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The Empirics of Currency and Banking Crises

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Andrew K. Rose*

Currency and banking crises are potholes on the road to financial liberalization. It is relatively rare for them to cause a vehicle to break an axle—to bring the process of growth and liberalization to an utter and extended halt—but the flats they cause can result in significant losses of time and output and set back the process of policy reform. The output costs of both currency and banking crises can be a year or more of economic growth and the resolution costs of banking crises have often been the equivalent of two or more years of GNP growth. As capital becomes increasingly mobile, the severity and prevalence of these problems has grown, as amply demonstrated by recent experience in Asia, Latin America, and Europe.

There is no shortage of theoretical models of the causes and consequences of banking and financial crises.¹ But in comparison, systematic empirical work has been scarce. For the last several years, therefore, together and with a number of collaborators, we have attempted to reorient work on this subject in empirical directions.

In this article, we review this empirical research on currency and

banking crises and provide a critical review of related literature. In addition, we offer some suggestions—and cautions—for future research.

Currency Crises

Contrary to the assumption of convenience made in some other recent writings, currency crises cannot be identified with changes in the exchange rate regime. Not all decisions to devalue or float the exchange rate are preceded by speculative attacks.² More importantly, a central bank may successfully defend its currency against attack by using its international reserves to intervene in the foreign exchange market. Alternatively, it may discourage speculation against the currency by raising interest rates or forcing the government to adopt other austerity policies.

An innovation of our work therefore has been to construct empirical measures of speculative attacks. We measure speculative pressure as a weighted average of changes in exchange rates, interest rates, and reserves, where all variables are measured relative to those of a center country.³ Intuitively, speculative pressure can lead to a loss of reserves, be rebuffed by a rise in domestic interest rates, or be conceded by a depreciation or devaluation of the exchange rate.⁴ Speculative attacks or currency crises (we use the terms interchangeably) are then defined as periods when this speculative pressure index reaches extreme values.

With this distinction in mind, we have analyzed of the experience of more than 20 OECD countries, using data that stretch back to the late 1950s.⁵ We find that devaluations—as distinct from currency crises—generally have occurred after periods of overly expansionary monetary and fiscal policies. These expansionary policies lead to price and wage infla-

tion, deteriorating international competitiveness, and weak external accounts. They occur when unemployment is high, as if governments are attempting to stimulate an economy in which unemployment has political and economic costs. But that stimulus leads to a loss of reserves, which jeopardizes exchange rate stability. There are some signs that governments react by adjusting policy in more restrictive directions in an effort to stem the loss of reserves. In episodes that culminate in devaluation, however, these adjustments prove inadequate. Reserves continue to decline, eventually forcing the government to devalue the exchange rate. When devaluation finally occurs, it is accompanied by some monetary and fiscal retrenchment to reassure investors and render the new level of the exchange rate sustainable. As inflationary pressures fall, there is a sustained boost to competitiveness that helps to restore balance to the external accounts. This comes at the expense of sustained unemployment and falling employment and output growth.

It is more difficult to generalize about currency crises. Put another way, devaluations are more predictable than speculative attacks.⁶ Although there are signs that crises, like devaluations, are preceded by loose monetary policies and inflation, there is less sign of governments attempting to rein in their expansionary policies as the threat to the exchange rate develops. The foreign exchange market intervention that occurs is sterilized (its potential effects on the domestic money supply are neutralized, and its effectiveness is therefore reduced). There are fewer signs of monetary and fiscal retrenchment in the wake of the event. The exchange rate changes that take place in response tend to be disorderly. They do not lead to the

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establishment of parities that are clearly sustainable. Indeed, the exchange rate is frequently floated rather than merely being devalued.

Thus, the failure of governments to adapt policy in a manner consistent with their exchange rate targets is at the heart of many currency crises. This points to the need for studying political incentives and constraints on economic policy formulation. One approach is to build on the theory of optimum currency areas and ask whether economic characteristics of countries that make exchange rate stability advantageous are associated with extensive and concerted foreign exchange market intervention.⁷ Another approach is to assess political considerations directly. We have tested whether speculative attacks are more likely to occur before or after elections and whether left- or right-wing governments are more susceptible to their effects. We also ask whether changes in government and changes in finance minister help to explain speculative attacks. We find that these standard measures of political conditions are in fact only loosely linked to speculative attacks and devaluations, although there is some evidence that when a new government assumes office because of the electoral defeat of its predecessor, it feels relatively free to devalue the currency. On other occasions the finance minister is used as the sacrificial lamb and takes the blame for the unsuccessful defense. It is perhaps not surprising that the evidence on political determinants of currency crises is less than definitive, as identifying them requires pinning down a number of separate effects—the effect of politics on economic policies, the effect of economic policies on expectations, and the effect of expectations on financial market outcomes—each of which is elusive. Clearly, this is an important area for further work.

