SUDDEN STOPS, CURRENCY CRISES, AND TWIN DEFICITS

BY

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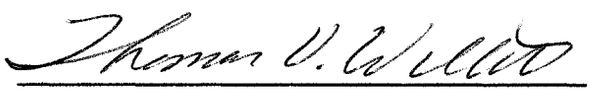

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Abstract of the Dissertation

Sudden Stops, Currency Crises and Twin Deficits

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Over the last thirty five years many emerging and developing countries experienced severe financial crises. Two stand-alone essays of this dissertation respectively examine: i) Empirical characteristics of commonly used measures of international financial crises, specifically "sudden stop" and currency crisis measures; and ii) The role of twin deficits (joint occurrence of fiscal and current account deficits) on the probability of sudden stops across the decades of the 1970s, 80s and 90s.

Sudden stop and currency crisis measures are analyzed using the annual data of 25 emerging market countries from 1990 to 2003. According to the study, sudden stops are more likely to precede currency crises and the output costs are higher when both crises occur simultaneously. Less than half of the sudden stops occur simultaneously with currency crises, while less than 60 percent of currency crises are accompanied by sudden stops. This examination led to the grouping of sudden stop and currency crisis episodes in the following categories: sudden stops that lead to currency crises (introduced here as "twin crises," another kind of twin crises, not the one that refers to joint banking and currency crises) and sudden stops without currency crises. Twin crises have the highest output losses. Moreover, high current account deficits and large portfolio and bank flows could be used as early warning signs to predict twin crises.

The relationship between twin deficits (simultaneous fiscal and current account deficits) and sudden stops across the three decades is examined with Probit analysis using the annual data of 42 developing countries (25 of them are emerging market countries) from 1970 to 2004. Results support the hypothesis that the magnitude of twin deficit effects declined over the decades, but twin deficits have not disappeared in the 90s and they still played a significant role in the likelihood of a sudden stop.

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Chapter 1

Introduction

The alarming frequency and severity of the balance-of-payment crises during the last three decades has motivated a large volume of theoretical and empirical literature on the subject. The search for predictors and characteristics of these crises produced several crises models. Sudden international capital flow reversals, exchange rate devaluations or depreciations and subsequent output losses in many of the affected countries have been substantial. Argentina's losses in the early 1980s crisis reached 55 percent of its GDP. Thailand, Indonesia, Malaysia and South Korea experienced on average an 11 percent drop in their per capita real GDP during the 1997 Asian crises.[1]

In the two stand-alone essays of this dissertation I respectively investigate: i) Empirical characteristics of commonly used measures of international financial crises, specifically "sudden stop" and currency crisis measures; and ii) The role of twin deficits (joint occurrence of fiscal and current account deficits) on the probability of sudden stops across the decades of the 1970s, 80s and 90s.

The capital account liberalization wave that started in the 1980s boosted the amount of capital flows among the emerging market and industrial countries. Along the expected economic benefits, these capital flows carried the hidden dangers of sudden reversibility. The term "sudden stop" was first introduced by Dornbusch, Goldfajn and Valdes (1995). It describes sudden and large drops in capital inflows. Along with other measures of balance-of-payments crises (i.e. currency crisis measures, capital account

[1] The Economist (2007) and (2008).

reversals), sudden stops have become a popular empirical measure to identify and study the crises.

Sudden Stops and Currency Crises: Empirical Regularities

Chapter 2 presents the study of empirical (ir)regularities among several popular measures of sudden stops and currency crises using the annual data of 25 emerging market countries from 1990 to 2003. Empirical papers quite often adopt new or modified versions of previously used crisis measures, without sufficient discrimination among them. This dissertation contributes to the systematic evaluation of available crisis measures, specifically focusing on various sudden stop and currency crisis measures. Such a comparison has not appeared in the published literature. The crisis research produced a number of different crises measures, but contradicting empirical results and confusing terminology create serious problems to policy makers as well as to researchers.

We find that less than half of the sudden stops occur simultaneously with currency crises, while less than 60 percent of currency crises are accompanied by sudden stops. Sudden stops are more likely to precede currency crises and the output costs are higher when both sudden stops and currency crises occur simultaneously. This examination led to the grouping of sudden stop and currency crisis episodes in the following categories: sudden stops that lead to currency crises (introduced here as "twin crises") and sudden stops without currency crises. The twin crises term has been used before for the episodes of joint banking and currency crises, but here we use it for the episodes of joint sudden stops and currency crisis. Here twin crises have the highest

output losses. Moreover, high current account deficits and excessive portfolio and bank flows could be used as early warning signs to predict twin crises.

Twin Deficits and Sudden Stops

In chapter 3 I investigate the role of twin deficits (joint occurrence of fiscal and current account deficits) in the triggering of balance-of-payments crises. I use sudden stop measures to identify crises. While the early currency crisis models in the 1970s and 80s emphasized the roles of fiscal deficits and inflation, the crisis models of the 90s emphasized vulnerabilities to self-fulfilling attacks, balance sheet affects, government implicit guarantees and other aspects of the crisis. This dissertation documents the effects of simultaneous occurrences of fiscal and current account deficits, or shortly twin deficits, for each decade of the 1970s, 80s and 90s.

The effects of twin deficits on the likelihood of sudden stops across the decades are estimated with the Probit model using the data of 42 developing countries from 1970 to 2004. 25 countries in this sample are classified as emerging market countries. Results support the hypothesis that twin deficits increase the likelihood of sudden stops, although the magnitude of twin deficit influence diminished over the decades.

Chapter 2

Sudden Stops and Currency Crises: Empirical Regularities[2]

2.1. Introduction

The alarming frequency of the balance-of-payment crises during the last three decades has motivated a large volume of theoretical and empirical literature on the subject. The significance of these events is obvious from the sizable losses the affected countries suffered. Argentina's losses in the early 1980s crisis amounted to 55 percent of its GDP. The bailout costs of failed banks during the early 1990s crisis in Finland reached 8 percent of its GDP. More recently, during the 1997 Asian crises, Thailand, Indonesia, Malaysia and South Korea experienced on average an 11 percent drop in their per capita real GDP.[3] Increased volatility of international capital flows has been a defining feature of these crises.

The term "sudden stop" was first introduced by Dornbusch, Goldfajn and Valdes (1995). It refers to sudden and large drops in capital inflows. Along with other measures of balance-of-payment crises (i.e. currency crisis measures, capital account reversals), sudden stops have become a popular empirical measure to identify and study the crises.

Empirical papers quite often adopt new or modified versions of previously used crisis measures. Sudden stop and currency crisis measures are often used interchangeably to study the same episodes of financial crises (e.g. Radalet et al. 1998; Milesi-Ferretti et al. 2000; Kaminskey et al. 1997). But do they really identify the same events?

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[2] Coathored with Ozan Sula.
[3] The Economist (2007) and (2008).

We seek to answer this and other related questions by examining empirical regularities or irregularities between various sudden stop and currency crisis measures. We think that time is ripe for such research, since we have accumulated a fair amount of evidence on all of these measures. Contradicting results and confusing terminology produced by the crisis research creates serious problems for policy makers as well as to researchers.

In this study we look for empirical characteristics among the popular measures of sudden stops and currency crises using the annual data of 25 emerging market countries from 1990 to 2003. We hypothesize and find that the characteristics of the captured balance of payments crises depend on the type of crises measure used in the identification process. This examination led us to group various sudden stop and currency crises episodes in the following categories: severe sudden stops followed by currency crises (we call these events "twin crises") and sudden stops without currency crises. Twin crises term has been used before for the episodes of joint banking and currency crises, but here it refers to the episodes of joint sudden stops and currency crises. The sudden stops that trigger twin crises have the highest output losses. We find that high current account deficits and large portfolio and bank flows could be used as early warning signals to distinguish them from sudden stops without currency crises. We also find that sudden stops are more likely to precede currency crises.

2.2 Literature Review

Our initial look at the behavior of capital flows, reserves, exchange rates and current account balances, around the time periods of well publicized crises events in

emerging market countries, suggests that the first signs of stress tend to show up in net capital flows, rather than in changes in reserves, interest rates or exchange rates. Figure A.1 of appendix A shows capital flows, exchange market pressure index and real exchange rate behavior around the 1994 crises in Mexico. Do crises theories explain this?

All formal crises models are based on the investor/speculator behavior (e.g., Krugman 1979; Obstfeld 1994; Tirole 2002; Tornell and Westermann 2005; Willett 2000). Depending on the model, either because of the country's macroeconomic fundamentals or external factors, investors backward induct the possibility of a crisis and decide to flee the country. This behavior is immediately reflected in monthly capital inflows and outflows, which is somewhat conditioned by the level of capital controls in the country.

According to Miles-Ferretti and Razin (2000) and Calvo et al. (2004) capital flow reversal could also be a response to a country's macroeconomic policy that promises capital flow restrictions, or it could occur as a result of an unfavorable terms-of-trade shock.

