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Three sisters: The interlinkage between sovereign debt, currency, and banking crises

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ABSTRACT

This study analyzes the interlinkage between sovereign debt, currency, and banking crises by applying panel data probit and multivariate probit models to a sample of 21 emerging economies observed monthly between 1985 and 2020. The results establish the simultaneity of the three crises in a given month, where banking, sovereign debt, and currency crises tend to occur jointly caused by common unobservable factors. The results also indicate that banking crises usually precede sovereign defaults, but not vice versa. Indirect effects suggest that short-term external indebtedness during banking crises, and misaligned exchange rates corrected by currency crises increase the future sovereign default likelihood.

1. Introduction

Sovereign debt defaults have always been a part of the history of the emerging economies, and has been popular in the empirical literature of financial crises, especially in analyzing the determinants of these defaults. However, if one looks at the previous incidences of sovereign debt defaults in emerging economies, it is not uncommon to notice that they are coupled with either banking or currency crises, in fact, in some cases all three crises occur in the same month. Looking back at history, especially in the last four decades there are various examples of currency, banking and debt crises occurring at close time intervals in Latin American and Asian countries. Some examples include the Tequila crisis in Mexico in 1994, the Russian financial crisis in 1998, the Asian financial crisis of 1997–98, and the Argentinian economic crisis of 2001–02. There are cases where default is the result or the cause of crises in the exchange rate market and financial sectors. In others, growing tensions in the economic and political system trigger three crises occurring at the same time. Yet empirical studies pay little attention to analyzing these triple crises which are especially common in emerging economies.[1]

Like the empirical literature, theoretical literature analyzing the connection of sovereign debt crisis with currency and banking crises is not as ample as the literature on twin – currency and banking – crises. The most well-known theoretical

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[1] There is a growing literature following the Eurozone crisis focusing on the advanced countries such as Candelon and Palm (2010), Reinhart and Rogoff (2013), and Babecký et al. (2014). However, except for Babecký et al. (2014), these studies mainly focus on the relationship between banking and debt crises.

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link from currency to sovereign debt crisis is the "original sin" argument suggesting that a devaluation may lead to sovereign default if most of the debt is denominated in foreign currency (Eichengreen and Hausmann, 1999, 2005; Jeanne, 2005). There are other factors that link an initial currency crisis to a sovereign debt crisis like overvalued exchange rates (Jahjah and Montiel, 2003), a rise in international interest rates (Dreher et al., 2006), or a fall in the credit ratings (Reinhart, 2002). On the other hand, an initial sovereign default might cause a currency crisis through central bank's expansionary monetary policies for avoiding a recession after foreign creditors pull their capital away from the economy. The expansionary monetary policies might result in a second generation currency crisis where the policy maker's intention to give up the exchange rate peg can be self-fulfilling (Obstfeld, 1994).

Theoretically, a crisis in the banking sector might lead to a sovereign debt crisis when the financial sector debt becomes massive government liabilities after a banking crisis through bank bailouts (Velasco, 1987; Arellano and Kocherlakota, 2014). The reverse causality is also possible if domestic financial sector holds a large amount of government debt on their balance sheets (Gennaioli et al., 2014; Bolton and Jeanne, 2011; Sosa-Padilla, 2018; Thaler, 2021). Reinhart and Rogoff (2011) argue that domestic financial sector need not be directly exposed to the government debt; a fall in nation-wide credit ratings and resulting "sudden stop" after a sovereign debt crisis might also lead to a banking crisis.

Most of the empirical works exploring the link between currency, banking, and debt crises focus on the dual relationships either between banking and sovereign debt or between currency and sovereign debt crises. The exceptions are the studies by Bordo and Meissner (2006), and Babecký et al. (2014) analyzing the interactions of the three crises. However, Bordo and Meissner (2006) does not take into account the possible simultaneity of the three crises, and Babecký et al. (2014) focuses only on OECD countries which makes debt crises relatively rare in their dataset. The studies analyzing the link between currency and debt crises establish an asymmetric relationship between these two crises: Reinhart (2002), and Bordo and Meissner (2006) find that an initial currency crisis leads to a sovereign debt crisis, but not vice versa; Herz and Tong (2008), and Babecký et al. (2014) find that a sovereign default increasing future currency crisis likelihood, but not the other way around. Dreher et al. (2006), on the other hand, find that a currency crisis decreases the future sovereign debt crisis likelihood. Besides this, Herz and Tong (2008), and Bordo and Meissner (2006) establish positive contemporaneous relationship between currency and sovereign debt crises. As for the empirical links between banking and sovereign debt crises, studies like Gennaioli et al. (2014), and Babecký et al. (2014) find a two directional relationship between these two crises; and Reinhart and Rogoff (2011) establish simultaneity between banking and sovereign debt crises apart from an initial banking crisis leading to sovereign debt crisis.

The theoretical studies indicate clear correspondences between banking and debt crises, and between currency and debt crises. Nevertheless, the non-comprehensive empirical literature lags behind in providing information regarding the triple crises. Grounded from these interesting yet rarely explored occurrences of triple crises in emerging economies, this study provides empirical evidence on sovereign debt crises and their links with currency and banking crises. Our sample covers 21 emerging countries observed monthly between 1985 and 2020. By relying on monthly frequency and focusing on the simultaneity of these three types of crises, we fill an important gap in the empirical literature about financial crises and their influence on each other.

Our research contributes to the literature in various dimensions. Firstly, we reveal the determinants of sovereign debt defaults on a monthly basis, relying not only on economic indicators but also on the quality of the institutions and the political structure of the countries.[2] Secondly, we discover the contemporaneous and lagged links between sovereign debt, currency and banking crises. In this sense, monthly analysis gives the benefit of investigating the time structure of these three crises and helps us to determine whether these crises occur jointly because of unobservable common factors or whether there are contagion effects that makes one crisis occur after the onset of another crisis.

In the first part of our empirical analysis, we look at the impact prior of currency and banking crises on the probability of sovereign default along with the institutional, political and macroeconomic indicators. We also analyze the indirect effect of currency crises through overvalued real exchange rates, since the overvaluation corrected by a depreciation of the currency might lead to worsening of the government finances and accelerate the likelihood of a sovereign debt crisis (Jahjah and Montiel, 2003). An initial banking crisis is also hypothesized to increase future debt crisis probability if the losses of the banking sector become a burden for the government (Velasco, 1987; Arellano and Kocherlakota, 2014). Therefore we include the interaction of lagged currency crises with misaligned exchange rates, and the interaction of prior banking crises with short-term external debt to examine the theoretical linkages from currency and banking crises to sovereign debt crises.

In the second part of the empirical analysis, we analyze the reverse relationship: the likelihood of an initial sovereign debt default leading to a banking or a currency crisis as well as the simultaneity between these three crises. We estimate banking and currency crises models including lagged sovereign debt default as one of the determinants of these crises. Finally, using a multivariate probit approach, we estimate the three crises equations jointly to discover the contemporaneous correlation between them and to determine if they are led by common unobservable factors.

Our study finds evidence that not only economic and institutional indicators, but also the prior onset of banking crises influence the likelihood of sovereign debt defaults. However, the main contribution of our study is that we establish the simultaneity between sovereign debt, currency, and banking crises in a given month. According to our findings, banking, sovereign debt and currency crises have a tendency to occur jointly caused by common unobservable factors. Although the-

[2] Readers can refer to Das et al. (2012) for an extensive review of sovereign default literature.

oretically sound, to our knowledge, this result is unique in the empirical literature thanks to our monthly frequency data. Lastly, we also find evidence that prior currency and banking crises have significant indirect effects on the probability of sovereign defaults: currency crises through misaligned exchange rates, and banking crises through high short-term foreign debt contribute to the likelihood of future sovereign defaults.

The rest of the study is structured as follows: Section 2 presents the methodology and data of the study, followed by the results of the pooled probit estimations of the determinants of sovereign default in Section 3; Section 4 offers evidence on the predictive power of lagged sovereign defaults on the probability of currency and banking crises, and the simultaneity of currency, banking and sovereign debt crises; lastly the conclusion is presented in Section 5.

2. Methodology and data

2.1. Starting dates of sovereign debt, currency and banking crises

Almost all empirical studies investigating financial crises rely on annual data since establishing the exact month of the onset of sovereign debt and banking crises is not easy. Annual dating of crises lowers concern about precision in dating the onset of crises and gives the benefit of including a high number of countries in the sample. However, it leads to a significant loss of information regarding the leads and lags of particular crises types, especially in the analysis of the relation between multiple crises types. Therefore, acknowledging the limitations of monthly crisis dating, in this study, we use the monthly starting dates of financial crises.

Information about the months in which the sovereign debt crises started is taken from Arteta and Hale (2008). They define the start of the sovereign debt crisis as the date when the renegotiation of the sovereign debt from the official and private creditors is first mentioned in the English-language media prior to any restructuring agreement.[3] They take the final agreements on debt restructuring from the World Bank (Global Development Finance) and Paris Club, but their definition of a 'restructuring episode" doesn't include only negotiated restructurings, but also voluntary debt swaps and debt buybacks. Therefore it is a broader definition compared to other studies, like Reinhart et al. (2003) and Tomz and Wright (2005). As for the corresponding default dates of the government debt, they trace financial news in the Lexis-Nexis database to distinguish the initial announcement of the debt renegotiations. Their database lasts until 2002, the data from this date onwards is taken from sovereigin debt restructuring report of IMF (2021), which also documents sovereign debt restructurings of both official and private debt and coincides well with the dates of Arteta and Hale (2008). The onset of currency crises in our sample is identified following Kraay (2003), and Eijffinger and Karataş (2012): A country is experiencing a currency crisis if the depreciation of domestic currency price per US dollar exceeds 10 percent in a given month following an episode of stable exchange rates (i.e. the average absolute percentage change should be lower than 2.5 percent for the twelve month-period prior to the depreciation). For the starting months of the banking crises in our sample, we use the systemic banking crises database developed byLaeven and Valencia (2008, 2012, 2020).[4] They extend the banking crises database of Caprio and Klingebiel (1996), and Caprio et al. (2005) and provide the staring months of the banking crises which is crucial for our analyses. The detailed description of the systemic banking crisis definition can be found on Laeven and Valencia (2012).

We apply windows to the data to exclude the months following the sovereign default, indicated as the start of the renegotiations, until the corresponding restructuring date. In case there are more than one restructuring agreement, the latest agreement is referring to the end of the sovereign debt crisis. Similarly, for the banking crisis, we exclude from the dataset the months after the crisis onset until the end dates of each crisis determined by Laeven and Valencia (2020). For the currency crisis, any depreciation following the twelve months after the currency crisis onset is treated as the same crisis and excluded from our dataset.

Table 1 in gives the overview of the sovereign debt, banking and currency crises onsets for the period between January 1985 and December 2020 for the 21 emerging economies used in our study. The number of countries in our sample is limited due to the low availability of the monthly starting dates of banking crises. In total we have 49 debt, 53 currency and 25 banking crises in our sample. Following the approach of Kaminsky and Reinhart (1999), we calculate the probabilities of the occurrence of each crisis conditional on the occurrence of the other crises. The conditional probability of an occurrence of sovereign default in the same month or in the twelve-month period after a currency crisis is 7.5 percent. The default either occurs simultaneously with the currency crisis or few months after a currency crisis. On the other hand, after a banking crisis it takes a year for the government to default, if it does not do so immediately in the same month as the banking crisis: following a banking crisis, the conditional probability of a default in the next twelve months is 28 percent. As for the reverse relationship, the conditional probability of a country experiencing a currency crisis in the twelve months following a default is 18 percent, while the probability of a banking crisis following a default in the one-year-window is 16 percent in our sample.

[3] Most of the studies either select the restructuring date as the onset of a debt crisis (such as Balkan (1992) and Detragiache and Spilimbergo (2001) where a combination of restructuring and the level of arrears is used to define debt crisis), or arbitrarily set one year prior to restructuring date as the start of the sovereign debt crisis (such as Herz and Tong (2008)). The restructuring agreement represents the end of the debt crisis period. In this respect, Arteta and Hale (2008) identify the months for the start of debt renegotiations corresponding to each restructuring agreement. Hence, in our study, renegotiation of debt represents the start, and the corresponding restructuring agreement is the end of the debt crisis period.

[4] Extended to the end of 2019 by Nguyen et al. (2022).

Table 1
Debt, Banking and Currency Crisis Dates between 1985 and 2020.

