crisis is more complex still. We think of the Finnish flotation as being the first important incident (making Finland "ground zero"), but one can make a case for Italy (which began to depreciate immediately following the Danish Referendum of June 1992) or Germany because of the aftermath of Unification. We show in our working paper that our results are insensitive to the exact choice of "first victim" country.

4.4 Trade Linkages

Once our "ground zero" country has been chosen, we need to be able to quantify the importance of international trade links between the first victim and other countries. We focus on the degree to which ground zero competes with other countries in foreign (third country) export markets. Our default measure of trade linkage is

$$\text{Trade}_i \equiv \Sigma_k \{[(x_{0k} + x_{ik})/(x_{0.} + x_{i.})] \cdot [1 - |(x_{ik} - x_{0k})|/(x_{ik} + x_{0k}]\}$$

where x_{ik} denotes aggregate bilateral exports from country i to k ($k \neq i, 0$) and $x_{i.}$ denotes aggregate bilateral exports from country i. This index is a weighted average of the importance of exports to country k for countries 0 and i. The importance of country k is greatest when it is an export market of equal importance to both 0 and i. The weights are proportional to the importance of country k in the aggregate trade of countries 0 and i. Higher values of Trade_i denote greater trade competition between 0 and i in foreign export markets. Our trade measures

are computed using annual data for the relevant crisis year taken from the IMF's *Direction of Trade* data set.

Our default measure is an imperfect measure of the importance of trade linkages between country i and "ground zero." It relies on actual rather than potential trade, and aggregate data. It ignores direct trade between the two countries. Imports are ignored. Countries of vastly different size are a potential problem. Cascading effects are ignored. Thus we have computed a number of different perturbations to our benchmark measure. Reassuringly, that our trade measures are insensitive to the exact way we measure trade linkages.

4.5 Macroeconomic Controls

Our objective is to use a variety of different macroeconomic controls to account for the standard determinants of currency crises dictated by conventional economic models. We do this so that our trade linkage variable picks up the effects of currency crises that spill over because of trade *after* taking account of macroeconomic and financial imbalances that might lead to a currency crisis.

Our most important macro controls are: the annual growth rate of domestic credit; the government budget as a percentage of GDP; the current account as a percentage of GDP; the growth rate of real GDP; the ratio of M2 to international reserves; domestic CPI inflation; and the degree of currency under-valuation.[3] Our data set is annual, and was extracted from the

[3] We measure the last by constructing an annual real exchange rate index as a weighted sum of bilateral real exchange rates (using domestic and foreign CPIs) in relation to the currencies of all trading partners with available data. The weights sum to one and are proportional to the bilateral export shares with each partner. The degree of currency under-valuation is defined as the percentage change in the real exchange rate index between the average of the three prior years and the episode year. A positive value indicates that the real exchange rate is depreciated relative to the average of the three previous years.

IMF's *International Financial Statistics*. It has been checked for outliers via both visual and statistical filters.

5: Some Results

5.1 Univariate Evidence on Trade and Macroeconomic Linkages

Table 1 is a series of t-tests that test for equality of cross-country means for countries affected and unaffected by currency crises. These are computed under the null hypothesis of equality of means between crisis and non-crisis countries (assuming equal but unknown variances). Thus, a significant difference in the behavior of the variable across crisis and non-crisis countries – for instance consistently higher money growth for crisis countries – would show up as a large (negative) t-statistic.

There are two important messages from Table 1. First, the strength of trade linkage to "ground zero" varies systematically between crisis and non-crisis countries. In particular, it is systematically higher for crisis countries at reasonable levels of statistical significance. Second, macroeconomic variables do *not* typically vary systematically across crisis and non-crisis countries. While some variables sometimes have significantly different means, these results are not consistent across episodes. And they are never as striking as the trade results. These findings are consistent with the importance of the trade channel in contagion.

5.2 Multivariate Probit Results

Table 1 is not completely persuasive, since it consists of a set of univariate tests. We remedy that problem in Table 2. The top panel of Table 2 is a multivariate equivalent of Table 1, including a host of macroeconomic variables simultaneously with the trade variable. It reports

probit estimates of cross-country crisis incidence on trade linkage and macroeconomic controls. The latter variables are dictated by a variety of different models of speculative attacks, which can be viewed as primitive determinants of vulnerability to speculative pressure. Table 2b uses a wider range of countries (since many macroeconomic observations are missing in our sample) but restricts attention to the degree of currency under- or over-valuation. This is viewed by some as a summary statistic for macroeconomic misalignment.

Since probit coefficients are not easily interpretable, we report the effects of one-unit (i.e., one percentage point) changes in the regressors on the probability of a crisis (also expressed in probability values so that .01=1%), evaluated at the mean of the data. We include the associated z-statistics in parentheses; these test the null of no effect variable by variable. Diagnostics are reported at the foot of the table. These include a test for the joint significance of all the coefficients ("Slopes") which is distributed as chi-squared with seven degrees of freedom under the null hypothesis of no effect. We also include a p-value for the hypothesis that none of the macro effects are jointly significant (i.e., all the coefficients except the trade effect).

The results are striking. The trade channel for contagion seems consistently important in both statistical and economic terms. While the economic size of the effect varies significantly across episode it is consistently different from zero at conventional levels of statistical significance. Its consistently positive sign indicates that a stronger trade linkage is associated with a higher incidence of a currency crisis.

On the other hand, the macroeconomic controls are small economically and rarely of statistical importance. This is true both of individual variables, and of all seven macroeconomic factors taken simultaneously. It is also true of currency under-valuation.

