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IMPLICATIONS OF PAST CURRENCY CRISES FOR THE U.S. CURRENT ACCOUNT ADJUSTMENT

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Abstract

This paper examines past currency crises to shed light on the likelihood that the adjustment of the U.S. current account deficit will involve a dollar crisis. A currency crisis is narrowly defined to be a depreciation that exceeds a critical threshold, regardless of whether it has an adverse effect on the real economy. The literature suggests that one should not infer from the experience of emerging economies what will happen to the dollar. This paper's empirical findings lend support to that view. Everything else being equal, currencies are more likely to collapse in emerging economies than in industrial countries. The collapse of a currency in industrial countries actually helped to revive economic growth in some instances, even though it tended to cause severe output loss in emerging economies with a pegged currency.

The estimated probability of a dollar crisis, which contains a significant upward bias, has risen significantly from 2003 (about five percent) to 2006 (about 10 percent), a period during which both the current account deficit and the oil price rose substantially. That rise in the estimated probability, though in part due to the oil price hike, signals that the probability would keep increasing if the U.S. current account deficit continues to grow faster than GDP. Nevertheless, a more thorough analysis taking into account of many factors beyond the regressions suggests that the adjustment of the U.S. current account deficit is likely to be gradual rather than involving a dollar crisis; and, in the unlikely event of a dollar crisis, the U.S. economy should be able to withstand it without suffering a severe recession.

1. Introduction

Currency upheavals have been a recurring phenomenon since the end of the classical gold standard in 1914. The inter-war period witnessed numerous currency crises. Hopes for an international monetary system free of currency crises were raised by the creation of the Bretton Woods system in 1945, only to be dashed by that system's demise in early 1973. Currency crashes have occurred frequently since then, sometimes with devastating real consequences. In the 10-year period between 1992 and 2002, the world again witnessed several currency collapses in quick succession: the crisis of the European Exchange Rate Mechanism (ERM) in 1992-93; the Mexican crisis in 1994-95; the Asian crisis in 1997-98; the Russian crisis of 1998; the Brazilian peso crisis of 1999; and Argentina's crisis of 2002. Those developments have rekindled research interest in improving the understanding and management of currency crises and have spawned a large literature.

Against this backdrop, the large and growing global trade imbalances of recent years have raised the possibility of another sharp and sudden realignment of exchange rates. What insight can we draw from past currency crises to help assess the risk of a dollar crisis posed by the large U.S. current account deficit (6.5 percent of GDP in 2005)? Whether that large deficit may result in a hard-landing for the dollar has been a subject of much debate. Some analysts worry that if policies are not adopted to bring down the U.S. current account deficit, there is a high risk that a dollar crisis will ensue.[1] At some point, investors may not want to continue holding dollar assets. If that scenario were to occur

[1] For example, see Bergsten (2004), Martin Wolf (2004), Roubini and Setser (2004, 2005) and Obstfeld and Rogoff (2005).

suddenly, according to those analysts, the dollar could crash and cause serious consequences for the U.S. and the global economy.

Some analysts, however, argue that the risk of a hard landing for the dollar is small. They point out that precedents of high current account deficits leading to currency crises are mostly those of developing countries with inflexible exchange rate systems, hardly applicable to the United States, which is an advanced country with a freely floating exchange rate. Some argue that the large U.S. current account deficit is an endogenous result of some emerging economies' attempt to avoid future currency crises in an international monetary system in which the dollar is the major reserve currency, not an imbalance that threatens an impending dollar crisis.[2] Still others believe that the United States, in fact, does not have a problem of large external imbalances, once the value of "dark matter" is included in the measurement of U.S.-owned assets abroad.[3]

This paper looks to the experience of past crises in both emerging and industrial economies to shed light on these issues. We begin by identifying crisis events from a sample of 51 countries over the years from 1970 through 2004, pointing out stylized patterns displayed by those crisis events. Next, we briefly summarize prominent theories advanced in the literature to explain why and how currency crises occur and what factors make some crises more severe (in output loss) than others. We then conduct empirical

[2] See Dooley, Folkerts-Landau, and Garber (2003, 2004, and 2005) for the so-called Bretton Woods II theory.

[3] Inferring from the fact that the United States has been earning more income from its assets abroad than paying foreign investors for assets they own in this country, Hausmann and Stuzenegger (2005) argue that the United States owns valuable "dark matter"—assets that must exist because they generate revenue but cannot be seen or measured, such as U.S. firms' superior know-how, the liquidity service provided the U.S. dollar, and the lower risk of U.S. assets than emerging-country assets—that are not included in the official measurement of U.S. international assets. Counting their rough measure of "dark matter" as a part of U.S.-owned assets, the authors estimated the U.S. net international investment position to be about $600 billion, not -$2.5 trillion, at the end of 2004.

analyses to estimate the influence of economic fundamentals on the probability and the severity of a currency crisis, drawing explanatory variables from those theories.

Thus, rather than attempting to test some individual theories, we aim to bring the leading theories together to sort out the common fundamental factors that trigger a currency crisis as well as pre-crisis conditions that tend to deepen the severity a currency crisis. This approach is grounded in our view that, even though each crisis episode is unique in some way and may be better explained by one theory than by others, the factors focused on by each theory are not necessarily mutually exclusive. We also hope to find out whether some fundamental economic factors, if any, deserve particular attention because of their dominant role in causing the most severe crises.

Following Frankel and Rose (1996), we define a currency crisis as a currency's depreciation that exceeds a critical threshold, regardless of whether there is a collapse of the currency regime, a large drop in foreign exchange reserves, or an adverse effect on economic activity. This approach allows us to investigate the influence of exchange-rate regimes and the development status of an economy, among other factors, on the probability and economic effect of a currency crisis. With this definition, we identify 133 episodes of currency crisis in our sample. We then conduct probit regressions to estimate the effect of some commonly-cited fundamental variables on the probability of a currency crisis. Separately, we also conduct OLS and tobit regressions to estimate the effect of fundamental variables on the severity (in terms of output loss) of a currency crisis. The list of those fundamental variables includes the exchange rate regime, the current account balance, the budget balance, the origin of legal rules, inflation, trade openness, whether a country is industrialized, among others.

Our findings include the following. First, a rise in the current account deficit/GDP ratio indeed increases the probability of a crisis, as well as the severity of output losses resulting from a crisis. An increase in some other indicators of economic imbalances, such as fiscal deficit or inflation, also leads to a higher probability of a crisis. Second, exchange-rate regimes have a significant effect, statistically and quantitatively, on both the probability and severity of a currency crisis. Countries with a currency-peg regime are less prone to a currency crisis than those with an intermediate regime (such as a crawling-peg or target-zone regime); however, once those countries are hit by a crisis they tend to suffer a larger output loss than those adopting either an intermediate regime or a free-floating regime. Third, countries with a higher degree of openness to international trade and capital flows are less prone to currency crises. Finally, industrial countries are less likely to experience currency crises and, in the event of a currency crisis, the impact of that crisis on the real economy tends to be less severe or even positive.

Our empirical results and overall analyses thus give rise to three broad-stroke implications. First, the large U.S. current account deficit cannot keep rising relative to GDP without triggering some kind of adjustment process some time down the road. Second, in the absence of policy blunders or other shocks, the U.S. current account adjustment is likely to evolve gradually rather than to entail a dollar crisis.[4] Third, in the unlikely event of a dollar crisis, the U.S. economy should be able to withstand the crisis without suffering a severe recession in the absence of policy errors.

The remainder of this paper consists of six sections. Section 2 describes how we identify a crisis and measure the severity of its impact on output, and observes the

[4] A recent paper by Edwards (2006) lends some support to this conclusion.

stylized patterns of the frequency and severity of currency crises since 1970. Section 3 synthesizes the most prominent theories in the literature regarding the causes and effects of currency crises. Section 4 reports the methods and results of our quantitative analyses. Section 5 discusses the implications of what we have learned from past currency crises for the U.S. current account adjustment. Section 6 concludes.

2. Measuring a Crisis: Definition, Frequency, and Severity

We follow Frankel and Rose (1996) and define a currency crisis as a nominal depreciation of a currency that meets two criteria: (1) it is at least a 25 percent depreciation from a year ago, and (2) it represents an increase in the rate of depreciation from the previous year by a margin of at least 10 percentage points.[5] This definition differs from those which regard a currency crisis as a balance-of-payments crisis, either successfully or unsuccessfully defended.[6] By this definition, a sufficiently large depreciation of a currency in a flexible exchange rate regime is counted as a crisis, allowing us to estimate the influence of exchange rate regimes on the probability and consequence of a currency crisis. By not including a successfully defended balance-of-

[5] The requirement of a margin of 10 percentage points is to ensure that a 25 percent or more nominal currency depreciation in a country with high inflation rates (and correspondingly high rates of depreciation) is not automatically considered as an independent currency crisis; it is only counted as one if it also represents a sufficiently large increase in the rate of depreciation.

[6] Generally, other methods in the literature identify a currency crisis when an index of exchange market pressure exceeds a critical threshold. The index is typically calculated as a weighted average of the exchange rate change, short-term interest rate change, and reserve change relative to the center country, usually the United States. For example, this type of method was used in Eichengreen *et al.* (1996a, 1996b), in Kaminsky, Lizondo, and Reinhart (1998), in Kaminsky and Reinhart (1999). In Bordo *et al.* (2001), the definition of a currency crisis is even broader, including a forced change in exchange rate parity, an abandonment of a pegged exchange rate, an international rescue, or when their index of exchange market pressure exceeds a critical threshold.

payments crisis in our sample, this definition also enables us to gauge the economic effects of allowing a currency to succumb to market forces.

We apply our definition of a currency crisis to 51 industrial and emerging economies over the period of 1970-2004. (See Appendix 1 for a list of those countries.) As in Frankel and Rose (1996), we use a three-year exclusion "window" to avoid counting the same crisis more than once. Any event occurring within three years of the first crisis is defined to be an extension of that crisis. Crises are counted by country and by period: if there are ***n*** currencies whose depreciation exceeds the threshold in period ***t***, there would be ***n*** crises identified for period ***t***. With this method, we identify a total of 133 crisis episodes in 48 countries over the entire sample period. Three countries---Canada, Singapore, and the United States---never experienced a currency crisis within the sample period. (See Appendix 1 for details of these crises and their pre-conditions.)

The economic effect of a crisis can be measured in several different ways, including the changes in jobs, output, or consumption. Because of data limitations, we choose to measure severity by output changes. We use two alternative measures:

(1) One-sided measure. This measure follows that used in Bordo *et al.* (2001), defining severity as the cumulative sum of the differences between the actual and trend growth rates of real GDP over the duration of the crisis. The trend rate is calculated as the average growth rate over the five years preceding the crisis event. Thus, one flaw of this measure is that it overstates (understates) severity if the average pre-crisis growth rate is higher (lower) than the true trend rate. The duration of a crisis is defined as the number of years from the onset of the crisis until the actual growth rate returns to the trend rate. When the growth rate in a crisis year is above the trend rate, output loss is

defined to be zero. Thus, by construction, this severity measure is censored to be less than or equal to zero, and the minimum *duration* is one year.

(2) Two-sided measure. In this measure, severity is defined as the cumulative sum of the difference between the actual rate of growth in each year during the (3-year) crisis period and the average growth rate in the (3-year) pre-crisis period. (To be consistent with our using a three-year exclusion "window" to avoid multiple-counting the same crisis, each period is defined to be three years.) This measure of severity is not bounded below zero as in the one-sided measure. Instead, it can be positive (indicating an increase in the growth rate following the crisis event) or negative (indicating a reduction in the growth rate). When there was not enough data to calculate the three-year averages, we exclude the observation. As in the one-sided measure, this measure overstates (understates) severity if the average pre-crisis growth rate is higher (lower) than the true trend rate.

Several other notable observations regarding the frequency and severity of currency crisis emerge from an overview of the 133 currency crises that we have identified over the 1970-2004 period:

- Crises occurred with high frequency throughout the post-1973 period (Figure 1).
- Crises were more concentrated in the 1980s than in the 1990s. There were 60 crises in the 1980s, compared to 25 in the 1970s and 39 in the 1990s (Figure 1 and Table 1).
- The number of crises that were followed by growth recoveries has been rising. (During 1990-2004, the number of crises resulting in economic revivals has risen to rival those resulting in contraction. See Figures 2 and 3.)
- The number of crises in emerging economies during the 1970-2004 period was almost double that in industrial economies. There were 86 crises in emerging economies, as compared to 47 crises in industrial countries (Table 3).

- Crises in emerging economies were considerably more severe than those in industrial countries.

- More crises occurred, over the sample period, in an intermediate currency regime than in either a pure-peg or a free-floating regime. This pattern fits into the bi-polar view, which argues that either a hard peg (such as a currency board system) or a free-floating exchange rate regime is more sustainable than an intermediate regime, which is more prone to speculative attacks, for countries open to private capital flows.[7]

    - By the *de jure* classification of regimes, which is based on the regimes declared by countries, the number of crises in an intermediate regime totaled 58 during 1970-1999, compared to 36 in a pegged regime and 27 in a floating regime (Table 1).

    - By the *de facto* classification, which is based on the Natural Classification proposed in Rogoff *et al.* (2003), 89 crises occurred in an intermediate regime (either limited flexibility or managed float), compared to 16 in a pegged regime and 17 in a free-float regime (Table 2).[8]

- Crises in a pegged regime were more severe and lasted longer than those in an intermediate regime, and even more so when compared to those in a floating regime (Tables 1 and 2).

- Twin (banking plus currency) crises were more severe than single (currency) crises in emerging economies, but this was not the case in industrial countries (Table 3).

- Crises in Asia were fewer in number, but had more severe aftereffects on the economies, than those in Latin America and Europe (Table 4).

[7] The bipolar view gained much currency following the quick succession of currency crisis in the 1990s. See Summers (2000) and Fischer (2001).

[8] The IMF classifies *de jure* exchange rate regimes based on the regimes declared by countries. However, it has been noted that many countries actually do not follow their declared exchange rate arrangement. Many countries that say they float actually do not and many intermediate regimes, in fact, have *de facto* pegs. Thus, Reinhart and Rogoff (2004) classify countries' *de facto* regimes based on the Natural Classification proposed in Rogoff *et al.* (2003). See Appendix 1 for detail.

3. Causes and Effects of Currency Crises: A Synthesis of Theories

Why have crises occurred so frequently in the post-1973 period?[9] Why are some countries hit by crises more frequently than others? Why did some crises have more severe effects on the real economy than others? Many hypotheses have been proposed in the literature. While the factors stressed by each theory differ, they tend to complement rather than compete with each other. Some factors may explain some crises better than others; however, in many cases those factors actually reinforce each other in triggering, spreading and/or deepening a crisis. In this section, we synthesize the most prominent theories in the literature, grouping them into six categories.

Fundamental Imbalances. The first-generation models of speculative attacks, pioneered by Krugman (1979) and developed by Flood and Garber (1984), stress the role of fundamental imbalances in causing a balance-of-payments crisis. These models typically attribute those imbalances to overly expansionary macroeconomic policies---most notably those manifested in large fiscal deficits or high inflation rates---that are incompatible with a country's commitment to a currency peg. In a currency-peg regime, the government needs to hold a comfortable level of foreign exchange (FX) reserves in order to have the ability to prevent its currency from depreciating. If that country runs a large budget deficit and finances it by borrowing from abroad or by monetization, its currency will be under increasing pressure to depreciate. As long as the country continues to maintain its currency at the pegged value by selling its foreign exchange reserves, those reserves will continue to dwindle. Eventually, the country will run out of

[9] Bordo *et al*. (2001), which defined a crisis differently from this paper and analyzed a database spanning 120 years, also noted that crises have become more frequent since 1973 (doubling the number of the Bretton Woods and classical gold standard periods and rivaling those of the crisis-ridden 1920s and 1930s), and that currency crises were actually more prevalent between 1973 and 1987 than subsequently.

foreign exchange reserves and be forced to devalue its currency. As soon as speculators are confident that a devaluation of its currency is inevitable, they would begin to shift money out of the country before those reserves run out. The government's initial attempt to defend its currency will only deplete its FX reserves even more quickly, moving the time of the crisis forward.

