university of groningen / faculty of economics and business

13016-EEF

Sovereign debt crises in Latin America: A market pressure approach

Tjeerd M. Boonman
Jan P.A.M. Jacobs
Gerard H. Kuper

SOM is the research institute of the Faculty of Economics & Business at the University of Groningen. SOM has six programmes:
- Economics, Econometrics and Finance
- Global Economics & Management
- Human Resource Management & Organizational Behaviour
- Innovation & Organization
- Marketing
- Operations Management & Operations Research

Research Institute SOM
Faculty of Economics & Business
University of Groningen

Visiting address:
Nettelbosje 2
9747 AE Groningen
The Netherlands

Postal address:
P.O. Box 800
9700 AV Groningen
The Netherlands

T +31 50 363 7068/3815

www.rug.nl/feb/research

university of groningen / faculty of economics and business

Sovereign debt crises in Latin America: A market pressure approach

Tjeerd M. Boonman
University of Groningen and TEC de Monterrey, campus Guandalajara
t.m.boonman@rug.nl

Jan P.A.M. Jacobs
University of Groningen and University of Tasmania, CAMA and CIRANO

Gerard H. Kuper
University of Groningen

Sovereign Debt Crises in Latin America: A Market Pressure Approach

Tjeerd M. Boonman[a,b*], Jan P.A.M. Jacobs[a,c] and Gerard H. Kuper[a]

[a] University of Groningen

[b] Tecnologico de Monterrey, campus Guadalajara

[c] University of Tasmania, CAMA and CIRANO

November 2013

Abstract

We construct a continuous sovereign debt crisis index for four large Latin American countries for the period 1870–2012. Our sovereign debt crisis index is similar to the Exchange Market Pressure Index for currency crises, and the Money Market Pressure Index for banking crises. To obtain the optimal set of indicators and the optimal value of the threshold for dating crises we apply the Receiver Operating Characteristic (ROC) curve. We calculate our sovereign debt crisis index as a weighted average of three indicators, the debt to GDP ratio, the external interest rate spread and the exports to imports ratio. The continuous index allows a more advanced analysis of sovereign debt crises. We include two applications. In the first application we investigate the relationship between sovereign debt crises and the business cycle in Latin America. Our second application constructs a similar index for five European countries.

Keywords: sovereign debt crises, debt crisis index, Receiver Operating Characteristic (ROC) curve

JEL-code: C25, G01, N26

---

*Corresponding author: Tjeerd M. Boonman, Faculty of Economics and Business, University of Groningen, PO Box 800, 9700 AV Groningen, The Netherlands [t.m.boonman@rug.nl].

1 Introduction

The sovereign debt crisis in Europe has renewed interest in sovereign debt crises. Until now the analysis of sovereign debt crises is limited by the crisis indicator that is traditionally used, which is a binary variable to distinguish debt default periods from non-debt default periods. This may be too restrictive in two ways. First, a continuous index is more informative, and second, a more general definition of a debt *crises* that allows for debt servicing difficulties—rather than a sovereign debt *default* index—may enhance the usefulness of such an index. This paper proposes a continuous sovereign debt crises index, where a debt crises, indicating market pressure, differs from a debt default. The construction of the Debt Market Pressure Index (DMPI) is our main contribution to the literature.

To construct a continuous index we combine indicators that show different behavior in times of a debt crisis compared to normal times for the four largest Latin American countries, Argentina, Brazil, Chile and Mexico, for the period 1870–2012. We have chosen these countries for their long history of sovereign debt crises. In fact, we construct two indices: one for a "wide" definition of sovereign debt *crises* that includes debt servicing difficulties (market pressure), and one for a "narrow" definition of sovereign debt *defaults*.

When the DMPI is used a crisis indicator, it has to be combined with a decision rule—a crisis is signaled when the index exceeds a threshold—and compared to a benchmark crisis series. The threshold is determined by the trade-off between missed crises and false alarms—each having its own cost. We apply the Receiver Operating Characteristic (ROC) curve to find simultaneously the optimal set of indicators and the value of the threshold. We find that for our sample of four Latin American economies over a long time span the DMPI for debt crises that replicated best the benchmark debt crisis series consists of debt-to-GDP, imports-to-exports, and external spread. The best DMPI for debt *defaults* consists of debt-to-GDP and imports-to-exports. The difference is the external spread indicator that does indicate market pressure, but not debt default.