Theoretical models suggest that

speculative attacks unfold differently in situations of high and low capital mobility.⁸ Our empirical work confirms this supposition. The presence of capital controls makes devaluations less likely and increases the likelihood that a government will be able to rebuff a speculative attack. In our empirical analysis, we have taken pains to allow for the fact that capital controls are endogenous. Indeed, we find that controls are more likely to appear after the exchange rate has been devalued and to disappear after a failed attack.

Contagion

The Asian crisis has focused attention not just on the determinants of speculative attacks but also on contagion. We think of contagion as a tendency for a currency crisis somewhere in the world to increase the probability of a crisis in another country after controlling for the latter's fundamentals. Some continue to question whether contagion exists, arguing that when several countries are attacked simultaneously this reflects not contagion but the fact that they all exhibit a weak underlying economic and financial position. Using our measure of currency crises, we have considered this question in a series of recent papers.⁹ We do so by adding the incidence of crises elsewhere in the world to the standard domestic determinants of currency crises. The results strongly suggest that the existence of a currency crisis elsewhere in the world (whether it leads to a devaluation or not) raises the probability of an attack on the domestic currency by about 8 percent, even after taking into account a variety of domestic political and economic factors. This evidence is strikingly robust: A variety of tests and a battery of sensitivity analyses confirm that a crisis abroad increases the probability of a speculative attack by an economi-

cally and statistically significant amount, even after controlling for economic and political fundamentals in the country concerned. This would appear to be the first systematic evidence of the existence of contagious currency crises.

How does the infection spread? One possibility is that attacks spread contagiously to other countries with which the subject country trades. In the presence of nominal rigidities, countries that devalue gain competitiveness at the expense of their trading partners. These competitors are therefore less likely to resist attacks and thus more likely to be attacked themselves. A second possibility is that attacks spread to other countries where macroeconomic and financial conditions are broadly similar, so that there is reason to suspect that the same underlying problems exist. We test these hypotheses by weighting our measure of contagion (that is, currency crises in other countries) by the importance of trade linkages, and, alternatively, by the similarity of macroeconomic policies and conditions. For our panel of 20 OECD countries, it turns out that contagion operating through trade is stronger than contagion as a result of macroeconomic similarities. When measures of both are included in the specification, trade-related contagion dominates. Moreover, our proxies for both trade-related contagion and macro-weighted contagion outperform a naive contagion measure (the simple existence of speculative attacks in other countries). We take this as confirmation that our results are picking up contagion per se and not just the effects of omitted environment factors common to the countries in question, although the latter might still be present. Admittedly, similarities in macroeconomic policies and performance across countries are more difficult to capture than the intensity of trade linkages; the stronger showing of

trade-related contagion may simply reflect our greater success in proxying this effect. But, reassuringly, our OECD panel evidence has been confirmed by other investigators using cross-sectional evidence for OECD and developing countries.¹⁰

Future work needs to pay more attention to currency crises in emerging markets. Unfortunately, attempts to construct proper measures of exchange market pressure tend to be stymied by the absence of comparable interest rate data for a large cross-section of developing countries. It may be argued that the absence of relevant interest rate data reflects the underdevelopment of the relevant financial markets, implying in turn that the authorities are not able to use the interest rate as an instrument for defending the currency. With this justification it is possible to construct a measure of currency crashes, either as a weighted average of exchange rate changes and reserve losses, or simply as large changes in the exchange rate. Analyzing the correlates of the latter measure suggests that currency crashes in developing countries are subject to many of the same determinants as those in advanced industrial countries.¹¹ Crashes tend to occur when the rate of growth of domestic credit is high and when output growth is slow, consistent with the behavior of industrial countries. In addition, emerging market crashes are most likely when global interest rates are high and rising and when the share of foreign direct investment (FDI) in total external debt is relatively low. A fall in FDI inflows by 10 percent of total debt is associated with an increase in the probability of a crash by 3 percent. Still, there is much work to be done. For example, developing countries are much more likely to threaten or impose capital controls in the face of speculative attacks; they are also much more likely to receive bailout packages led by the International

Monetary Fund. Incorporating the effects of these factors remains an important topic in the research agenda.