Overall, such models have captured the basic elements of what typically triggers a balance-of-payments crisis. The Latin-American debt crisis of the 1980s is an important example of crises caused by large budget deficits, currency overvaluations and external debt accumulation. However, these models have fallen short of explaining why crises with similar degrees of fundamental imbalances can have vastly different degrees of severity.

Herding Behavior and Self-Fulfilling Expectations. Second-generation models, first advanced by Obstfeld (1986, 1994), emphasize the effect of self-fulfilling expectations of a currency crisis. These effects arise from herding behavior, namely cases where investors act in response to what other investors do, not on the basis of fundamental analysis. For whatever reason, if the devaluation of a country's currency is expected to be inevitable at some future date, then speculators would surely try to get out of the currency ahead of time. In so doing, they would lead to an earlier devaluation of that currency. When everyone tries to unload the currency before others do, the currency will plunge. Such herding behavior means a currency crisis can occur so long as a critical mass of investors has decided to sell a country's currency, even if that country's economic fundamentals are basically sound.

Many recent studies have lent support to this theory, even though they disagree on whether self-fulfilling behavior plays a dominant or supplemental role in triggering and

spreading currency crises.[10] A prime example of crises better explained by the second-generation model than the first-generation model is the 1992-93 ERM crisis (see Appendix 2).

Herding behavior also helps to explain the so-called "contagion effect": a domino effect among those countries that have anything less than immaculate fundamentals. Calvo and Reinhart (1996) present evidence of contagion in capital flows to Latin American countries, while Eichengreen *et al.* (1996a) find evidence that knowing there is a crisis elsewhere increases the probability of a domestic currency crisis.

Radelet and Sachs (1998) argue that international financial markets are even more prone to self-fulfilling crises than domestic markets because there is no international lender of last resort. They argue that the lender of last resort helps prevent crises in two ways. First, it prevents outright default by providing liquidity on an elastic basis.[11] Second, and perhaps more important, it can eliminate a self-fulfilling panic if investors believe that the lender of last resort will provide the credit needed to forestall the collapse of a solvent debtor. When the loans are denominated in a foreign currency, a country's central bank is unable to fulfill its role as lender of last resort because it cannot create foreign money. The lack of an international lender of last resort means that, even though individual creditors may act rationally, market forces can produce capital-flow reversals that are sharper and

[10] For example, see Calvo and Mendoza (1996); Eichengreen, Rose, and Wyplosz (1996b); and Kaminsky and Reinhart (1999).

[11] In an illiquidity-insolvency model, a liquidity crisis occurs if a solvent but illiquid borrower is unable to borrow fresh funds from capital markets to remain current on debt-servicing obligations. Asymmetric information among creditors is a main cause of market instability: each individual creditor may rationally respond more to the action of other creditors---now taken as signals---than to private information. See Banerjee (1992); Mishkin (1991); Stiglitz and Weiss (1981).

more costly than necessary to restore equilibrium.[12] This theory helps to explain why the frequency of currency crises nearly doubled after the demise of the Bretton Woods system, which provided a semblance of an international lender of last resort.

Extra Vulnerability of Poor Countries. A currency crash tends to cause economic hardship in an emerging economy, even though it has often helped to revive growth in an advanced country.[13] Everything else being equal, an emerging economy is more prone to costly currency crises than an advanced economy because of two "curses." The first is the *original sin* problem, namely a country's inability to borrow abroad in its own currency.[14] An emerging country's external debt is typically denominated in foreign currency to avoid paying the exorbitant premium demanded by international investors to compensate for its currency risk. This situation means it is much harder for that country to pay off or service that debt through a real depreciation of its currency: even though a real depreciation will help improve its trade balance, it will also raise the domestic-currency values of that debt and interest payments on that debt. Recognizing that reality, foreigners are even less willing to roll over the existing debt or to provide new loans to that country than otherwise.

[12] To support their view, the authors presented evidence that each of the three major currency crises in the 1990s---Mexico in 1994-95, Argentina in 1995, and East Asia in 1997---displays elements of a self-fulfilling crisis, in which capital withdrawals by creditors cascade into a financial panic and result in an unnecessarily deep contraction.

[13] Some currency crises are followed by a severe recession, but they need not be: a currency's depreciation by itself is expansionary because it stimulates net exports. Take some crises in the 1990s as examples. Both the Mexican peso crisis of 1994-95 and the Asian currency crisis of 1997-1998 led to severe contractions of real GDP in the crisis countries. But the ERM crisis of 1992, which resulted in the withdrawal of the United Kingdom and Italy from the exchange rate mechanism, actually helped boost output growth for those two countries. Indeed, of all 47 crisis events that occurred in industrial countries over the sample period, 19 were followed by economic expansion, while 28 were followed by contraction. See Table A1.a of Appendix 1.

[14] The term "original sin" was coined by Eichengreen, Hausmann and Panizza (2003a).

The second curse is the *debt intolerance* problem--- the inability of emerging countries to manage levels of external debt that are manageable for advanced countries.[15] A level of debt that would not necessarily seem high by the standards of rich countries can get some "debt-intolerant" developing countries into repeated troubles. When an emerging country runs into difficulty, international institutions/investors tend to make demands that actually make the problem worse. For example, when crisis countries' budgets turned into deficit (from roughly in balance) in response to economic contraction induced by the 1997-98 Asian crisis, the initial response of international community was to ask those governments to cut their budget deficits, making economic recession even more severe in the those countries. In contrast, investors tend to be more tolerant when advanced countries need to run larger deficits to combat recession.

These two "curses" also feed on each other. Emerging economies are more prone to the original sin problem because foreign investors tend to be reluctant to lend to a country in its own currency if that country has underdeveloped institutions and/or its government has low credibility. Moreover, Reinhart *et al.* (2003) find that a country's credit ratings fall more rapidly when an emerging-market economy increases its debt than in the case of an advanced country, as though the former have less debt-management capacity. They attributed this "debt intolerance" to original sin, among several other factors.[16]

Premature Capital-Account Liberalization Amidst Domestic Financial Fragility. Third-generation theories emphasize the central role of premature capital-

[15] The term" debt intolerance" was coined by Reinhart, Rogoff and Savastano (2003)

[16] The authors also show that countries that defaulted in the past and have histories of high inflation have lower credit ratings in the present. They conjecture that default on external debt may weaken a country's financial system and that a weaker financial system increases the likelihood of subsequent default because countries with weaker financial systems suffer larger output losses when access to external finance is interrupted. Default on external debt may also weaken a country's tax system by encouraging capital flight and tax avoidance, in turn making it harder to raise the revenues needed to service public debts.

account liberalization and domestic financial fragility in the deepening of a currency crisis. Even though those factors were common to a substantial number of crises before the Asian crisis, those third-generation theories mainly arose to help make sense of the Asian crises of 1997-98, an episode characterized by the severity of twin crises in many Asian economies that did not appear to have large fundamental imbalances.[17] The interaction of capital-account liberalization, a fixed-exchange rate system, and an underdeveloped financial structure (including the prevalence of *crony capitalism*) allowed hot money to first inundate and overheat many Asian economies, and then to flee and collapse those economies. (See Appendix 2 for a detailed discussion.) Authors subscribing to this view include Radelet and Sachs (1998), Kaminsky and Reinhart (1999), and Stiglitz (2000).

Nevertheless, empirical evidence appears mixed on whether capital controls protect governments and investors against currency crises. This conflict may be because governments in countries with capital controls tend to run riskier policies and markets view their presence as unfavorable signals of official resolves, while a country more open to capital mobility sends a positive signal that its government is confident of its ability to withstand potential financial disciplines that are part and parcel of being open to foreign investment. Moreover, countries with weaker financial indicators, such as a low external debt/exports ratio, a low foreign exchange reserves/GDP ratio, and/or a high short-term debt/foreign reserves ratio, are more likely to suffer rather than benefit from capital mobility

[17] For example, Kaminsky and Reinhart (1999) write: "Consider an economy that had successfully stabilized inflation, enjoyed an economic boom, and was running fiscal surpluses. However, this economy had liberalized its capital account and its domestic financial sector amidst an environment of weak regulation and poor banking supervision. Banking-sector problems emerged and intensified, eventually undermining the ability of the central bank to maintain its exchange-rate commitment. While this profile fits Asia rather well, this was Diaz-Alejandro's description of the antecedents to the fierce Chilean crisis of 1982. At the roots of the meltdown of the Thai baht, Korean Won, and Indonesian rupiah lay systemic banking problems."

because they are more exposed to the risk of sudden changes in investors sentiment. In contrast, those with stronger financial indictors are more likely reap net benefits from capital mobility by lowering the risk of speculative attacks or herding behavior.

Abrupt and Large Changes in External Conditions. Adverse and large changes in external conditions can hurt emerging economies that are linked with the world economy through international trade and capital movements. For example, a sharp rise in oil prices could push the budget deficit and/or the current account deficit of many oil-importing countries beyond a level tolerated by international investors. Conversely, an abrupt fall in oil (or other commodity) prices could enlarge those deficits of countries heavily dependent on revenues from oil (or commodity) exports to levels that spook investors. Moreover, to the extent that some emerging countries export similar products, a currency crisis in one emerging country could spread to others because that first crisis constitutes an abrupt shift in external conditions to those other countries.

A sharp rise in U.S. interest rates could undermine the ability of countries with large external debts to service and/or repay outstanding loans. Financial crises were heavily bunched in the early 1980s, when real interest rates in the United States were at their highest level since the 1930s. This situation suggests that external factors (such as U.S. interest rates) matter a great deal, as argued in Calvo *et al.* (1993). Jeffrey Frankel and Rose (1996) also find that foreign interest rates play a significant role in predicting currency crashes.

Generally speaking, a country that is more open to international trade would be more vulnerable to external shocks such as a large shift in commodity prices or a crisis in another country, while a country more open to capital mobility would be more vulnerable

to a large increase in the U.S. interest rate or other changes in world financial conditions, as well herding behavior of international investors. However, an increase in trade openness may also enhance creditors' confidence in receiving real transfers for their financial claims on the debtor country, thereby reducing the probability of sudden reversals in capital flows and currency crashes in the debtor country.

Problems with a Currency-Peg Regime. Emerging economies tend to adopt a currency-peg regime for several reasons, such as providing a stable exchange rate to facilitate international trade and investment or using it as a guarantor of credibility on controlling inflation.[18] However, a currency-peg regime also breeds its own problems. First and foremost, the inability of the country's exchange rate to adjust in response to external shocks may be very costly, especially for those that depend on export revenues or capital inflows heavily. For example, when an adverse shock---such as a plunge in the prices of commodities it exports, or an increase in U.S. interest rates---hits a country with a pegged currency, that country's foreign exchange reserves are likely to keep falling until they dwindle to a level that is insufficient to fend off speculators. By not allowing the currency to depreciate in response to negative shocks, the eventual devaluation tends to occur in a more devastating fashion: a plunge of the currency that is much steeper than needed to restore equilibrium after the initial shock.

Second, a currency-peg regime constrains the array of policy tools at a government's disposal; consequently, fundamental imbalances tend to grow until they make it impossible for the country to keep that peg. Take Thailand and Argentina as examples. Large capital inflows kept pouring into Thailand for years prior to the 1997-98

[18] See Hausmann, *et al.* (1999) for a comprehensive discussion of the potential benefits that fixed exchange rates could offer to developing economies.

crisis, resulted in rising inflation and current-account deficit; but that country's currency-peg system constrained its central bank's ability to put a lid on its economy's unsustainable growth. Argentina's currency-board system also rendered its monetary authority powerless in combating that country's deep recession that began in 1999, a recession that did not end until 2003, a year after Argentina abandoned the currency-board regime and allowed its currency to float.[19] Unless the government is able to successfully impose capital controls, its commitment to a currency peg would deprive it of the option of conducting monetary policy to fight inflation or combat recession. Moreover, crises also could be more costly in a currency-peg regime because that regime encourages the accumulation of unhedged exposures to currency risk (that was falsely assumed to be nonexistent) while frustrating the (domestic) lender of last resort function of its central bank by assigning monetary policy to goals other than the provision of liquidity.[20]

For the above reasons, the commitment to a currency peg appears to lower the frequency of currency crises in a country, but increase the severity of a crisis once it occurs. This result indeed is the broad-stroke picture we observed in the previous section: the number of crises is higher in the intermediate regimes, as predicted by the bi-polar view, but crises occurring in pegged regimes are the most severe and have the longest duration. Both the severity and the duration of crises decrease as crisis countries

[19] Argentina entered a deep recession in 1999 in large part because the Asian crisis and (especially) the collapse of the Brazilian *real* adversely affected capital inflows to Argentina, while rendering its exports less price-competitive internationally.

[20] Friedman and Schwartz (1963) and Wigmore (1987) argue convincingly that during the Great Depression, the Federal Reserve System refused its role as lender of last resort in part for fear of pushing the United States off the Gold Standard. More recently, a consensus view is that Argentina's vulnerability to financial panic in 1995 in part came from its government's limited capacity to act as a lender of last resort because of the currency board arrangement, which fixed the Argentine peso at one-to-one with the US dollar, and limited the government's ability to issue credits that are not backed by dollar reserves.

move to a more flexible exchange rate regime; those results stay unchanged when data are sorted by *de facto* exchange rate regime.

4. Quantitative Analysis

The preceding synthesis suggests that a currency crisis is more likely to occur in an emerging economy with an intermediate exchange rate system that has weak economic fundamentals (such as a high current account deficit, high budget deficit, high inflation, etc.), and less likely to occur in an advanced economy with a flexible exchange rate that has strong economic fundamentals. Moreover, it suggests that the impact of a currency crisis is much more devastating for an emerging economy with a fixed exchange rate system and weak economic institutions than for an advanced economy with a more flexible exchange rate and stronger economic institutions; if anything, the crisis may even revive GDP growth in an advanced economy rather than cause a recession.

This section conducts an empirical analysis to see whether the above view receives discernable support from data. Our analysis consists of two parts. Part one uses probit regressions to estimates the impact of a country's economic fundamentals---including its exchange rate system and whether it is an advanced economy---on the probability of a currency crisis. Part two uses OLS and tobit regressions to estimate the impact of an economy's fundamentals on the severity of output loss following a crisis.

4a. The Probit Regression

We use a panel data of 49 countries over the period of 1970-2004 to estimate the impact of fundamental economic variables on the probability of a currency crisis. We do

so by estimating a probit regression equation that postulates the probability of a crisis (P) is a function of the variables listed in Box 1.

The dependent variable is the crisis indicator (P), which is a dummy variable. For each country *i*, $P_{it} = 0$ if no crisis occurred in period *t*, and $P_{it} = 1$ if a crisis occurred. We also construct dummy variables for each different exchange rate system. For example, the dummy variable representing the floating exchange rate system takes the value of 1 when a country is, and 0 when a country is not, under that system. The industrial country indicator is also a dummy variable which takes the value of 1 for industrial countries, and 0 for emerging countries.

We estimate the probit regression equation using three alternative samples: (1) the full sample (including both advanced and emerging economies); (2) the advanced-economy sample; and (3) the emerging-economy sample. For each sample, we conduct two sets of regressions. In the first set, the exchange-rate regime dummy is set to equal 1 when the *de jure* regime is not a currency-peg regime. The results of this set of regressions are reported in Table 5a.