Country	Debt Crisis	Currency Crisis	Banking Crisis
Argentina	09/1986; 01/2001; 07/2014[a]; 12/2019[a]	01/2002; 01/2014; 12/2015 05/2018	12/1989; 01/1995; 11/2001
Bolivia	09/1985; 04/1993; 04/1997; 02/2000		09/1986; 11/1994
Brazil	09/1989; 01/1993; 12/1996	01/1999; 10/2002; 09/2008 03/2015; 03/2020	02/1990; 12/1994
Chile	12/1985; 01/1988	10/2008	
China		07/1986; 01/1994	11/1998
Colombia	07/1987; 03/1990; 06/1999	09/2008; 12/2014; 03/2020	06/1998
Dominican Republic	03/1990; 11/1993; 04/2004[a]	06/1987; 04/1990	04/2003
Ecuador	02/1987; 09/1992; 04/1999 11/2008[a]; 03/2020[a]	12/1985; 09/1992	08/1998
India		07/1991	09/1993[b]
Indonesia	10/1997; 04/2002[a]	09/1986; 08/1997; 11/2008 03/2020	11/1997
Jamaica	08/1986; 04/1988; 04/1992		12/1996
Korea	08/1997	12/1997; 10/2008	08/1997
Malaysia		12/1997	07/1997
Mexico	06/1985; 12/1994	12/1994; 09/1998; 10/2008 03/2020	12/1994
Paraguay	05/1986[a]	12/1986; 03/1989 06/2002; 09/2008	05/1995
Philippines	02/1985; 10/1986; 04/1987 06/1988; 07/1990	09/1997	07/1997
Russia	01/1991; 01/1992; 08/1998	09/1998; 11/2009; 05/2012 11/2014; 03/2020	08/1998; 09/2008
Thailand		07/1997	07/1997
Turkey	07/1998	02/2001; 10/2008; 08/2018	11/2000
Uruguay	09/1985; 03/2003[a]	03/2020	01/2002
Venezuela	01/1986; 12/1988; 01/1994; 01/2005[a]; 11/2017[a]	12/1986; 12/1995 02/2002; 01/2010 02/2013; 03/2016; 01/2018	01/1994

[a] The default dates and the corresponding restructuring dates are taken from IMF's "Issues of Restructuring of Sovereign Domestic Debt (2021).
[b] The starting month is taken from Khan (2011) as the forced merger between New Bank of India and Punjab National Bank due to increased problems of New Bank of India.

2.2. Data

In predicting the onset of sovereign debt crises, we choose the set of macroeconomic, and institutional variables which are widely accepted in the empirical literature (i.e. Balkan, 1992; Detragiache and Spilimbergo, 2001; Manasse et al., 2003; and Das et al., 2012) as significant determinants of debt crises. Table A1 in Appendix A lists the detailed explanation, construction and sources of the all data used in our analyses.

To measure sovereign solvency, we use the public debt of a country divided by its GDP. This data is taken from IMF's Global Debt Database and defined as gross (external plus internal) central government debt over GDP. In order to capture whether or not a country is experiencing liquidity problems prior to a default, we include the ratio of short-term external debt service to foreign exchange reserves. High short-term external indebtedness creates maturity problems, as well as currency mismatches. According to Manasse et al. (2003), this indicator is regarded as one of the best determinants of sovereign debt crises during 1990s.

Manasse et al. (2003) also find that the current account balance worsens prior to a debt crisis and improves afterwards. In order to address the contribution of current account problems to the probability of sovereign default, we use the current account balance divided by foreign exchange reserves as another macroeconomic indicator.

Apart from being the main indicator of a currency crisis, the overvaluation of the real exchange rates brings along the risk of default (Eaton and Gersovitz, 1981; and Jahjah and Montiel, 2003). The reason is that the external trade position and the general macroeconomic environment of the country become vulnerable with overvalued real exchange rates. If the country has a fixed exchange rate regime it becomes costly for the government to correct the misaligned exchange rates, increasing the likelihood of sovereign default. Therefore, we include overvaluation of the real exchange rates as another macroeconomic variable in predicting sovereign debt crisis.

The general domestic macroeconomic environment is also essential in signaling the vulnerability of the government when servicing its external debt. Therefore the key domestic macroeconomic indicators which are expected to increase the likelihood of sovereign default – the monthly growth rate of GDP as an indicator of government having enough resources to repay its debt, the percentage change in the real monetary policy interest rate (since rising interest rates lead to difficulties

in future debt service and increasing the incentive of the government to default), and the rate of inflation that captures monetary mismanagement – are all included in the estimations for controlling domestic macroeconomic developments.

External developments that influence the borrowing costs are also important in determining the debt management of emerging economies. Increased international interest rates may lead to lower capital flows to the emerging economies and therefore increase the country's vulnerability to rolling over its debt. As a proxy for global liquidity, the percentage change in the real US federal funds rate is used in the analysis. Arora and Cerisola (2001) claim that US policy rates are more in line with the emerging economy sovereign spreads as they serve as a benchmark in pricing other longer term assets in international markets. Most of the studies using longer term interest rates find a negative relationship, if any, between advanced economy interest rates and emerging economy sovereign spread.[5] Using US policy rates reduces the reverse causality concerns between debt crises and US treasury rates that a decrease in the default risk in emerging markets might also change the US treasury rates due to the lower demand for the US treasury bonds. Additionally, theoretical considerations, like Uribe and Yue (2006), and Foley-Fisher and Guimaraes (2013), suggest that it is the real, rather than the nominal, US interest rates that influence the default risk of the emerging economies. Therefore we use the real US federal funds rate as a proxy for global lending conditions.

Institutional variables are aimed at capturing the changes in the credibility of policy implementation and in the government's incentive to follow policies that guarantee the sustainability of its debt position. In this respect, elections bring political uncertainty and play an important role in increasing political tensions prior to sovereign defaults. We intend to capture this effect by including a dummy for parliamentary and presidential elections. Apart from election dates, the stability of the political system has been proven (Citron and Nickelsburg, 1987; and Balkan, 1992 amongst others) to have an influence on a country's willingness to repay its debt. In order to address how risky a country is, the ratings of the International Country Risk Guide (ICRG) are taken into account. Specifically, the focus is on several political variables: government stability, bureaucracy quality, law and order, investment profile, democratic accountability, economic quality (the economic weaknesses and strengths of a country), and financial quality (the ability of the country to finance its obligations in terms of official and commercial debt). The risk of high correlation in these institutional variables requires a correction before including these indicators into the analyses. Therefore we conduct factor analysis (Jae-On and Mueller, 1978;Torres-Reyna, 2012) in order to generate fewer unobserved, uncorrelated random variables representing the above mentioned observed and correlated seven institutional indicators for any given country in our sample. The institutional variables are represented by two factors; the factor representing the political indicators is called "political environment" and the one representing the economic and financial quality is named "market environment".[6] The rotated loadings of the two factors are represented in Table A2 (Appendix A). The positive loadings of the two factors mean that higher scores of these factors relate to better quality of institutions.

Finally, as the main interest of our study is the relationship between sovereign debt, currency, and banking crises, we include the indicators of the onsets of currency and banking crises. Additionally, in order to analyze the impact of the prior onset of sovereign debt crises on the probability of currency and banking crises,[7] apart from the above mentioned indicators, we include capital account openness index, change in the stock prices, domestic credit by banking sector divided by GDP, and domestic credit to private sector over GDP in our data.[8]

An econometric concern for a sample having at most 432 observations per country is the possible non-stationarity of the variables. To take this into account, we conduct the Im-Pesaran-Shin (2003) unit root test for each variable in our dataset. This test allows for heterogeneity in the unbalanced panel data sets. The results suggest that for all variables, except public debt over GDP, domestic credit over GDP, and domestic credit to private sector over GDP, the null of non-stationarity is rejected. Hence these variables are transformed into first differences. Additionally, to minimize the concerns of endogeneity in our estimations, all regressors are lagged. In order to choose the number of lags for each variable, we apply the general-to-specific methodology: We initially include up to twelve lags for each variable in the estimations and then remove the statistically insignificant lags stage by stage. The parsimonious model in the study is estimated using the first significant lag for each variable. Lastly, the existence of statistical dependence within country observations is controlled for by using robust standard errors clustered for each country.[9]

The summary statistics of the variables for our unbalanced sample running from January 1985 until December 2020 are given in Table 2. As can be observed from the table, the occurrences of sovereign default, currency and banking crises are rather rare in our sample because of the monthly frequency. This rare event problem might create a bias in our estimation results. We address this issue in the sensitivity analyses.

[5] Some examples are: Kamin and Kleist (1999), Cline and Barnes (1997), Eichengreen and Mody (1998), and Calvo et al. (1993).

[6] We use Kaiser Criterion that retains the factors with eigenvalues – the total variance accounted by each factor – equal to or greater than one.

[7] The estimations of currency and banking crises models, and the simultaneous occurrence of the three crises are explored in Section 4.

[8] The indicators for the banking and currency crises equations are taken from Eijffinger and Karataş (2020) which follows previous studies, as Lestano et al. (2003), Kaminsky and Reinhart (1999), Demirgüç-Kunt and Detragiache (1997), and Kaminsky (2006).

[9] The specifications are also estimated with clustering of the standard errors both across countries and across time (see Petersen (2009) for the details of this method). The results, available upon request, do not change from the estimations presented.

Table 2
Summary Statistics.

Variable	Obs.	Mean	Std. Dev.	Min	Max	Unit of Account
Sovereign Default	5565	0.005	0.068	0	1	Dummy
Currency Crisis	5116	0.006	0.080	0	1	Dummy
Banking Crisis	4771	0.003	0.054	0	1	Dummy
Δ Public Debt	5565	0.010	0.723	−4.182	8.556	Ratio to GDP
Real International Interest Rate	5565	−0.104	2.783	−39.250	21.733	Percentage Change
Real Domestic Interest Rate	5559	0.035	0.873	−24.278	36.990	Percentage Change
Exchange Rate Overvaluation	5565	−0.003	0.082	−0.367	0.720	Percentage Deviation
Current Account Position	5544	−0.031	0.150	−1.847	0.542	Ratio to Reserves
GDP Growth	5565	0.348	0.328	−1.009	1.524	Percentage Change
Short Term External Debt	5565	0.623	0.561	0.017	7.815	Ratio to Reserves
Stock Prices	3971	0.016	0.110	−0.780	2.129	Percentage Change
Δ Domestic Credit by Banks	5190	0.147	0.778	−7.956	3.948	Ratio to GDP
Δ Domestic Credit to Private Sector	5542	0.125	0.533	−5.383	3.276	Ratio to GDP
Capital Account Openness	5433	−0.025	1.136	−1.924	2.322	Index
Inflation	5565	0.009	0.023	−0.033	0.474	Percentage Change
Election	5565	0.030	0.171	0	1	Dummy
Market Environment	5565	0.203	0.863	−3.578	2.345	Index
Political Environment	5565	−0.049	0.940	−2.116	2.932	Index

3. Empirical results: Determinants of sovereign defaults

3.1. The model

In order to address the determinants of the sovereign debt crises, a discrete choice model is preferred using macroeconomic and institutional indicators alongside contemporaneous and lagged starting months of currency and banking crises as predictors of sovereign debt defaults. The onset of a sovereign debt crisis is denoted by the unobservable latent random variable, $D_{i,t}^*$. The observable discrete variable, $D_{i,t}$ takes value of *1* if a sovereign debt crisis has started in country *i* in month *t*[10]:

$$D_{i,t} = 1 \quad \text{if} \quad D_{i,t}^* > 0 \text{ and } 0 \text{ otherwise}$$

The model is defined by the following equation:

$$D_{i,t}^* = \beta_0 + \beta_1 X_{i,t-k} + \beta_2 C_{i,t-1tot-12} + \beta_3 B_{i,t-1tot-12} + \beta_4 C'_{i,t-1tot-12} X_{i,t-k} + \beta_5 B'_{i,t-1tot-12} X_{i,t-k} + \mu_{i,t} \quad (1)$$

and k = 1, 2, 3,. ...

The vector $X_{i,t-k}$ includes the set of macroeconomic and institutional variables which play a role in influencing sovereign defaults.[11] $C_{i,t-1\ to\ t-12}$ and $B_{i,t-1\ to\ t-12}$ are the composite lagged currency and banking crises dummies, respectively, taking the value 1 if currency and/or banking crises occur in the previous twelve-month period.[12] In order to capture the channels through which each crisis affects the sovereign debt crisis, the interaction terms of lagged currency and banking crises with macroeconomic variables, $C_{i,t-1to\ t-12}\hat{}\ X_{i,t-k}$ and $B_{i,t-1\ to\ t-12}\hat{}\ X_{i,t-k}$, are included in the equation.

The distribution of the error term, $\mu_{i,t}$, is assumed to be stationary normal. The efficient estimation of equation (1) is done by maximum likelihood estimation methods on an unbalanced panel data set composed of 21 emerging economies for the period between January 1985 and December 2020.