Other balance of payments or macroeconomic variables may also reflect sudden changes in investor behavior. Which variable captures the crisis the earliest and more accurately is an interesting question. Among the most commonly used are foreign reserves, exchange rates, domestic interest rates, current account balances and capital account balances.

Here we focus on the following questions: What can be learned from a comparison of different crisis measures? Is there any empirical regularity between them?

Does it matter which crisis measure we use? Do they measure the same type of event? What determines when you have one type of crisis, but not the other?

It is helpful to first remember what the components of balance of payments are and use them to categorize measures accordingly. Three components of balance of payments are: current account (used in the calculation of current account reversals), capital account (used in the calculation of sudden stops and capital flow reversals), and changes in foreign reserves (used in calculation of exchange market pressure index, which may also include exchange rate and/or interest rate.) These three parts together must add up to zero, for an exchange rate to maintain the same level. If the components are not in balance, exchange rate must change to bring back the balance.

This basic balance of payments relationship has been used in various ways to study the crises. While there are papers that do comparisons among some of the measures of the external crises, we find that there is a significant research gap in the analysis of sudden stop and currency crisis measures. The Milesi-Ferretti and Razin (2000) paper has a section comparing currency crises and current account reversals in the sample of low and middle income countries. They find little coincidence or precedence between these two types of events. On average only about 30% of reversals for low income countries (50 percent for middle income countries) are preceded with currency crises within a three year window. The authors call these two events "distinct."

Edwards (2004 and 2006) examines the relationship between sudden stops and current account reversals on the sample of 157 countries during 1970-2001. In addition, he extends the discussion to incorporate the effects of exchange rate regimes, trade openness, financial openness and output losses. We replicate the sudden stop measure

used by Edwards (2004) and use it in our analysis (see appendix B for variable descriptions). He finds that 46.1 percent of sudden stops coincide with current account reversals, and 22.9 percent of countries with current account reversals also experience a sudden stop in the same year. Moreover, even with these apparent differences, these events are not statistically independent.

Calvo (2000) emphasizes that recent "financial crises" have been preceded by surges in capital inflows and ended with large drops in output growths. Calvo et al. (2004) uses his own version of the sudden stop measure to capture the "unexpected" and "large" changes in capital account, which at the same time has a large negative effect on a country's output. Thus, a sudden stop for them is an episode that has a fall in net capital flows larger than two standard deviations from the country's own sample mean and this event coincides with the large fall in output (see appendix C for CalvogdpdropSS variable description). He argues that this measure catches more crises episodes than current account deficit based measures, because some countries have low volatility in current accounts. Working with monthly data is preferred also for the reasons of crises discovery. The authors use the large fall in output as an additional criteria to identify those sudden stops that have negative economic consequences. Monthly net capital flows in this study equal the monthly trade balance minus changes in international reserves. We also replicate this particular measure in our study.

Calvo et al. (2004) also look at the behavior of key macroeconomic variables around sudden stop episodes. Looking at the window of [t-2, t+2], they compared trough and peak values for each key variable. Sudden stops caused on average a 46.7 percent rise in real interest rates and also reduced foreign reserve holdings on average by 35.69

percent in emerging markets. Current accounts also reverse as a result of sudden stops on average by 6.12 percent of GDP (again for emerging markets). Based on the sharp rises of real interest rates, Calvo et al. (2004) conclude that sudden stops represent mainly supply-side shifts in capital markets. For example, the 1998 Russian default forced highly leveraged world financial centers in US and Europe to sell assets in Latin America.

Becker and Mauro (2006) document output effects of a variety of shocks. They find that the largest output losses for emerging markets are associated with external shocks, particularly with sudden stops in capital flows. For developing countries terms-of-trade shocks have the largest output losses.

Hutchison and Noy (2006) define a sudden stop as simultaneous occurrence of capital flow reversal and currency crisis, but they use the current account balance instead of the capital account to identify capital flow reversals. They justify it, by the claim that current account and capital account are highly correlated. Calvo's sudden stop measure dates the Asian crises in 1997, while the Hutchison and Noy (2006) measure puts it in 1998. This type of disparity in years could have important consequences in the empirical analysis of the crises. The authors find that sudden stops have higher output costs than currency crises or current account reversals. Here we do not replicate Hutchison and Noy's measure of sudden stops. We believe that their measure is closer to current account reversal measure than to other sudden stops, which are typically used to capture sudden and large capital flow reversals.

Based on the review of the literature and some of the initial data observation, we focus on answering the following questions: i) What is the temporal ordering of sudden stops and currency crises? ii) Do empirical findings on the causes of the crises depend on

a crisis measure used as a dependent variable? And iii) Do sudden stops that coincide with currency crises have higher output costs?

2.3 Description of Crisis Measures

2.3.1 Sudden Stop Measures

CalvoSS: The annual dummies are derived from monthly data. Monthly capital flow series are constructed by netting out monthly exports and imports from changes in monthly reserves. Then, the sudden stop crisis is defined as a phase where year-on-year change in capital flows is at least two standard deviations below its sample mean. The sample is defined as an expending window with a minimum of 24 months that always starts in Jan, 1990. Once the sudden stop phase is detected, it is converted into a dummy variable with annual frequency. Calvo et al. (2004) point out the timing difference between sudden stops and currency crises and prefer using sudden stops to study crises, which they see as to originate by "credit shocks in international markets."

CalvogdpdropSS: This variable is a product of CalvoSS and annual GDP drop dummy. Calvo et al. (2004) use this to capture only those capital flow reversals that are caused by adverse external shocks.

EdwardsSS: This measure is based on annual capital account data. A sudden stop is defined as a fall in net capital flows that is at least 3 (or 5) percent of the current year's GDP. Also the country should have had positive net capital flows in the previous year.

No particular rational is given to why Edwards prefers using this measure to other types of sudden stops or currency crises measures to study crises.

3.2 Currency Crisis Measures

Currency Crisis: Currency crisis dummies are constructed from changes in an index of exchange market pressure (EMP), defined as a weighted (with equal or precision weights) average of monthly real exchange rate changes, monthly reserve losses and/or interest rate changes. The precision weights are inversely related to the variance of changes of each component over the sample of each country. Annual crises dummy takes the value of 1 if change in the pressure index exceeds the mean plus 2 (or 1.25, 1.5, 1.75) times the country-specific standard deviation.

2.3.3 Data Description

We use annual and monthly data for 25 emerging market countries for the period of 1990-2003. Emerging market country classification matches with the Economist magazine classification. The source of the data is the International Financial Statistics Database produced by International Monetary Fund. The list of countries is provided in appendix A and is organized by region. All of the collected and constructed variables are described in appendix B.

2.4 Examination of Empirical Regularities

In this section we discuss the major findings that stand out from the table of several sudden stop and currency crises measures, correlation tables, two way frequency tables and precedence tables.

Table D.1 of appendix D includes the following measures: sudden stops based on standard deviations (CalvoSS and Calvogdpdrop with 2 standard deviation thresholds), sudden stops based on the % of GDP thresholds (EdwardsSS with 5% threshold) and currency crises (EMP measure with precision weights, including interest rates and with 2.5SD).

The main finding from table D.1 is that different measures produce different dating of crises years. Further analysis of this phenomenon using the two-way frequencies in tables 2.1 and 2.2 reveals that on average less than half of the sudden stops occur simultaneously with currency crises, while less than 60% of currency crises coincide with sudden stops.

Table 2.1. Two-way Frequencies (each episode includes 1 or more years) Percentages in parenthesis

		Currency Crises		
		Yes	**No**	**Total**
CalvoSS	**Yes**	15	38 (72%)	53
	No	9 (38%)	X	
	Total	24		

		Currency Crises		
		Yes	**No**	**Total**
EdwardsSS	**Yes**	7	15 (68%)	22
	No	17(70%)	X	
	Total	24		

		Currency Crises		
		Yes	**No**	**Total**
EdwardsSS	**Yes**	10	7 (41%)	17
	No	14(58%)	X	
	Total	24		

Note: See Appendix C for the description of variables.

Table 2.3 shows that sudden stops precede currency crises events. Sudden stops captured by CalvoSS precede the currency crises nine times, while a currency crisis precedes a sudden stop only once. It is not a surprising result, if we consider that exchange rate represents an important component of currency crisis measure, and exchange rate changes tend to come late, especially when a government defends a pegged exchange rate regime.

Table 2.2. Two-way Frequencies (each episode includes only 1 year)
Percentages in parenthesis

		Currency Crises (EMP equal weights)			
		Yes	**No**	**Total**	**%**
CalvoSS (2SD)	**Yes**	25	84	109	*(40.7%)*
	No	17	142	159	*(59.3%)*
	Total	42	226	268	
	%	*(15.7%)*	*(84.3%)*		

		Currency Crises (EMP precision weights)			
		Yes	**No**	**Total**	**%**
CalvoSS (2SD)	**Yes**	31	78	109	*(40.7%)*
	No	24	135	159	*(59.3%)*
	Total	55	213	268	
	%	*(20.5%)*	*(79.5%)*		

		Currency Crises (EMP equal weights)			
		Yes	**No**	**Total**	**%**
EdwardsSS (5%)	**Yes**	10	15	25	*(9.2%)*
	No	32	215	247	*(90.8%)*
	Total	42	230	272	
	%	*(15.4%)*	*(84.6%)*		

Table 2.3. Temporal Ordering of Sudden Stops and Currency Crises

	CalvoSS (2SD)	Currency Crisis
CalvoSS (2SD)		9
Currency Crisis	1	

Note: The row variable precedes the column variable.
See variable descriptions in appendix C.