In the second set of regressions, the exchange-rate regime dummy is set to equal 1 when the *de facto* regime is not a currency peg; the results are reported in Table 5b. In both Tables 5a and 5b, the coefficient estimate on variable $\boldsymbol{X}$ is its probit slope derivatives (at the mean of X) in percent terms, or $(100)^* dF(x)/dx$, which can be interpreted as the change in probability of a crisis caused by a one unit change in $\boldsymbol{X}$ around the mid-point of $\boldsymbol{X}$.

The main results reported in Table 5a and Table 5b do not differ significantly, and most variables are estimated to have the expected effect on the probability of a crisis. An

increase in **the current account balance/GDP** is estimated to have a negative and significant effect on the probability of a currency crisis in the full-sample regression as well as in both sub-sample regressions.[21] In Table 5a (Table 5b), a one percentage-point increase in the current account /GDP ratio is estimated to reduce the probability of a currency crisis by about 0.85 (0.75) percentage points in the full-sample regression, and by 0.87 (0.85) percentage points in the industrial-country regression. In the emerging-economy sample, a one percentage-point increase in the current account/GDP ratio is estimated to reduce the probability of a crisis by about 0.6 percentage points in both Tables 5a and 5b. (The difference between the coefficients in the two sub-sample regressions may in part arise from the fact that a one percentage-point increase in the ratio represents a larger percent increase in industrial countries than in emerging countries.) Clearly, the current account matters.

[21] We also tested whether the effect of a current account deficit on the probability of a crisis jumps up when it exceeds a threshold. We did so by including a constant dummy for episodes in which the current account deficit was greater than 4, 5, or 6 percent of GDP. But we found no threshold effects.

Box 1. Explanatory Variables in Probit Regressions

Variable	Expected Effect
Exchange Rate Regime	According to the bi-polar view, an intermediate regime is more prone to crisis than either a pegged or a floating regime.
Current Account Balance/GDP	A higher current account balance should reduce the probability of a crisis: a higher current account deficit subjects a country to a greater risk of sudden stop of foreign financing, raising the probability of a crisis.
Fiscal Balance/GDP	A higher fiscal deficit either leads to a higher current account deficit or undermines investor's confidence in the country's price stability, thus raising the probability of crisis.
Non-FDI Inflows/GDP	This variable serves as a proxy for capital account openness. A lower level of non-FDI inflows, indicating a higher level of capital restrictions, may reduce the probability of a crisis by avoiding the large swings in hot moneys. However, it may also increase the risk of crisis by shielding the country's financial system from benefits of healthy financial disciplines. Investors may also regard it as an adverse signal of the country's poor economic fundamentals. The net effect of capital account openness on the crisis indicator is thus ambiguous *ex ante*.
Inflation Rate	A sustained increase in the inflation rate can raise the probability of a crisis for two reasons: (1) It results in the overvaluation of currencies under a pegged exchange rate system; (2) It indicates macroeconomic mismanagement, thereby hurting investors' confidence and economic growth.
Real Oil Price	High oil prices hurt economic growth and generally increase inflation in oil-importing countries, raising the risk of a financial crisis. But they benefit the economic conditions of oil-exporting countries, lowering the risk of financial crisis.
Real U.S. interest rate	An increase in the real U.S. interest rates hurt debtor countries' economy by raising the interest burden of their external debt and lowering net capital inflows to those countries, thus increasing the probability of crisis.
Trade Openness	An increase in trade openness may enhance creditors' confidence in receiving real transfers for their financial claims on the debtor country, thereby reducing the probability of sudden reversals in capital flows and currency crashes in the debtor country.
Total External Debt/Exports	Higher indebtedness is expected to raise vulnerability to a reversal in capital flows and hence to raise the probability of a crisis.
Foreign Exchange Reserves/GDP	Higher ratios are assumed to lower vulnerability to liquidity problems and hence lower the probability of a financial crisis.
Industrial Country Dummy	Industrial countries have a lower probability of a crisis than emerging economies because of stronger fundamentals, less debt intolerance, and more free of original sin.

Note: See Appendix 1 for data source and constructions.

An increase in **the fiscal balance/GDP** ratio has the expected effect of lowering the probability of a crisis, but that effect is smaller (and estimated with a lower degree of statistical significance) than that of the current account. In full-sample regressions, a one percentage-point increase in the fiscal balance/GDP ratio lowers the probability by about 0.4 percentage points in both tables. In the advanced-economy sample, that effect is statistically significant in Table 5a, but not in Table 5b. In the emerging-economy sample, that effect is not statistically significant in either table. These results may in part reflect the fact that the correlation between the current account and the fiscal balance in emerging economies is higher than that in industrial economies.[22]

An increase in the **non-FDI inflows/GDP** ratio (a proxy for capital-account openness) helps to reduce the probability of a currency crisis for industrial countries, but does not have a significant net effect on the probability of a crisis for emerging countries.[23] (A one percentage-point increase in non-FDI inflows/GDP reduces the probability by 0.8 percentage points in industrial economies.) This difference between the coefficients on non-FDI inflows/GDP in the two sub-sample regressions may arise because those inflows tend to be better channeled to truly productive uses in industrial economies (because of better-established financial institutions), while they are more likely to lead to overinvestment and overpricing in financial and real-estate assets in emerging economies.

[22] Our simple regressions of the current account on the fiscal account (and a constant term) show that the two variables are positively correlated, with a partial correlation coefficient of 0.27 for industrial economies and 0.37 for emerging economies.

[23] We also tried to test the effect of capital-account openness by including the index of capital-account liberalization constructed by Chinn and Ito (2002). However, regressions including that index result in less reasonable coefficient estimates on many explanatory variables, including that index itself. A possible reason for these puzzling results may be that capital controls are correlated with the error term because countries more prone to crises are more likely to put on capital controls.

An increase in **inflation** has the expected effect of increasing the probability of a crisis, but that effect is bigger in advanced economies than in emerging economies. A one percentage-point increase in the inflation rate increases the probability about by 0.19 percentage points for advanced economies, but only by 0.003 percentage points for emerging economies (Table 5a). This result could be because, on average, a one percentage-point increase in the inflation rate amounts to a much smaller percent increase in the inflation rate for emerging economies, many of which experienced hyperinflation for many years in the sample period, than for industrial economies.

An increase in the real **oil price** (i.e., oil prices deflated by the U.S. consumer price index) increases somewhat the probability of a currency crisis for all- and advanced economies (a one-dollar increase in the real oil price increases the probability by about 0.2 percentage points) but not for emerging countries. This result may be because there are more oil-exporting countries in the emerging-country group, and those countries' economies tend to do better as the price of oil rises.[24]

An increase in the **real U.S. interest rate** raises the probability of a crisis for emerging economies significantly, both quantitatively and statistically. A one percentage-point increase in the real U.S. interest rate is estimated to raise the probability of a crisis in an emerging economy by about 2.6 percentage points. Comparing this coefficient with those of other regressors suggests that an increase in the real US interest rate may be the single most critical factor, besides a currency regime, that could cause a currency crisis in an emerging economy. In comparison, an increase in the real U.S.

[24] There are 34 crises in our sample that occurred in emerging economies (Argentina, Columbia, Egypt, China, Indonesia, Malaysia, Mexico, Peru, Russia, and Venezuela) when they are net oil-exporters. There are only 5 crises that took place in advanced economies (Denmark, Norway, and the United Kingdom) when they are net oil-exporters.

interest rate does not have a significant effect on the probability of a crisis in industrial economies. This difference may be in part because many emerging economies' currencies are pegged to the dollar, while most industrial countries have a flexible exchange rate vis-à-vis the dollar. An increase in the real U.S. interest thus tends to attract immediate and large capital outflows from emerging countries by raising the expected rate-of-return differential in favor of dollar assets relative to those countries' assets, but it will not necessarily increase the expected rate of return on dollar assets relative to assets of other industrial countries. (In general, the expected rate-of-return differential between U.S. assets and other countries' assets equals the interest-rate differential plus the expected rate of dollar depreciation. If an emerging country's dollar-peg regime is credible, the expected rate of dollar depreciation against its currency is zero; if that regime is not credible, the expected rate of dollar depreciation against its currency is positive, further enhancing the expected return differential on dollar assets.)

The coefficient estimates on the dummies for **exchange rate regimes** suggest that, everything else being equal, a country under an intermediate regime is more prone to a currency crisis than that under currency-peg regime; but it is less clear whether a country is more prone to crisis in a free-floating regime than in a currency-peg regime. The coefficient estimate on **the intermediate exchange-rate regime** is positive (4.14, at five percent significant level) in the full sample, while that on t**he floating exchange rate regime** is statistically insignificant (Table 5a). The coefficient estimates on the managed-floating regime and on the freely-floating/free-falling regime in the full sample

in Table 5b suggest that these results do not change when we replace dummies of *de jure* exchange-rate regimes with dummies of *de facto* regimes in the regressions.[25]

Neither a decrease in the **foreign exchange reserves/GDP** ratio, nor an increase in the *gross* **external debt/exports** ratio, is estimated to increase the probability of a crisis in emerging economies.[26] In Table 5b, the coefficient estimate on the external debt/exports ratio is statistically significant but has a "wrong" sign: a one percentage-point increase in that ratio lowers the probability of a crisis by 0.009 percentage points. These results suggest that the importance of these two variables are not unconditional; if the overall external condition---such as the oil price, the U.S. interest rate---is benign, and other economic fundamentals are sound, a low foreign reserves/GDP ratio or a low external debt/exports ratio is not likely to trigger a crisis by itself.

Finally, the coefficient estimate on the **industrial-country** dummy is negative (-3.92) and statistically significant at the 95 percent confidence level (in Table 5a), suggesting that being an industrial country by itself helps to lower the probability of a currency crisis. (The coefficient on that industrial-country dummy is also negative in Table 5b, but is statistically significant only at an 80 percent confidence level.)

It is important to note that the Pseudo-$R^{2'}$s of the regressions reported in Tables 5a and 5b are quite low, suggesting that the origin of currency crises remains largely unexplained by the included explanatory variables. This result is not surprising given that many factors cited in the literature---such as herding behavior, weak financial

[25] The free-floating/free-falling regime includes both the free-floating regime and the free-falling regime. Free-falling regimes are regimes that are managed-floating regimes based on the *de jure* classification but are forced (for example, by hyperinflation) to allow the exchange rate to freely plunge.

[26] This variable is not included in the full- and industrial-country samples because many industrial countries only reported their external debt in a few selected years during the sample period.

institutions, capital openness, and crony capitalism, etc.---are either poorly measured (by use of proxy) or excluded (due to lack of data) all together.

Nevertheless, those regression results make a useful contribution by confirming the core of the theories we synthesized in the previous section:

- Countries under an intermediate exchange rate regime are more prone to currency crises than those under a fixed or free-float regime.
- Being an advanced country by itself appears to help reduce the probability of a currency crisis.
- Countries with stronger economic fundamentals (especially, the current account, the fiscal balance, and inflation) are less prone to currency crises.
- The effect of a shift in some fundamental variables on the probability of a crisis in an advanced economy could be quite different from than that in an emerging economy.

4b. The Severity Regressions

We run two alternative regressions to estimate the impact of selected fundamental variables on the severity of a currency crisis. The first is an OLS regression which uses the two-sided measure of severity as the dependent variable. The second is a tobit regression which uses the one-sided measure of severity as the dependent variable. A list of explanatory variables and why they are included are provided in Box 2. Since the difference made by using either *de jure* or and *de facto* exchange-rate regime in the probit regressions is not significant enough to cause concern, we use only *de jure* exchange rate dummies in all severity regressions to streamline the analysis.

Box 2. Explanatory Variables in the Severity Regressions

Variable	Expected Effect
Current Account/GDP; Fiscal Balance/GDP	A higher level of current account deficit or budget deficit may increase the severity of a crisis because it signals that the crisis country has poorer fiscal discipline, discouraging the speedy return of capital needed to revive economic growth.
Inflation	Higher inflation before the crisis may deepen the severity of a crisis because (1) it undermines the credibility and effectiveness of monetary authorities, and (2) it places a constraint on using monetary policies to counter the contractionary effect of a crisis.
Real GDP per capita	A higher real GDP per capita is expected to lower the severity of a crisis because it serves as a proxy for soundness of economic fundamentals not captured by other explanatory variables.
Real Oil Prices	Higher oil prices may deepen the severity of a crisis by making it harder to use expansionary fiscal/monetary policies to counter the contractionary effect of a crisis.
Real U.S. Interest rate	The higher the real U.S. interest rate, the more difficult emerging economies have in attracting net capital inflows to help revive its economy following a crisis.
Real GDP Growth in G7	Crisis in emerging economies may have more severe output loss if import demand of industrial economies is weak due to cyclical downturn.
Trade Openness	The more an economy is open to trade, the more should a currency crisis help revive its net exports and real GDP after a 2-3 year lag.
Twin Crisis	A twin crisis (a combination of currency and banking crises) will tend to result in more severe output loss than a currency crisis alone. A steep currency depreciation, by itself, is expansionary after some time lag by boosting net exports. In contrast, a banking crisis drastically reduces liquidity needed for investment and consumption, thereby hampering economic recovery.
Origins of Legal rules	A currency crisis is less likely to trigger a banking crisis in countries with better legal and financial infrastructures Thus, origins of legal rules---serving as a proxy for market capitalization and the efficiency of financial institutions---could matter for the severity of a currency crisis. La Porta, Shleifer, Lopez-de-Silanes, and Vishny (1997) found that countries with poorer investor protections, measured by both the character of legal rules and the quality of law enforcement, have smaller and narrower equity and debt markets.

Note: See Appendix 1 for data source and constructions.

The results of OLS regressions are reported in Table 6, and those of tobit regressions are in Table 7. In both tables, the first two columns report the results of regressions using the full sample, and columns (3) and (4) those of the two sub-samples. Column (1) excludes the industrial-country dummy, while column (2) excludes the twin-crisis dummy.[27]

The coefficient estimates (and statistical significance) change somewhat from Table 6 to Table 7. Nevertheless, the qualitative results of both OLS and tobit regressions are roughly similar and provide a solid support to the collective theory that we synthesized. First, countries having a more flexible exchange rate system tend to suffer less output loss once a currency crisis has occurred than those with a currency-peg system. The difference made by the free-floating regime is both quantitatively and statistically significant in regressions using the full-sample, and strikingly large for emerging countries alone. In table 6, for emerging countries, the cumulative growth rate of a floating-exchange-rate country during the 3-year crisis period (beyond that during the pre-crisis period) is estimated to be about 15 percentage points higher than that of a pegged-currency country. In Table 7, that difference is even bigger: the cumulative growth rate over the duration of the crisis in an emerging country adopting a floating regime is about 27 percentage points higher than that with a pegged-currency regime. For industrial countries, the difference made by the floating regime is not as striking. The cumulative growth rate in an industrial country with a floating exchange regime is about nine percentage points higher than that with a pegged-currency regime in Table 7

[27] Twin crises occurred much more frequently in emerging-market countries than in industrial countries. We circumvent the problem of multi-collinearity by not including both (twin-crisis and industrial-country) dummies in the same regression.

but not statistically significant in Table 6. These results, however, could be due to the fact that very few industrial countries had a floating exchange rate system in the pre-crisis period (Appendix 1).

Second, being an industrial economy helps. The significant and positive coefficient estimate on the industrial-country dummy in Table 6 could have resulted from the fact that industrial economies tend to have stronger economic, financial, and legal infrastructures that are not sufficiently controlled by other variables included in the regression. It could also be because of the power of "brand name," which affords added credibility to a country. (Foreign investors are less likely to panic at some unfavorable events and withdraw *en masse* funds that are critical to help a country stabilize the negative impact of a currency crisis.) If we believe that the real GDP per capita and the legal origin are sufficient as a proxy for the soundness of legal and economic infrastructure, then we can probably attribute the estimated effect of the advanced-economy dummy (in Table 6) to that of "brand name" alone.