3.2. Pooled probit estimation results

The probability of sovereign default represented by equation (1) is estimated by a pooled probit model using maximum likelihood estimation and the results are presented in Table 3. In probit models the estimated coefficients do not give the measure of the change in the conditional mean of the dependent variable given a change in each regressor. Therefore in addition to estimated coefficients and z-statistics, the marginal effects of the probability of a sovereign debt crisis with respect to each independent variable are calculated and reported in every column. In presenting the goodness of fit of the estimations, each column contains the log-likelihood, pseudo R-squared, and the percentage of correctly classified crisis and non-crisis observations. In calculating the correctly classified observations, low thresholds of predicted probabilities – greater than

[10] Throughout the study, we only consider the starting months of crises as crisis events, and exclude the observations following the onset until the end of crisis periods.

[11] Lagging explanatory variables minimizes simultaneity concerns. However endogeneity might still be present. Therefore the reader should be cautious in interpreting the presented results as causal relationships.

[12] The composite lagged crises minimize the multicollinearity problem caused by including multiple lagged crisis dummies in the estimations. Debt crises do not occur immediately following banking and currency crises, therefore the composite lagged crises dummies embrace a one-year period.

Table 3
Pooled Probit Estimation Results of Sovereign Debt Crisis.

Variables	(1)Estimates (z-stats)	(2)Estimates (z-stats)	(3)Estimates (z-stats)	(4)Estimates (z-stats)	(5)Estimates (z-stats)	(6)Estimates (z-stats)
	Elasticity	Elasticity	Elasticity	Elasticity	Elasticity	Elasticity
ΔPublic Debt $_{t-1}$	*−0.074*	*−0.066*	*−0.187**	*−0.181**	*−0.161*	*−0.171**
	(−0.76)	(−0.62)	(−1.97)	(−1.71)	(−1.59)	(−1.66)
	−0.0004	0-0.0004	−0.001	−0.001	−0.0003	−0.001
Real International Interest Rate $_{t-4}$	**0.012*****	**0.013*****	**0.011*****	**0.012*****	**0.011*****	**0.012*****
	(3.73)	(4.09)	(3.78)	(4.04)	(3.46)	(4.26)
	0.0001	0.0001	0.0001	0.0001	0.00002	0.0001
Real Domestic Interest Rate $_{t-3}$	0.046**	0.046**	0.045**	0.046**	0.048**	0.045**
	(2.31)	(2.32)	(2.11)	(1.95)	(2.18)	(2.09)
	0.0002	0.0003	0.0002	0.0002	0.0001	0.0002
Exchange Rate Overvaluation $_{t-1}$	**−2.844*****	**−2.770*****	**−3.128*****	**−3.084*****	**−2.587*****	**−3.256*****
	(−2.79)	(−2.56)	(−3.14)	(−2.95)	(−2.32)	(−2.91)
	−0.016	−0.016	−0.016	−0.016	−0.005	−0.017
Current Account Position $_{t-4}$	**−0.653*****	**−0.636*****	−0.492**	−0.480**	−0.451**	−0.337*
	(−4.82)	(−4.65)	(−2.48)	(−1.44)	(−1.98)	(1.83)
	−0.004	−0.004	−0.003	−0.003	−0.001	−0.002
GDP Growth $_{t-1}$	−0.429	−0.441	−0.433	−0.439	−0.481	−0.414
	(−1.55)	(−1.59)	(−1.41)	(−1.44)	(−1.48)	(−1.32)
	−0.002	−0.002	−0.002	−0.002	−0.001	−0.002
Short-Term External Debt $_{t-8}$	**0.153*****	**0.148*****	**0.167*****	**0.165*****	**0.137****	**0.157*****
	(3.26)	(2.86)	(3.19)	(2.92)	(2.49)	(2.79)
	0.001	0.001	0.001	0.001	0.0003	0.001
Inflation $_{t-1}$	**4.552*****	**4.498*****	**5.075*****	**5.025*****	**4.467*****	**4.818*****
	(6.49)	(6.26)	(4.86)	(4.58)	(4.26)	(4.17)
	0.025	0.025	0.026	0.026	0.009	0.025
Currency Crisis $_{t-1 \text{ to } t-12}$		*−0.175*		*−0.103*	*−2.940***	*−0.107*
		(−0.41)		(−0.24)	(−2.16)	(−0.25)
		−0.001		−0.001	−0.001	−0.001
Banking Crisis $_{t-1 \text{ to } t-12}$			**0.655*****	**0.655*****	**0.676*****	0.455*
			(3.43)	(3.41)	(3.49)	(1.65)
			0.009	0.009	0.004	0.005
Election $_{t-1}$	0.065	0.064	0.137	0.139	0.142	0.143
	(0.16)	(0.16)	(0.33)	(0.33)	(0.33)	(0.35)
	0.0004	0.0004	0.001	0.001	0.0004	0.001
Market Environment $_{t-1}$	**−0.309*****	**−0.309*****	**−0.309*****	**−0.308*****	**−0.338*****	**−0.312*****
	(−3.86)	(−3.85)	(−3.59)	(−3.59)	(−4.02)	(−3.54)
	−0.002	−0.002	−0.002	−0.002	−0.001	−0.002
Political Environment $_{t-1}$	−0.197**	−0.207**	−0.209**	−0.214**	−0.200**	−0.215**
	(−1.96)	(−2.03)	(−2.07)	(−2.12)	(−2.05)	(−2.13)
	−0.001	−0.001	−0.001	−0.001	−0.0004	−0.001
Currency Crisis $_{t-1 \text{ to } t-12}$ X RER $_{t-1}$					**−19.338*****	
					(−3.53)	
					−0.067	
Banking Crisis $_{t-1 \text{ to } t-12}$ × St External Debt $_{t-8}$						0.174
						(1.33)
						0.011
Pseudo-R^2	0.186	0.185	0.201	0.200	0.218	0.201
Number of Observations	5565	5446	4881	4803	4803	4803
Log-Likelihood	−134.695	−134.372	−121.071	−120.930	−118.141	−120.752
Goodness of fit (10 percent cutoff)						
% of observations correctly predicted	99.26	99.23	99.36	99.35	99.31	99.27
% of crises correctly predicted	7.69	7.69	12.50	12.50	16.67	12.50
% of non-crises correctly predicted	99.69	99.67	99.79	99.79	99.73	99.71
Goodness of fit (1 percent cutoff)						
% of observations correctly predicted	90.84	90.45	89.78	89.59	90.51	90.05
% of crises correctly predicted	61.54	57.69	62.50	62.50	66.67	62.50
% of non-crises correctly predicted	90.97	90.61	89.91	89.73	90.63	90.19

Notes: Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. The marginal effects are evaluated at the sample mean for continuous variables and for change from zero to one for dummy variables holding all other variables at their mean. In order to convert the marginal effects into percentages they should be multiplied by 100.

10 percent and 1 per cent – are used to classify a country experiencing a sovereign debt crisis. We choose low cut-off points because the debt crisis observations are rather rare in our monthly sample, and raising these thresholds do not increase the correct classification of the non-crisis observations, but cause a significant decrease in the correctly classified crisis observations.

The estimations in column 1 of Table 3 are conducted by using macroeconomic and institutional variables leaving out the crises indicators. The following specifications after column 1 include crises indicators one by one: In column 2 the lagged onset of currency crisis is included, column 3 includes the lagged banking crisis onset, and column 4 includes both lagged crises indicators.[13] In columns 5 and 6 interaction terms with lagged currency crisis and misaligned exchange rates, and with lagged banking crisis and foreign short-term debt, are included in the estimations.

Public debt to GDP ratio does not enter significantly in the estimations indicating that the insolvency of the central government is not a main indicator of a sovereign debt crisis. On the other hand, short-term external debt is highly significant and positive. This finding confirms Manasse et al. (2003) that also finds short-term external debt rather than public debt to GDP as having high predictive power in explaining debt crises, especially after 1990s. Real international interest rate enters significantly indicating that an increase in the monthly real US policy rate increases the default probability in the following four months by about 0.01 percent. This finding confirms the argument of Arora and Cerisola (2001) that a higher US policy rate increases the default risk of emerging economies. Higher inflation rate, rising current account deficit, and tight domestic monetary policy are also highly correlated with future debt crises. Additionally, the significant coefficient of real exchange rate overvaluation shows that exchange rate misalignment precedes the onset of a debt crisis confirming the theoretical findings of Jahjah and Montiel (2003). Generally these results are in line with the empirical findings of Manasse and Roubini (2009) regarding the economic determinants of sovereign defaults.

As for the institutional factors, the coefficient of market environment indicates that the negative assessment of the quality of the economic and financial situation of a country increases the debt crisis probability. A unit increase in market riskiness increases the debt crisis probability by around 0.2 percent in the subsequent month. Political environment also has a significant and negative coefficient, confirming the findings of Citron and Nickelsburg (1987), and Balkan (1992) that increased political riskiness of a country increases the probability of sovereign default. A unit decrease in the political environment indicator, meaning an increase in the political riskiness, increases the probability of a sovereign default by about 0.1 percent in the following month.

The currency crisis occurring in the twelve-month period preceding sovereign default does not have any significant influence on the probability of sovereign default, as shown in columns 2 and 4. Herz and Tong (2008) also find a weak relationship between lagged currency crises and debt crises. A banking crisis, on the other hand, occurring in the twelve-month period prior to a default is estimated to increase the probability of debt crisis by around 0.9 percent. This economically important result confirms the finding of Gennaioli et al. (2014) who also study a sample of 21 emerging economies.

The incidence of a currency or a banking crisis possibly increases the probability of a sovereign debt crisis through economic fragilities. Therefore in order to analyze the indirect links from prior banking and currency crises to sovereign debt crisis, the interaction effects of the lagged currency crises with misaligned exchange rates[14] and lagged banking crises with global illiquidity are introduced into the estimations. Columns 5 and 6 present the results with the inclusion of the interaction terms with currency and banking crises. The interpretation of the interaction terms is different compared to the other regressors in the estimations. The magnitude and the significance of the terms change for each observation. Therefore we calculate the marginal effects and z-statistics of each interaction term at their mean, minimum and maximum levels for each observation and present them in Table 4.

Besides the direct influence of the appreciated real exchange rates, the indirect effect of this indicator on the sovereign default probability is emphasized in the literature. Jahjah and Montiel (2003) show the contribution of overvalued exchange rates on the sovereign default probability. Additionally, Jahjah et al. (2013) mention in their study that misaligned exchange rates corrected by a currency crisis might lead to sovereign default due to the resulting currency mismatch in the government's balance sheet. The interaction between lagged currency crisis onset and overvalued real exchange rates investigates this effect in column 5 of Table 3. The term enters significantly and shows that appreciated real exchange rates coupled with a currency crisis increase the sovereign debt crisis probability. Table 4 indicates that the mean interaction effect is negative and for most of the observations the marginal effect is negative and significant which supports the theoretical literature.

High short-term foreign debt to foreign exchange reserves indicates that the country has international illiquidity problems which might lead to a bank run, according to Diamond and Dybvig (1983). The historical graphical observations by Reinhart and Rogoff (2011) link this finding to debt crisis by showing that short-term foreign debt levels aggravate in the phase of a banking crisis and are immediately followed by sovereign debt crises. Since the illiquidity of the country spreads the vulnerability of the banking system to the government because of the costly bail-outs, it is expected that in a country facing illiquidity, a banking crisis might lead to sovereign default. The interaction term of lagged banking crisis with short-term external debt over foreign exchange reserves tests for this relation. The results in column 6 of Table 3 point out that the term is insignificant, also the mean marginal effect is around zero (see Table 4). But more than half of the marginal effects are positive and significant, confirming that the probability of a sovereign debt crisis rises if international illiquidity of the country is accompanied by a banking crisis prior to a default.

[13] We include only lagged crises indicators in single equation estimation. The potential endogeneity problem due to the simultaneity of the three crises is dealt with joint probability estimations in the second part of empirical section.

[14] Another indirect link from currency crisis to sovereign default might be through the high foreign indebtedness of a country. If a country is internationally illiquid, this might increase the default risk following currency depreciation. We analyse this indirect link by including the interaction of the lagged currency crisis dummy with short-term external debt. However, the term is mainly insignificant or having a counter-intuitive sign for significant observations. The reason might be that this variable also includes the domestic currency-denominated external debt as well as foreign currency debt.

Table 4
Marginal Effects of the Interaction Terms.

	Mean	Min	Max
Interaction Terms	(z-stats)	(z-stats)	(z-stats)
Currency Crisis $_{t-1 \text{ to } t-12}$ × Exchange Rate Overvaluation $_{t-1}$	−0.067	−8.650	0.623
	(1.34)	(−10.184)	(4.563)
Banking Crisis $_{t-1 \text{ to } t-12}$ × Short-term External Debt $_{t-8}$	0.011	0.000	0.115
	(1.44)	(0.014)	(3.667)

Notes: The marginal effects of the interactions terms are calculated with the "inteff" command (Norton et al., 2004) in STATA 14.