2.5 Discussion of Measures

2.5.1 Explaining Low Correlations Among Different Crises Measures

Table D.2 of appendix D shows that correlations between the sudden stop and currency crises measures are less than 0.25. The correlations among different standard deviation based sudden stops range between 0.62 and 0.86. We would expect some differences, but why are the correlations so low among sudden stops and currency crises? Even if the events we are looking to identify were similar, just the differences in types of variables and calculating methods used would produce dissimilar crisis dates. First, they are based on different balance-of-payments accounts. Sudden stops primarily are capital flow reversal measure, whereas currency crises or EMP indexes are calculated with reserves, exchange rate and interest rate changes. Moreover, economic shocks are not immediately transmitted among the balance-of-payment accounts and macroeconomic variables. The second explanation of the low correlations could be that sudden stop and currency crisis measures identify somewhat different types of events or distinct stages of the same kind of event.

Some of the crises measures use monthly data that are then converted into yearly crises dummies (Calvo's sudden stops), while others (Edwards sudden stops) use only annual data. Also, some researchers construct measures using standard deviations as a threshold of abnormal deviation (e.g. CalvoSS and Calvogdpdrop), while others use changes that are scaled by GDP in percentages (e.g. EdwardsSS). Moreover, the standard deviation based measures (Calvo's sudden stops and EMP measures) have no crises in the first two years of data series, while capital flow reversals/GDP measures could have the crises in the second year of the data series.

Furthermore, theoretical and empirical work accumulated on these crises makes us believe that there is a distinction as well as a relationship between the crises measured by these different indexes. They are not the same, nor are they unrelated. Having only a sudden stop is different from having a sudden stop that leads to a currency crisis. Either one of the crises alone is less harmful to an economy than having them simultaneously or in a sequence (e.g., Milessi-Ferretti and Razin 2000, Edwards 2006). This proposition is explored in section 2.7.

In summary, different measures emphasize only certain types of crises and no single measure can systematically capture and explain all of the external crises, assuming that there are several types of crises even within our sample of years (Kaminsky 2003).

2.6 Using Sudden Stop and Currency Crisis Measures in the Regressions

To compare the predictors of sudden stop and currency crises we follow the existing theoretical and empirical literature and use following explanatory variables in the multivariate probit model: current account deficit as percentage of current output, external debt as a percentage of current output, terms-of-trade, real exchange rate appreciation, short-term debt ratio over foreign reserves, domestic credit growth, foreign reserves as a percentage of output, foreign direct investment as a percentage of output and accumulated hot flows (portfolio flows and bank loans) of the previous three years as a percentage of current output.

Table 2.4 presents results of these regressions. Surprisingly, even with so much variation in dating crises by different measures, which we discussed in previous sections, we don't see major differences among the significant variables and coefficient signs,

when we change an underline dependent variable. Current account deficits are significant in all of the regressions.

Table 2.4: Crisis Determinants
Estimated Marginal Effects at Mean (Standard Errors in Parenthesis)

Regression #	*(1)*	*(2)*	*(3)*	*(4)*
Dependent Variable	*Calvo gpddropSS*	*CalvoSS*	*EdwardsSS*	*Currency Crisis*
/ Independent Variables				
CA/GDP(t-1)	-1.19***	-3.47***	-1.20***	-1.82***
	(0.40)	(0.96)	(0.40)	(0.45)
Exdebt/GDP(t-1)	0.07	0.079	0.11	-0.199**
	(0.07)	(0.17)	(0.72)	(0.08)
ToT(t-1)	-0.0003	0.001	0.0001	-0.0014
	(0.001)	(0.003)	(0.0007)	(0.001)
RERappr(t-1)	-0.09	-0.14	-0.066	0.214**
	(0.09)	(0.21)	(0.07)	(0.098)
Short-termDebt/GDP(t-1)	0.01*	-0.018	0.009	0.01
	(0.008)	(0.031)	(0.008)	(0.01)
LendingBoom(t-1)	-0.01	-0.033	-0.07	0.14
	(0.12)	(0.282)	(0.13)	(0.09)
FDI/GDP(t-1)	-0.57	-0.82	0.86	-0.34
	(0.70)	(1.72)	(0.56)	(0.77)
# of Observations	223	222	220	223
Pseudo R^2	0.15	0.07	0.24	0.16

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

2.7 Output Losses and the Classification of Crises by Their Severity

Based on the analysis in previous sections we conjecture that some sudden stops lead to currency crises, while others don't. This could be due to the differences in the magnitudes of the capital flow reversals that underlie sudden stops and also due to certain amplifying economic conditions that may accompany sudden stops. In this section we explore whether the output costs are different among the sudden stops that lead to currency crises and the crises that are captured by various other common sudden stop and currency crises measures replicated in this paper. We calculate output costs associated

with each sample of crises using a method that is similar to one used by Hutchison and Noy (2006). There is substantial disagreement about how to measure output costs of crisis in the literature, but here we are interested in a relative output costs associated among the crisis types, rather than precise absolute values of GDP loss. Output growth rates are regressed on a crisis measure with two lags and two leads. Then changes in the coefficients are compared to see how average output growth changes around the crises.

For comparison purposes, we create the "twin crises" measure, which captures simultaneous occurrences of sudden stops and currency crises. Sudden stops that don't lead to currency crises are named as "sudden stops without currency crises." We use these two measures in the next section to find early warning signals that help distinguish among the two types of sudden stops from each other.

The results of output regressions are reported in table 2.5. Twin crises show on average a 6 percent decline per year in output growth rate during the crises years. Other sudden stop and currency crises measures show much smaller changes in output growth (between 1-3.5 percent).

Table 2.5. Summary Statistics of Output Growth Before and After Each Type of Crisis

Type of crisis	*t-2*	*t-1*	*t*	*t+1*	*t+2*
Twin Crises	2.17	-2.16	**-9.2*** **	1.95	0.27
CalvoSS	-0.07	-1.74***	-1.51**	0.54	1.52
EdwardsSS	1.32	-2.27**	-2.83**	1.65*	0.42
Currency Crises	1.73**	-1.63*	**-4.16*** **	1.97**	0.64

*significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

2.8 Early Warning Signals: Can We Predict the Severity of a Sudden Stop at the Time of Its Start? What Determines When You Have a Sudden Stop, But Not a Currency Crisis?

In principle, severe sudden stops could force the authorities to devalue the currency and sudden stops will be accompanied (or followed) by the currency crises. Let's examine the probability distributions of key macroeconomic variables separately at or before the twin crises and the episodes of the sudden stops without currency crises.

As we see from table 2.6, twin crises take place in countries with 4.3 percent current account deficit (at a median of the sample), while countries that experience only the sudden stops show nearly a balanced current account. Also twin crises arise in countries with high level of portfolio and bank flows. Two-tailed t-tests show that the means are significantly different (at 1% significance level) between the two samples for the portfolio and bank flows (measured by hot flows/GDP, see appendix B), and marginally significant (at 10.5% significance level) for current account deficits.

Table 2.6: The 50th Percentile Values of Key Variables at or Before the Start of Sudden Stops

Variable	*Twin Crises*	*Sudden Stops without Currency Crises*
Output Growth (t)	0.55%	5.19%
CA/GDP (t-1)	**-4.3%**	**-1.3%**
Exdebt/GDP(t-1)	47.5%	38.3%
RERappr(t-1)	-8.6%	-1.7%
Short-termDebt/GDP(t-1)	1.12	0.46
LendingBoom(t-1)	4.5%	1.9%
Res/GDP(t-1)	9.1%	15%
Hotflows/GDP(pr.3year.avg.)	**6.9%**	**1.6%**

2.9 Conclusion

The severity of recent balance-of-payments crises in the emerging markets and developing economies have generated enormous interest in understanding the nature of these crises and produce appropriate policy recommendations. One of the crucial issues in this area of research is to develop a sound methodology for crisis identification. In this paper we analyzed two types of commonly used crises measures: sudden stops and currency crises. Empirical analysis on these measures shows that there is a substantial difference among the crises dates identified by different measures. Two-way frequency tables reveal that on average less than half of the sudden stops occur simultaneously with currency crises, while less than 60 percent of currency crises coincide with sudden stops. We also find that sudden stops are more likely to precede currency crises. Despite these distinctions, sudden stops and currency crises measures did not produce substantially different probit regression results. Current account deficits were consistently significant across all regressions.