The remainder of the paper is structured as follows. After a review of theoretical and empirical literature on sovereign debt crises in Section 2, Section 3 describes the design of our new crisis index, weights and threshold. The data are presented in Section 4, followed by the results in Section 5. We present applications of our market pressure index in Section 6. Section 7 concludes.

2 Literature

Standard and Poor's rates sovereign issuers in default if a government fails to meet principal or interest payment on external obligation on due date, or when a rescheduling of principal and/or interest is at less favorable terms than the original obligation. This traditional definition of debt crises—focusing on defaults—does not capture all debt-servicing difficulties.[1] A country may avoid a default through a large financial package from the IMF, as was the case in Mexico and Argentina in 1995, and in Brazil in 1998–1999 and 2001–

[1] For example Moody's did not report the default of Greece before 2012, despite Greece having major debt servicing problems since 2010.

2002. Therefore Manasse, Roubini, and Schimmelpfennig (2003) extend the debt crisis definition to account for large financial packages from the IMF (see Appendix A). According to Sy (2003) and Pescatori and Sy (2007) the relative low number of sovereign debt crises since the 1990s can partly be attributed to the definition of debt crises. Default on debt was common in the 1980s, but since bond markets developed strongly in the mid 1990s the number of debt defaults has diminished, while numerous countries faced difficulties in their debt servicing.

Our crisis identification procedure is based on the idea underlying the Exchange Market Pressure Index (EMPI) which was introduced by Girton and Roper (1977), and used by Eichengreen, Rose and Wyplosz (1995) to identify currency crises. The EMPI not only captures significant currency depreciations, but also periods where the exchange rate is under pressure, and defended by depleting foreign reserves and/or increasing interest rates. Similarly, we extend the traditional focus on sovereign debt default to sovereign debt crises by including periods of debt servicing difficulties which puts a pressure on the market for sovereign debt.

The indicators we select to construct the DMPI are based on the theoretical literature on sovereign debt crises, notably the sudden stop model of Calvo (2003), and Arellano's (2008) incarnation of the reputation model of sovereign default of Eaton and Gersovitz (1981). These models will be discussed briefly below.[2]

[2]Another body of literature (for instance Minsky, 1986, and 1992) builds upon the ideas of Keynes. This literature focuses on institutions and lack of control mechanisms. Only when control mechanisms (i.e. regulation, interventions) are installed, the capitalist economy can be stable for a longer period, which allows institutional evolution and sustainable economic growth. Control mechanisms are not static: controls and interventions become

In the sudden stop model of Calvo (2003) a high government debt and current account deficit financed by capital flows can trigger a sudden stop, which can cause a balance of payment (BOP) crisis. In the case of debt denominated in foreign currency (original sin), a depreciation of the currency will increase the probability of a sovereign debt default.

Recently new versions of the seminal model of Eaton and Gersovitz (1981) were developed to cope with empirical evidence from emerging economies. One of these new models is Arellano (2008): endogenous time-varying default probabilities influence interest rate spreads, which affect economic output. In booms debt is cheap and borrowing is abundant, and the trade balance is negative. In recessions the probability of default increases, which increases interest rates.

Recent empirical research on sovereign debt suggests that the debt-to-GDP ratio is a strong indicator for sovereign defaults in emerging economies (Manasse and Roubini, 2009; Furceri and Zdzienicki, 2012). Borensztein and Panizza (2009) observe that credit ratings and external interest rate spreads surge in the first years of a debt default. Another indicator is the current account (Aguiar and Gopinath, 2006), which typically reverses in times of a debt crisis. Since the overall balance of payments (trade balance and capital balance) must always be zero, a country that attracts large capital inflows will necessarily run a trade deficit (Krugman 1996). A reversal in capital flows is therefore always accompanied by an opposite reversal in the trade balance.

less effective over time, as agents innovate to avoid restrictions on their profitable activities. These mechanisms are difficult to quantify, so in this paper we assume no changes in regulation and interventions.

Aiolfi, Catão and Timmermann (2011) describe in a narrative way the relation between sovereign debt crises and business cycle turning points for Argentina, Brazil, Chile and Mexico during the period 1870-2004. We contribute to the literature by applying our crisis index to analyse the relation in a more formal way.