The model, on average, has 20 percent pseudo R-squared which is a reasonable fit. However compared to Manasse et al. (2003) its success is somewhat lower in explaining the sovereign debt crisis. The reasons might be due to the fact that our models have monthly observations with a large number of tranquil periods and we do not include as extensive a set of explanatory variables asManasse et al. (2003).[15] The goodness of fit measure for the percentages of correct predictions represents a loose predictive power of the crisis variable if the threshold is set to 10 percent in defining a crisis, which is around 8 – 12 percent for the crisis months. When the threshold is set to 1 percent, the model predicts 58 – 67 percent of the actual crisis episodes and 90 percent of the actual non-crisis episodes correctly depending on the specification. This represents a relatively successful fit of the model to the data. These results are analogous to similar studies in the empirical literature for the overall prediction of observations.[16]

The findings of Table 3 in general confirm the results of previous literature, but we find that among the two main indicators of sovereign debt crises which are solvency and liquidity, we find that illiquidity plays a main role in rising the default probability. Besides illiquidity, worsening current account position, inflation, misaligned exchange rates and rise in the domestic and world interest rates increase the probability of sovereign default. Apart from these results, the political and institutional environment, which indicate the willingness to pay of debtor country, and finally, the lagged banking crises are also significant determinants of sovereign debt crisis.

We also test the performance of the model by re-estimating the model with the sample until the end of 1995 and generating out-of-sample predictions for the observations after the year 1995. The estimates for the sub-sample with observations until 1995 are used to generate the predictions of the subsample for the years after 1995. Table 5 shows the percentage of the correct predictions of the observations from 1996 onwards. The predictions are based on the estimations of specifications in column 1 of Table 3. Once again, for classifying a crisis observation we use the same thresholds that if the predicted value of the dependent variable exceeds 10 and 1 percent it is considered as a crisis observation.

The out-of-sample predictions with the 10 percent cut-off value perform poorly in predicting crisis observations. Two out of 13 crisis observations (Colombia 1999, Russia 1998) are predicted by the model while 513 observations are diagnosed incorrectly as crisis observations (type 1 error is 11.44 percent). Setting a lower cut-off value increases the correctly predicted crisis observations to 6 (Argentina 2001, Brazil 1996, Colombia 1999, Ecuador 2008, Indonesia 1997, Russia 1998), although it decreases the percentage of correct non-crisis observations predicted by the model. The lower threshold, on the other hand, increases type 1 errors to 27.40 percent. The predictions are fairly accurate given the low number of crisis observations and high number of tranquil periods in our sample.

3.3. Sensitivity analyses

In this part, we present the results of the robustness checks of the specifications in Table 3 to changes in estimation methods and an alternative definition of sovereign debt crisis. First, we consider the rare nature of the crisis events. Monthly data limits the actual crises observations to a small number leading to a large number of non-crises observations compared to crises observations in the sample. This might lead to a bias in the pooled probit estimations. Therefore the specifications in Table 3 are estimated with the rare events logit estimator (readers can refer to King and Zeng (2001) for the details of the estimation technique) which corrects the data in the presence of the rare realizations of the dependent variable. The results are presented in Appendix B, Table B1. Apart from the significant GDP growth rate and lower significance of the interaction term of lagged currency crises with misaligned exchange rates, the results confirm the pooled probit estimation results.

Another concern is that macroeconomic and institutional variables included in the analyses may not control for all the country-specific characteristics existing in the models estimated. These unobservable country effects might lead to biased results of the pooled probit estimations. The fixed-effects model assumes that the individual characteristics of each country are correlated with the regressors and eliminates the time-invariant characteristics from the predictor variables. Since fixed-

[15] Our results also have lower fits compared to other yearly studies as Gennaioli et al. (2014), and Bordo and Meissner (2006).

[16] Since every study sets a different threshold for crisis prediction, it is difficult to compare these percentages exactly with other studies. Bordo and Meissner (2006) also set their threshold to 1 percent and they have a high percentage of actual crises correctly predicted by their model. Our model is more successful in predicting non-crisis observations. The reasons might be the higher frequency data in our study and different sample coverages.

Table 5
Out of Sample Predictions for the sample after 1995.

Goodness of fit (10 percent cutoff)		Goodness of fit (1 percent cutoff)	
% of observations correctly predicted	99.72	% of observations correctly predicted	72.52
% of crises correctly predicted	15.38	% of crises correctly predicted	46.15
% of non-crises correctly predicted	88.35	% of non-crises correctly predicted	72.60

effects probit model cannot be consistently estimated, the specifications in Table 3 are estimated with the conditional logit model[17] (Chamberlain, 1980) taking into account the fixed country effects.[18] The results of the re-estimation of the specifications in Table 3 by conditional logit model are presented in Appendix B, Table B2. Some variables like real international and domestic interest rates, short-term external debt, lagged banking crisis, political environment, and the interaction of lagged currency crisis with exchange rate overvaluation have lower significance levels; the other results confirm the pooled probit estimation results.

As the last part of the sensitivity analysis we use an alternative sovereign debt crisis dates that is developed by Asonuma and Trebesch (2016) which is extended until September 2020. Their database includes defaults and restructurings between governments and foreign private creditors. A given month is considered as a "default month" if i) the government misses the first payment to foreign creditors or ii) the government announces a debt restructuring. According to their database there are 33 sovereign debt defaults in our sample,[19] which is a smaller number compared to the database of Arteta and Hale (2008). There are several reasons for this; Arteta and Hale (2008) (and IMF, 2021) also include official debt in their database as well as voluntary debt swaps and debt buybacks on top of the restructuring agreements, which makes it a broader definition compared to that of Asonuma and Trebesch (2016). We re-estimate our specifications in Table 3, with the Asonuma and Trebesch (2016) default dates using the pooled probit model and present the results in Appendix B, Table B3. We observe some different results in Table B3: Public Debt to GDP becomes positive and significant, while short-term external debt becomes negative. Indicating that solvency plays a higher role in leading to sovereign debt defaults to private creditors rather than liquidity. The reason for the negative sign of short-term external debt might be that the negotiations with private creditors start after the country starts decreasing their external leverage. Arteta and Hale (2008) argues that the negotiations with private creditors take place after official creditors negotiate with the sovereigns. Therefore the country might already start deleveraging before it defaults on its private debt. Real domestic interest rates, inflation and political environment have lower significance. On the other hand, real US policy rates, misaligned exchange rates, current account position, and market environment are robust to changes in default dates. As for the currency and banking crises; currency crises still negatively influence future defaults, banking crises have a robust positive effect, but significance and the magnitude of the effect is somewhat smaller. The interaction terms confirm our results with having the anticipated effect on future defaults. In general, the specifications with the default dates of Asonuma and Trebesch (2016) have higher explanatory power and predict higher percentage of correct crisis periods, though once again the specifications are more successful in predicting non-crisis observations. So, our model fits well to the default dates of Asonuma and Trebesch (2016).

The results from this section point out that the main conclusions do not differ substantially with changes in the estimation methods and sovereign debt crisis definition. Similar to the main results, currency crisis onset does not significantly increase future debt crisis probability, and banking crisis onset positively contributes to the future debt defaults. Generally, we see that the effects of macroeconomic and institutional variables on debt crisis probability are robust to changes in estimation methods and sovereign debt crisis definition.

4. Empirical results: Debt, banking and currency crises

So far our focus has been on the sovereign debt crisis and its determinants. In this part of the empirical analysis we focus firstly on the role of sovereign default in predicting future banking and currency crises, and secondly on the probability of the joint occurrence of the three crises. Initially the lagged effects of sovereign default on the probability of currency and banking crises are analyzed by estimating two separate models for currency and banking crises with a lagged debt crisis indicator included along with other determinants of these crises. Secondly, the simultaneity of the three crises models is handled with joint estimation of a three-equation system applying a multivariate probit model using maximum simulated likelihood estimation.

[17] The conditional logit is the probability which is conditional on the number of the matched set. The intercept is different for each set and is not estimated by the model. Therefore, the predicted probabilities cannot be estimated, making the reader rely on the marginal effects and the percentage of correct predictions resulting from the pooled probit estimations.

[18] The joint significance of the fixed-time effects are also tested resulting in a failure in rejecting the null that all month coefficients are jointly equal to zero. Therefore they are not included in the specifications.

[19] Except India which is not included in the database of Asonuma and Trebesch (2016).

Table 6
Pooled Probit Estimation Results of Currency and Banking Crises Models.

Variables	Estimates (z-stats)	Variables	Estimates (z-stats)
	Elasticity		Elasticity
Dependent Variable: Currency Crisis Onset		Dependent Variable: Banking Crisis Onset	
Debt Crisis $_{t-1 \text{ to } t-12}$	0.154	Debt Crisis $_{t-1 \text{ to } t-12}$	0.132
	(0.53)		(0.22)
	0.001		0.0005
Real International Interest Rates $_{t-1}$	**0.059*****	Exchange Rate Overvaluation $_{t-1}$	**−4.182*****
	(2.89)		(−2.70)
	0.0004		−0.013
Exchange Rate Overvaluation $_{t-1}$	**−3.082*****	Capital Account Openness $_{t-1}$	−0.085
	(−3.25)		(−0.89)
	−0.021		−0.0003
Current Account Position $_{t-1}$	−0.787	Current Account Position $_{t-1}$	**−1.876*****
	(−0.72)		(−1.55)
	−0.005		−0.006
Stock Prices $_{t-3}$	**−3.141*****	Inflation $_{t-6}$	**10.453*****
	(−4.31)		(4.15)
	−0.022		0.034
Capital Account Openness $_{t-1}$	*0.050*	Stock Prices $_{t-2}$	−2.319**
	(0.67)		(−2.18)
	0.0003		−0.007
Δ Public Debt $_{t-1}$	**0.367*****	Δ Public Debt $_{t-6}$	0.230
	(3.59)		(1.15)
	0.003		0.001
GDP Growth $_{t-1}$	−0.067	GDP Growth $_{t-1}$	−0.328
	(−0.31)		(−1.41)
	−0.001		−0.001
Δ Domestic Credit by Banking Sector $_{t-1}$	**0.221*****	Election $_{t-1}$	**0.914*****
	(3.48)		(3.77)
	0.002		0.012
Election $_{t-1}$	0.155	Real International Interest Rate $_{t-2}$	0.013**
	(0.42)		(2.53)
	0.001		0.00004
Market Environment $_{t-1}$	*0.040*	Real Domestic Interest Rate $_{t-1}$	0.007
	(0.37)		(0.25)
	0.0003		0.00002
Political Environment $_{t-1}$	−0.058	Δ Domestic Credit to Private Sector $_{t-1}$	0.218**
	(0.83)		(2.25)
	−0.0004		0.001
		Market Environment $_{t-1}$	*0.312***
			(2.06)
			0.001
		Political Environment $_{t-1}$	−0.012
			(−0.21)
			−0.00004
Pseudo-R^2	0.185	Pseudo-R^2	0.272
Number of Observations	4708	Number of Observations	4115
Log-Likelihood	−143.940	Log-Likelihood	−76.304

Notes: Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. The marginal effects are evaluated at the sample mean for continuous variables and for change from zero to one for dummy variables holding all other variables at their mean. In order to convert the marginal effects into percentages they should be multiplied by 100.

4.1. Debt crisis as a determinant of currency and banking crises

The theoretical studies mentioned before also suggest that an initial debt crisis might lead to a currency and/or banking crisis. Some empirical studies look at these reverse causalities from debt crises to currency crises (Reinhart, 2002; Dreher et al., 2006; Herz and Tong, 2008) or to banking crises (Reinhart and Rogoff, 2011; Borensztein and Panizza, 2009) and their findings, outlined in this paper, are mixed. In order to analyze the predictive power of sovereign default occurring prior to banking and currency crises, we estimate the banking and currency crises models based on Eijffinger and Karataş (2020) including the composite lagged occurrence of sovereign default in the previous twelve-month period together with the macroeconomic and institutional indicators.[20]

[20] We use, again, the general-to-specific approach to determine the appropriate lag structure of the regressors.

Table 7
Multivariate Probit Estimation Results for Banking, Currency and Debt Crises.