The examination led us to group various sudden stop and currency crises episodes in the following categories: twin crises (sudden stops joined by currency crises) and sudden stops without currency crises. Twin crises show the highest output losses. In addition, empirical evidence suggests that high current account deficits, and excessive portfolio and bank flows could be used as early warning signals to predict twin crises.

Although it is tempting to look for the one best measure of crises, we think that the proper analysis should focus on how to use these different measures to understand the nature of the crises. Thus, sudden stop and currency crisis measures should be used as

complements, rather than substitutes. In other words, both types of measures could be useful to understand different features of the crisis episodes. More work is needed in this direction, but based on this study we think that standard deviation based sudden stop measure is more useful in catching sudden and large capital flow changes early on, thus providing valuable information to manage the crises and possibly prevent their further spread.

Chapter 3

Twin Deficits and Sudden Stops

3.1 Introduction

Many countries have experienced severe currency crises during the last 35 years. Sudden capital flow reversals, known as sudden stops, often accompany these crisis episodes. The explanations of the crises vary among the crisis models. While the early currency crisis models in the 1970s and 80s emphasized the roles of fiscal deficits, and inflation, the crisis models of the 90s emphasized vulnerabilities to self-fulfilling attacks, balance sheet effects, government implicit guarantees and other aspects of the crisis. This chapter documents the effects of simultaneous occurrences of fiscal and current account deficits, commonly termed twin deficits, for each decade of the 1970s, 80s and 90s.

The need to understand the crises is great. Most recently Mexican, Asian, Russian and Argentinean crises have caused a great despair to millions of people. Some estimates of potential welfare losses from Asian crisis show 40-60% loss in GDP.

This paper investigates the effect of twin deficits (fiscal and trade deficits) on the likelihood of sudden stops and whether the role of twin deficits changed across the decades of the 1970s, 80s and 90s. In this study I only use a sudden stop measure as a dependent variable, but further study of using currency crisis measure will be an important extension to document. Probit analysis is conducted on the data of 42 developing countries from 1970 to 2004. This sample includes 25 emerging market countries as well. Results support the proposition that although the role of twin deficits in

the triggering of sudden stops declined over the decades, they still played a significant role across all three decades.

3.2 Theory

The first generation currency crisis model, proposed by Salant and Henderson (1978) and developed by Krugman (1979), suggests that currency crises are predictable by the state of the countries' economic fundamentals. If a country has deteriorating economic fundamentals (i.e. "excessive" fiscal deficits, high inflation, etc.), then it is a matter of time that there will be a crisis to correct a disequilibrium. The second generation crises model (Obstfeld, 1994) argues that "even sustainable pegs may be attacked and even broken," which means that even if the fundamentals are not so bad[4], self-fulfilling attacks on the currency could drive markets to believe, for known (behavioral and information asymmetry problems) or unknown reasons, that the currency rate will fall, thus causing a panic, capital flight and crisis.

Numerous studies have been conducted on the Mexican, Asian, Russian and Argentina's currency crises. The empirical results have been mixed. Salvatore (1999) sees similarities in these crises, but others like Stiglitz and Furman (1998) emphasize the unpredictability of Thai Baht crisis based on the fundamentals at play (Thailand only had current account deficit in 1997, not a budget deficit). This paper adopts the composite variables approach from Nitithanprapas and Willett (2000) and Willett et al. (2005), where variables are converted to dummies using thresholds and then combined in composite variables to check if simultaneous disequilibria of two or more variables could

[4] The first generation model only breaks economic fundamentals in good and bad zone, whereas the second generation models use good, vulnerable (intermediate) and bad zone.

predict the crisis. The following three sub-sections develop testable hypotheses to study the influence of twin deficits on sudden stops.

3.2.1 Twin Deficit Effects

Open economy macroeconomics demonstrates the relationship between budget deficits and current account deficits. A government budget deficit pushes real domestic interest rates up and this attracts foreign capital inflows, which in turn leads to the appreciation of the domestic currency. The result is a current account deficit. According to the "Lawson's Doctrine," a current account deficit must be a concern only when it is caused by a fiscal deficit. When the budget deficit is "excessive" (this paper uses a -5% thresholds for budget balance/GDP ratio and for current account/GDP ratio, but also tests sensitivity with a -4% threshold; while Salvatore (1999) considers that even -3% budget deficit is problematic for economic stability) and at the same time country runs current account deficit, foreign investors will be worried about the currency devaluation and they will withdraw capital from the country.

Hypothesis 1: Twin deficits increase the probability of a sudden stop.

3.2.2 Protective Role of Reserves

Foreign reserves are used by countries to protect themselves from speculative attacks and reduce the likelihood of the currency crisis, and/or reserves accumulate due to mercantilist behavior. Increased capital mobility in the 80s and 90s, caused by the capital

account liberalizations across the globe, made countries more vulnerable to attacks and, therefore, foreign reserves became more important.

Hypothesis 2: A lower level of foreign reserves increases the probability of a sudden stop in the 80s and 90s.

3.2.3 Effects of Twin Deficits Across Different Decades

Due to the increased capital mobility and decrease in capital flow restrictions in the 80s and 90s, destabilizing or stabilizing speculations may force the countries even without twin deficits into crisis. While twin deficits make countries vulnerable to speculative attacks, the 1997 crises in Asia demonstrated that fiscal deficits were not a necessary precursor of the crisis. Second and third generation models discussed above suggest that crises could occur without fiscal or current account deficits under the conditions of high capital mobility and financial integration that took place in the 80s and 90s. Thus the crisis predicting power of twin deficits would decline over the decades.

Hypothesis 3: The influence of twin deficits on sudden stops declined in the 80s and 90s.

3.3 Empirical Methodology

This paper uses the Probit model of estimation to test each hypothesis for the decades of the 70s, 80s and 90s separately and in combination. The data is taken from the IFS database of the International Monetary Fund (2005). The dependent variable is a

sudden stop dummy, which is calculated by the following formula:

$\frac{K_{t-1} - K_t}{Y_{t-1}} > 0.05$ and $K_{t-1} > 0$. Where K_t is net capital flows at time t and Y is nominal GDP. This dependent variable takes values of 1 if the condition holds, and 0 otherwise.

Main equation for all models is:

$$Sudden\ Stop\ Dummy = b_1 + b_2 COM1 + b_3(Low\ Reserves\ Dummy) + b_4(Exchange\ Rate\ Rapid\ Appreciation\ Dummy) + \Sigma b_i(X_i) + \varepsilon$$

Description of variables:

To test the effects of the simultaneous occurrence of budget and current account deficits, and to deal with possible non-linearities in relationships among variables, some of the independent variables were converted into dummy variables using the literature based threshold values.

These are the constructed explanatory variables:

COM1=1, if Current Account/GDP<-0.05 and Budget Balance/GDP<-0.05 (simultaneously), and equals 0 otherwise. By comparison, Salvatore (1999) used a -3% threshold for Budget Deficit/GDP. According to the hypothesis 1 sign of the COM1 coefficient should be positive.

Low Reserves Dummy=1, if Short-term Foreign Debt/Reserves>1 and 0 otherwise. When Short-term Foreign Debt/Reserves>1, country has full capacity for all short-term foreign debt repayment, which would adequately protect foreign investors.

Exchange Rate Rapid Appreciation Dummy=1, if %change in exchange rate>10% and 0 otherwise.

All of the above described variables are expected to have positive marginal effects on the probability of next year's Capital Flow Reversal.

Robustness Checks:

Robustness checks were conducted by changing the time period of the observations and sample of countries, using different thresholds (a -4% instead of -5% for twins deficits), using fixed effects estimators, including and excluding control variables, including the emerging markets dummy, using the robust white estimator, and using the Logit model instead of Probit. Some of these results are reported in tables E.6 and E.7.

3.4 Empirical Results

Tables E.1, E.2 and E.3 in appendix E report the summary statistics of the variables and correlation coefficients. None of the variables are highly correlated, for the full sample, which reduces the multicollinearity in the regressions.

Tables 3.1, E.4 and E.5 present marginal effect results that support Hypothesis 1. The COM1 coefficient is highly significant and positive across most of the regressions. When I included the low reserves dummy and the exchange rate rapid appreciation dummy, COM1 still stayed significant, except in the 90s regression.

Hypothesis 3 is also supported by the results in regressions 1, 2 and 3 in table 3.1 and in regressions 1, 2 and 3 in table E.4. Since COM1 is a dummy variable, Probit marginal effects can be interpreted as marginal probability effects on the dependent variable. The COM1 effects in the 70s were 31% and then dropped to 12% in the 80s and 14% in the 90s. After the 70s, the probability of a crisis being generated by twin deficits

dropped by a half. Moreover, the frequency of twin deficits rose from the 70s to the 80s from 18 to 40 and then decreased to 22 during the 90s. Thus even though the twin deficit impact on sudden stops decreased, frequency of twin deficits has not dropped substantially over the thirty years.

Hypothesis 2 is also supported by the results. Table E.5 in appendix E shows that low reserves played little role in the crisis of the 70s and 80s, whereas, in the 90s, the low reserve variable dilutes the significance of the twin deficit variable, it is only border line significant at 17% level.