It is true that the coefficient estimate in column (2) of the tobit regressions (Table 7) indicates that being labeled an "advanced economy" by itself does not make a significant difference. However, by using the one-sided measure of severity as the dependent variable, that result very likely underestimates the effect of being labeled an *advanced economy*. In several crisis episodes among advanced economies, the economic growth rate is higher in the crisis period than in a pre-crisis period, largely because the large depreciation of their currencies helped to boost exports (an economic activity) by more than its depressive effect on the economy. But the one-sided measures of severity

in those episodes are set to be zero, rather than a positive number as in a two-sided measure.

Third, the severity of a **twin crisis** is much greater than that of a currency crisis alone. Both tobit and OLS regressions estimate a negative and significant coefficient on the twin-crisis dummy in the full sample and in the emerging-economy sample. For industrial countries, the coefficient estimate on the twin crisis dummy is negative and significant in the tobit regression but insignificant in the OLS regression. Again, this difference could be because the one-sided measures of severity in episodes with above-trend growth rates are set to be zero, artificially amplifying the degree of output losses in twin crises for industrial countries.[28]

Finally, macroeconomic conditions in the pre-crisis period matter, but they tend to matter differently for industrial versus emerging countries. First, countries with a larger **current account** deficit suffer a larger output loss during the crisis period, but that relationship is more pronounced among emerging economies than among industrial countries. (In Table 6, the full-sample OLS regression estimates that a one percentage-point increase in a country's current account balance/GDP ratio during the pre-crisis period is estimated to increase (decrease) that country's cumulative output growth (loss) over the crisis period by about one percentage point; that effect rises to nearly two percentage points for emerging countries and lowers to a statistically insignificant level for industrial countries.) In Table 7, the coefficients on the current account/GDP ratio estimated by the full-sample tobit regressions are nearly double those in the OLS

[28] There are only three episodes of twin crises in the industrial countries, as indicated in Table 3. The average two-sided measure of severity in those three episodes was 9.2 percentage points, but the average one-sided measure was -1.3 percentage points (Tables 3 and 4).

regressions. The coefficients estimated by the two sub-sample regressions are also much larger than those estimated in the OLS regressions.

The effect the **fiscal balance on** the severity of a crisis in industrial countries also appears to be different than that in emerging countries. In both the OLS and tobit regressions, the coefficient estimates on the fiscal balance/GDP ratio are statistically insignificant for all countries and for emerging economies. (Again, this result could be in part due to the correlation between the fiscal deficit and the current account deficit, especially in emerging economies.) For industrial economies, the coefficient estimate is negative and significant in the OLS regression, indicating that a larger fiscal surplus (deficit) in the pre-crisis period helps to *lower* output growth (loss) in a crisis. The seemingly perverse relationship may stem from the likelihood that a currency crisis in an advanced country tends to occur after economic growth has weakened, a time in which the fiscal deficit tend to rise; the crisis then revive growth by boosting net exports.

A higher **inflation** rate in the pre-crisis period is followed by a more severe crisis in industrial economies, but not so in emerging economies. This result may be because a higher inflation rate makes it more difficult for industrial countries to lower interest rates to combat output loss during the crisis, thus making the crisis more severe than otherwise. In comparison, this policy constraint may be less relevant for emerging economies where hyper-inflation and double-digit interest rates tend to be a common phenomenon. Moreover, a one-percentage increase in inflation in countries that have persistent double-digit inflation is likely to matter less than the same increase in countries where inflation is generally kept around a low single-digit rate.

Origin of legal rules, which is included in the regressions as a proxy for the soundness and efficiency of financial institutions, matter significantly for industrial countries both statistically and quantitatively, but not for emerging countries. Crises in industrial countries having the French civil law are estimated to suffer more severe output loss than those having the British common law or other legal origins.[29] However, the legal origin dummy does not have a statistically significant coefficient in the regressions using the emerging-country samples.

Overall, the results indicate that the exchange rate regime is the most critical factors influencing the severity of a currency crisis, followed the current account, whether the country is labeled an "advanced economy," and whether the country's crisis is also accompanied by a banking crisis.[30] For example, the current account/GDP ratio would need to increase 10 percentage points for it to have the same effect on severity as a currency-peg regime has (in comparison to a free-floating regime).

[29] La Porta, Shleifer, Lopez-de-Silanes, and Vishny (1997) found that French civil law countries had weaker investor protections, and less developed capital markets, than the other three types of legal origins (i.e., the British common law, German civil law, and Scandinavian civil law). Common law countries provide companies with better access to equity finance than civil law countries, and particularly French civil law countries. They also found that the creditor-rights index is the highest in common law countries, intermediate in German and Scandinavian civil law countries, and the lowest in the French civil law countries.

[30] The coefficient estimates on other explanatory variables---namely, real GDP per capita, real GDP growth in the G7 countries, real oil prices, the real U.S. interest rate, trade openness, the foreign exchange reserve/GDP ratio, and the external debt/exports ratio---are all statistically insignificant in the OLS regressions. In the tobit regressions, a higher real U.S. interest rate is estimated to increase the severity of a crisis (as expected) in the full-sample regression, but not in the sub-sample regression. An increase in real oil prices is estimated to reduce the severity of a crisis in emerging economies (most of them are net oil-exporters), but have no significant effect on the severity in industrial countries. An increase in the trade openness has the puzzling effect of increasing the severity in industrial countries, while having no effect on the severity in emerging economies.

5. Implications for the U.S. Current Account Adjustment

Overall, the literature and our empirical findings have three broad implications for how the U.S. current account adjustment might unfold. First, the large U.S. current account deficit cannot keep rising relative to GDP without triggering some kind of adjustment process some time down the road. Second, it is not very likely that the downward adjustment will involve massive capital outflows and a dollar crisis. Third, in the (unlikely) event of a dollar crisis, this country is not likely to be thrown into the type of recession that tends to be associated with a currency crisis in emerging economies.

Our regression results indicates that a sharp fall of the dollar is a possible scenario of the U.S. current account adjustment, but they also confirm the collective insight of the literature that investors are more willing to allow the self-adjusting market mechanism to work out imbalances in industrial countries with sound financial and legal institutions than in emerging economies with weaker institutions. The average of the full-sample estimates of probit regressions (in both Tables 5a and 5b) indicates that the probability of a dollar crisis has grown to about 11 percent in 2006, up from the six percent estimated for 2003. The average estimates based on the industrial-country sample also indicate a large rise in the probability, from three percent in 2003 to nine percent in 2006 (Figure 4). If other factors remain the same, that probability will rise further if the U.S. current account deficit climbs higher. However, that probability rises only very modestly in response to an increase in that deficit: the estimated probability only rose to 11 percent in 2006 even though both the current account deficit and the oil prices surged to record levels.[31] At 11 percent, the risk of a dollar crisis appears to be much lower than it was

[31] The hike in oil prices no doubt also contributed significantly to the rise in the estimated probability. From 2002 to 2005, oil prices rose from $25/barrel to $53/barrel, while the current account

back in 1981, when high oil prices and inflation were the scourges. The estimated probability of a dollar crisis was about 19 percent in 1981. However, at that time, the dollar actually rose rapidly until it peaked in late 1985 (Figure 4).

Considerable uncertainty surrounds the estimated probability of currency crises. Some emerging economies have experienced serious currency crises when the estimated probabilities of those crises were around or even below 11 percent (Figure 5). However, for the reasons discussed in section 3, emerging countries' experiences are simply not applicable for forecasting what may happen to the U.S. dollar. Moreover, our probit regressions, which are designed to assess the relative importance of economic fundamentals in the making and unfolding of a currency crisis, are grossly inadequate to serve as forecast models. Those regressions have a very low pseudo-R^2, indicating that the included explanatory variables together explain only a very small part of the variation in the probability of a crisis. For example, Thailand did not have a currency crisis in 1981 when the probability of a baht crisis was about 23 percent in that year, but had one in 1997 when that probability was only six percent. This result is not surprising in light of the widely-shared view that it is inherently difficult to predict a currency crisis by using regression estimations. That inherent difficulty mainly arises from the fact that many potentially important contributors to a currency crisis---such as herding behavior, crony capitalism, weak financial institutions, financial-account openness---either can only be included in regressions with large measurement errors, by inadequate proxies, or are omitted from regression analyses altogether. We thus take into account factors in addition to those included in the regressions to assess the likely paths of U.S. current-

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deficit/GDP ratio rose from 4.5 percent to 6.3 percent. In the full-sample regressions, the coefficient estimate on lagged oil prices is about 0.2, while that on the lagged current account/GDP ratio ranges is about 0.8.

account adjustment. With such an approach, we find that the literature and our empirical findings, together, suggest a rather centrist view for the U.S. current account adjustment: the dollar will need to depreciate substantially down the road to help narrow the U.S. current account deficit, but the downward adjustment is more likely to be gradual than involving a dollar crisis.

Some readers of Freund (2000) are inclined to think that a dollar crisis is imminent because that deficit has exceeded five percent of GDP for over two years.[32] Our results indicate that it would take a much larger current account deficit/GDP ratio, by itself, to trigger a currency crisis. Our findings, in fact, do not contradict those of Freund, which do not imply a compelling case for an imminent dollar crisis even though some readers have come to that conclusion. The author used 25 industrial countries data from 1980 to 1997 to identify 25 episodes of current account reversal. It is true that the average current account/GDP ratio for those countries (at the peak of their respective deficits during those 25 episodes) was about five percent. However, the distribution of the current account ratios that triggered a crisis ranged from 2.2 percent in France (1982) to 16.8 percent in Portugal (1981). The triggering ratio was above 10 percent in three countries, and was below three percent in three countries. Clearly, there is no undisputed

[32] As early as in 2002, the press and even some analysts began to voice their concern that there may be a problem because the U.S. current account deficit was reaching five percent of GDP. Many of them cite a paper by Freund (2000), then an economist at the Federal Reserve Board. For example, in reaction to the paper, an article in *The Economist* (April 27, 2002) writes: "A study by the Federal Reserve of large current-account deficits in developed economies found that deficits usually began to reverse when they exceeded five percent of GDP. And this adjustment was accompanied by an average fall in the nominal exchange rate of 40 percent, along with a sharp slowdown in GDP growth. America is likely to move into this danger-zone by the end of this year."

evidence that five percent current account/GDP is the magic number that will trigger a currency crisis.[33]

Shouldn't we nevertheless be worried about the size of net U.S. external liabilities? Given our finding that the external debt/exports ratio by itself does not have a quantitatively significant effect on the probability of a currency crisis for emerging economies, it would seem that the effect of that ratio on industrial economies would be even more easily blunted by other factors. Moreover, the fact is that U.S. net international investment position (NIIP) is not yet large relative to GDP. That net position amounted to about -21 percent of GDP at the end of 2004, a ratio lower than that in many emerging countries. The experiences of Australia and Canada also suggest that the U.S. position is far from an alarming level. (Australia's NIIP fell to -80 percent of GDP in 1990; Canada's NIIP fell to -43 percent of GDP in 1993. In both countries, net international liabilities were brought down without incurring excessive hardship in their economies.) Neither does the U.S. net external investment position look particularly bad now when compared with its own experience in the late 19th century.[34]

Moreover, the case for a gradual U.S. external adjustment, as opposed to a hard-landing scenario for the dollar, is bolstered by the U.S. possession of many factors that would help to deter a sudden reversal of capital:

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[33] Freund (2000) uses the Frankel and Rose (1996) method to identify a currency crisis, as we do in this paper, and finds that 10 out of 20 episodes of current account reversal in industrial countries were associated with currency crisis. However, none of those 10 crises occurred in countries under a floating exchange-rate regime (Table 4 of the paper). Thus, it is possible that managed currency regimes were as likely to blame as large current account deficits for causing those crises.

[34] The U.S. net external debt (measured by NIIP) relative to GDP in 2004 is still a bit below where it was during 1894-1895 when that ratio was about -24 percent. As its borrowing from abroad was put to productive use, the United States did not crumble under the weight of that high level of international debt. Instead, its rapid development enabled it to become a net lender after 1914, when World War I changed the warring European countries from net lenders to net debtors.

- The exchange value of the dollar is market-driven, not pegged to another currency or a commodity. This means that to a large extent its high value, despite the large current account deficit, reflects high investors' demand for dollar assets. Moreover, a strong case can be made that the high demand was driven mainly by economic fundamentals, not irrational exuberance.[35] Thus, the dollar is more likely to adjust downward gradually along with economic fundamentals rather than burst like a bubble.[36] At the very least, a free-floating dollar exchange rate makes it less likely for "one-way" bets to rule the day.
- The United States has even stronger financial institutions than other advanced countries. This strength, by itself, would help reduce the probability of a dollar crisis by avoiding extra risks associated with "debt intolerance."
- Most U.S. international liabilities are denominated in dollars, virtually eliminating the problems of "lack of lender of last resort" and "original sin." Moreover, it also means that foreign countries and investors with large holdings of dollar-denominated assets will hurt the value of their portfolio sharply if they dump their dollar holdings en masse, making it less likely that a dollar crisis would be triggered by massive foreign dumping.
- The dollar is the international reserve currency and is used as a medium of international transactions. This provides a basic level of precautionary and transaction demand for the dollar, providing a stabilizing cushion to the dollar's

[35] For example, see CBO (2004, 2005) and papers on the revived Bretton Woods system.

[36] The sharp rise in the share of dollar assets in international investors' portfolios over the past decade means that the growth in demand for dollar assets is more likely to taper off than keep rising. At the same time, the supply of dollar assets will continue to rise as long as the current account is still in deficit, exerting downward pressure on the dollar.

exchange value. (Indeed, many Asian governments have accelerated their accumulation foreign reserves, and thus dollar-denominated assets, after the Asian crisis of 1997-98, in part to help prevent another crisis from occurring.)

Finally, it is quite likely that the U.S. net international investment position is significantly underestimated in the official data reported by the Bureau of Economic Analysis (BEA), as forcefully argued by Hausmann and Sturzenegger (2005). In their view, the United States owns valuable assets (dark matter)---such as U.S. firms' know-how, the liquidity provided by the U.S. dollar, and the insurance premium the world pays for exchanging safer U.S. assets for riskier assets---that are not included in the official measurement. In all likelihood, the authors have grossly overestimated the value of dark matter.[37] Nevertheless, given the fact that much is still unknown regarding why there has been a persistent return gap favoring U.S. investments abroad, their view deserves some recognition.[38]

[37] According to the authors' estimate, the United States has a net international asset position worth about $600 billion, not a net liability position of $2.5 trillion. We judge that the value of dark matter is significantly overestimated by the authors for three reasons. First, even when we use the market-value measures of FDI assets and liabilities---which already reflect, though imperfectly, the market's valuation of "dark matter"--- to derive the rate of returns on them, we still find the persistent return gap favoring U.S.-owned FDI assets. Second, given that foreign holdings of U.S. currency has accounted for less than five percent of total foreign holdings of U.S. assets since 1982, the value of liquidity service provided by the U.S. dollar can only contribute to a very small portion of the return gap favoring U.S. investments abroad.

[38] Hung and Mascaro (2004) also look into this issue and find that the return gap favoring U.S. investments abroad can be attributed, at least in part, to two factors. First, U.S. subsidiaries abroad have generally been in business longer than foreign-owned subsidiaries in this country; experience and other age-related factors thus helped to increase the aggregate profitability of U.S. investments abroad. Second, investors may have required higher return on U.S. subsidiaries abroad than foreign subsidiaries in this country because the former face greater (political or economic) risks than the latter. A third possible factor is that U.S.-owned subsidiaries abroad may have overstated their profits—and foreign-owned subsidiaries in the US understate their profits—for tax reasons. However, empirical evidence on the extent to which such misstatements affect the gap in returns is sketchy.