Dependent Variable: Sovereign Default	Estimates (z-stats)	Dependent Variable: Banking Crisis	Estimates (z-stats)	Dependent Variable: Currency Crisis	Estimates (z-stats)
ΔPublic Debt $_{t-1}$	*−0.207***	ΔPublic Debt $_{t-6}$	0.176	ΔPublic Debt $_{t-1}$	**0.638****
	(−2.31)		(0.96)		(5.68)
Real Inter. Interest Rate $_{t-4}$	0.022**	Real Intern. Interest Rate $_{t-2}$	0.008	Real Inter. Interest Rate $_{t-1}$	**0.063****
	(2.46)		(1.32)		(2.76)
Real Dom. Interest Rate $_{t-3}$	0.019	Real Dom. Interest Rate $_{t-1}$	*0.012*	ER Overvaluation $_{t-1}$	**−3.159****
	(0.77)		(0.63)		(−2.60)
ER Overvaluation $_{t-1}$	**−4.349****	ER Overvaluation $_{t-1}$	−3.180**	Current Account Pos. $_{t-1}$	*0.089*
	(−3.03)		(−1.97)		(0.06)
Current Account Pos. $_{t-4}$	*0.592*	Current Account Pos. $_{t-1}$	−0.875	GDP Growth $_{t-1}$	−0.154
	(1.18)		(−0.69)		(−0.57)
GDP Growth $_{t-1}$	−0.280	GDP Growth $_{t-1}$	−0.499	Election $_{t-1}$	0.223
	(−0.64)		(−1.63)		(0.61)
Inflation $_{t-1}$	*−6.019*	Inflation $_{t-6}$	**12.858****	Market Environment. $_{t-1}$	−0.027
	(−0.77)		(4.86)		(−0.31)
Election $_{t-1}$	0.205	Election $_{t-1}$	**0.942****	Political Environment. $_{t-1}$	−0.142*
	(0.53)		(3.21)		(−1.92)
St External Debt $_{t-8}$	0.127**	Market Environment $_{t-1}$	*0.321**	Stock Prices $_{t-3}$	**−2.196****
	(2.50)		(1.82)		(−2.62)
Market Environment $_{t-1}$	**−0.511****	Political Environment. $_{t-1}$	*0.025*	KA Openness $_{t-1}$	0.055
	(−3.29)		(0.30)		(0.62)
Political Environment $_{t-1}$	−0.271*	Stock Prices $_{t-2}$	**−2.753****	ΔDomestic Credit $_{t-1}$	−0.100
	(−1.93)		(−2.77)		(−1.41)
		KA Openness $_{t-1}$	−0.120		
			(−1.04)		
		ΔDom. Crd. to Prv. Sect. $_{t-1}$	**0.330****		
			(5.09)		
Number of Observations	3095				
Rho (12)	0.628***	Rho (23)	0.455***	Rho (13)	0.410**
Likelihood ratio test of rho (12) = rho (23) = rho (13) = 0: chi2(3) = 15.924 Prob > chi2 = 0.001					

Notes: The estimation is conducted by using the ‘‘mvprobit” command for STATA 14 written by Cappellari and Jenkins (2003) applying 50 number of draws in calculating the simulated likelihood. Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. Calculation of marginal effects is not straightforward in multivariate probit models. Hence the reader should rely on the elasticities of single equation probit estimations.

The results, indicated in Table 6 suggest that debt crises do not significantly increase the likelihood of future banking and currency crises. We confirm the robustness of these findings with the rare events and conditional logit estimations; the estimations with the Asonuma and Trebesch (2016) sovereign default dates are shown in Table B5, which confirms our results inTable 6.[21] For the currency crisis, the result confirms the findings of Reinhart (2002) and Bordo and Meissner (2006). They also do not find any significant relationship between lagged debt crises and currency crises. For the banking crisis, the result is analogous to those of Reinhart and Rogoff (2011), and Borensztein and Panizza (2009). The studies that find a significant relationship between lagged debt crisis and banking crisis find that link only for the countries that have banks exposed highly to sovereign debt (Gennaioli et al., 2014) or for advanced economies (Babecký et al., 2014), which can explain the insignificant effect in our emerging economy sample. Thus we can conclude that the expected reverse relationship between debt crises and currency/banking crises suggested by the theoretical literature is not supported empirically.

4.2. Simultaneity of debt, currency and banking crises

Rather than spreading to one another; currency, banking, and sovereign debt crises might also be jointly determined by common fundamentals. In this section, we apply the method of maximum smoothly simulated likelihood estimation in order to jointly estimate the three crises equations. Initially developed by Börsch-Supan and Hajivassiliou (1993), this method uses Geweke-Hajivassiliou-Keane (GHK)[22] simulation to calculate the high dimensional normal integrals in the likelihood function resulting from estimating a system of three equations. Each replication calculates a likelihood contribution for every observation. These generated values from each replication are averaged to calculate the simulated likelihood contribution. After this, the standard maximum likelihood method is used to maximize the simulated likelihood function for the whole sample. This method provides asymptotically efficient simulation-based estimation for the banking, currency and sovereign debt crises mod-

[21] The lagged debt crisis indicator is omitted in the banking crisis probit estimation – indicating that these two indicators are never 1 in the same month – the linear probability estimation confirms that lagged debt crisis doesn't increase banking crisis probability.
[22] See Greene (2003) for further explanation.

els by computing the high dimensional integrals that define the joint probabilities in the likelihood function. The estimated extra parameter, ρ *(rho),* measures the correlation of the error terms between the three equations and addresses the endogeneity of three crises models that they might be caused by common unobservable factors. Since there are three equations, three correlation coefficients are estimated: *(rho(12))* is the correlation coefficient between the error terms of sovereign debt and banking crises equations, *(rho(23))* is between banking and currency crises, and *(rho(13))*, is the correlation coefficient between sovereign debt and currency crises. The estimation results of the multivariate probit model are represented in Table 7. For the sovereign debt crisis equation, we use the specification in column 1 of Table 3, and for currency and banking crises we use the specifications in Table 6, excluding the lagged debt crisis indicator.

The estimated correlation coefficients between the models are presented in the lower part of Table 7. The likelihood ratio test rejects the null of zero correlation between the error terms of the three crises equations, implying that the three models are connected and endogenously determined by common unobservable factors. Therefore, the estimated coefficients of the multivariate probit model account for the unobserved correlations among the three crises. If we look at the correlation coefficients between the crises equations, we see that the correlation coefficients of the error terms of sovereign default and banking crisis equations *(rho(12))*, and between currency and banking crises equations *(rho(23))* are highly significant and positive. The last correlation coefficient of the error terms of sovereign debt and currency crises *(rho(13))* is also positive with a lower significance. This result suggests that the unobservable factors that affect the probability of one of the three crises influence the probability of the other two crises as well indicating that a country can experience a simultaneous banking, currency, and sovereign debt crisis in the same month caused by common unobservable factors. Again, we check the robustness of this result by using the alternative debt crisis database of Asonuma and Trebesch (2016). The results (Table B6 in Appendix B) indicate a correlation coefficient between banking and debt crises equations equal to 0.519, and between banking and currency crises equations equal to 0.449 that are highly significant. However, the correlation between the error terms of sovereign debt and currency crises equations, 0.066, is insignificant. The likelihood ratio fails to reject the null that all three correlation coefficients are zero at 5 % significance level. So, apart from the debt and currency crisis equations, the alternative default dates confirm our initial results.

Therefore, by estimating the crises models jointly with multivariate probit analysis, we evidence the interdependence of the three crises models, that banking crises, currency crises and sovereign debt crises increase one another's likelihood and they can all occur jointly in a given month.

5. Conclusion

This study provides high frequency empirical analysis on the determinants of sovereign debt crises and the probability of triple – banking, currency and sovereign debt – crises in emerging economies. We include 21 countries from January 1985 until December 2020 in our sample. Initially, we analyze the determinants of sovereign debt crises. The influence of macroeconomic and institutional indicators, together with the indicators of currency and banking crises on the likelihood of sovereign defaults are investigated. In uncovering indirect links, we include the interactions of international illiquidity with banking crises, and overvalued exchange rates with currency crises. Following these estimations, we analyze the contribution of lagged sovereign defaults on the likelihood of currency and banking crises. Finally, the simultaneity of sovereign debt, currency and banking crises is investigated by jointly estimating these three types of crises models using the multivariate probit approach.

The empirical literature gains important insights from the results of this study. Firstly, we establish simultaneity between sovereign debt, currency, and banking crises. These three crises tend to occur in the same month caused by common unobservable factors. There is also strong evidence that a banking crisis increases the future sovereign default risk. However, sovereign defaults do not increase the future banking crises likelihood. This finding is in line with the results of Reinhart and Rogoff (2011), who also find that lagged and contemporaneous banking crises help in predicting sovereign defaults in a single equation setting.[23] As for the relationship between currency and sovereign debt crises, we find a positive simultaneous relationship between these two crises models. However, the lagged currency crisis has a negative effect on the sovereign debt crisis likelihood, which has a higher significance level for the default dates of Asonuma and Trebesch (2016). Theoretically Bauer et al. (2003) proves, that sovereign default and currency crises can be two alternatives for the government in financing its budget deficit. Empirically, this result confirms the findings of Dreher et al. (2006) which explains the lagged negative effect of currency crisis on debt crisis through the alternative way of government budget financing, but claims that contagion effects play a higher role in the relationship between currency and sovereign debt crisis in the short-term.

Additionally, our study discovers some indirect effects of currency and banking crises on sovereign defaults through the worsening of macroeconomic variables. Currency crisis gives rise to the future debt crisis probability through appreciated real exchange rates, confirming the results of Jahjah and Montiel (2003). International illiquidity – proxied by the ratio of

[23] Gennaioli et al. (2014) and Babecký et al. (2014) also find a strong relationship between lagged banking crises and sovereign defaults. Borensztein and Panizza (2009) also fail to find any relationship between lagged defaults and banking crises.

short-term foreign debt to reserves – indirectly increases default probability if a banking crisis happens prior to a sovereign default. This result is in line with the theoretical model of Arellano and Kocherlakota (2014). As for the determinants of sovereign defaults, our results follow the previous empirical evidence. We find that both macroeconomic indicators and the quality of institutions are important determinants of sovereign defaults, apart from the lagged banking crises onset. Sovereign defaults are more likely in countries where there is rising current account deficit, the ratio of short-term foreign debt to reserves is large, the inflation rate is high, the real exchange rates are overvalued, domestic interest rates are rising, there is exposure to elevated international interest rates, and the institutional and political environments are highly risky.

The most important policy implication from the results of our study is that the banking sector problems go hand in hand with sovereign problems. The costs of financial sector crises to an economy are substantial. These costs can directly damage the fiscal budget through rescue plans or degraded tax revenues. Additionally, the economic downturn following the banking crisis itself indirectly increases the fiscal burden and decreases government income through unemployment and output costs. Governments should be careful in using fiscal policies during financial crises since, as argued by Baldacci and Gupta (2009), even in favorable external environments, banking crises are detrimental for the government deficit. Especially the role played by illiquidity is crucial in linking banking crisis to sovereign debt crisis. This is demonstrated by this empirical analysis with banking crises and rising short-term external debt prior to defaults. On the other hand, the rise in the instability of the financial system might result in currency, banking and sovereign debt crises occurring jointly. A coordinated, sudden stop by foreign investors anticipating a default increases the risk of a currency crisis, rises the costs of funding for the government, and hence puts pressure on the domestic financial sector. Where government relies heavily on the foreign investors and domestic financial sector, as in emerging economies, this "coordination failure" results in simultaneous sovereign debt, currency, and banking crises.

The consistency of government and the central bank in implementing their policies is crucial whether the three crises occur simultaneously or a default is led by a banking crisis. Unsustainable fiscal and monetary policies might change the perception of the foreign creditors, and crisis anticipation leads them to pull their funds out of the country leaving the financial sector, domestic currency, and government in crisis. Similarly, any loss of trust in the domestic financial sector might cause a panic in the markets, leading to a financial crisis, while the resulting economic downturn cannot be cushioned by the government which relies heavily on the foreign creditors and the domestic financial sector. To avoid these cases, government should focus on strengthening the growth potential of the economy and improving the external financial position of the country. Monetary policy should support fiscal policy to sustain the markets' trust in the economy. Our findings also implies that as long as the financial sector is sound, the government postpones the default decision. In this sense, the results not only explain the default decisions by emerging economies, but also provide some insights in explaining the sovereign debt crises in advanced economies.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Data Descriptions

See Table A1-A3

Table A1
Data Descriptions.