3 Method

To build a debt market pressure index (DMPI) we need to select indicators, weights and thresholds similarly to the construction of an exchange market pressure index for currency crises or a money market pressure index for banking crises (see Appendix B).

3.1 Construction of the DMPI

We construct different debt crisis indices, with different combinations of indicators suggested by the literature. All indicators are transformed when required to avoid non-stationarity, and standardized per country.

Define $DMPI_t^i$ as a weighted average of, say three variables $X_{1,t}^i$, $X_{2,t}^i$ and $X_{3,t}^i$, with standard deviations $\sigma_{X_{1,t}^i}$, $\sigma_{X_{2,t}^i}$ and $\sigma_{X_{3,t}^i}$ resp. Index i refers to the country (1 = Argentina, 2 = Brazil, 3 = Chile, 4 = Mexico), and t refers to the observation ($t = 1, \ldots, T$). For the weights we follow Eichengreen *et al.* (1995) by taking inverted standard deviations

$$DMPI_t^i \equiv \frac{X_{1,t}^i}{\sigma_{X_{1,t}^i}} + \frac{X_{2,t}^i}{\sigma_{X_{2,t}^i}} + \frac{X_{3,t}^i}{\sigma_{X_{3,t}^i}}. \tag{1}$$

The $DMPI_t^i$'s are pooled and standardized, such that we obtain a vector of size $4T$.

We construct two crisis indices:

- DMPI: "broad" definition—debt crises. Refers to defaults and debt servicing difficulties that require significant IMF assistance.
- DMPI–: "narrow" definition—debt default. Refers to defaults only.

3.2 DMPI as a crisis indicator

The DMPI identifies periods with increased pressure on debt servicing. However, we have no benchmark that captures debt servicing difficulties. Therefore, to evaluate the effectiveness of the continuous index as a crisis indicator we convert the index into a binary variable such that we can compare our index with a benchmark. If the index exceeds a pre-established threshold, then a crises is signaled and the value of 1 is assigned to the binary variable, and zero otherwise. The higher the threshold, the less exceedences are to be expected. This will result in less false alarms (type I error), but also in more missed crises (type II error). The optimal threshold depends on the relative cost of the two error types. To determine the optimal threshold we do a grid search over the interval [-2.5; 2.5] in steps of 0.1 times the standard deviation of the DMPI and we compare the crisis signals to a published benchmark crisis indicator series.

For each country and each period the constructed crisis signal dummy is compared with the benchmark crisis dummy. For each threshold we construct a contingency table as in Table 1. Contingency tables can be constructed both for debt crises (the "broad" definition) and for debt defaults (the "narrow" definition).

Table 1: Contingency table of crisis realisations and model predictions (signals)

	Realisation	
Indicator (model)	Crisis	No crisis
Crisis	n_1 (TP)	n_2 (FP)
No crisis	n_3 (FN)	n_4 (TN)

Notes.

- n_1: number of observations in which the model signals a crisis that actually took place: correct crisis signals (TP: True Positive)
- n_2: number of observations in which the model signals a crisis that did not take place: false alarms (FP: False Positive)
- n_3: number of observations in which the model does not signal a crisis that actually took place: missed crises (FN: False Negative)
- n_4: number of observations in which the model does not signal a crisis that did not take place: correct non-crisis signals (TN: True Negative)

3.3 The ROC curve

In signal detection theory a Receiver Operating Characteristic (ROC) curve is a graphical illustration of the performance of a binary classifier system as its discrimination threshold is varied. The ROC curve was first developed by electrical engineers and radar engineers during World War II for detecting enemy objects in battlefields and was soon introduced to psychology to account for perceptual detection of stimuli. One application in economics is Berge and Jordà (2011) to evaluate the performance of their business cycle indicator. They argue that "... A major advantage of the ROC curve is that it is not tied to a specific loss function as it itself is a map of the entire space of trade-offs for a given classification problem. The ROC curve can be estimated non-parametrically and ROC-based summary statistics have large sample Gaussian distributions that make formal inference convenient ..." (Berge and Jordà, 2011, p249) We apply the method to calibrate our crisis index, and the threshold in the decision rule.