Even if a dollar crisis does occur, it is unlikely to wreak havoc on the U.S. economy as a crisis typically does for an emerging economy. First, a dollar crisis is not likely to spread into a devastating twin crisis as what often occurs in emerging economies. To be sure, the U.S. financial sector will take a hit as a large sum of capital leaves the country, and the sharp drop in liquidity will hurt the economy in the short run. Nevertheless, a full-scale financial crisis is unlikely to be triggered as a result. The U.S. financial system is much stronger and better diversified than that of emerging economies. Moreover, U.S. banks' international assets (loans to foreigners) and liabilities (foreigners' deposits) are almost all denominated in dollars; thus, U.S. banks will not see their net liabilities soar as the dollar plunge, a critical development that often pushes banks in emerging economies over the brink once a currency crisis erupted.

The fact that the United States is an advanced economy and has a floating exchange rate system will also help mitigate any negative impact of a dollar's sharp fall may have on the economy. While a sharp fall of the dollar may hurt consumption, investment, and employment in the United States (by increasing import prices, inflation, and interest rates), it also helps to revive investment and employment by boosting net exports. A large exit of capital flows from the United States is also more likely to occur when foreign economies are booming, a condition that will also help boost U.S. net exports. The net impact on the economy of a sharp dollar depreciation thus may even be positive. That almost all foreign claims on the United States (both private and official) are denominated in dollars also allows the redeeming aspect of a sharp depreciation to work its way without enlarging the dollar burden of external debt at the same time. This prospect, in turn, will also help limit the degree to which capital flows are reversed.

Indeed, the past four episodes of sharp dollar declines since 1970 did not cause severe harm to the U.S. economy. Inflation did rise in all four episodes. However, the unemployment rate also fell in all four episodes, and GDP growth accelerated in all but the episode from 1971 to 1973. This result is perhaps not surprising given that the 1971-73 episode is also the only one (among those four) that occurred as a collapse of a fixed exchange rate regime.[39] Overall, those post-1970 experiences testify to the healing ability of the self-adjusting mechanism offered by the floating exchange rate and a free market economy.

The preceding observations, of course, do not amount to arguing that a gradual decline of the dollar does not have negative consequences for the United States in the long run. A steady decline of the dollar's exchange value will lower U.S. residents' welfare by lowering the dollar's purchasing power of foreign goods. It also erodes the dollar's position as an international reserve currency over time, thereby reducing the many benefits accruing to an international reserve currency (such as seigniorage from foreign holdings of U.S. currency, etc.)

6. Conclusion

This paper draws from the existing literature on currency crises and conducts new empirical analyses, to shed light on how likely it is that the adjustment of the U.S. current account deficit will involve a dollar crisis. The literature suggests that one should not

[39] The dollar upheaval in 1971-72 was the collapse of a unsustainable exchange-rate peg: the dollar was becoming increasingly overvalued (relative to gold), and the balance-of-payment deficit of the United States was rising to a level perceived to be unsustainable. Even though the United States was not running a significant current account deficit, its large capital outflows meant it was running a large balance of payments deficit.

casually infer from emerging-economies' experiences to predict what will happen to the dollar. Our findings lend support to that view, suggesting that a dollar crisis is not likely in the near future. This conclusion appears to be supported by the fact that the dollar's downward adjustment since the early 2002 has proceeded in a gradual and orderly fashion. Our findings also suggest that, in the unlikely event of a dollar crisis, the U.S. economy should be able to withstand it without suffering a severe recession. To be sure, the negative impact of a (unlikely) dollar crisis could be much greater on the rest of the world. Analyzing that prospect, however, is beyond the scope of this paper.

Figure 1. Number of Currency Crises: 1970 - 2004

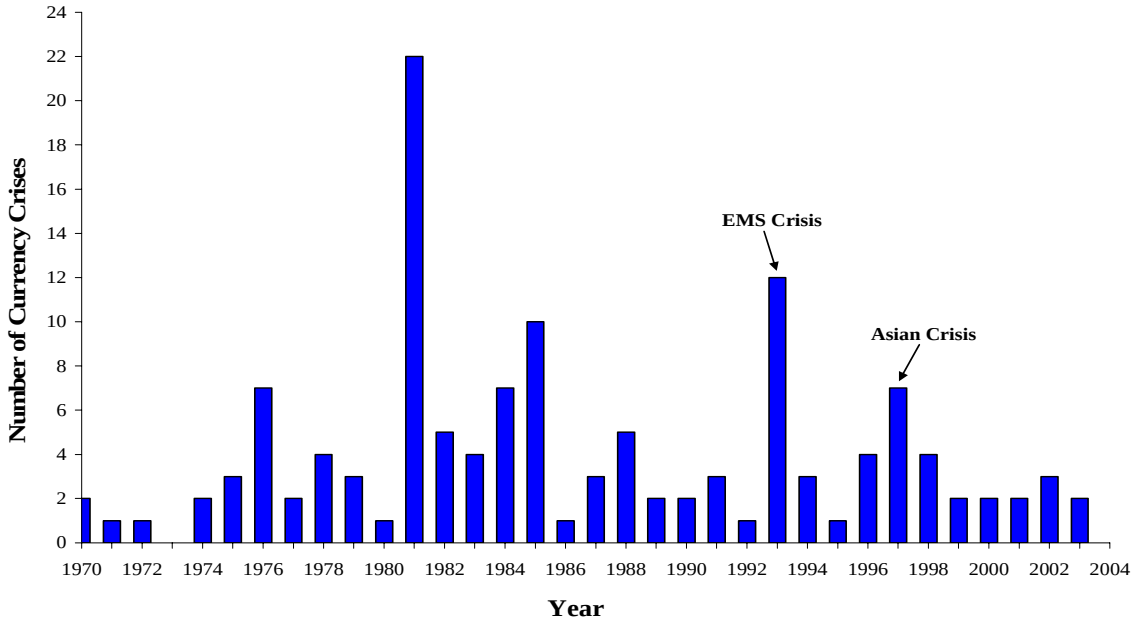


Figure 2. Severity of Currency Crises (one-sided measure): 1970 - 2004

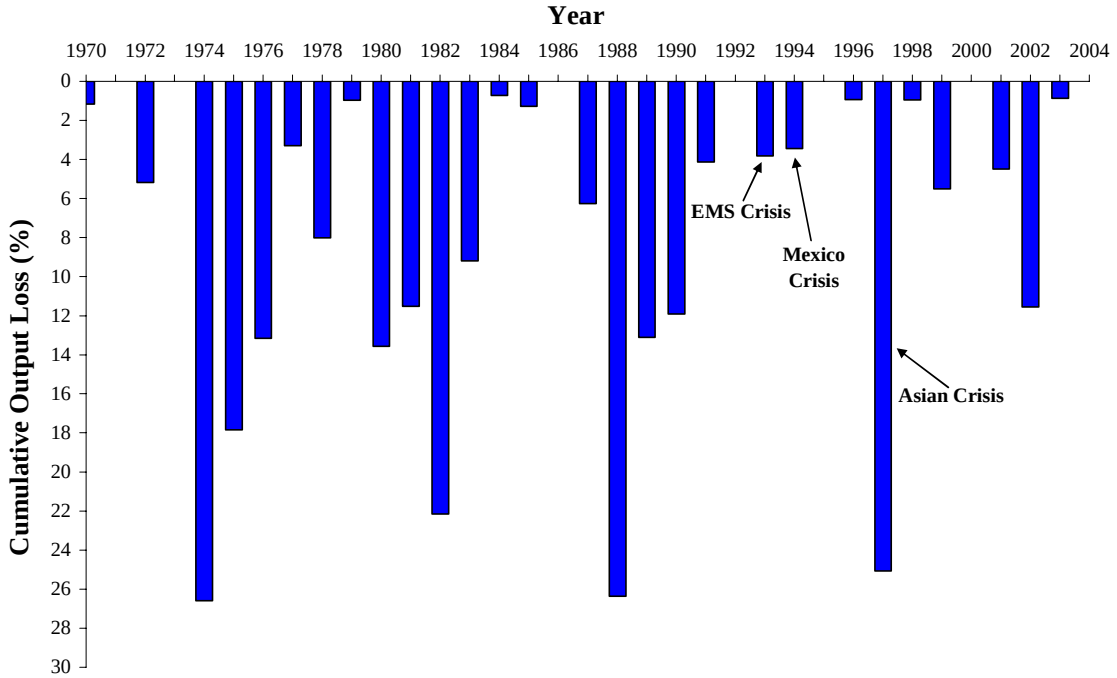


Figure 3. Severity of Currency Crises (two-sided measure), 1970 - 2004

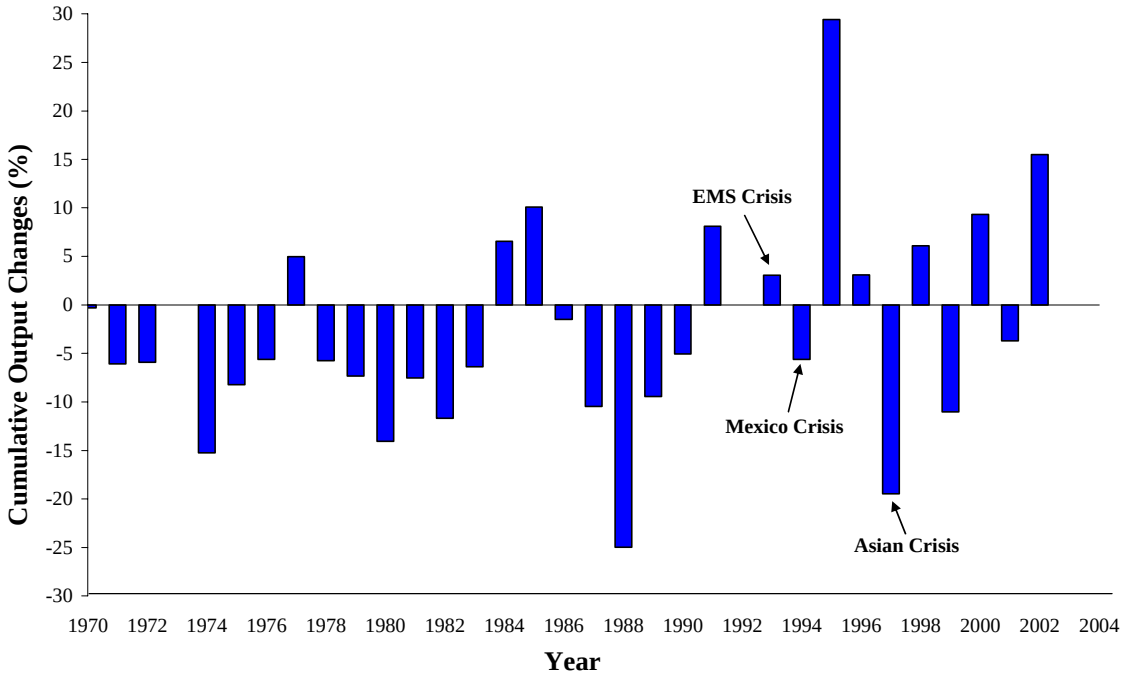
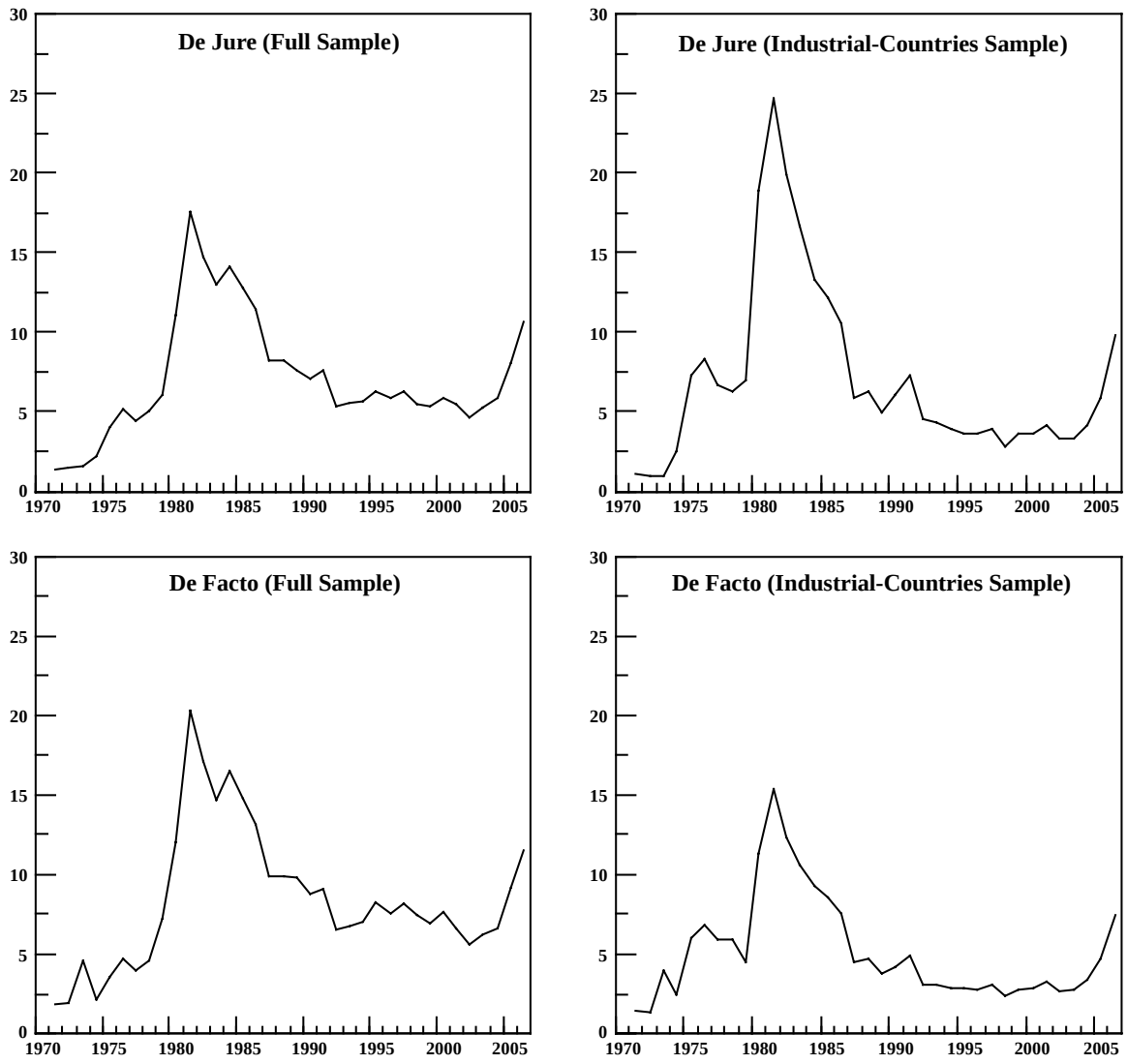
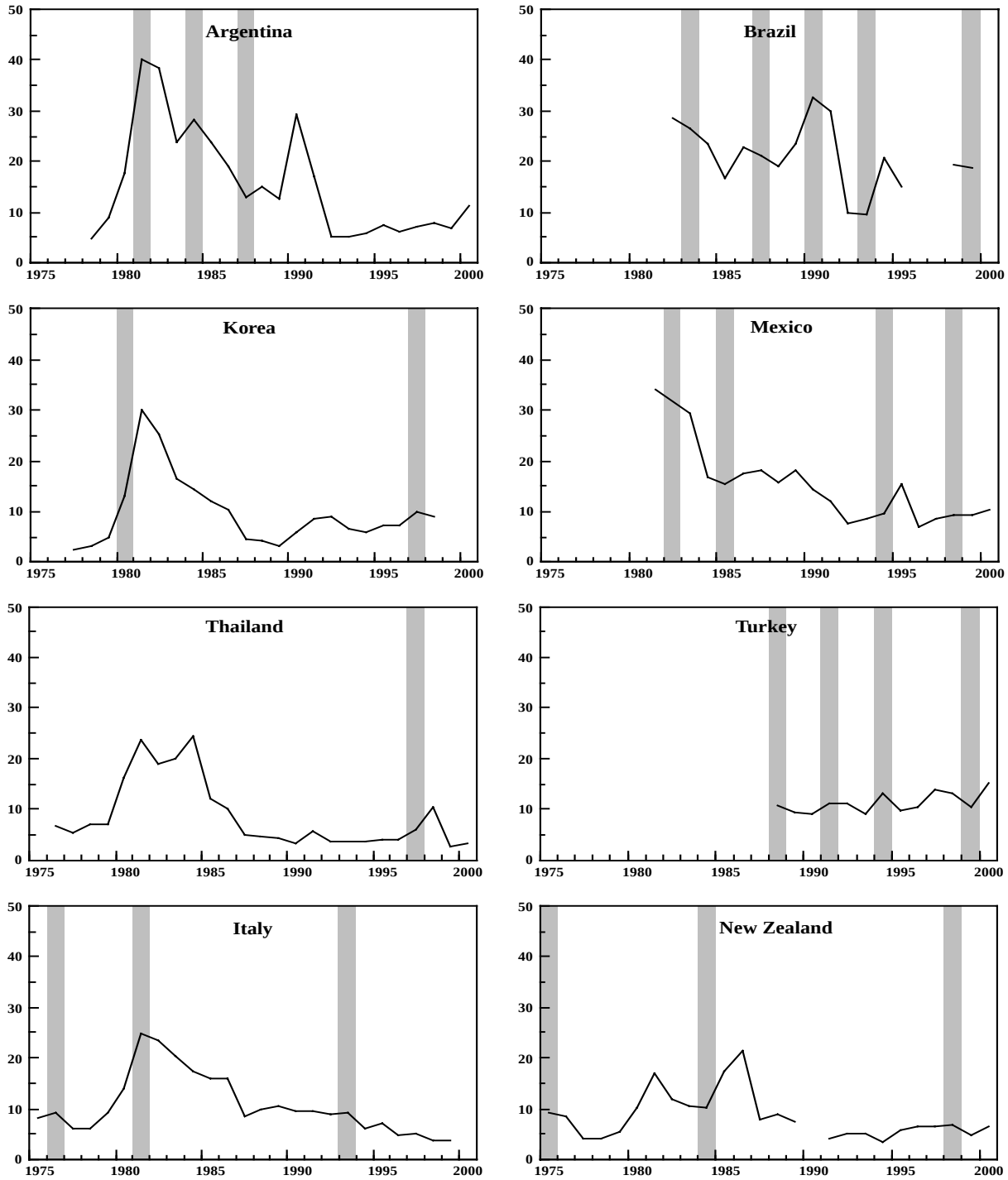