Banking Crises

Compared to currency crises, far less empirical work of a systemic, cross-country, comparative nature has been done on the causes and consequences of banking crises, especially in emerging markets.¹² Our own work does, however, point to a number of regularities.¹³ We find that the stage is set for banking crises by the interaction of fragilities in domestic financial structure and unpropitious global economic conditions. Our central finding is of a large, highly significant correlation between changes in industrial country interest rates and banking crises in emerging markets. We show that interest rates in the United States, Europe, and Japan tend to rise sharply and significantly in the year preceding the onset of banking crises. This result comes through strongly in univariate and multivariate analyses alike and is robust to changes in specification. There is also some evidence that the global business cycles and OECD growth in particular play important roles in the incidence of banking crises, with slowing growth in the advanced industrial countries associated with the onset of crises. These results point to the role of external conditions in heightening the vulnerability of emerging markets to banking problems. There are also signs that real overvaluation and slow growth at home help to set the stage for bank crises, but the evidence is inconsistent with the notion that domestic macroeconomic problems provide the entire explanation for emerging market banking crises. This is precisely the same result found, of course, for emerging market currency crashes.

In addition, our analysis confirms that banking crises can have quite

severe, if short-lived, macroeconomic effects. The disruptions associated with a banking crisis cause output growth to decline by 2 to 3 percent relative to the control group of non-crisis countries. That effect lasts only for a year, however; by the second year after a crisis, growth has recovered nearly to the levels typical of developing countries that are not in crisis.

Back to Theory

These results provide some guidance as to what kind of theoretical models are likely to reward further study. The results for OECD countries suggest that models in which governments are reluctant to raise interest rates to defend the currency for fear of aggravating an already serious domestic unemployment problem are likely to have considerable relevance.¹⁴ The results for emerging markets—for example, that the share of FDI in foreign debt is associated with currency and financial stability—are consistent with the many models in which the maturity structure of the debt is an important determinant of vulnerability to currency and financial crises. In turn, these conclusions point to the relevance of so-called second-generation models of currency and financial crises, in which crises cannot simply be predicted on the basis of macroeconomic fundamentals like the stance of monetary and fiscal policy. Instead, crises are possible—but not necessary—when the economy enters a zone of vulnerability in which authorities will be reluctant to use restrictive policies to defend the currency for fear of aggravating already-existing economic and financial fragilities.¹⁵ In such circumstances, attacks may occur if a sufficient number of currency traders coordinate on short sales of a currency. We expect future theoretical work to continue this line of argument.

Misleading Indicators

Concern over the disruptive effects of currency and banking crises has led to the development of a considerable industry in which econometric models like these are used in a mechanistic attempt to predict currency and banking crises.¹⁶ Our work suggests that these exercises are subject to important criticisms. Devaluations and floatations are intrinsically heterogeneous from a theoretical perspective; they may be caused by the slow deterioration of macroeconomic fundamentals (as in "first-generation" models), or they may result from self-fulfilling attacks. As a result, they defy generalization empirically, complicating efforts at prediction. Theoretical models have identified the kind of variables that can sap a government's ability to defend itself, thereby rendering it vulnerable to attack; but the domestic considerations that governments weigh when contemplating a costly defense of the currency vary across time and country. High unemployment, weak economic growth, a fragile banking system, and large amounts of short-term debt may have rendered governments reluctant to hike interest rates in the past, but one could imagine in the future that a government will be concerned instead with the level of property prices, the solvency of a heavily indebted nonfinancial corporation, or some very different consideration.