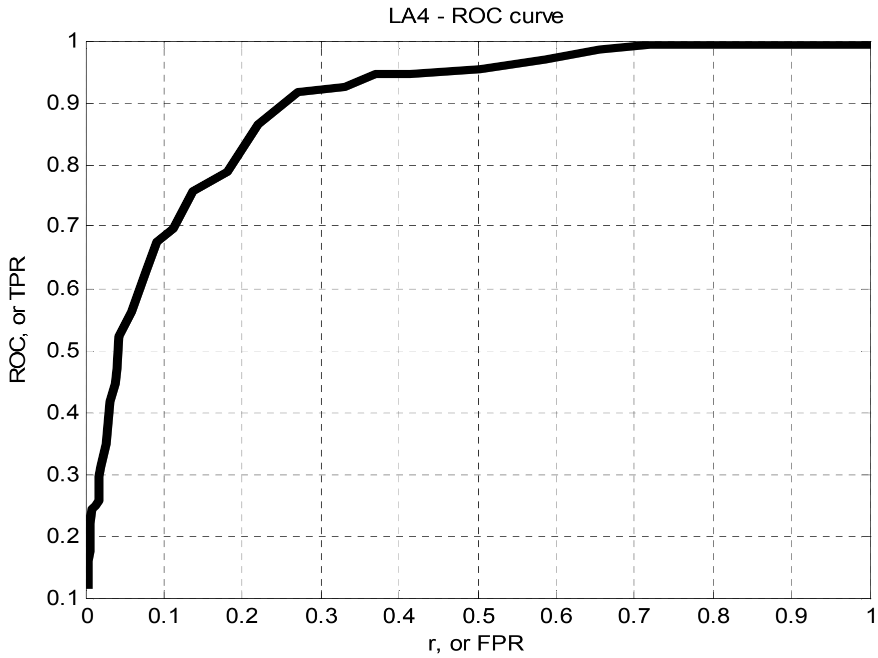
The Total Positive Rate (TPR), or $ROC(c)$ is defined as $n_1/(n_1 + n_3)$, *i.e.* the percentage of correct crisis predictions relative to the total number of crises. The TPR depends on the threshold c. A high TPR means that the model predicts the crises well, while a low TPR implies that the model misses crises. TPR is also known as the *sensitivity* or recall rate, the power of the test, or 1 minus the Type II error.

The other principal statistic indicator is the False Positive Rate (FPR), or $r(c)$, which is defined as the percentage of false alarms relative to the total number of non-crisis years: $n_2/(n_2 + n_4)$. FPR equals 1 minus the *specificity*, or the Type I error, the size of the test. A high FPR means that the model predicts crises that do not take place, and a low FPR implies that the model correctly does not predict a crisis. In the remainder of this paper we use ROC and r to indicate the Total Positive rate and the False Positive Rate, respectively.

Figure 1 displays a ROC curve. A completely random guess gives a point along a diagonal line from the left bottom to the top right corner (the so-called line of no-discrimination). Points above the diagonal represent good classification results (better than random), points below the line poor results (worse than random). The perfect classifier system has a TPR of 1, and a

FPR of 0. This means that the model shows 100% sensitivity (no missed crises) and 100% specificity (no false alarms).

Figure 1: An ROC curve



There are various way to evaluate the predictions of binary variables: the Area under the Curve, and as a special case the Youden index, and the utility approach. We apply the utility approach for reasons that will be discussed below.

AUROC

One of the methods to evaluate predictions of binary variables is the Area Under the ROC (AUROC), calculated as the integral of the ROC curve. A perfect classifier has an AUROC value of 1; a non-discriminant classifier has an AUROC value 0.5. The classifier that generates the highest AUROC is considered best. Berge and Jordà (2011) use this measure to evaluate the classification of the business cycle.

The main advantage of the AUROC is its objectivity: there is no arbitrary judgment on what weighs heavier—a false alarm or a missed crisis. However, this is at the same time a disadvantage, because in reality missed crises may be considered more important than false warnings (Lobo, Jimenez-Valverde and Real, 2008).

Various refinements have been proposed among which Jordà and Taylor (2009) who extend the ROC with the argument that an indicator that correctly classifies many events with low costs but misses a key event that generates a devastating loss will be less desirable than an indicator that is equally accurate on average but correctly classifies the large events. They attach little weight to wrong signals when the costs are small; but when costs are large they penalize classifiers for not picking events, and reward classifiers for picking events. We assume that missed crises have higher costs than false alarms, and correctly predicting crises is more important than correctly predicting periods of tranquility.