Succinctly, the hypothesis of no significant trade channel for contagion seems wildly inconsistent with the data, while macroeconomic controls do not explain the cross-country incidence of currency crises.

We have checked for the sensitivity of our probit results with respect to a number of perturbations to our basic methodology; these are available in the working paper version of this paper. None indicate that our results are very sensitive.

6: Concluding Comments

We have found strong evidence that currency crises tend to spread along regional lines. This is true of five recent waves of speculative attacks (in 1971, 1973, 1992, 1994-95, and 1997). Accounting for a variety of different macroeconomic effects does not change this result. Indeed macroeconomic factors do not consistently help much in explaining the cross-country incidence of speculative attacks.

Our evidence is consistent with the hypothesis that currency crises spread because of trade linkages. That is, countries may be attacked because of the actions (or inaction) of their neighbors, who tend to be trading partners merely because of geographic proximity. This externality has important implications for policy. If this effect exists, it is a strong argument for international monitoring. A lower threshold for international assistance is also warranted than would be the case if speculative attacks were solely the result of domestic factors. And it gives guidance to investors searching to capitalize on the contagious nature of currency crises.

Reference

Eichengreen, Barry, Andrew K. Rose and Charles Wyplosz (1996). "Contagious Currency Crises: First Tests," *Scandinavian Journal of Economics*.

Table 1: T-Tests for Equality by Crisis Incidence

	1971	**1973**	**1992**	**1994**	**1997**
Trade	-9.5	-10.9	-4.7	-6.9	-7.5
%DM1	.8	1.1	1.2	-.9	-.1
%DM2	1.6	.8	1.1	-.6	.0
%DCredit	.8	1.3	.4	-.2	-.4
%DPrivate Credit	1.2	.1	.7	-.5	.3
M2/Reserves	-3.5	-2.6	.3	.5	-.3
%DReserves	-1.8	.7	1.3	1.4	2.1
%DExports	-1.0	-.9	.1	-.5	.1
%DImports	-1.5	-1.1	.8	-1.1	-.6
Current Account/GDP	-2.0	-2.1	-.8	.2	-.8
Budget/GDP	-1.6	-1.9	1.4	-.9	-.4
Real Growth	.7	.5	1.1	-1.6	-2.7
Investment/GDP	-3.2	-2.8	1.0	-.2	-2.7
Inflation	-.3	.7	1.5	-1.0	.6
Under-valuation	-.5	-.9	.6	1.5	-.6

Values tabulated are t-statistics, calculated under the null hypothesis of equal means and variances. A significant negative statistic indicates that the variable was significantly higher for crisis countries than for non-crisis countries.

Table 2a: Multivariate Probit Results with Macro Controls

	1971	1973	1992	1994	1997
Trade	2.09	3.18	.003	.50	.68
	(2.7)	(2.7)	(2.1)	(2.9)	(2.6)
%DCredit	-.01	-.01	.00	.00	N/A.
	(1.2)	(0.4)	(1.1)	(0.0)	
Budget/GDP	.01	.04	-.00	.00	N/A.
	(0.3)	(1.2)	(0.8)	(0.9)	
Current Account/GDP	.00	.03	.00	-.00	.00
	(0.2)	(1.0)	(0.1)	(1.7)	(0.0)
Real Growth	-.00	.04	-.00	.00	.04
	(0.2)	(1.2)	(1.6)	(0.1)	(2.2)
M2/Reserves	.00	.01	.00	-.00	.00
	(0.2)	(0.4)	(1.0)	(0.5)	(0.8)
Inflation	.01	.01	-.00	.00	.00
	(0.4)	(0.5)	(1.3)	(0.7)	(0.3)
Observations	53	60	67	67	50
Slopes (7)	26	36	24	16	17 (5df)
McFadden's R^2	.38	.49	.50	.36	.38
P-value: Macro=0	.89	.64	.59	.68	.26

Absolute value of z-statistics in parentheses.
Probit estimated with maximum likelihood.

Table 2b: Probit Results with Currency Misalignment

	1971	1973	1992	1994	1997
Trade	2.25	2.88	.31	.45	.54
	(4.5)	(4.2)	(3.2)	(3.8)	(4.5)
Under-valuation	.00	.00	-.00	-.00	.00
	(1.3)	(1.8)	(0.5)	(1.4)	(1.1)
Observations	80	85	111	109	107
McFadden's R^2	.38	.48	.21	.34	.36

Absolute value of z-statistics in parentheses.
Probit estimated with maximum likelihood.

Appendix: Countries Affected by Speculative Attacks

	1971	1973	1992	1994	1997
U.S.A.	1	1			
U.K.	1	1	1		
Austria	1	1			
Belgium	1	1	1		
Denmark	1	1	1		
France	1	1	1		
Germany	0	0			
Italy	1	1	1		
Netherlands	1	1			
Norway	1	1			
Sweden	1	1	1		
Switzerland	1	1			
Canada				1	
Japan		1			
Finland	1	1	0		
Greece	1	1			
Iceland		1			
Ireland	1		1		
Portugal	1	1	1		
Spain	1		1		
Australia	1	1			
New Zealand	1	1			
South Africa					1
Argentina				1	1
Brazil				1	1
Mexico				0	1
Peru				1	
Venezuela				1	
Taiwan					1
Hong Kong				1	1
Indonesia				1	1
Korea					1
Malaysia					1
Pakistan					1
Philippines				1	1
Singapore					1
Thailand				1	0
Vietnam					1
Czech Republic					1
Hungary				1	1
Poland					1

"0" denotes "first victim"/"ground zero"; "1" denotes target of speculative attack