Table 3.1: Estimated Marginal Effects at Mean (Standard Errors in Parenthesis)

	Dependent Variable: Sudden Stop Dummy						
	Probit Model						
Regression #	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	1970-1980	*1980-1990*	*1990-2000*	*1970-2004*	*1970-2004*	*1970-2004*	*1970-2004*
/ Independent Variables							
COM1 (twin deficit dummy with 5% thresholds)	0.30*** (0.10)	0.13** (0.06)	0.14** (0.098)	0.18*** (0.05)	0.17*** (0.05)	0.17*** (0.05)	0.18*** (0.05)
Low Reserves Dummy					0.017 (0.014)	0.016 (0.014)	
Exchange Rate Rapid					0.002 (0.024)		0.005 (0.025)
M2 / Reserves							
Short-term Foreign Debt / Reserves							
Real Effective Exchange Rate Index							
Emerging Market Dummy							
Log-likelihood	-53.74	-115.37	-136.89	-324.40	-323.62	-323.62	-324.38
# of Observations	462	462	462	1470	1470	1470	1470
Pseudo R^2	0.19	0.03	0.01	0.04	0.04	0.044	0.04

Notes: * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level. COM1=1, if Current Account/GDP<-0.05 and Budget Balance/GDP<-0.05 (simultaneously), and equals 0 otherwise.

3.5 Conclusion

This chapter studied the relationship of twin deficits and sudden stops with the annual data of 42 developing countries from 1970 to 2004. The composite dummy variable was used to measure the effects of twin deficits on sudden stops.

The results support the proposition that twin deficits played a large role in the triggering of sudden stops during the years of 1970-2004. The twin deficit coefficient is significant in all three decades for the given sample of countries. The importance of twin deficits in predicting the crisis declined after the 70s. However, twin deficits have not disappeared in the 80s and 90s and they represented a significant danger of causing a sudden stop.

This finding is important because the empirical results have been mixed during the 90s over the role of fiscal and current account balances in explaining the recent crisis, especially the ones that took place in the East Asia in 1997-8. But as documented here there were other countries that suffered with twin deficits, with a possibility of inviting a crisis.

Chapter 4

Conclusion

The severity of recent balance-of-payments crises in the emerging market and developing economies generated enormous interest in better understanding the nature of these crises and produce appropriate policy recommendations. One of the crucial issues in this area of research is to develop a sound methodology for crisis identification. This dissertation compares commonly used measures of the balance-of-payments crises and also studies the role of twin deficits in the prediction of sudden stops.

Empirical analysis of the sudden stop and currency crises measures shows that there is a substantial difference among the crises dates identified by different measures. Two-way frequency tables reveal that on average less than half of the sudden stops occur simultaneously with currency crises, while less than 60 percent of currency crises coincide with sudden stops. Sudden stops are more likely to precede currency crises. Twin crises (sudden stops joined by currency crises) show the highest output losses. In addition, empirical evidence suggests that high current account deficits, and excessive portfolio and bank flows could be used as early warning signals to predict twin crises.

Although it is tempting to look for the one best measure of crises, the proper analysis should focus on how to use these different measures to understand the nature of the crises. Sudden stop and currency crisis measures could be used as complements, rather than substitutes. We used sudden stops and currency crisis measures together to categorize crises episodes and study their differing characteristics. This way of using the measures sheds more light on some of the important intricacies of the external crises, so they could be prevented or managed better. With the analysis of temporal ordering of

crisis events identified by different measures we saw that standard deviation based sudden stop measure is more useful to catch a crisis in the early stages.

The study of twin deficits and sudden stops reveals that twin deficits played a significant role in triggering sudden stops during the years of 1970-2004. The twin deficit coefficient is significant in all three decades for the given sample of countries. The importance of twin deficits in predicting the crisis declined after the 70s. However, twin deficits have not disappeared in the 80s and 90s and they represented a significant danger of inviting the speculative attack that would turn into a sudden stop.

Appendix A

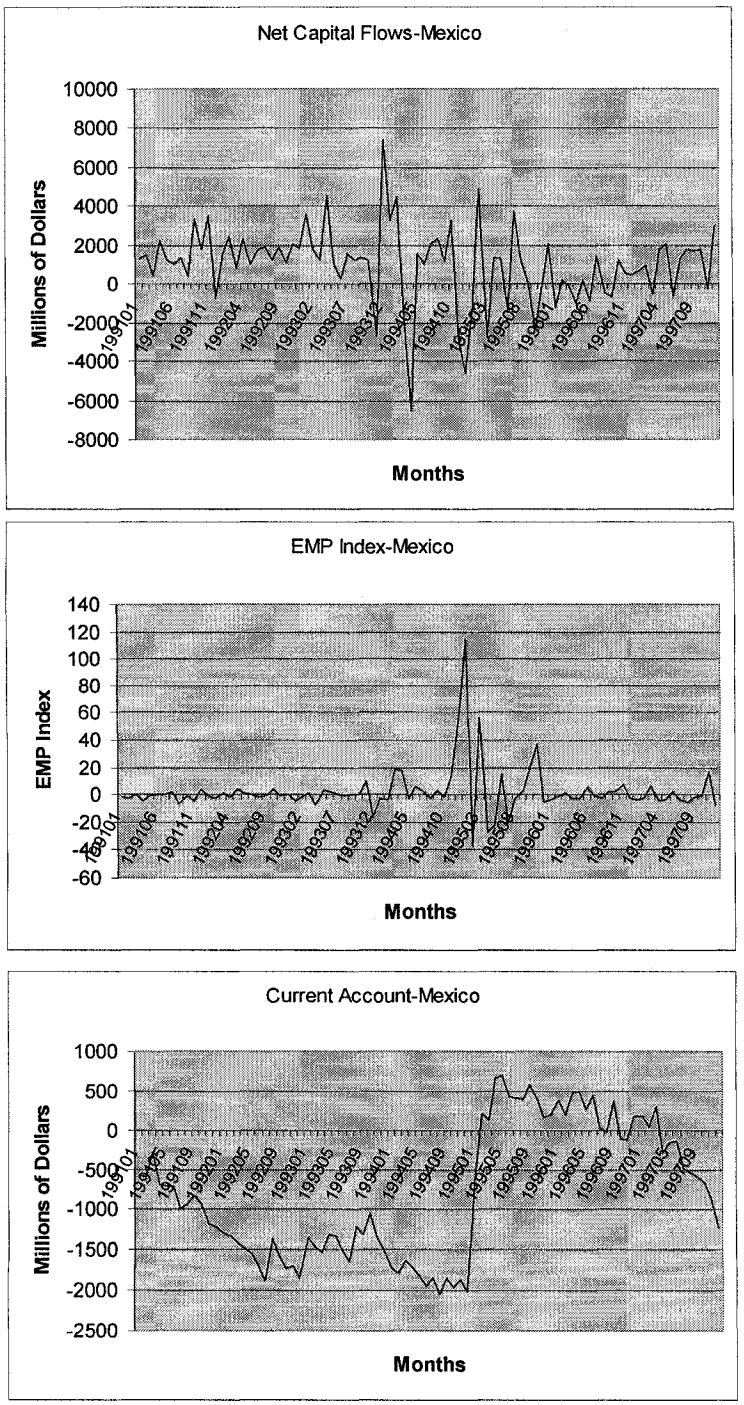

Figure A.1. The 1994 Crisis in Mexico.

Appendix B

List of Countries: 25 Emerging Market Countries (according to The Economist magazine classification)

Asia	Europe	Africa/Middle East	Latin America
China	Czech Republic	Egypt	Argentina
Hong Kong	Hungary	Israel	Brazil
India	Poland	South Africa	Chile
Indonesia	Russia		Colombia
Malaysia	Turkey		Mexico
Philippines			Peru
Singapore			Venezuela
South Korea			
Taiwan			
Thailand			

Appendix C

Description of Variables

Crises Variables

Sudden stop measures:

CalvoSS: The annual dummies are derived from monthly data. First monthly capital flow series are constructed by netting out monthly exports and imports from changes in monthly reserves. Then, sudden stop crisis is defined as a phase where year-on-year change in capital flows is at least two standard deviations below its sample mean. The sample is defined as a minimum of 24 months of previous observations. Once the sudden stop phase is detected then it is converted into a dummy variable with annual frequency.

CalvogdpdropSS: This variable is a product of CalvoSS and annual GDP drop dummy. Calvo et al. (2004) use this to capture only those capital flow reversals that are caused by adverse external shocks.

EdwardsSS: Based on annual capital account data. A sudden stop is defined as a fall in capital inflows of at least 5 percent of current year's GDP. Also the country should be receving positive capital inflows in the previous year.

Currency crisis measure:

Currency Crisis: Currency crisis dummies are constructed from "large" changes in an index of currency pressure, defined as a weighted average of monthly real exchange rate changes and monthly (percent) reserve losses. The weights are inversely related to the variance of changes of each component over the sample for each country. Annual Crises dummy takes the value of 1 if changes in the pressure index exceed the mean plus 2.5 times the country-specific standard deviation.