These variables do not provide much guidance on when the attack will come. Whether speculators attack will depend not just on the weakness of the banking system or the level of unemployment, but on how much governments care about further aggravating these problems when deciding whether to defend the currency. The only thing more difficult to measure than governments' resolve is investors' assessment of it. Even if observers con-

clude that the currency peg is vulnerable, no one market participant is likely to be large enough to build up the short position needed to exhaust the authorities' reserves. For that to occur, multiple investors would have to coordinate their actions. Coordinating devices vary from case to case and generally elude prediction; both the French Referendum on the Maastricht Treaty and the Chiapas uprising were exceptional noneconomic events. All in all, it is easy to understand why so many speculative attacks have come as surprises, even to the speculators themselves.¹⁷

A close look at existing attempts to build early warning systems underscores these points.¹⁸ These studies show that the estimated relationship between observable macroeconomic and financial indicators and the probability of large changes in exchange rates and reserves tends to be very sensitive to the sample of countries and the period for which the exercise is carried out. This belies the notion that there exist a single set of variables and a stable set of relationships on which crisis forecasting can be based. As most attacks come as surprises, models that rely on time-series data tend always to predict "no crisis."¹⁹ The models that perform best, in statistical terms, tend to be cross-sectional. They ask which countries were affected most severely during episodes of speculative pressure, and they rely on variables like reversals in the direction of capital flows and sudden reserve losses. Such variables are properly regarded as concurrent rather than leading indicators of currency crises; once this information is available, the horse has left the barn. The same criticisms apply to models that rely for their predictive power on the number of crises erupting in other countries in the current or immediately preceding months.

None of this is to deny the value of statistical studies seeking to deepen our understanding of past crises.

However, the success of future papers in explaining past crises does not mean that they will necessarily succeed in predicting future crises. This creates a real danger that the policy community, if led to think otherwise, will be lulled into a false sense of complacency.

¹ One seminal contribution is P. Krugman, "A Model of Balance-of-Payments Crises," *Journal of Money, Credit and Banking*, 11 (1979), pp. 311-25. A good recent review is R. Flood and N. Marion, "Perspectives on the Recent Currency Crisis Literature," NBER Working Paper No. 6380, January 1998. On the causes and consequences of banking crises, see D. Diamond, "Bank Runs, Deposit Insurance and Liquidity," *Journal of Political Economy*, 91 (1983), pp. 401-19; and B. Bernanke, "Nonmonetary Effects of the Banking Crisis in the Propagation of the Great Depression," *American Economic Review*, 73 (1983), pp. 57-76.

² Recall, for example, the decision of the Taiwanese authorities in October 1997 to devalue their currency despite the absence of significant speculative pressure in the foreign exchange market, or the numerous EMS realignments undertaken in periods of tranquility before 1987.

³ We typically choose Germany, as it is both a strong-currency country and has been at the core of all OECD fixed exchange rate regimes. See B. Eichengreen, A. Rose, and C. Wyplosz, "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration With Special Reference to the European Monetary System," in *The New Transatlantic Economy*, M. Canzoneri, W. Ethier, and V. Grilli, eds. New York: Cambridge University Press, 1996.

⁴ Other empirical studies, which have failed to distinguish actual changes in exchange rates from speculative attacks, can therefore be subject to serious bias. Models like those of L. Girton and D. Roper, "A Monetary Model of Exchange Market Pressure Applied to Postwar Canadian Experience," *American Economic Review*, 67 (1977), pp. 537-48, can be used to derive the weights on the three elements of our speculative pressure index. Given the limitations of the empirical literature on exchange rate determination, we instead choose weights on the basis of data characteristics and undertake extensive sensitivity analysis.

⁵ See also B. Eichengreen, A. Rose, and

C. Wyplosz, "Is There a Safe Passage to EMU? Evidence on Capital Controls and a Proposal," in *The Microstructure of Foreign Exchange Markets*, J. A. Frankel, G. Galli, and A. Giovannini, eds. Chicago: University of Chicago Press, 1996; and "Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks," *Economic Policy*, 21 (1995), pp. 249–312.

⁶ That currency crises are more heterogeneous than devaluations and that their timing is difficult to predict is consistent with the conclusions of Rose and Svensson, who found that macroeconomic fundamentals are of relatively little use for explaining the credibility of exchange rate parities. Eichengreen and Wyplosz also found that fundamentals did not obviously predict the timing of the 1992 attack on the EMS. A. Rose and L. Svensson, "European Exchange Rate Credibility Before the Fall," in *European Economic Review*, 38 (1994), pp. 1185–1216; B. Eichengreen and C. Wyplosz, "The Unstable EMS," *Brookings Papers on Economic Activity*, 1 (1993), pp. 51–144.

⁷ One of us has recently reported evidence to this effect: B. Eichengreen and T. Bayoumi, "Exchange Rate Volatility and Intervention: Implications of the Theory of Optimum Currency Areas," *Journal of International Economics*, 45 (1998), pp. 191–209.