Explanatory Variables	Construction and Sources	Frequency
Macroeconomic Variables		
Public Debt	Gross Central Government Debt divided by GDP (IMF GGD[a])	Annual, linear interpolation
Short-term External Debt Position	The ratio of short-term external debt to total reserves (World Bank, WDI[d])	Annual, linear interpolation
Current Account Position	The difference of a country's exports and imports expressed in US dollars divided by non-gold reserves. (IMF IFS[b] lines 70D, 71D, RF and 1LD)	Monthly
Exchange Rate Overvaluation	The deviation of the real exchange rate from the trend which is calculated using Hodrick-Prescott filter with a parameter of 129,000 (IMF IFS[b] lines RF and 64)	Monthly
The Growth Rate of GDP	The percentage change in the GDP in constant prices local currency. (World Bank, WDI[d])	Annual, linear interpolation
Real Domestic Interest Rate	The money market interest rate subtracted by the inflation rate expressed as percentage change (IMF IFS[b] lines 60B and 64)	Monthly
Inflation	The percentage change in the Consumer Price Index (IMF IFS[b] line 64)	Monthly
Real International Interest Rate	The US Federal Funds rate subtracted by the US inflation rate expressed as percentage change (IMF IFS[b] lines 60B and 64)	Monthly
Stock Prices	The percentage change in share prices (IMF IFS[b] line 62), OECD, DataStream	Monthly
Capital Account Openness Index	The Chinn-Ito Index measuring country's degree of financial openness (Chinn and Ito, 2006[c])	Annual
Domestic Credit by Banking Sector	The ratio of domestic credit provided by the banking sector to GDP. (World Bank, WDI[d])	Annual, linear interpolation
Domestic Credit to Private Sector	The ratio of domestic credit to private sector to GDP. (World Bank, WDI[d])	Annual, linear interpolation
Institutional and Political Variables		
Election	The Parliamentary and presidential election dates. (Election Guide[e],)	Monthly
Financial Risk Rating	Assessment of a country's ability to finance its official, commercial and trade debt obligations. (PRS Group, ICRG[f])	Monthly
Economic Risk Rating	Assessment of a country's current economic strengths and weaknesses. (PRS Group, ICRG[f])	Monthly
Government Stability	Assessment of the government's ability to carry out its declared programs and its ability to stay in the office. (PRS Group, ICRG[f])	Monthly
Bureaucracy Quality	Assessment of the strength and quality of the bureaucracy in the political system. (PRS Group, ICRG[f])	Monthly
Law and Order	Assessment of the strength of the legal system and observance of law. (PRS Group, ICRG[f])	Monthly
Democratic Accountability	Assessment of how responsive the government is towards its people. (PRS Group, ICRG[f])	Monthly
Investment Profile	Assessment of the risk to investment. (PRS Group, ICRG[f])	Monthly

[a] International Monetary Fund, Global Debt Database [b] International Monetary Fund, International Financial Statistics [c] Extracted from: <http://web.pdx.edu/~ito/> [d] World Development Indicators [e] Consortium for Elections and Political Process Strengthening. Extracted from: <http://www.electionguide.org/> [f] Political Risk Services Group, International Country Risk Guide Rating.

Table A2
Rotated Factor Loadings of Institutional Variables.

	Factor 1 Market Environment	Factor 2 Political Environment	Uniqueness
Financial Quality	**0.842**	0.030	0.289
Economic Quality	**0.803**	0.181	0.322
Government Stability	**0.715**	−0.079	0.483
Investment Profile	**0.655**	0.309	0.476
Bureaucracy Quality	0.167	**0.786**	0.354
Law and Order	0.352	**0.446**	0.677
Democratic Accountability	−0.027	**0.807**	0.348
Variance Explained	0.350	0.229	

Notes: The factor analysis is conducted in STATA 14 based on principal-component method. All institutional variables are lagged one-month. Orthogonal varimax rotation is implemented to generate uncorrelated factor loadings by maximizing the variance of the squared loadings within factors. The relevant variable per factor is indicated in bold. The two factors explain 57.9% of the total variance in the indicators.

Table A3
Correlation Coefficients.

	Debt Crisis	Currency Crisis	Banking Crisis	ΔPub. Debt	Real Int. Int Rates	Real Dom. Int. Rates	ER Over.	CA Pos.	GDP Growth
Debt Crisis	1.000								
Currency Crisis	0.056	1.000							
Banking Crisis	0.219	0.123	1.000						
ΔPublic Debt	0.010	0.092	0.011	1.000					
Real Int. Interest Rates	0.004	0.039	0.004	−0.012	1.000				
Real Dom. Interest Rates	0.004	−0.002	0.007	−0.012	0.015	1.000			
ER Overvaluation	−0.051	−0.080	−0.078	−0.023	−0.006	−0.013	1.000		
CA Position	−0.065	−0.013	−0.009	−0.196	−0.016	0.029	0.031	1.000	
GDP Growth	−0.027	−0.068	−0.034	−0.405	−0.026	0.004	0.044	0.119	1.000
St External Debt	0.110	0.040	0.051	0.018	0.022	−0.020	−0.085	−0.351	−0.087
Inflation	0.016	0.003	0.008	−0.063	−0.016	−0.035	0.040	−0.248	−0.070
Election	0.015	0.009	0.074	0.012	0.026	−0.006	−0.021	−0.011	0.002
Stock Prices	−0.014	−0.060	−0.029	−0.020	−0.005	−0.015	0.037	−0.038	0.041
KA Openness	−0.019	0.008	−0.020	0.026	0.024	−0.031	−0.092	−0.002	−0.260
Δ Domestic Credit	−0.013	0.028	−0.009	0.272	−0.007	−0.016	−0.129	−0.048	−0.080
Δ Priv. Sector Dom. Cr.	−0.019	0.017	−0.022	0.004	−0.012	0.003	−0.178	−0.022	0.079
Market Environment	−0.084	−0.009	0.012	−0.045	−0.013	0.046	−0.098	0.432	0.300
Political Environment	−0.021	−0.026	−0.012	0.038	0.003	−0.032	0.039	−0.156	−0.190
	St Ext. Debt	Inflation	Election	Stock Prices	KA Openness	ΔDom. Credit	Δ Priv. Dom. Cr.	Market Env.	
St External Debt	1.000								
Inflation	0.264	1.000							
Election	0.032	0.007	1.000						
Stock Prices	0.120	0.080	0.019	1.000					
KA Openness	0.127	−0.135	−0.013	−0.043	1.000				
Δ Domestic Credit	−0.088	−0.077	−0.009	−0.007	−0.047	1.000			
Δ Priv. Sector Dom. Cr.	−0.044	−0.055	0.003	−0.005	0.003	0.805	1.000		
Market Environment	−0.476	−0.346	−0.025	−0.076	−0.013	0.100	0.116	1.000	
Political Environment	0.129	0.086	0.001	0.014	0.223	−0.094	−0.089	−0.413	

Appendix B. Results of sensitivity analyses

See Table B1-B6

Table B1
Rare Events Logit Estimation Results of Sovereign Debt Crisis.

Variables	(1)Estimates (z-stats) Elasticity	(2)Estimates (z-stats) Elasticity	(3)Estimates (z-stats) Elasticity	(4)Estimates (z-stats) Elasticity	(5)Estimates (z-stats) Elasticity	(6)Estimates (z-stats) Elasticity
ΔPublic Debt $_{t-1}$	*−0.140*	*−0.119*	*−0.454**	*−0.444*	*−0.378*	*−0.417*
	(−0.56)	(−0.44)	(1.81)	(1.50)	(−1.38)	(−1.46)
Real International Interest Rate $_{t-4}$	**0.047*****	**0.051*****	**0.041*****	**0.050*****	**0.040*****	**0.051*****
	(5.53)	(6.24)	(5.53)	(6.62)	(4.64)	(7.00)
Real Domestic Interest Rate $_{t-3}$	**0.226*****	**0.223*****	**0.225*****	**0.223*****	**0.228*****	**0.220*****
	(5.91)	(5.87)	(5.42)	(5.39)	(5.36)	(3.70)
Exchange Rate Overvaluation $_{t-1}$	−6.810**	−6.556**	**−7.579*****	−7.482**	−6.341**	−7.945**
	(−2.27)	(−2.01)	(−2.87)	(−2.58)	(−2.10)	(−2.47)
Current Account Position $_{t-4}$	**−1.874*****	**−1.824*****	**−1.383*****	−1.361**	−1.223*	**−1.092*****
	(−5.89)	(−5.58)	(−2.64)	(−2.46)	(−1.93)	(−2.65)
GDP Growth $_{t-1}$	−1.267**	−1.302**	−1.262*	−1.270*	−1.365*	−1.214*
	(−1.96)	(−2.00)	(−1.79)	(−1.82)	(−1.87)	(−1.67)
Short-Term External Debt $_{t-8}$	**0.338*****	**0.325*****	**0.409*****	**0.404*****	**0.354*****	**0.395*****
	(3.40)	(2.73)	(3.45)	(2.84)	(2.87)	(2.86)

Table B1 (*continued*)

Variables	(1)Estimates (z-stats) Elasticity	(2)Estimates (z-stats) Elasticity	(3)Estimates (z-stats) Elasticity	(4)Estimates (z-stats) Elasticity	(5)Estimates (z-stats) Elasticity	(6)Estimates (z-stats) Elasticity
Inflation $_{t-1}$	**10.512*****	**10.469*****	**12.558*****	**12.497*****	**11.372*****	**12.069*****
	(6.60)	(6.61)	(5.23)	(4.73)	(4.69)	(4.42)
Currency Crisis $_{t-1 \text{ to } t-12}$		*−0.022*		0.261	*−1.614*	0.272
		(−0.02)		(0.20)	(−0.57)	(0.21)
Banking Crisis $_{t-1 \text{ to } t-12}$			**1.714*****	**1.707*****	**1.756*****	1.355*
			(4.04)	(4.02)	(4.08)	(1.65)
Election $_{t-1}$	0.434	0.434	0.626	0.630	0.615	0.653
	(0.39)	(0.39)	(0.54)	(0.55)	(0.53)	(0.56)
Market Environment $_{t-1}$	**−0.788*****	**−0.783*****	**−0.759*****	**−0.756*****	**−0.817*****	**0.759*****
	(−4.17)	(−4.18)	(−3.65)	(−3.61)	(−4.14)	(−3.52)
Political Environment $_{t-1}$	−0.471	−0.499*	−0.521*	−0.530**	−0.492*	−0.536*
	(−1.59)	(−1.65)	(−1.81)	(−1.85)	(−1.73)	(−1.87)
Currency Crisis $_{t-1 \text{ to } t-12}$ X RER $_{t-1}$					−21.528*	
					(−1.86)	
Banking Crisis $_{t-1 \text{ to } t-12}$ × St Ext. Debt $_{t-8}$						0.327
						(0.84)
Number of Observations	5565	5446	4881	4803	4803	4803

Notes: The estimations are conducted using "relogit" command in STATA 14. Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold.

Table B2
Conditional (Fixed- Effects) Logit Estimation Results of Sovereign Debt Crisis.

Variables	(1)Estimates (z-stats) Elasticity	(2)Estimates (z-stats) Elasticity	(3)Estimates (z-stats) Elasticity	(4)Estimates (z-stats) Elasticity	(5)Estimates (z-stats) Elasticity	(6)Estimates (z-stats) Elasticity
ΔPublic Debt $_{t-1}$	0.082	0.122	*−0.218*	*−0.204*	*−0.116*	*−0.204*
	(0.35)	(0.49)	(−0.71)	(−0.64)	(−0.35)	(−0.64)
Real International Interest Rate $_{t-4}$	0.035	0.036	0.038	0.039	0.038	0.038
	(0.26)	(0.27)	(0.25)	(0.26)	(0.24)	(0.23)
Real Domestic Interest Rate $_{t-3}$	0.108	0.108	0.097	0.097	0.101	0.097
	(1.08)	(1.08)	(0.92)	(0.93)	(0.98)	(0.92)
Exchange Rate Overvaluation $_{t-1}$	**−6.550*****	**−6.367*****	**−7.336*****	**−7.268*****	−5.946**	**−7.384*****
	(−3.00)	(−2.87)	(−3.17)	(−3.10)	(−2.35)	(−3.05)
Current Account Position $_{t-4}$	**−4.767*****	**−4.660*****	−3.945**	−3.891**	−3.439**	−3.760**
	(−3.08)	(−2.99)	(−2.30)	(−2.23)	(−1.98)	(2.06)
GDP Growth $_{t-1}$	−0.519	−0.526	−0.581	−0.578	−0.454	−0.574
	(−0.65)	(−0.66)	(−0.65)	(−0.64)	(−0.50)	(−0.64)
Short-Term External Debt $_{t-8}$	0.355**	0.335**	0.388**	0.380**	0.296	0.373*
	(2.16)	(1.99)	(2.11)	(2.00)	(1.52)	(1.94)
Inflation $_{t-1}$	**12.474*****	**12.460*****	**26.238*****	**26.049*****	**23.347*****	**23.913*****
	(2.95)	(2.89)	(2.88)	(2.85)	(2.65)	(2.82)
Currency Crisis $_{t-1 \text{ to } t-12}$		*−0.565*		*−1.162*	*−5.728*	*−0.163*
		(−0.49)		(−0.14)	(−1.28)	(−0.14)
Banking Crisis $_{t-1 \text{ to } t-12}$			1.727*	1.735*	1.940*	1.372
			(1.82)	(1.82)	(1.93)	(0.75)
Election $_{t-1}$	0.166	0.164	0.397	0.399	0.448	0.408
	(0.16)	(0.15)	(0.37)	(0.37)	(0.42)	(0.38)
Market Environment $_{t-1}$	−0.693**	**−0.709*****	−0.720**	−0.728**	**−0.880*****	−0.722**
	(−2.58)	(−2.61)	(−2.34)	(−2.34)	(−2.67)	(−2.32)
Political Environment $_{t-1}$	−0.048	−0.071	−0.041	−0.045	*0.028*	−0.055
	(−0.15)	(−0.23)	(−0.13)	(−0.15)	(0.09)	(−0.18)
Currency Crisis $_{t-1 \text{ to } t-12}$ X RER $_{t-1}$					−38.593	
					(−1.79)	
Banking Crisis $_{t-1 \text{ to } t-12}$ × St Ext. Debt $_{t-8}$						0.340
						(0.23)
Pseudo-R^2	0.188	0.186	0.228	0.225	0.247	0.226
Number of Observations	3639	3525	3180	3105	3105	3105
Log-Likelihood	−109.343	−109.153	−93.928	−93.887	−91.246	−93.856

Notes: The time invariant 1926 (at most) variables are dropped from the estimations. Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold.