Explanatory Variables used in Crises Regressions

CA/GDP: current account balance as a percentage of gdp

RERAppr: three year percentage change in the real exchange rate. (An increase is depreciation)

LendingBoom (credit growth): Defined as the three year change in the banking sector credit to non-government sector divided by the GDP.

Short-termDebt/Res: Short-term debt as a percentage of reserves.

Exdebt/GDP: External debt as a percentage of gdp

ToT: Terms of trade index.

FDI/GDP: FDI flows as a percentage of current gdp

HotF/GDP: accumulated hot flows in the previous three years as a percentage of current gdp. Hot flows are portfolio flows and other investment (bank loans, etc…)

Res/GDP: reserves as a percentage of gdp

Appendix D

Table D.1. List of Crises in 25 Emerging Countries

Country	Year	Net Capital Flows			EMP
		Monthly Based		Yearly	Yearly
		CalvogdpdropSS	CalvoSS	EdwardsSS	Currency Crisis
Argentina	1994	-	1	-	-
	1995	1	1	-	-
	1999	1	1	-	-
	2000	1	1	-	-
	2001	1	1	1	-
	2002	1	1	-	-
Brazil	1992	1	1	-	-
	1993	-	1	-	-
	1995	-	1	-	-
	1996	-	1	-	-
	1997	-	1	-	-
	1998	-	1	-	1
	1999	-	1	-	1
	2000	-	1	-	-
	2002	-	-	1	-
	2003	-	1	-	-
Chile	1991	-	-	1	-
	1995	-	1	-	-
	1997	-	1	-	-
	1998	-	1	1	-
	1999	1	1	-	-
	2003	-	1	-	-
China	1992	-	1	-	1
	1994	-	-	-	1
	2003	-	1	-	-
Columbia	1995	-	1	-	-
	1996	-	1	-	-
	1997	-	1	-	1
	1998	-	-	-	1
	1999	1	1	-	1
	2002	-	-	-	1
Czech Republic	1996	-	-	1	-
	1997	1	1	1	-
	1999	-	-	-	1
	2000	-	1	-	-
	2003	-	1	1	-
Egypt	1991	-	-	-	1
	1996	-	1	-	-
	2002	-	1	-	-
Hong Kong	2001	-	-	1	-

Country	Year	Net Capital Flows			EMP
		Monthly Based		Yearly	Yearly
		CalvogdpdropSS	CalvoSS	EdwardsSS	Currency Crisis
Hungary	1991	-	-	-	1
	1994	-	1	1	-
	1995	-	1	-	-
	1996	-	1	1	-
	2001	-	1	-	-
India	1991	-	-	-	1
	1992	-	1	-	-
	1993	-	-	-	1
	1994	-	1	-	-
	1995	-	1	-	-
	1997	-	1	-	-
	1998	-	1	-	-
	2001	-	1	-	-
Indonesia	1992	-	1	-	-
	1997	-	1	1	1
	1998	1	1	-	1
	2000	-	1	-	-
	2001	-	1	-	-
Israel	1995	-	1	-	-
	1998	-	-	1	-
Korea	1990	-	1	-	-
	1992	-	1	-	-
	1993	-	1	-	-
	1995	-	1	-	-
	1996	-	1	-	-
	1997	-	1	1	1
	1998	-	-	-	1
	2001	-	1	-	-
Malaysia	1992	-	1	-	-
	1993	-	1	-	-
	1994	-	1	1	-
	1995	-	1	-	-
	1997	-	1	1	1
	1998	-	-	1	1
Mexico	1993	-	1	-	-
	1994	-	1	-	1
	1995	1	1	1	1
Peru	1990	-	-	-	1
	1992	1	1	-	-
	1995	-	1	-	-
	1997	-	1	-	-
	1998	1	1	1	-
	1999	-	1	-	-

(continued)

		Net Capital Flows			EMP
Country	Year	Monthly		Yearly	Yearly
		CalvogdpdropSS	CalvoSS	EdwardsSS	Currency Crisis
Philippines	1992	-	1	-	-
	1993	-	1	-	-
	1994	-	1	-	-
	1995	-	1	-	-
	1997	-	1	1	1
	1998	1	1	1	1
	1999	-	1	-	-
	2000	-	1	-	-
Poland	1990	-	-	-	1
	1994	-	-	1	-
	1996	-	1	-	-
	1997	-	1	-	-
	1998	-	1	-	-
	1999	-	1	-	-
	2000	-	1	-	-
	2003	-	1	-	-
Russia	1998	-	-	-	1
	1999	-	-	-	-
	2000	-	-	-	-
South Africa	1995	-	1	-	-
	1996	-	1	-	-
	1998	-	1	-	1
	2001	-	-	-	1
Singapore	1993	-	-	1	-
	1994	-	1	-	-
	1995	-	1	-	-
	1996	-	1	-	-
	1997	-	1	-	1
	1998	1	1	-	1
	1999	-	1	-	-
	2001	1	1	-	-
Thailand	1992	-	1	-	-
	1994	-	1	-	-
	1996	-	1	-	-
	1997	1	1	1	1
	1998	1	1	-	1
	2003	-	1	-	-

(continued)

25 Emerging Countries					
		Net Capital Flows			EMP
Country	Year	Monthly		Yearly	Yearly
		CalvogdpdropSS	CalvoSS	EdwardsSS	Currency Crisis
Turkey	1993	-	1	-	-
	1994	1	1	1	1
	1995	-	1	-	-
	1997	-	1	-	-
	1998	-	1	-	-
	1999	1	1	-	-
	2001	1	1	1	1
	2002	-	1	-	-
Venezuela	1992	-	1	-	-
	1994	1	1	1	-
	1996	-	-	-	-
	1998	-	1	-	-
	1999	-	-	-	-
	2000	-	1	-	-
	2002	-	-	-	-

Table D.2. Correlation coefficients between crisis measures

(obs=261)

Variable	CalvoSS (1.25SD)	CalvoSS (1.5SD)	CalvoSS (1.75SD)	CalvoSS (2SD)	EMP (eqw)	EMP (prw)	Edwards SS (3%)	Edwards SS (3%)	GDP drop
CalvoSS (1.25SD)	1.00								
CalvoSS (1.5SD)	0.82	1.00							
CalvoSS (1.75SD)	0.71	0.86	1.00						
CalvoSS (2SD)	0.62	0.75	0.86	1.00					
EMP(eqw)	**0.13**	**0.18**	**0.16**	**0.17**	1.00				
EMP(prw)	**0.13**	**0.14**	**0.12**	**0.16**	0.57	1.00			
EdwardsSS (3%)	0.21	0.26	0.21	0.25	**0.20**	**0.24**	1.00		
EdwardsSS (5%)	0.15	0.18	0.20	0.22	**0.22**	**0.23**	0.77	1.00	
GDPdrop	0.15	0.19	0.20	0.17	0.16	0.27	0.22	0.26	1.00

Table D.3. Correlation Coefficients between Explanatory Variables
(obs=206)

Variable	CA /GDP	Ext debt /GDP	RER appr	Sh. Deb /Res	Lend. boom	Res /GDP	ToT	Hot Flow 3y /GDP	FDI /GDP
CA/GDP	1.00								
Exdebt/GDP	0.22	1.00							
RERappr	0.29	0.42	1.00						
ShDebt/Res	-0.13	0.04	0.14	1.00					
Lendingboom	-0.38	-0.25	-0.26	0.09	1.00				
Res/GDP	0.26	0.33	0.04	-0.46	-0.07	1.00			
ToT	-0.21	-0.21	0.04	-0.04	0.12	0.17	1.00		
HotFlow3y/GDP	-0.06	0.04	0.04	-0.32	-0.10	0.47	0.18	1.00	
FDI/GDP	-0.70	-0.24	-0.27	0.13	0.41	-0.23	0.21	-0.20	1.00

Table D.4. Selected Crisis Countries

Country	*CalvoSS*	*EdwardsSS*	*CurrencyCrisis*
Mexico	1993, 1994	1995	1994, 1995
Thailand	1996, 1997, 1998	1997	1997, 1998
Korea	1996, 1997	1997	1997, 1998
Philippines	1997, 1998, 1999, 2000	1997, 1998	1997, 1998
Malaysia		1997, 1998	1997, 1998
Indonesia	1997, 1998	1997	1997, 1998

Appendix E

Table E.1. Summary Statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
net capital flows	1007	1,366.59	6,139.96	-34,435.00	39,966.00
M2 / reserves	1183	9.85	16.72	0.00	268.56
short-term foreign debt / reserves	982	1.63	2.59	0.00	31.43
current account balance / GDP	986	-0.02	0.07	-0.37	0.81
budget balance / GDP	994	-0.03	0.09	-0.86	0.78
real effective exchange rate index	863	117.29	51.13	48.44	632.26
GDP	1250	82,530.79	143,803.00	0.00	1,409,852.00