Figure 4. Estimated Probability of a Dollar Currency Crisis, 1970-2006
(Percent)



Note: Estimates are based on the coefficient estimates of the full-sample regressions in Table 5a.

Figure 5. Estimated Probability of a Currency Crisis in Selected Countries, 1975-2000 (Percent)



Notes: Estimations are based on the coefficient estimates of the full-sample regressions in Table 5a. Shaded regions indicate the beginning year of actual crises.

Table 1. Currency Crises and *De Jure* Exchange Rate Regimes
(Period: 1970 – 1999)

Exchange Rate Regime	Total Number of Crises	Average Severity (two-sided measure) [1] [2]	Average Severity (one-sided measure) [1]	Average Recovery Time (Years)
Pegged	36	-8.69	-14.52	3.71
Intermediate	58	-4.18	-9.14	3.47
Floating	27	2.29	-2.53	1.70

Notes: (1) The average severity of crises in an exchange rate regime is obtained by taking the simple average of severities of all crises occurred in that exchange rate regime. (2) Episodes that do not have sufficient data to calculate the three-year averages are excluded from the computation of the average.

Table 2. Currency Crises and *De Facto* Exchange Rate Regimes
(Period: 1970 – 2001)

Exchange Rate Regime	Total Number of Crises	Severity (two-sided measure) [1]	Severity (one-sided measure)	Average Recovery Time (Years)
Pegged	16	-7.60	-11.34	3.50
Limited Flexibility	43	-5.32	-12.92	3.90
Managed Floating	48	-2.62	-6.57	2.62
Freely Floating	17	1.04	-4.58	2.00

Note: See notes in Table 1.

Table 3. Currency Crises in Industrial Countries vs. Emerging Markets

Severity of Crisis (one-sided measure)

Period	Industrialized Countries	Emerging Economies
1970 – 1979	-5.48	-12.99
1980 – 1989	-10.25	-9.48
1990 – 1999	-3.05	-9.87
2000 – 2004	-8.99	-4.55
1970 – 2004	-7.42	-9.77
Twin Crises	-1.28	-14.12

Severity of Crisis (two-sided measure)

Period	Industrialized Countries	Emerging Economies
1970 – 1979	-2.52	-7.73
1980 – 1989	-4.31	-4.97
1990 – 1999	2.84	-3.80
2000 – 2004	-9.21	8.99
1970 – 2004	-2.13	-4.40
Twin Crises	9.20	-6.91

Average Recovery Time (Years)

Period	Industrialized Countries	Emerging Economies
1970 – 1979	2.38	3.47
1980 – 1989	4.60	2.56
1990 – 1999	2.54	2.80
2000 – 2004	4.00	1.50
1970 – 2004	3.64	2.70
Twin Crises	1.67	2.96

Number of Crises

Period	Industrialized Countries	Emerging Economies
1970 – 1979	8	17
1980 – 1989	25	35
1990 – 1999	13	26
2000 – 2004	1	8
1970 – 2004	47	86
Twin Crises	3	28

Note: A crisis episode is defined to be a twin crisis if a banking crisis occurred 2 years before, during or after that currency crisis.

Table 4. Currency Crises across Regions

Severity of Crises (one-sided measure)

Period	Latin America	East Asia	Europe	Other
1970 - 1979	-13.69	-0.58	-2.12	-16.13
1980 - 1989	-11.98	-7.31	-9.76	-8.74
1990 - 1999	-5.79	-22.22	-3.59	-3.57
2000 - 2004	-8.67	0.00	-8.99	-0.58
1970 - 2004	-10.35	-12.53	-6.91	-8.02
Twin Crises	-11.44	-29.47	-1.28	-6.32

Severity of Crises (two-sided measure)

Period	Latin America	East Asia	Europe	Other
1970 - 1979	-5.99	1.97	0.99	-13.01
1980 - 1989	-4.90	-5.53	-4.48	-4.40
1990 - 1999	1.61	-16.29	3.86	0.23
2000 - 2004	15.51	19.70	-9.21	0.38
1970 - 2004	-2.67	-7.72	-1.55	-4.50
Twin Crisis	-3.96	-22.50	9.20	0.55

Average Recovery Time (Years)

Period	Latin America	East Asia	Europe	Other
1970 - 1979	3.14	1.50	1.67	4.50
1980 - 1989	2.80	2.50	4.90	2.47
1990 - 1999	2.56	4.14	2.90	1.83
2000 - 2004	1.75	1.00	4.00	1.33
1970 - 2004	2.69	3.00	3.84	2.61
Twin Crises	2.36	5.17	1.67	2.29

Number of Crises

Period	Latin America	East Asia	Europe	Other
1970 - 1979	7	2	6	10
1980 - 1989	15	6	21	18
1990 - 1999	9	7	10	13
2000 - 2004	4	1	1	3
1970 - 2004	35	16	38	44
Twin Crises	14	6	3	8

Note: See notes in Tables 1 and 3.

Table 5a. Probit Regression Results (De Jure Exchange Rate Regime)
Dependent Variable: Crisis Indicator (1 = Crisis, 0 = Otherwise)

	All Countries	Industrial Countries	Emerging Economies
	(1)	(2)	(3)
Current Account/GDP (L)	**-0.845**	**-0.871**	**-0.563**
	(-4.41)* **	**(-3.33)*** **	**(-1.89)** **
Fiscal Balance/GDP (L)	**-0.442**	**-0.356**	-0.448
	(-2.99)* **	**(-1.65)***	(-1.36)
Non-FDI Inflows/GDP (L)	-0.352	**-0.834**	0.246
	(-1.39)	**(-2.64)*** **	(0.73)
Inflation (L)	**0.003**	**0.186**	**0.003**
	(2.66)* **	**(2.75)*** **	**(2.27)** **
Real Oil Price (L)	**0.202**	**0.242**	-0.178
	(2.63)* **	**(3.98)*** **	(-1.29)
Real U.S. Interest Rate	**0.591**	0.078	**2.619**
	(1.91)*	(0.32)	**(4.03)*** **
Trade Openness (L)	**-0.038**	-0.016	-0.039
	(-1.79)*	(-0.65)	(-0.90)
Foreign Exchange Reserve / GDP (L)			-0.288
			(-1.06)
Total External Debt / Exports (L)			-0.006
			(-1.32)
DUMMY VARIABLES			
Intermediate Ex. Rate Regime (L)	**4.135**	1.302	5.281
	(2.24) **	(0.66)	(1.30)
Floating Ex. Rate Regime (L)	3.913	3.524	3.530
	(1.42)	(0.93)	(0.87)
Industrial Country	**-3.92**		
	(-2.29) **		
Number of Observations	1010	540	409
Pseudo R2	0.09	0.13	0.09

Notes:

1. Coefficient estimates are probit slope derivatives,dF(x)/dx, in percent terms, and thus can be interpreted as the change in probability of a crisis casued by a one-unit change in the explanatory variable.
2. Values of z-statistics in parentheses; * significant at 10%; * * significant at 5%; *** significant at 1%
3. (L) means that the variable is lagged one year.
4. Coefficient on an exchange-rate regime indicates the effect of that regime relative to a fixed exchange-rate regime.
5. The cluster option in STATA is used to correct for heteroskedasticy and serial correlation within each country.

Table 5b. Probit Regression Results (De Facto Exchange Rate Regime)
Dependent Variable: Crisis Indicator (1 = Crisis, 0 = Otherwise)

	All Countries	Industrial Countries	Emerging Economies
	(1)	(2)	(3)
Current Account / GDP (L)	**-0.747**	**-0.845**	**-0.579**
	(-4.29)* **	**(-3.49)*** **	**(-2.09)** **
Fiscal Balance/GDP (L)	**-0.405**	-0.318	-0.333
	(-2.48) **	(-1.26)	(-1.12)
Non-FDI Inflows/GDP (L)	-0.248	-0.636	0.124
	(-0.96)	(-1.50)	(0.40)
Inflation (L)	**0.003**	**0.098**	0.002
	(2.33) **	**(1.66)* **	(1.12)
Real Oil Price (L)	**0.172**	**0.231**	-0.163
	(2.24) **	**(3.03)*** **	(-1.21)
Real U.S. Interest Rate	**0.769**	0.165	**2.294**
	(2.53) **	(0.58)	**(3.86)*** **
Trade Openness (L)	**-0.049**	-0.028	-0.038
	(-2.09) **	(-0.90)	(-0.89)
Foreign Exchange Reserve/GDP (L)			-0.364
			(-1.48)
Total External Debt/Exports (L)			**-0.009**
			(-2.17) **
DUMMY VARIABLES			
Limited-Flexibility Regime (L)	1.962	2.608	-0.371
	(0.87)	(1.05)	(-0.09)
Managed-Floating Regime (L)	**5.611**	**5.754**	4.869
	(2.27) **	**(1.84)* **	(1.28)
Free Floating/Falling Regime (L)	3.791	0.508	**9.477**
	(1.15)	(0.10)	**(2.47)** **
Industrialized Country	-2.233		
	(-1.27)		
Number of Observations	1036	520	461
Pseudo R2	0.09	0.12	0.10

Note: see Table 5a.

Table 6. Severity of Currency Crises (OLS Regression)

Dependent Variable: Output Loss (two-sided measurment; "+" indicates gain and "-" loss)

	All Countries		Industrial	Emerging
	(1)	(2)	(3)	(4)
Current Account / GDP (L)	**0.948**	**1.034**	0.705	**1.961**
	(2.15)**	**(2.23)****	(1.35)	**(2.40)****
Fiscal Balance / GDP (L)	-0.120	-0.175	-0.557	0.819
	(-0.50)	(-0.71)	(-1.46)	(1.62)
Inflation (L)	**0.004**	**0.004**	-0.108	**0.005**
	(6.83)***	**(6.46)*****	(-1.00)	**(6.20)*****
Real GDP Per Capita (L)	-0.014	-0.312	-0.261	-0.441
	(-0.08)	(-1.35)	(-0.84)	(-0.44)
G7 Real GDP Growth				1.621
				(0.57)
Real Oil Price	0.032	0.020	-0.254	0.582
	(0.20)	(0.13)	(-1.07)	(1.62)
Real U.S. Interest Rate	-0.559	-0.419	0.141	-0.402
	(-1.11)	(-0.88)	(0.18)	(-0.25)
Trade Openness (L)	-0.025	-0.034	-0.047	-0.072
	(-0.60)	(-0.78)	(-1.34)	(-0.57)
Foreign Exchange Reserve / GDP (L)				0.450
				(0.91)
External Debt / Exports (L)				0.010
				(0.77)
DUMMY VARIABLES				
French Civil Law	-1.270	-2.524	**-8.271**	-4.919
	(-0.43)	(-0.91)	**(-2.61)****	(-0.81)
Intermediate Ex. Rate Regime (L)	**5.983**	5.312	7.292	**10.670**
	(1.67)*	(1.44)	(1.49)	**(1.94)***
Floating Ex. Rate Regime (L)	**10.021**	**9.485**	5.614	**15.237**
	(2.73)***	**(2.53)****	(1.45)	**(2.10)****
Twin Crisis	**-5.875**		2.817	**-9.725**
	(-1.78)*		(0.64)	**(-1.99)***
Industrial Country		**6.437**		
		(2.10)**		
Constant	-0.798	-1.449	8.539	-11.174
	(-0.18)	(-0.33)	(1.16)	(-0.84)
Number of Observations	101	101	41	51
Adjusted R2	0.227	0.210	0.293	0.270

NOTES:

1. Values of t-statistics in parentheses; * significant at 10%; * * significant at 5%; *** significant at 1%.
2. White's correction is used to correct for heteroscedasticity.
3. (L) means that the variable is lagged one year.
4. Coefficient on French Civil Law indicate the effect of that legal origin relative to that of British common law.
5. Coefficient on an exchange-rate regime indicates the effect of that regime relative to a fixed exchange-rate regime.

Table 7. Severity of Currency Crises (Tobit Regression)
Dependent Variable: Output Loss (one-sided measures, censored to be less or equal zero)

	All Countries		Industrial Countries	Emerging Economies
	(1)	(2)	(3)	(4)
Current Account / GDP (L)	**1.873**	**1.930**	**1.675**	**2.979**
	(3.57)* **	**(3.57)*** **	**(3.38)*** **	**(2.67)** **
Fiscal Balance / GDP (L)	0.322	0.275	**-1.303**	1.669
	(0.90)	(0.75)	**(-2.82)*** **	(1.51)
Inflation (L)	0.002	0.002	**-0.486**	0.008
	(0.58)	(0.63)	**(-2.84)*** **	(0.54)
Real GDP Per Capita (L)	-0.305	-0.201	0.538	-1.034
	(-1.03)	(-0.45)	(1.49)	(-0.59)
G7 Real GDP Growth				4.582
				(1.23)
Real Oil Prices	0.224	0.269	0.016	**0.962**
	(0.96)	(1.11)	(0.06)	**(2.00)***
Real U.S. Interest Rate	**-1.430**	-1.428	-0.932	-1.008
	(-1.66)*	(-1.60)	(-1.14)	(-0.38)
Trade Openness (L)	-0.075	-0.084	**-0.261**	-0.193
	(-1.15)	(-1.24)	**(-3.30)*** **	(-1.10)
Foreign Exchange Reserve/GDP(L)				1.289
				(1.38)
External Debt / Exports (L)				0.023
				(0.86)
DUMMY VARIABLES				
French Civil Law	-5.069	-5.871	**-16.650**	-7.812
	(-1.12)	(-1.26)	**(-3.20)*** **	(-0.82)
Intermediate Ex. Rate Regime (L)	**8.100**	**8.393**	**18.278**	11.093
	(1.79)*	**(1.78)***	**(3.39)*** **	(1.51)
Floating Ex. Rate Regime (L)	**19.104**	**18.211**	**9.214**	**26.808**
	(3.39)* **	**(3.18)*** **	**(1.81)***	**(2.21)** **
Twin Crisis	**-8.557**		**-17.165**	**-13.836**
	(-2.16) **		**(-2.31)** **	**(-2.11)** **
Industrial Country		-0.237		
		(-0.04)		
Constant	11.529	8.504	8.443	-13.505
	(1.48)	(1.07)	(0.81)	(-0.58)
Number of Observations	101	101	41	51
Pseudo R2	0.066	0.058	0.179	0.077

Note: See notes in Table 6.