Table B3
Pooled Probit Est. Results of Sovereign Debt Crisis with Alternative Default Dates.

Variables	(1)Estimates (z-stats) Elasticity	(2)Estimates (z-stats) Elasticity	(3)Estimates (z-stats) Elasticity	(4)Estimates (z-stats) Elasticity	(5)Estimates (z-stats) Elasticity	(6)Estimates (z-stats) Elasticity
ΔPublic Debt $_{t-1}$	0.323**	0.361**	0.368**	0.445**	0.447**	0.455**
	(2.21)	(2.27)	(2.35)	(2.51)	(2.42)	(2.48)
	0.0003	0.0004	0.0004	0.0004	0.0003	0.0004
Real International Interest Rate $_{t-4}$	0.018**	0.017**	0.014	0.014	0.013	0.014
	(2.43)	(2.21)	(1.21)	(1.25)	(1.25)	(1.26)
	0.00002	0.00002	0.00001	0.00001	0.00001	0.00001
Real Domestic Interest Rate $_{t-3}$	−0.001	−0.001	−0.002	−0.002	−0.003	−0.002
	(−0.15)	(−0.17)	(−0.52)	(−0.61)	(−0.63)	(−0.17)
	−0.000001	−0.000001	−0.000002	−0.000002	−0.000002	−0.000002
Exchange Rate Overvaluation $_{t-1}$	**−2.916*** **	−2.731**	**−3.369*** **	**−3.132*** **	−2.923**	−3.395**
	(−2.60)	(−2.31)	(−2.94)	(−2.58)	(−2.15)	(−2.50)
	−0.003	−0.003	−0.003	−0.003	−0.002	−0.003
Current Account Position $_{t-4}$	**−1.301*** **	**−1.277*** **	**−1.150*** **	**−1.103*** **	**−1.064*** **	**−0.881*** **
	(−3.85)	(−3.63)	(−3.53)	(−3.11)	(−2.72)	(−3.63)
	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
GDP Growth $_{t-1}$	*0.100*	*0.118*	*0.145*	*0.184*	*0.185*	*0.236*
	(0.26)	(0.29)	(0.32)	(0.40)	(0.39)	(0.29)
	0.0001	0.0001	0.0001	0.0002	0.0001	0.0002
Short-Term External Debt $_{t-8}$	*−0.055*	*−0.068*	*−0.072***	*−0.094****	*−0.093***	*−0.109****
	(−1.51)	(−1.66)	(−2.26)	(−2.57)	(−2.34)	(−3.23)
	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001	−0.0001
Inflation $_{t-1}$	0.680	0.139	*−0.073*	*−1.094*	*−1.194*	*−1.479*
	(0.22)	(0.05)	(−0.02)	(−0.32)	(−0.36)	(−0.41)
	0.001	0.001	−0.0001	−0.001	−0.001	−0.001
Currency Crisis $_{t-1 \text{ to } t-12}$		*−0.416*		*−0.638***	*−0.813****	*−0.792***
		(−1.44)		(−2.50)	(−3.13)	(−2.02)
		−0.0002		−0.0003	−0.0002	−0.0003
Banking Crisis $_{t-1 \text{ to } t-12}$			0.586	0.648*	0.696**	0.299
			(1.59)	(1.93)	(2.02)	(0.60)
			0.002	0.002	0.002	0.0004
Election $_{t-1}$	0.429*	0.435*	0.451*	0.464*	0.466*	0.466*
	(1.74)	(1.75)	(1.83)	(1.84)	(1.91)	(1.83)
	0.001	0.001	0.001	0.001	0.001	0.001
Market Environment $_{t-1}$	**−0.780*** **	**−0.789*** **	**−0.799*** **	**−0.826*** **	**−0.825*** **	**−0.840*** **
	(−6.01)	(−6.21)	(−6.72)	(−7.48)	(−7.31)	(−7.53)
	−0.001	−0.001	−0.001	−0.001	−0.001	−0.001
Political Environment $_{t-1}$	−0.034	−0.034	−0.049	−0.046	−0.026	−0.060
	(−0.23)	(−0.24)	(−0.34)	(−0.33)	(−0.19)	(−0.46)
	−0.00003	−0.00003	−0.0001	−0.00004	−0.00002	−0.0001
Currency Crisis $_{t-1 \text{ to } t-12}$ X RER $_{t-1}$					−6.163*	
					(−1.76)	
					−0.014	
Banking Crisis $_{t-1 \text{ to } t-12}$ × St External Debt $_{t-8}$						0.252
						(1.28)
						0.004
Pseudo-R^2	0.352	0.354	0.363	0.370	0.373	0.374
Number of Observations	5336	5216	4624	4546	4546	4546
Log-Likelihood	−78.040	−77.537	−75.076	−74.092	−73.641	−73.624
Goodness of fit (10 percent cutoff)						
% of observations correctly predicted	99.19	99.21	99.11	99.12	99.12	99.08
% of crises correctly predicted	16.67	22.22	22.22	22.22	22.22	16.67
% of non-crises correctly predicted	99.47	99.48	99.41	99.43	99.43	99.40
Goodness of fit (1 percent cutoff)						
% of observations correctly predicted	95.16	95.25	93.94	94.39	94.30	94.39
% of crises correctly predicted	83.33	83.33	88.89	88.89	88.89	88.89
% of non-crises correctly predicted	95.20	95.29	93.96	94.41	94.32	94.41

Notes: Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. The marginal effects are evaluated at the sample mean for continuous variables and for change from zero to one for dummy variables holding all other variables at their mean. In order to convert the marginal effects into percentages they should be multiplied by 100.

Table B4
Marginal Effects of the Interaction Terms.

Interaction Terms	Mean (z-stats)	Min (z-stats)	Max (z-stats)
Currency Crisis $_{t-1 \text{ to } t-12}$ × Exchange Rate Overvaluation $_{t-1}$	−0.014	−3.178	0.679
	(0.742)	(−1.878)	(2.474)
Banking Crisis $_{t-1 \text{ to } t-12}$ × Short-term External Debt $_{t-8}$	0.004	0.000	0.098
	(0.799)	(0.139)	(4.169)

Notes: The marginal effects of the interactions terms are calculated with the "inteff" command (Norton et al., 2004) in STATA 14.

Table B5
Pooled Probit Est. Results of Currency and Banking Crises with Alt. Default Dates.

Variables	Estimates (z-stats)	Variables	Estimates (z-stats)
Elasticity Dependent Variable: Currency Crisis Onset		Elasticity Dependent Variable: Banking Crisis Onset	
Debt Crisis $_{t-1 \text{ to } t-12}$	0.325	Debt Crisis $_{t-1 \text{ to } t-12}$	Omitted [a]
	(1.09)		
	0.004		
Real International Interest Rates $_{t-1}$	**0.060*****	Exchange Rate Overvaluation $_{t-1}$	−**4.182*****
	(2.89)		(−2.70)
	0.0005		−0.013
Exchange Rate Overvaluation $_{t-1}$	−**3.466*****	Capital Account Openness $_{t-1}$	−0.085
	(−3.30)		(−0.89)
	−0.027		−0.0003
Current Account Position $_{t-1}$	−0.237	Current Account Position $_{t-1}$	−**1.876*****
	(−0.20)		(−1.55)
	−0.002		−0.006
Stock Prices $_{t-3}$	−**3.125*****	Inflation $_{t-6}$	**10.453*****
	(−4.64)		(4.15)
	−0.024		0.034
Capital Account Openness $_{t-1}$	*0.003*	Stock Prices $_{t-2}$	−2.319**
	(0.69)		(−2.18)
	0.00002		−0.007
Δ Public Debt $_{t-1}$	**0.280*****	Δ Public Debt $_{t-6}$	0.230
	(3.45)		(1.15)
	0.002		0.001
GDP Growth $_{t-1}$	−0.089	GDP Growth $_{t-1}$	−0.328
	(−0.43)		(−1.41)
	−0.001		−0.001
Δ Domestic Credit by Banking Sector $_{t-1}$	**0.235*****	Election $_{t-1}$	**0.914*****
	(3.98)		(3.77)
	0.002		0.012
Election $_{t-1}$	0.177	Real International Interest Rate $_{t-2}$	0.013**
	(0.42)		(2.53)
	0.002		0.00004
Market Environment $_{t-1}$	*0.052*	Real Domestic Interest Rate $_{t-1}$	0.007
	(0.37)		(0.25)
	0.0004		0.00002
Political Environment $_{t-1}$	−0.009	Δ Domestic Credit to Private Sector $_{t-1}$	0.218**
	(−0.16)		(2.25)
	−0.0001		0.001
		Market Environment $_{t-1}$	*0.312***
			(2.06)
			0.001
		Political Environment $_{t-1}$	−0.012
			(−0.21)
			−0.00004
Pseudo-R^2	0.190	Pseudo-R^2	0.272
Number of Observations	4481	Number of Observations	4115
Log-Likelihood	−145.844	Log-Likelihood	−76.304

Notes: Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. The marginal effects are evaluated at the sample mean for continuous variables and for change from zero to one for dummy variables holding all other variables at their mean. In order to convert the marginal effects into percentages they should be multiplied by 100.

[a] As an alternative, Linear Probability Estimation is conducted for the Banking Crisis Equation. The coefficient for the lagged Debt Crisis is (−0.007) which is not significant.

Table B6
Multivariate Probit Estimation Results for Banking, Currency and Debt Crises with Alternative Default Dates.

Dependent Variable: Sovereign Default	Estimates (z-stats)	Dependent Variable: Banking Crisis	Estimates (z-stats)	Dependent Variable: Currency Crisis	Estimates (z-stats)
ΔPublic Debt $_{t-1}$	0.460*	ΔPublic Debt $_{t-6}$	0.196	ΔPublic Debt $_{t-1}$	**0.594****
	(1.85)		(0.95)		(4.56)
Real Inter. Interest Rate $_{t-4}$	0.025*	Real Intern. Interest Rate $_{t-2}$	0.001	Real Inter. Interest Rate $_{t-1}$	**0.065****
	(1.81)		(0.12)		(2.80)
Real Dom. Interest Rate $_{t-3}$	*−0.232***	Real Dom. Interest Rate $_{t-1}$	0.016	ER Overvaluation $_{t-1}$	**−3.041****
	(−2.01)		(0.71)		(−2.74)
ER Overvaluation $_{t-1}$	**−3.977****	ER Overvaluation $_{t-1}$	**−3.918****	Current Account Pos. $_{t-1}$	*0.570*
	(−2.00)		(−2.62)		(0.34)
Current Account Pos. $_{t-4}$	*0.672*	Current Account Pos. $_{t-1}$	−2.331	GDP Growth $_{t-1}$	−0.046
	(1.04)		(−1.32)		(−0.19)
GDP Growth $_{t-1}$	*0.256*	GDP Growth $_{t-1}$	−0.462	Election $_{t-1}$	0.267
	(0.52)		(−1.32)		(0.75)
Inflation $_{t-1}$	*−2.055*	Inflation $_{t-6}$	**12.919****	Market Environment. $_{t-1}$	−0.006
	(−0.31)		(4.66)		(−0.06)
Election $_{t-1}$	0.725**	Election $_{t-1}$	**1.833****	Political Environment. $_{t-1}$	−0.120*
	(2.43)		(4.09)		(−1.34)
St External Debt $_{t-8}$	*−0.133****	Market Environment $_{t-1}$	*0.429***	Stock Prices $_{t-3}$	**−2.483****
	(−2.86)		(2.08)		(−3.47)
Market Environment $_{t-1}$	**−0.901****	Political Environment. $_{t-1}$	*0.068*	KA Openness $_{t-1}$	0.086
	(−5.79)		(0.74)		(1.06)
Political Environment $_{t-1}$	−0.256*	Stock Prices $_{t-2}$	**−3.216****	ΔDomestic Credit $_{t-1}$	−0.066
	(−1.78)		(−3.07)		(−0.82)
		KA Openness $_{t-1}$	−0.114		
			(−0.88)		
		ΔDom. Crd. to Prv. Sect. $_{t-1}$	**0.301****		
			(3.71)		
Number of Observations	2915				
Rho (12)	0.519***	Rho (23)	0.449***	Rho (13)	0.065
Likelihood ratio test of rho (12) = rho (23) = rho (13) = 0: chi2(3) = 6.561 Prob > chi2 = 0.087					

Notes: The estimation is conducted by using the ''mvprobit'' command for STATA 14 written by Cappellari and Jenkins (2003) applying 50 number of draws in calculating the simulated likelihood. Robust standard errors are clustered by country. The significance levels of the variables are indicated by * (10%), ** (5%) and *** (1%). Counter intuitively signed coefficients are represented in italics. Highly significant coefficients with anticipated signs are represented in bold. Calculation of marginal effects is not straightforward in multivariate probit models. Hence the reader should rely on the elasticities of single equation probit estimations.