⁸ C. Wyplosz, "Capital Controls and Balance of Payments Crises," *Journal of International Money and Finance*, 5 (1986), pp. 167–79.

⁹ B. Eichengreen, A. Rose, and C. Wyplosz,

"Contagious Currency Crises: First Tests," *Scandinavian Journal of Economics*, 98 (1996), pp. 463–84; B. Eichengreen and A. Rose, "Contagious Currency Crises: Channels of Conveyance," in *Changes in Exchange Rates in Rapidly Developing Countries*, T. Ito and A. Krueger, eds. Chicago: University of Chicago Press, 1998; B. Eichengreen, A. Rose, and C. Wyplosz, "Contagious Currency Crises," NBER Working Paper No. 5681, August 1996.

¹⁰ R. Glick and A. Rose, "Contagion and Trade: Why Are Currency Crises Regional?" *Federal Reserve Bank of San Francisco Working Paper*.

¹¹ J. Frankel and A. Rose, "Currency Crashes in Emerging Markets: An Empirical Treatment," *Journal of International Economics*, 41 (November 1996), pp. 351–66.

¹² An important exception is A. Demirgüç-Kunt and E. Detragiache, "The Determinants of Banking Crises: Evidence From Developing and Developed Countries," *IMF Working Paper No. 97/107*, September 1997.

¹³ B. Eichengreen and A. Rose, "Staying Afloat When the Wind Shifts: External Factors and Emerging-Market Banking Crises," NBER Working Paper No. 6370, January 1998.

¹⁴ B. Eichengreen and O. Jeanne, "Currency Crises and Unemployment: Sterling in 1931," NBER Working Paper No. 6563, May 1998.

¹⁵ M. Obstfeld, "Models of Currency Crises With Self-Fulfilling Features," NBER

Working Paper No. 5285, February 1997; also published in *European Economic Review*, 40 (1996), pp. 1037–47. We claim patrimony (in 1994) of the first- and second-generation terminology used to distinguish alternative approaches to modeling currency crises. See B. Eichengreen, A. Rose, and C. Wyplosz, "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration With Special Reference to the European Monetary System."

¹⁶ International Monetary Fund, "Financial Crises: Characteristics and Indicators of Vulnerability," in *World Economic Outlook*, International Monetary Fund, May 1998; G. Kaminsky, S. Lizondo, and C. Reinhart, "Leading Indicators of Currency Crises," *Policy Research Working Paper No. 1852*, The World Bank, November 1997; D. Hardy and C. Pazarbasioglu, "Leading Indicators of Banking Crises: Was Asia Different?" *IMF Working Paper No. 98/91*, June 1998.

¹⁷ A. Rose and L. Svensson, "European Exchange Rate Credibility Before the Fall."

¹⁸ Another study that makes these points is A. Berg and C. Pattillo, "Are Currency Crises Predictable? A Test," unpublished manuscript, International Monetary Fund, July 1998.

¹⁹ Indeed, suppose that forecasts of a country's vulnerability trigger corrective policy actions that then prevent a crisis. In this case, the model would appear to forecast poorly, as the potential for a crisis would never be followed by an actual crisis.

Exchange Rates and Prices

Charles M. Engel*

In the early 1970s, when the industrialized countries abandoned the fixed exchange rates of the Bretton Woods system, many economists were surprised by the high volatility of exchange rates under the new regime of more flexible rates. Dornbusch provided a new paradigm,

based on the Mundell–Fleming model of the 1960s, but granting a prominent role to expectations in the determination of exchange rates.¹ His model assumed that nominal goods prices adjusted sluggishly, but that exchange rates resembled asset prices more closely. In that model, expectations generated the short-run "overshooting" of exchange rates in response to monetary and other demand shocks.

The Dornbusch model dominated academic discussions of exchange rates for at least a decade, but gradually began to lose favor. There were

two reasons for the decline of the overshooting model. First was evidence that the model was not very useful in forecasting exchange rates. Meese and Rogoff showed that forecasts of the exchange rate based on the Dornbusch model could not beat the simplest forecast of no-change-in-the-exchange-rate.² Still, not all of the empirical evidence on the Dornbusch model was negative. For example, Frankel and I used the Dornbusch model to explain the famous money supply announcements puzzle of the early 1980s.³ The model was successful in explaining the simultane-

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