Table 8. Economic Indicators in the Post-1970 Episodes of Steep Dollar Declines

	1971Q2- 1973Q3	1977Q2-1978Q3	1985Q1-1988Q2	2002Q1-2004Q4
Dollar Depreciation	Total: 14% Annual: 6.2%	Total: 11% Annual: 8.8%	Total: 22% Annual: 6.8%	Total: 22% Annual: 8.0%
Unemployment Rate	Average:5.5% Change: 5.9 to 4.8%	Average: 6.5% Change: 6.7 to 5.9%	Average: 6.6% Change: 7.2 to 5.5%	Average: 5.9% Change: 5.7 to 5.4%
Annual Real GDP Growth	Average: 4.7% Change: 2.3 to -2.1%	Average: 5.1% Change: 5.0 to 6.7%	Average: 3.8% Change: 3.7 to 5.3%	Average: 3.6% Change: 3.4 to 3.9%
Yield on 10-year Treasury-Note	Average: 6.4% Change: 6.2 to 7.2%	Average: 7.9% Change: 7.6 to 8.8%	Average: 8.9% Change: 11.6 to 8.8%	Average: 4.3% Change: 5.1 to 4.2%
Annual CPI Inflation	Average: 4.8% Change: 5.7 to 8.5%	Average: 6.5% Change: 6.3 to 7.8%	Average: 3.2% Change: 3.7 to 4.7%	Average 2.2% Change: 1.3 to 3.5%
Note: "Change" indicates the levels of economic indicators at the beginning and at the end of the period of a large dollar depreciation.				

Appendix 1. Data Descriptions

1. Selection of Countries

We include 51 countries, including industrial and emerging countries, in the study. Advanced countries are defined using the definition from World Economic Outlook (WEO) published by the International Monetary Fund (IMF). Emerging markets are defined using the Morgan Stanley Capital International (MSCI) classification. This index classifies a country as an emerging market using a number of different criteria: GDP per capita, local government regulations, perceived investment risk, foreign ownership limits, capital controls and other factors. (For detailed information on the method of MSCI's classification, see http://www.msci.com/equity/index.html.) Israel, Korea and Taiwan are classified as advanced countries by WEO, but they are also included in the MSCI emerging market index. We classify them as emerging economies. Taiwan is included in the original MSCI classification but is excluded in our sample due to the lack of data.

2. Dependent Variables

The Crisis Indicator We use the Frankel and Rose (1996) method, which focuses only on the successful speculative attacks. They define a currency crash as a depreciation of the nominal exchange rate of at least 25 percent that is also at least a 10 percentage-point increase in the rate of nominal depreciation. The original paper used annual data, but we use monthly data. We first measure the twelve-month log difference in the exchange rate ($\Delta exr_{i,t}(\%) = \log(exr_{i,t}) - \log(exr_{i,t-12})$); we then identify a crisis with the rule below:

$$\text{Crisis} = \begin{cases} 1 \text{ if } \Delta exr_{i,t}(\%) > 25\% \text{ and } \Delta exr_{i,t}(\%) - \Delta exr_{i,t-12}(\%) > 10\% \\ 0 \text{ otherwise} \end{cases}$$

Exchange rate data are obtained from the International Financial Statistics published by the IMF (line ae.zf).

Frankel and Rose (1996) use a three-year exclusion "window" to avoid counting the same crash twice. Any crisis occurring within three years of the first crash is defined to be an extension of the first identified crisis. With this method, we identify the crisis dates and find a total of 133 crisis episodes in 48 countries over the sample period of 1970-2004. Canada, Singapore and the United States did not have any crises during this period.

Two-sided Measure of Severity This measure of output effect of a currency crisis in country ***i*** in period ***t*** ($S_{i,t}$) is the difference between the total real GDP growth rate in the crisis period (***t***) and that on the pre-crisis period (***t-1***). That is,

$$S_{i,t} = 3*(g_{i,t} - g_{i\,t-1})$$

Where $g_{i,t}$ is the average real GDP growth rate during the three-year period that begins in the year when the crisis occurred and ends two years afterwards, and $g_{i,t-1}$ is the average growth rate during the three years prior to the crisis year. The severity, $S_{i,t}$ can be positive or negative. A positive $S_{i,t}$ indicates an expansionary episode and a negative $S_{i,t}$ indicates a contractionary episode.

One-Sided Measure of Severity The construction of the one-sided measure of severity follows that used by Bordo *et al*. (2001). In this measure, severity is the cumulative sum of the differences, over the duration of the crisis, between the rates of real GDP growth in each year following the crisis and the trend growth rate that prevailed before the crisis. The trend rate is calculated as the average growth rate of the five years preceding the crisis event. The *duration* of a crisis is defined as the number of years from the onset of the crisis until the actual growth rate returns to the trend rate. When the growth rate in a crisis year is above the trend rate, output loss is defined to be 0. Thus, by construction, this severity measure is censored to be less than or equal to 0, and the minimum *duration* is one year; in other words, no currency crisis is allowed to be expansionary. Real GDP data of all countries are obtained from the IMF's data base for World Economic Outlook.

Characteristics of Crises Episodes The characteristics of crises identified in the sample are reported in the table below.

Table A1. Time, Severity, and Pre-conditions of the Crisis Episodes

Country (E:emerging; A:advanced)	Time of Crisis	Twin Crisis	Severity (One-sided Measure)	Severity (Two-sided Measure)	Average Duration (Years)	*De Jure* Exchange Rate Regime	*De Facto* Exchange Rate Regime
Argentina** (E)	Mar-75		-9.52	-5.09	3	Pegged	Freely Floating
	Apr-81	X	-16.56	-16.64	3	Intermediate	Limited Flexibility
	Jul-84		0.00	9.27	1	Intermediate	Freely Floating
	Aug-87	X	0.00	-9.64	1	Intermediate	Freely Floating
	Jan-02	X	-11.57	15.51	2	#N/A	Pegged
Australia (A)	Feb-85		0.00	4.36	1	Floating	Freely Floating
	Aug-98		0.00	-1.35	1	Floating	Freely Floating
Austria (A)	May-81		-11.67	-2.14	8	Pegged	Limited Flexibility
Belgium** (A)	May-81		-13.44	-9.03	8	Intermediate	Pegged
Brazil** (E)	Jun-76		-56.24	-10.60	8	Pegged	Limited Flexibility
	Jul-79		0.00	-6.14	1	Intermediate	Managed Floating
	Feb-83		-6.47	4.51	2	Intermediate	Managed Floating
	Jun-87		-18.77	-14.43	7	Intermediate	Pegged
	Jul-90	X	-17.13	-10.28	4	Intermediate	Freely Floating

Country (E:emerging; A:advanced)	Time of Crisis	Twin Crisis	Severity (One-sided Measure)	Severity (Two-sided Measure)	Average Duration (Years)	*De Jure* Exchange Rate Regime	*De Facto* Exchange Rate Regime
	Aug-93	X	0.00	18.50	1	Floating	Freely Floating
	Jan-99		-2.44	0.40	2	Intermediate	Limited Flexibility
	Nov-02		-2.26		2*	#N/A	Managed Floating
Chile** (E)	Jul-71		0.00	-6.09	1	Pegged	Managed Floating
	May-75	X	-12.94	4.01	2	Pegged	Managed Floating
	Aug-82	X	-29.20	-27.70	3	Pegged	Pegged
	Sep-85		0.00	25.45	1	Intermediate	Managed Floating
China (E)	Sep-84		0.00	12.30	1	Pegged	Managed Floating
	Nov-90		-6.72	0.20	3	Pegged	Managed Floating
	Jan-94		0.00	-4.20	1	Intermediate	Limited Flexibility
Columbia** (E)	Jun-85	X	0.00	8.41	1	Intermediate	Managed Floating
	Nov-97		-18.92	-13.30	8*	Intermediate	Managed Floating
	Jan-03		0.00		1	#N/A	#N/A
Cyprus (A)	Jul-81		-48.93	-9.32	8	Pegged	Limited Flexibility
Czech Rep. (E)	Jul-97		-7.79	-12.99	4	Pegged	Managed Floating
Denmark (A)	May-81		-4.44	-1.97	2	Intermediate	Limited Flexibility
Egypt** (E)	Jan-79	X	-2.89	-13.44	2	Pegged	Managed Floating
	Aug-89		0.00	1.29	1	Pegged	Managed Floating
	Apr-03		-1.74		2*	#N/A	#N/A
Finland (A)	Mar-93	X	-1.05	16.67	2	Floating	Limited Flexibility
France** (A)	May-81		-8.65	-2.93	8	Intermediate	Limited Flexibility
Germany (A)	May-81		-13.27	-7.55	8	Intermediate	Managed Floating
Greece** (A)	Feb-81		-30.38	-14.97	8	Intermediate	Limited Flexibility
	Feb-85		0.00	0.97	1	Intermediate	Managed Floating
	Jul-93		-4.65	-1.30	5	Intermediate	Pegged
Hong Kong (A)	Sep-83		-2.28	-6.10	2	Floating	Limited Flexibility
Hungary (E)	May-89	X	-26.22	-20.17	6	Pegged	Managed Floating
	Jan-96		0.00	6.89	1	Intermediate	Limited Flexibility
	Oct-00		0.00	-1.03	1	Intermediate	Managed Floating
Iceland (A)	Sep-74		-9.21	-13.73	4	Intermediate	Limited Flexibility
	Feb-78		0.00	1.20	1	Intermediate	Managed Floating
	Mar-81		-19.73	-12.36	7	Intermediate	Managed Floating
	May-85		0.00	13.98	1	Intermediate	Managed Floating
	Dec-88		-25.18	-16.77	7	Pegged	Limited Flexibility
	Jun-93		0.00	6.94	1	Pegged	Limited Flexibility
	May-01		-8.99	-9.21	4	#N/A	Limited Flexibility
India (E)	Jul-91		-7.68	-11.06	4	Intermediate	Limited Flexibility
Indonesia** (E)	Nov-78		0.00	4.22	1	Pegged	Managed Floating
	Apr-83		0.00	1.12	1	Intermediate	Limited Flexibility
	Sep-86		0.00	-1.48	1	Intermediate	Limited Flexibility
	Aug-97	X	-44.75	-31.21	7*	Intermediate	Limited Flexibility
	Jun-00		0.00	19.70	1	Floating	Freely Floating
Ireland (A)	May-76		-3.52	2.15	2	Pegged	Pegged

Country (E:emerging; A:advanced)	Time of Crisis	Twin Crisis	Severity (One-sided Measure)	Severity (Two-sided Measure)	Average Duration (Years)	*De Jure* Exchange Rate Regime	*De Facto* Exchange Rate Regime
	May-81		-15.16	-7.97	7	Intermediate	Limited Flexibility
	Jul-93		-2.26	4.57	2	Intermediate	Limited Flexibility
Israel (A)	Nov-74		-43.97	-16.75	8*	Pegged	Managed Floating
	Dec-77	X	-6.58	-0.38	3	Pegged	Managed Floating
	Jan-81		0.00	-7.51	1	Floating	Managed Floating
	Feb-84		-5.10	-1.32	3	Floating	Managed Floating
Italy** (A)	Mar-76		0.00	2.76	1	Intermediate	Limited Flexibility
	Apr-81		-16.64	-10.01	8*	Intermediate	Managed Floating
	Feb-93		-3.07	0.12	2	Floating	Limited Flexibility
Japan (A)	Oct-79		0.00	-2.40	1	Intermediate	Managed Floating
	May-96		0.00	0.86	1	Floating	Managed Floating
Jordan** (E)	Oct-88		-31.70	-27.70	5	Pegged	Pegged
Korea (A)	Sep-80		-13.56	-14.07	4	Pegged	Pegged
	Nov-97	X	-16.89	-17.42	3	Intermediate	Limited Flexibility
Luxembourg** (A)	May-81		-3.97	-3.69	3	Intermediate	Pegged
Malaysia (E)	Oct-97	X	-42.22	-22.94	7*	Intermediate	Limited Flexibility
Mexico** (E)	Sep-76		-4.74	-2.62	3	Pegged	Pegged
	Feb-82	X	-59.16	-28.92	8*	Intermediate	Limited Flexibility
	Jul-85		-11.49	1.91	5	Intermediate	Managed Floating
	Dec-94	X	0.00	-6.41	1	Intermediate	Pegged
	Aug-98		0.00	9.49	1	Floating	Managed Floating
Morocco** (E)	Apr-81		-8.27	-4.37	2	Intermediate	Limited Flexibility
	May-84		0.00	12.66	1	Intermediate	Limited Flexibility
Netherlands** (A)	May-81		-7.84	-6.04	4	Intermediate	Limited Flexibility
New Zealand (A)	Aug-75		-31.08	-23.65	8	Pegged	Limited Flexibility
	Jul-84		0.00	-2.51	1	Pegged	Limited Flexibility
	May-98		-3.78	-1.21	2	Floating	Managed Floating
Norway (A)	Aug-93	X	0.00	3.38	1	Floating	Managed Floating
Pakistan (E)	May-72		-5.18	-5.91	2	Pegged	#N/A
	Oct-82		-0.24	-3.51	2	Pegged	Pegged
Peru** (E)	Jun-76		-12.40	-15.38	4	Pegged	#N/A
	Feb-81	X	0.00	-14.38	1	Intermediate	Freely Floating
	Jan-85	X	0.00	28.00	1	Intermediate	Freely Floating
	Feb-88		-38.01	-46.34	6	Pegged	Freely Floating
	Mar-91		0.00	32.04	1	Floating	Freely Floating
Philippines** (E)	Jan-71		-1.16	-0.28	2	Pegged	Managed Floating
	Jun-83	X	-28.03	-24.95	6	Floating	Managed Floating
	Sep-97	X	0.00	-6.91	1	Floating	Pegged
Poland (E)	Dec-78					#N/A	#N/A
	Jan-82					#N/A	#N/A
	Feb-85					#N/A	#N/A