Table E.2. Correlation Coefficients Between Continuous Variables (obs=551)

Variable	net capital flows	M2 / reserves	short-term foreign debt / reserves	current account bal / GDP	budget balance / GDP	real effective exchange rate index	GDP
net capital flows	1.00						
M2 / reserves	0.00	1.00					
short-term foreign debt / reserves	-0.07	**0.59**	1.00				
current account balance / GDP	**-0.27**	-0.06	-0.14	1.00			
budget balance / GDP	0.07	-0.16	-0.11	0.07	1.00		
real effective exchange rate index	0.05	0.17	0.04	-0.12	-0.08	1.00	
GDP	**0.49**	0.03	-0.11	0.12	0.02	0.01	1.00

Table E.3. Correlation Coefficients Between Dummy Variables (obs=1470)

Variable	Sudden Stop dummy	COM1	Low reserves dummy	Exchange rate rapid appreciation dummy	Emerging markets dummy
Sudden Stop dummy	1.00				
COM1 (5% thresholds)	0.17	1.00			
Low reserves dummy	0.05	0.11	1.00		
Exchange rate rapid appreciation dummy	0.01	-0.01	0.09	1.00	
Emerging markets dummy	-0.04	-0.08	0.11	0.09	1.00

Table E.4. Estimated Marginal Effects at Mean (Standard Errors in Parenthesis)

Dependent Variable: Sudden Stop Dummy

	Probit Model						
Regression #	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
	1970-1980	*1980-1990*	*1990-2000*	*1970-2004*	*1970-2004*	*1970-1980*	*1990-2000*
/ Independent Variables							
COM1 (twin deficit dummy, 5% thresholds)	0.31*** (0.10)	0.12** (0.06)	0.14** (0.10)	0.18*** (0.05)	0.17*** (0.05)	0.285*** (0.12)	0.10 (0.10)
Low Reserves Dummy					0.018 (0.014)		
Exchange Rate Rapid Appreciation Dummy					0.004 (0.024)		
M2 / Reserves						-0.0017 (0.0014)	-0.003 (0.003)
Short-term Foreign Debt / Reserves						0.0057 (0.0047)	0.004 (0.014)
Real Effective Exchange Rate Index							
Emerging Market Dummy	Variable is dropped. It perfectly predicts 0.	-0.021 (0.026)	0.01 (0.03)	-0.013 (0.014)	-0.016 (0.014)		
Log-likelihood	-51.3	-115.1	-136.8	-323.9	-323.0	-37.7	-111.5
# of Observations	363	462	462	1470	1470	268	365
Pseudo R^2	0.178	0.03	0.01	0.431	0.046	0.178	0.014

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

Table E.5. Estimated Marginal Effects at Mean (Standard Errors in Parenthesis)

	Dependent Variable: Sudden Stop Dummy *Probit Model*				
Regression #	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
	1970-1980	*1980-1990*	*1990-2000*	*1970-2004*	*1970-2004*
/ Independent Variables					
COM1 (twin deficit dummy, 5% thresholds)	0.29*** (0.10)	0.12** (0.06)	0.13 (0.09)	0.17*** (0.05)	0.17*** (0.05)
Low Reserves Dummy	0.008 (0.016)	0.013 (0.024)	0.076 (0.18)	0.016 (0.014)	0.018 (0.014)
Exchange Rate Rapid Appreciation Dummy					0.004 (0.024)
M2 / Reserves					
Short-term Foreign Debt / Reserves					
Real Effective Exchange Rate Index					
Emerging Market Dummy					
Log-likelihood	-53.62	-115.21	-136.80	-323.62	-323.03
# of Observations	462	462	462	1470	1470
Pseudo R^2	0.19	0.03	0.01	0.044	0.046

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level
COM1=1, if Current Account/GDP<-0.05 and Budget Balance/GDP<-0.05 (simultaneously), and equals 0 otherwise.

Table E.6. Estimated Marginal Effects at Mean (Standard Errors in Parenthesis) 4% Thresholds for Twin Deficits

	Dependent Variable: Sudden Stop Dummy *Fixed Effects Probit Model with Continent Dummies*			
Regression #	*(1)*	*(2)*	*(3)*	*(4)*
	1970-1980	*1980-1990*	*1990-2000*	*1970-2004*
/ Independent Variables				
COM1 (twin deficits dummy, 4% thresholds)	0.14***	0.12***	0.04	0.13***
	(0.06)	(0.05)	(0.06)	(0.04)
Low Reserves Dummy	0.002	-0.012	0.016	
	(0.02)	(0.02)	(0.03)	
Exchange Rate Rapid Appreciation Dummy		0.013	-0.054	
		(0.04)	(0.03)	

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level
Continent dummy coefficients are not reported.

Table E.7. Estimated Marginal Effects at Mean (Standard Errors in Parenthesis) 5% Thresholds for Twin Deficits

	Dependent Variable: Sudden Stop Dummy			
	Fixed Effects Probit Model with Continent Dummies			
Regression #	*(1)*	*(2)*	*(3)*	*(4)*
	1970-1980	*1980-1990*	*1990-2000*	*1970-2004*
/ Independent Variables				
COM1 (twin deficit dummy, 5% thresholds)	0.28***	0.10**	0.13*	0.16***
	(0.10)	(0.05)	(0.10)	(0.05)
Low Reserves Dummy	-0.002	-0.01	0.012	0.01
	(0.014)	(0.023)	(0.03)	(0.014)
Exchange Rate Rapid Appreciation Dummy		0.014	-0.06	-0.002
		(0.04)	(0.03)	(0.02)

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level
COM1=1, if Current Account/GDP<-0.05 and Budget Balance/GDP<-0.05 (simultaneously), and equals 0 otherwise.

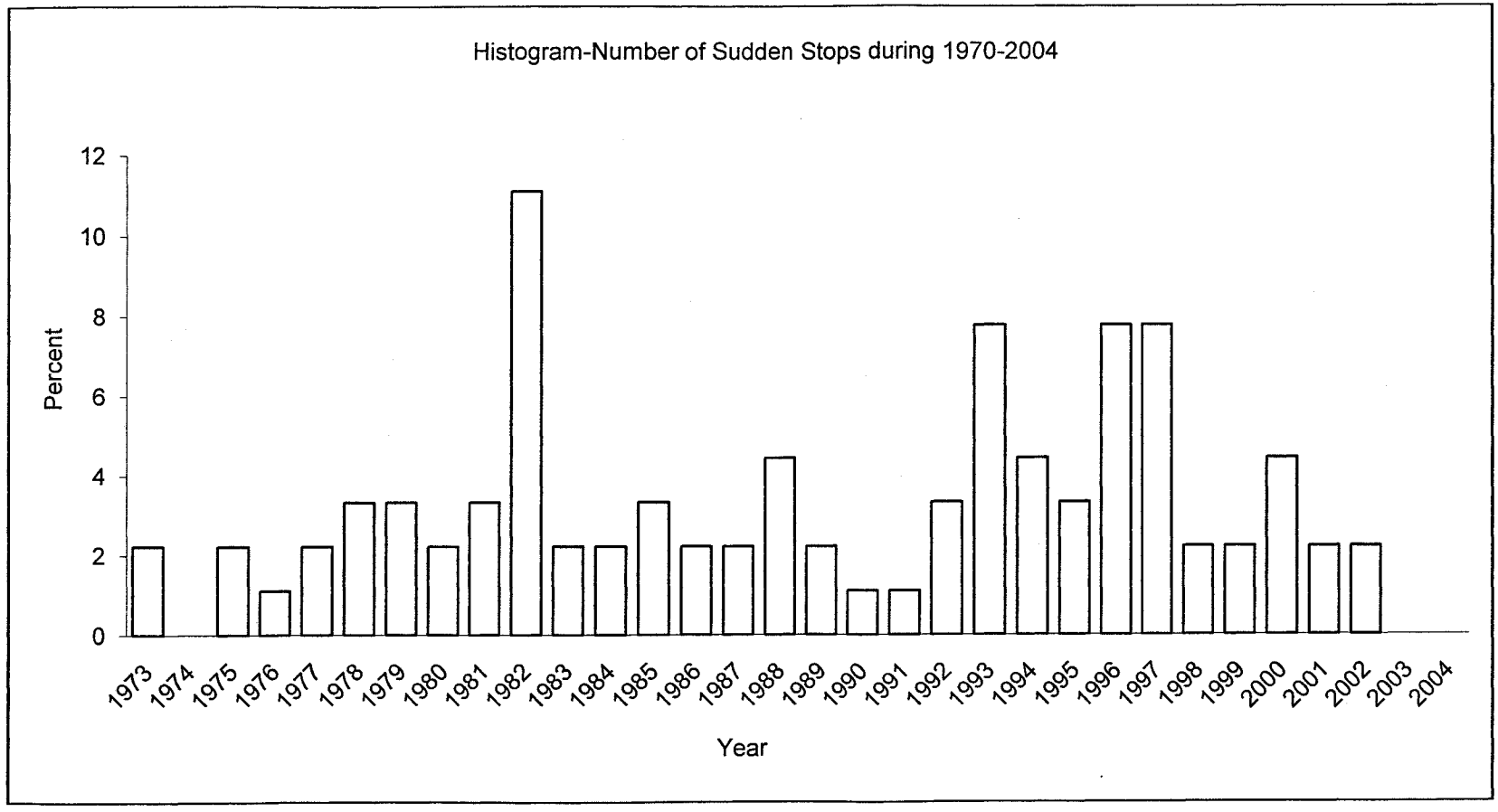

Figure E.1. Annual frequency of sudden stops in percentages, 1970-2004.