References

Arellano, C., Kocherlakota, N., 2014. Internal Debt Crises and Sovereign Defaults. J. Monet. Econ. 68 (S), 68–80.
Arora, V., Cerisola, M., 2001. How Does US Monetary Policy Influence Sovereign Spreads in Emerging Markets? IMF Staff. Pap. 48 (3), 474–498.
Arteta, C., Hale, G., 2008. Sovereign Debt Crises and Credit to the Private Sector. J. Int. Econ. 74 (1), 53–69.
Asonuma, T., Trebesch, C., 2016. Sovereign Debt Restructurings: Preemptive or Post-Default. J. Eur. Econ. Assoc. 15 (1), 175–214.
Babecký, J., Havránek, T., Matějů, J., Rusnák, M., Šmídková, K., Vašíček, B., 2014. Banking, Debt, and Currency Crises in Developed Countries: Stylized Facts and Early Warning Indicators. J. Financ. Stab. 15, 1–17.
Baldacci, E., Gupta, S., 2009. Fiscal Expansions: What Works. Finance Dev. 46 (4), 35–37.
Balkan, E.M., 1992. Political Instability, Country Risk and Probability of Default. Appl. Econ. 24 (9), 999–1008.
Bauer, Christian Bernhard Herz, Volker Karb, 2003. The Other Twins: Currency and Debt Crises, Rev. Econ. 54(3), 248–267.
Bolton, P., Jeanne, O., 2011. Sovereign Default Risk and Bank Fragility in Financially Integrated Economies. IMF Econ. Rev. 59 (2), 162–194.
Bordo, M.D., Meissner, C.M., 2006. The Role of Foreign Currency Debt in Financial Crises: 1880–1913 vs. 1972–1997. J. Bank. Financ. 830, 3299–3329.
Borensztein, E., Panizza, U., 2009. The Costs of Sovereign Default. IMF Staff. Pap. 56 (4), 683–741.
Börsch-Supan, A., Hajivassiliou, V.A., 1993. Smooth Unbiased Multivariate Probability Simulators for Maximum Likelihood Estimation of Limited Dependent Variable Models. J. Econ. 58 (3), 347–368.
Calvo, G.A., Leiderman, L., Reinhart, C.M., 1993. Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors. IMF Staff. Pap. 40 (1), 108–151.
Candelon, B., Palm, F.C., 2010. Banking and Debt Crises in Europe: The Dangerous Liaisons? De Economist 158 (1), 81–99.
Cappellari, L., Jenkins, S.P., 2003. Multivariate Probit Regression Using Simulated Maximum Likelihood. Stata J. 3 (3), 278–294.
Caprio, Gerard, Daniela, Klingebiel, 1996. Bank Insolvencies: Cross-Country Experience. World Bank Policy Research Working Paper No. 1620.
Caprio, Gerard, Daniela, Klingebiel, Luc, Laeven, Guillermo, Noguera, 2005. Appendix: Banking Crisis Database. In: Systemic Financial Crises: Containment and Resolution, edited by Patrick Honohan and Luc Laeven. Cambridge University Press, pp. 307–340.
Chamberlain, G., 1980. Analysis of Covariance with Qualitative Data. Rev. Econ. Stud. 47, 225–238.
Chinn, M.D., Ito, H., 2006. What Matters for Financial Development? Capital Controls, Institutions, and Interactions. J. Dev. Econ. 81 (1), 163–192.
Citron, J.-T., Nickelsburg, G., 1987. Country Risk and Political Instability. J. Dev. Econ. 25 (2), 385–392.
Cline, William R., Kevin J.S., Barnes, 1997. Spreads and Risk in Emerging Markets Lending. Institute of International Finance, IIF Research Papers No. 97–1.
Das, Udaibir S., Michael G., Papaioannou, Christoph, Trebesch, 2012. Sovereign Debt Restructurings 1950–2010: Literature Survey, Data, and Stylized Facts. IMF Working Paper No. 12/203.
Demirgüç-Kunt, Aslı, Enrica, Detragiache, 1997. The Determinants of Banking Crises: Evidence from Developing and Developed Countries. IMF Working Paper No. 97/106.
Detragiache, Enrica, Antonio, Spilimbergo, 2001. Crises and Liquidity: Evidence and Interpretation. IMF Working Paper No. 2/181.
Diamond, D.W., Dybvig, P.H., 1983. Bank Runs, Deposit Insurance, and Liquidity. J. Polit. Econ. 91 (5), 401–419.
Dreher, A., Herz, B., Karb, V., 2006. Is there a causal link between currency and debt crises? Int. J. Financ. Econ. 11 (4), 305–325.

Eaton, J., Gersovitz, M., 1981. Debt with Potential Repudiation: Theoretical and Empirical Analysis. Rev. Econ. Stud. 48, 289–309.
Eichengreen, Barry, Ricardo, Hausmann, 1999. Exchange Rates and Financial Fragility. New Challenges for Monetary Policy, 329–368. Federal Reserve Bank of Kansas City.
Eichengreen, B., Hausmann, R., 2005. Other People's Money: Debt Denomination and Financial Instability in Emerging Market Economies. University of Chicago Press.
Eichengreen, B., Mody, A., 1998. Interest Rates in the North and Capital Flows to the South: Is There a Missing Link? Int. Finance 1 (1), 35–57.
Eijffinger, Sylvester C.W., Bilge, Karataş, 2012. Currency Crises and Monetary Policy: A Study on Advanced and Emerging Economies. J. Int. Money Finance 31, 948–974.
Eijffinger, S.C.W., Karataş, B., 2020. Together or Apart? The Relationship Between Currency and Banking Crises. J. Bank. Financ. 119, 105631.
Foley-Fisher, N., Guimaraes, B., 2013. US Real Interest Rates and Default Risk in Emerging Economies. J. Money Credit Bank. 45 (5), 967–975.
Gennaioli, N., Martin, A., Rossi, S., 2014. Sovereign Defaults, Domestic Banks and Financial Institutions. J. Financ. 69 (2), 819–866.
Greene, W.H., 2003. Econometric analysis. Prentice-Hall International, Upper Saddle River, New Jersey.
Herz, B., Tong, H., 2008. Debt and Currency Crises – Complements or Substitutes? Rev. Int. Econ. 16 (5), 955–970.
Im, K.S., Pesaran, M.H., Shin, Y., 2003. Testing for Unit Roots in Heterogeneous Panels. J. Econ. 115 (1), 53–74.
Imf, 2021. Issues in Restructuring of Sovereign Domestic Debt. International Monetary Fund, Washington, DC.
Jae-On, K., Mueller, C.W., 1978. Introduction to Factor Analysis: What It Is and How To Do It. Sage Publications.
Jahjah, Samir, Peter J., Montiel, 2003. Exchange Rate Policy and Debt Crises in Emerging Economies. IMF Working Paper No. 3/60.
Jahjah, S., Wei, B., Yue, Z., 2013. Exchange Rate Policy and Sovereign Bond Spreads in Developing Countries. J. Money Credit Bank. 45 (7), 1275–1300.
Jeanne, O.D., 2005. Why Do Emerging Markets Borrow in Foreign Currency. In: Eichengreen, B., Hausmann, R. (Eds.), Other People's Money: Debt Denomination and Financial instability in Emerging Market Economies. University of Chicago Press, Chicago, pp. 190–217.
Kamin, Steven B., Karsten, Von Kleist, 1999. The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s. International Finance Discussion Paper No. 653.
Kaminsky, G.L., 2006. Currency Crises: Are They All the Same? J. Int. Money Financ. 25 (3), 503–527.
Kaminsky, G.L., Reinhart, C.M., 1999. The Twin Crises: The Causes of Banking and Balance-of- Payments Problems. Am. Econ. Rev. 89 (3), 473–500.
Khan, A.A., 2011. Merger and Acquisitions (M&As) in the Indian Banking Sector in Post Liberalization Regime. Int. J. Contemp. Business Stud. 2 (11), 2156–7506.
King, G., Zeng, L., 2001. Logistic Regression in Rare Events Data. Polit. Anal. 9 (2), 137–163.
Kraay, A., 2003. Do High Interest Rates Defend Currencies During Speculative Attacks? J. Int. Econ. 59 (2), 297–321.
Laeven, Luc, Fabian, Valencia, 2008. Systemic Banking Crises: A New Database. IMF Working Paper No. 224.
Laeven, Luc, Fabian, Valencia, 2012. Systemic Banking Crises Database: An Update. IMF Working Paper No. 163.
Laeven, L., Valencia, F., 2020. Systemic Banking Crises Database II. IMF Econ. Rev. 68 (2), 307–361.
Lestano, Jan P.A.M. Jacobs, Gerard H, Kuper, 2003. Indicators of Financial Crises Do Work! An Early-Warning System for Six Asian Countries. CCSO Working Papers Vol. 200313. University of Groningen.
Manasse, Paolo, Nouriel, Roubini, Axel, Schimmelpfenning, 2003. Predicting Sovereign Debt Crises. IMF Working Paper No. 03/221.
Manasse, P., Roubini, N., 2009. 'Rules of Thumb' for Sovereign Debt Crises. J. Int. Econ. 78 (2), 192–205.
Nguyen, Thanh Cong, Castro, V., Wood, J., 2022. A New Comprehensive Database of Financial Crises: Identification, Frequency, and Duration. Econ. Model. 108, 105770.
Norton, E.C., Wang, H.a., Ai, C., 2004. Computing Interaction Effects and Standard Errors in Logit and Probit Models. Stata J. 4 (2), 154–167.
Obstfeld, M., 1994. The Logic of Currency Crises. Cahiers Economiques et Monétaires Bank of France 43, 189–213.
Petersen, M.A., 2009. Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches. Rev. Financ. Stud. 22 (1), 435–480.
Reinhart, Carmen M., Kenneth S., Rogoff, 2013. Financial and Sovereign Debt Crises: Some Lessons Learned and Those Forgotten. IMF Working Paper No. 13/226.
Reinhart, Carmen M., Rogoff, Kenneth S., Savastano, Miguel A., 2003. Debt Intolerance. Brook. Pap. Econ. Act. 1, 1–62.
Reinhart, C.M., Rogoff, K.S., 2011. From Financial Crash to Debt Crisis. Am. Econ. Rev. 101 (5), 1676–1706.
Reinhart, Carmen M., 2002. Default, Currency Crises and Sovereign Credit Ratings. NBER Working Paper Series No. 8738.
Sosa-Padilla, Cesar, 2018. Sovereign Defaults and Banking Crises. Journal of Monetary Economics. 99, 88–105.
Thaler, Dominic, 2021. Sovereign Default, Domestic Banks and Exclusion from International Capital Markets. The Economic Journal. 131 (635), 1401–1427.
Tomz, Michael, Mark L.J., Wright, 2005. Sovereign Debt, Defaults and Bailouts, Paper presented at the NBER IFM SI 2005.
Torres-Reyna, O., 2012. Getting Started in Factor Analysis (using STATA 10). Princeton University.
Uribe, M., Yue, V.Z., 2006. Country Spreads and Emerging Countries: Who Drives Whom? J. Int. Econ. 69 (1), 6–36.
Velasco, A., 1987. Financial Crises and Balance of Payments Crises: A Simple Model of the Southern Corn Experience. J. Dev. Econ. 27 (1-2), 263–283.