Country (E:emerging; A:advanced)	Time of Crisis	Twin Crisis	Severity (One-sided Measure)	Severity (Two-sided Measure)	Average Duration (Years)	*De Jure* Exchange Rate Regime	*De Facto* Exchange Rate Regime
	Mar-88					#N/A	#N/A
	Feb-92	X				Intermediate	Limited Flexibility
Portugal** (A)	Feb-77		0.00	10.36	1	Intermediate	Managed Floating
	Jun-81		-22.01	-9.46	7	Intermediate	Managed Floating
	Jul-93		-14.87	-6.20	8*	Intermediate	Limited Flexibility
Russia (E)	Jun-95	X	0.00	29.43	1	#N/A	#N/A
	Aug-98	X	0.00	17.44	1	Intermediate	Limited Flexibility
South Africa (E)	Feb-76		-15.25	-18.95	5	Pegged	Managed Floating
	Oct-81		0.00	-13.48	1	Intermediate	Managed Floating
	Nov-84		0.00	1.28	1	Floating	Managed Floating
	Oct-96		0.00	0.13	1	Floating	Managed Floating
	Dec-01		0.00	1.80	1	#N/A	Managed Floating
Spain** (A)	Feb-81		-3.22	-0.83	5	Intermediate	Limited Flexibility
	Jun-93		-7.20	-3.15	5	Intermediate	Limited Flexibility
Sweden (A)	Sep-81		-1.64	-4.33	3	Pegged	Limited Flexibility
	Feb-93	X	-2.80	7.56	2	Floating	Limited Flexibility
Switzerland (A)	Jul-81		-4.47	-6.86	4	Floating	Managed Floating
	Feb-85		0.00	3.69	1	Floating	Limited Flexibility
Thailand (E)	Aug-97	X	-44.95	-31.56	7*	Pegged	Pegged
Turkey** (E)	Jan-71					Pegged	Managed Floating
	Mar-78		-24.06	-22.61	7	Intermediate	Limited Flexibility
	Jan-82	X	0.00	13.46	1	Intermediate	Managed Floating
	Jan-88		-10.60	-9.11	3	Intermediate	Managed Floating
	Feb-91		-4.70	3.33	2	Floating	Managed Floating
	Mar-94		-10.35	-6.21	2	Intermediate	Managed Floating
	Dec-99	X	-8.58	-22.47	2	Intermediate	Managed Floating
U.K. (A)	May-76		0.00	3.19	1	Floating	Managed Floating
	Aug-81		-3.25	0.08	2	Floating	Managed Floating
	Feb-85		0.00	4.05	1	Floating	Managed Floating
	Jul-93		0.00	10.00	1	Floating	Pegged
Venezuela** (E)	Feb-84		0.00	14.34	1	Pegged	Managed Floating
	Mar-87		0.00	-7.31	1	Pegged	Managed Floating
	Jan-93	X	-9.88	-20.38	3	Floating	Managed Floating
	Feb-96	X	-3.73	4.47	2	Pegged	Limited Flexibility
	Feb-02		-20.84		2*	#N/A	Limited Flexibility

Notes: (1) * indicates crisis episodes that are still ongoing or where the output loss measure was truncated at 8 years because real GDP growth did not return to trend after 8 years.
(2) ** indicates French civil law countries.

3. Data Sources and Constructions of Explanatory Variables

Explanatory Variables	Description	Source
Current Account/GDP	Current account deficit (-) or surplus (+) as a percent of GDP.	World Bank: *World Development Indicators* (WDI)
De Facto Freely Floating Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a freely floating or freely falling regime according to the coarse classification of the Natural Classification proposed by Reinhart and Rogoff (2004) and 0 otherwise.	Reinhart and Rogoff (2004). Available online at
De Facto Limited Flexibility Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a limited flexibility (mostly crawling band) regime according to the coarse classification of the Natural Classification proposed by Reinhart and Rogoff (2004) 0 otherwise.	Reinhart and Rogoff (2004).
De Facto Managed Floating Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a managed floating regime according to the coarse classification of the Natural Classification proposed by Reinhart and Rogoff (2004) and 0 otherwise.	Reinhart and Rogoff (2004).
De Facto Peg Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a hard pegged regime according to the coarse classification of the Natural Classification proposed by Reinhart and Rogoff (2004) and 0 otherwise.	Reinhart and Rogoff (2004). Available online at http://www.wam.umd.edu/~creinhar/Links.html
De Jure Floating Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a managed or free floating regime according to the IMF's classification and 0 otherwise.	IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.
De Jure Intermediate Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a limited flexibility (mostly crawling band) regime according to the IMF's classification and 0 otherwise.	IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*
De Jure Pegged Exchange Rate Regime	Equals 1 if the country's exchange rate regime is a hard pegged regime according to the IMF's classification and 0 otherwise.	IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*
External Debt/Exports	Total external debt in current U.S. dollars as a percent of exports in current U.S. dollars. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt.	World Bank: WDI IMF, *International Financial Statistics* (IFS)
Fiscal Balance/GDP	Central government deficit (-) or surplus (+) as a percent of GDP.	IMF, *International Financial Statistics* (IFS)

Foreign Exchange Reserve/GDP	Total foreign exchange reserve minus gold in current U.S. dollars as a percent of GDP in current U.S. dollars.	World Bank: WDI
G7 Real GDP Growth	G7 Real GDP Growth is the GDP weighted average of real GDP growth of the G7 countries (Canada, France, Germany, Italy, Japan, United Kingdom, and the United States).	IMF: World Economic Outlook
Industrialized Country Dummy	Equals 1 if country is classified as an industrialized country and 0 otherwise.	
Inflation	Annual inflation rate based on annual CPI data. $(CPI_t - CPI_{t-1})/CPI_{t-1}$ x 100%.	World Bank: WDI
Non-FDI Inflows/GDP	(Financial-Account Balance– Net Foreign Direct Investment) as a percent of GDP.	IMF: IFS; IMF: Balance of Payments Statistics (BOPS)
Origins of legal rules	A dummy variable is set to equal 1 if a country's legal origin is not English Common Law. (The legal origins are: English common law, French civil law, German civil law, Socialist law, and Scandinavian civil law.)	La Porta, Lopez-de-Silanes, Schleifer, and Vishny (1998); CIA World Factbook; also available at http://www.nationmaster.com/graph-T/gov_leg_ori
Real GDP per capita	GDP per capita is gross domestic product divided by midyear population. Data are in constant 2000 U.S. dollars.	World Bank: WDI
Real U.S. Interest Rate	The prime rate adjusted for inflation as measured by the GDP deflator. (in Percentage)	Board of Governors of the Federal Reserve System: "Selected Interest Rates." H.15 (415); Bureau of Economic Analysis: GDP Press Release. Tables 4 & 6.
Trade Openness	(Exports + Imports) as a percent of GDP.	World Bank: WDI
Twin Crisis Indicator	A currency crisis was defined to be a twin crisis if a banking crisis occurred within a 2 year "window" around the currency crisis date. The twin crisis indicator equals 1 if there was a twin crisis and 0 otherwise.	Banking crisis indicator is obtained from Caprio and Klingebiel (2003). Also available online at http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20349050~pagePK:64165401~piPK:64165026~theSitePK:469382,00.html
World Real Oil Price	Spot world oil price (U.S. dollar per barrel) deflated by the U.S. consumer price index (=1 over 1982-1984).	IMF: IFS

Appendix 2. A Brief History of Major Currency Crises in the 1990s

Almost all major currency crises in the 1990s occurred to countries with a fixed or intermediate exchange rate regime and weak fundamentals, and triggered by a sudden exit of massive capital flows. Some crises were made more severe than necessary by herding behavior, counter-productive policy responses, or both. As an illustration, this appendix gives a brief description of three major crises in the 1990s.

(1) The ERM crises of 1992-1993.

In the fall of 1992, massive capital flows led to the exit of Britain, Italy, and Spain from the Exchange Rate Mechanism (ERM) of the European Monetary System (EMS), even though they remained with the EMS itself. In the summer of 1993, a second wave of attacks led to a decision by the members to widen the exchange rate bands of ERM, from a margin of 2.25 percent to 15 percent, essentially to allow the French franc to depreciate without any formal exit.

The ERM crises are clear examples of the effect of speculative attacks, even though the question of whether those attacks are reactions to fundamentals remains a matter of debate. In all cases, the governments of attacked countries retained full access to domestic and international capital markets. This meant they had no need to monetize their budget deficits; and indeed the growth of domestic credit was not exceptionally rapid (see Eichengreen, Rose, and Wyplosze [1995]). It also meant that they were not suffering from any ironclad limitation on foreign exchange reserves. The target countries

did not run a large current account deficit (Table A2). Finally, all of the target economies had low and stable inflation both before and after the crisis.

However, many member countries of the ERM did have a fundamental problem of high unemployment. Authorities in member countries could not pursue expansionary policies to help alleviate high unemployment rates as long as they remained committed to a fixed exchange rate. Essentially, European countries with currencies pegged to the Deutsche mark found themselves importing tight monetary policies from Germany which were unsuitable for their weak economic conditions. High unemployment thus was the fundamental pressure on the narrow band of the ERM, providing the essential fuel for the crises.

A remarkable fact about the ERM crises is that the "crisis" countries---those forced to abandon their currency pegs---did better by almost any measure in the following period than those that succeeded in defending their currencies. The United Kingdom, in particular, experienced a rapid drop in its unemployment rate without any corresponding rise in inflation. This underscores the harm to the domestic economy that can be caused by forgoing exchange rate flexibility and the ability to conduct independent monetary policy, and the good that can come from relaxing those constraints.

(2) The Mexican crisis of 1994-95.

The causes of the Mexican peso crisis in 1994-95 have been a topic of much debate. For example, Dornbusch *et al.* (1995) assign heavy responsibility for the Mexican crisis to poor macroeconomic management within the country, underscored by the overvaluation of the peso exchange rate. In an alternative interpretation, Sachs *et al.*

(1996a, 1996b) argue that the overvaluation of the exchange rate played only an indirect role; more important was creditor panic.

Underlying the debate is the fact that, prior to the crisis, international financial conditions were generally stable and U.S. interest rates were moderate. Economic reforms in Mexico and euphoria about the potential benefits of Mexico's entering the North American Free Trade Agreement (NAFTA) with Canada and the United States had led to widespread enthusiasm for its economy, and attracted large capital inflows to the country. However, Dornbusch *et al*. (1995) maintain that the peso was overvalued and due for a large correction, citing the fact that the combination of a double-digit inflation and the inflexible nominal exchange rate had resulted in a real appreciation of 36 percent from 1988 to 1993 and the widening of the current account deficit to a staggering seven percent of GDP by 1994.

Mexico's fall from grace came suddenly in the second quarter of 1994, as election-year instability rattled investors and capital inflows dropped sharply.[40] The sudden capital-flow reversals posed a serious threat to the economy, and the Bank of Mexico expanded domestic credit in response. It also continued to peg the exchange rate, after an initial modest depreciation. The result was a steady decline in reserves. After the change of government in early December, investors' fear of a plummeting peso led to further capital outflows, and reserves dwindled further in mid-December, reaching around $6 billion at their nadir (compared to $28 billion in February 1994). The currency was devalued from December 19 to 22, and then allowed to float.

[40] First, there was an armed rebellion in the state of Chiapas. Second, the presidential candidate of the PRI was assassinated, there were accusations that the then president's brother had something to do with it.

Immediately after the devaluation, international and domestic creditors started to realize that the Mexican government was scheduled to repay around $28 billion of short-term dollar-denominated debts (*tesobonos*) within the following few months, but had only around $6 billion of reserves. Suddenly, Mexico was unable to borrow fresh funds to service this debt. The government found itself illiquid, though not insolvent. (Its solvency was reflected by the fact that $28 billion represented only around 10 percent of Mexico's pre-crisis GDP, a high but not crushing debt burden. Moreover, the budget was roughly in balance.)

Thus, the Mexican government was pushed to the edge of default in early 1995. To prevent that, the U.S. and the IMF led an emergency international loan to Mexico. The Mexican government used the loan to retire *tesobonos* and was able to repay the loan ahead of schedule in 1996. Mexican GDP growth collapsed in 1995 but recovered strongly in 1996 and 1997.

Mexico was vulnerable to crises because of substantial economic imbalances, as well as illiquidity (in the sense that short-term liabilities to foreigners exceeded short-term assets.) That it is a developing economy (with problems of *original sin* and *debt intolerance*) also contributed to its fragility.

(3) The Asian Crisis of 1997-1998.

Following years of stellar performances, the crisis countries in East Asia (Thailand, Malaysia, Indonesia, the Philippines, and South Korea) experienced a plunge in the exchange values of their currencies and a sudden reversal of private capital flows from June 1997 onward. Investors had poured massive amounts of funds into the Asian countries until the first half of 1997, before they drastically reversed the pattern in the

summer. The ensuing $100 billion net capital outflow---accounting for 10 percent of the combined GDP of the five crisis-hit countries---exerted severe economic costs to those countries.

East Asia was hit by several international macroeconomic shocks during 1994-96, including a dramatic surge in the (price) competitiveness of rival economies such as China and Mexico, and the abrupt reversal of the long-term trend of the yen's appreciation relative to the dollar. These shocks interacted with weaknesses in East Asian financial systems to provoke the crisis. Each of the five crisis economies had initiated, but had not completed, financial sector liberalization and reform. The partial reforms had led to increasingly fragile financial systems, characterized by growing short-term foreign debt, rapidly expanding bank credit, inadequate regulation and supervision of financial institutions, and crony capitalism. These weaknesses, in turn, left the Asian economies vulnerable to a rapid reversal of capital flows, even though other domestic factors that tend to cause severe currency crises did not seem to apply here. (The crisis countries' real exchange rates were, arguably, only mildly overvalued. Their overall debt-carrying capacities did not seem to present imminent risks of default. Their government budgets were basically in balance.) Once the capital withdrawals were underway, mistakes by both Asian governments and the IMF further contributed to the panic and unnecessarily deepened the crisis.

As in the case of the Mexico crisis of 1994-95, those five crisis countries were vulnerable in part because of the weakness of their financial infrastructures, and in part because their short-term liabilities to foreigners exceeded short-term assets. The still incomplete reforms led to dramatic growth in the number of banks and their linkages to

the international economy, which in turn, increased the exposure of these economies to international financial shocks by allowing a rapid buildup of short-term external debt into weak financial systems. Large amount of foreign capital flowed into the region both because East Asia's successful track records attracted foreign credits, and because partial financial market liberalization in the region made it easier for the entry of foreign capital. The inflows rapidly appreciated the real exchange rates, expanded bank lending, and increased vulnerability to a reversal in capital flows. When capital inflows did wane late 1996 and early 1997, a series of missteps by Asian governments, market participants and the IMF resulted in a financial panic. The resulting crisis was much deeper than was either necessary or inevitable.

Almost all of the major factors highlighted in section 3 of this paper played a role in causing and spreading the Asian crisis. In particular, external shocks rendered currency-peg regimes unsustainable, while precipitous capital-account liberalization overwhelmed flawed (and weak) domestic financial regulation.[41] The crisis countries were also vulnerable because of problems of *original sin* and *debt intolerance*. On top of all that, the initial conditions demanded by the IMF in exchange for providing bail-out loans were wrong prescriptions for the sick, further exacerbating the situation. For example, the IMF initially demanded that crisis countries cut the budget deficit (resulted from the crisis-induced contraction), a contractionary policy response to the already hard-hit economies, even though those countries did not have the problem of a large budget deficit at the outset of the crisis (Table A2).

[41] For example, see Radelet and Sachs (1998), Furman and Stiglitz (1998), Goldstein (1998), Mishkin (1999).

Table A2. Severity and Fundamental Variables at the Onset of Some Crises

Crisis Episodes	Severity (two-sided measure)	Current Account / GDP (%)	Fiscal Balance / GDP (%)	Total External Debt / GDP (%) 1/	Non-FDI Flow / GDP (%)
Latin American Debt Crisis (1979 - 1983)	-12.07	-6.09	-1.43	37.84	5.01
EMS Crisis (1993)	3.86	-1.62	-5.99	-20.32	-0.44
Mexico "Tequila" Crisis (1994)	-6.41	-5.80	0.51	32.37	6.99
Asian Crisis (1997)	-22.01	-4.96	0.64	52.82	6.59
Brazil and Russian Crisis (1998 - 1999)	8.92	-2.16	-7.09	31.06	1.24

1/. "-" indicates external assets; "+" indicates external debt.

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