Table E.8. Budget deficits and current account deficits when a twin deficit or sudden stop variable equals one.

Country	*Year*	*CA/GDP*	*Budget/GDP*	*Twin Deficits*	*Sudden Stop (t+1)*
Argentina	1988	-1.2%	-0.9%	0	1
	2000	-3.2%	-2.4%	0	1
Botswana	1976	-5.6%	-6.8%	1	1
	1986	8.2%	21.5%	0	1
	1992	4.9%	10.3%	0	1
Bulgaria	1988	-1.8%	-10.6%	0	1
	1990	-17.2%	-18.3%	1	0
	1992	-5.4%	-6.4%	1	0
	1993	-11.5%	-13.6%	1	1
	1995	-0.2%	-5.2%	0	1
Chile	1981	-15.2%	2.7%	0	1
	1982	-9.8%	-1.0%	0	1
	1990	-1.7%	0.8%	0	1
	1994	-3.1%	1.7%	0	1
	1997	-4.5%	1.8%	0	1
Croatia	1997	-14.3%	-1.0%	0	1
	1999	-7.3%	-1.9%	0	1
Czech Rep.	1995	-2.6%	0.5%	0	1
	1996	-7.2%	-0.1%	0	1
	2002	-6.1%	-2.0%	0	1
Ecuador	1982	-8.0%	-0.1%	0	1
	1998	-9.2%	0.0%	0	1
Egypt	1977	-7.7%	-18.2%	1	0
	1978	-6.6%	-17.3%	1	0
	1979	-12.9%	-23.4%	1	0
	1981	-11.7%	-8.6%	1	0
	1982	-8.0%	-22.1%	1	1
	1984	-5.6%	-13.1%	1	0
	1985	-5.1%	-11.5%	1	0
	1989	-1.5%	-5.6%	0	1
Hong Kong	2000	4.3%	.	0	1
Hungary	1989	-2.1%	-2.0%	0	1
	1993	-11.1%	-5.8%	1	1
	1994	-9.9%	-7.2%	1	0
	1995	-3.6%	-6.3%	0	1
	2003	-9.0%	-5.8%	1	0

(continued)

Country	Year	CA/GDP	Budget/GDP	Twin Deficits	Sudden Stop (t+1)
Indonesia	1996	-3.4%	1.2%	0	1
Israil	1974	-6.3%	-9.0%	1	0
	1975	-10.1%	-17.4%	1	1
	1978	-7.2%	-12.3%	1	0
	1981	-6.0%	-22.2%	1	0
	1982	-9.3%	-16.9%	1	1
	1983	-8.9%	-27.4%	1	0
	1984	-6.4%	-20.0%	1	0
	1987	-3.7%	-3.3%	0	1
	1997	-3.2%	0.3%	0	1
Jordan	1975	4.7%	-4.9%	0	1
	1978	-13.1%	-16.6%	1	1
	1982	-8.2%	-7.9%	1	0
	1983	-9.2%	-4.4%	0	1
	1984	-5.9%	-8.2%	1	0
	1985	-5.5%	-6.1%	1	0
	1987	-5.9%	-9.7%	1	0
	1988	-5.2%	-9.6%	1	1
	1991	-9.0%	0.4%	0	1
	1992	-15.4%	4.9%	0	1
	1997	0.4%	-3.0%	0	1
	2000	0.7%	-1.9%	0	1
	2002	4.1%		0	1
South Korea	1985	-0.7%	-0.9%	0	1
	1996	-4.1%	0.1%	0	1
Malaysia	1974	-5.4%	-5.8%	1	0
	1981	-10.2%	-16.2%	1	0
	1982	-13.4%	-16.7%	1	0
	1983	-11.7%	-10.1%	1	0
	1984	-5.0%	-6.2%	1	0
	1986	-0.3%	-9.6%	0	1
	1993	-4.5%	0.2%	0	1
	1996	-4.4%	0.7%	0	1

(continued)

Country	Year	CA/GDP	Budget/GDP	Twin Deficits	Sudden Stop (t+1)
Mexico	1981	-6.8%	-6.8%	1	1
	1994	-6.9%	0.0%	0	1
Morocco	1975	-6.2%	-10.2%	1	0
	1976	-15.3%	-18.2%	1	0
	1977	-17.4%	-16.2%	1	1
	1978	-10.3%	-10.9%	1	1
	1979	-9.7%	-10.0%	1	0
	1980	-8.1%	-10.5%	1	0
	1981	-12.7%	-14.1%	1	0
	1982	-12.4%	-11.8%	1	1
	1983	-6.6%	-8.0%	1	0
	1984	-7.7%	-6.0%	1	0
	1985	-7.0%	-7.3%	1	0
	1994	-2.3%	-3.1%	0	1
Nigeria	1979	9.8%	27.9%	0	1
	1982	-36.9%	-49.4%	1	0
	1983	-20.2%	-34.8%	1	1
	1993	-7.8%	-48.7%	1	0
	1994	-13.5%	-20.2%	1	0
	1998	-9.0%	-12.9%	1	1
Pakistan	1976	-5.6%	-8.9%	1	0
	1979	-5.4%	-8.8%	1	0
	1993	-5.8%	-8.5%	1	0
	1995	-5.5%	-6.4%	1	0
	1996	-7.2%	-7.6%	1	0
	1997	-2.8%	-7.6%	0	1
Panama	1979	-8.6%	-10.3%	1	1
	1981	-11.0%	-6.9%	1	0
	1982	-3.6%	-9.0%	0	1
	1999	-13.1%	0.3%	0	1
	2001	-1.6%		0	1
Peru	1977	-7.3%	0.0%	0	1
	1982	-6.5%	0.0%	0	1
	1997	-5.7%	0.6%	0	1
Philippines	1982	-7.9%	-4.1%	0	1
	1996	-4.7%	0.3%	0	1
	1997	-5.2%	0.1%	0	1
Poland	1980	-6.0%		0	1
	1993	-6.7%		0	1
Romania	1980	-7.1%	0.5%	0	1

(continued)

Country	Year	CA/GDP	Budget/GDP	Twin Deficits	Sudden Stop (t+1)
Singapore	1973	-11.9%	1.2%	0	1
	1985	0.0%	1.4%	0	1
	1992	11.7%	11.6%	0	1
Sri Lanka	1979	-7.2%	-12.8%	1	0
	1980	-16.5%	-18.4%	1	0
	1981	-10.4%	-12.8%	1	0
	1982	-12.0%	-14.7%	1	0
	1983	-9.7%	-11.3%	1	0
	1985	-7.7%	-10.6%	1	0
	1986	-7.0%	-10.9%	1	0
	1987	-5.3%	-9.3%	1	0
	1988	-5.9%	-13.2%	1	0
	1989	-6.1%	-8.9%	1	0
	1991	-6.7%	-9.5%	1	0
	1994	-6.4%	-8.4%	1	0
	1995	-5.9%	-8.3%	1	0
	2000	-6.1%	-9.0%	1	0
Syria	1977	-18.7%	-83.7%	1	0
	1978	-6.3%	-73.6%	1	1
	1981	-16.2%	-55.6%	1	1
	1984	-31.7%		0	1
	1985	-30.7%		0	1
	1986	-12.5%	-52.2%	1	0
	1988	-4.3%	5.9%	0	1
	1994	-7.9%	-16.8%	1	1
	1996	0.3%	-1.1%	0	1
Thailand	1996	-7.9%	0.9%	0	1
Turkey	1993	-3.6%	-6.7%	0	1
	2000	-4.1%		0	1
Uruguay	1982	-2.7%	-9.9%	0	1
	1984	-2.9%	-6.1%	0	1
	2001	-2.5%	-4.5%	0	1
Venezuela	1973	4.3%	1.3%	0	1
	1979	0.8%	2.2%	0	1
	1987	-3.8%	-5.9%	0	1
	1988	-11.5%	-5.7%	1	0
	1993	-3.5%	-2.4%	0	1
Zimbabwe	1981	-9.7%	-6.7%	1	0
	1982	-10.8%	-12.3%	1	1
	1983	-7.3%	-7.1%	1	0
	1991	-7.3%	-9.3%	1	0
	1992	-10.6%	-13.2%	1	0
	1993	-2.0%	-7.0%	0	1

Notes: In this table twin deficits are calculated with -5% threasholds for both budget and current account deficits. "1" means yes and "0" means no in twin deficit and sudden stop columns.

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