Youden index

The Youden index is a special case of the AUROC. In 1884, Charles Sanders Peirce introduced a measure for evaluating predictions of a binary outcome: "the science of the method " (Baker and Kramer, 2007). The Youden index

(Youden, 1950), as it was baptized, is defined as

$$J \equiv ROC - r = \text{sensitivity} + \text{specificity} - 1.$$

The optimal point is found were J is maximized, which corresponds to the point on the ROC curve that maximizes the vertical distance between the ROC curve and the diagonal.

Utility

To determine the combination of indicators and the threshold that generate the best possible outcome we may also turn to a utility function. This method was first introduced by Charles Sanders Peirce in 1884 (Baker and Kramer, 2007). After assigning utility values to correct and incorrect model outcomes, we compute the overall utility of the classification

$$U(r) = U_{11} ROC\pi + U_{01}(1 - ROC)\pi + U_{10} r(1 - \pi) + U_{00}(1 - r)(1 - \pi), \quad (2)$$

where U_{ij} is the utility associated with prediction i, given the true state j; U_{11} is the utility of a correctly predicted crisis; U_{01} is the utility of a missed crisis; U_{10} is the utility of a false alarm; and U_{00} is the utility of a correctly predicted non-crisis episode; and π is the unconditional probability of observing a crisis.

The utility is maximized by taking the first derivative of the utility function with respect to r, the false positive rate. After rearranging we obtain

$$s = \frac{dROC}{dr} = \frac{U_{00} - U_{10}}{U_{11} - U_{01}} \frac{1-\pi}{\pi}. \tag{3}$$

So, the optimum is the point where the slope of the ROC curve equals the expected marginal rate of substitution between the net utility of accurate non-crisis and crisis prediction. If the ROC curve is continuous and concave, the optimum is the point where the slope of the ROC curve equals s. More generally, the optimum on the ROC curve is the point on the ROC curve that intersects the line with slope s that has the largest intercept and hence the largest utility for that slope (Baker and Kramer, 2007).

If the loss-to-profit ratio $(U_{00} - U_{10})/(U_{11} - U_{01})$ is large or the outcome rare (π small), the slope will be steep and the optimal operating point will occur at a small value of FPR. This is the case when false alarms are relatively expensive compared to missed crises. If the loss-to-profit ratio is smaller or the outcome is more common, the slope will be less steep and the optimal operating point will occur at a larger FPR value. This is the case when missed crises are relatively 'expensive' compared to false alarms.

4 Data

We use an unbalanced panel consisting of four large Latin American economies (Argentina, Brazil, Chile and Mexico) for the period 1870 up to and including 2012.

For crisis indicators we use annual data from a variety of sources: debt to GDP ratio (from Reinhart and Rogoff, 2010), external spread, inflation, government expenditure increases, fiscal budget, nominal interest rate, terms of trade, and ratio of exports to imports (all from Aiolfi *et al.*, 2011), and polity2, a dummy variable that captures the political system on a scale of +10 (full democracy) to -10 (autocracy) drawn from Polity IV, Center for Systemic Peace. All series are standardized.

The external spread series is incomplete. We replace missing data by inflation as suggested by Manasse and Roubini (2009) and Reinhart and Rogoff (2009) especially for emerging markets, and especially after 1940—which is the start of the period when the bond market is not used (until the 1990s). Visual inspection of the combined series (external spread and inflation) shows no signs of structural breaks. The debt to GDP ratio is based on total gross central government debt, which consists of both external and domestic debt. We use this series as a proxy for the foreign currency sovereign debt. Appendix C contains details on data sources.

To determine the accuracy of the DMPI we compare the model's crisis signals with reported benchmark crisis dummies:

- DMPI (debt *crises* index): the benchmark consists of the debt defaults according to Standard and Poor's, as reported in Borensztein and Panizza (2009), complemented with IMF large financial assistance packages (Manasse and Roubini, 2009). (column (3) in Table 2).

- DMPI– (debt *defaults* index): the benchmark consists of debt defaults according to Standard and Poor's (column (1) in Table 2).

For both benchmarks we use an exclusion window of two years, which implies that debt crises with two years intervals or shorter are considered the same crisis.

Table 2: Sovereign debt crisis episodes, LA-4 1870–2012

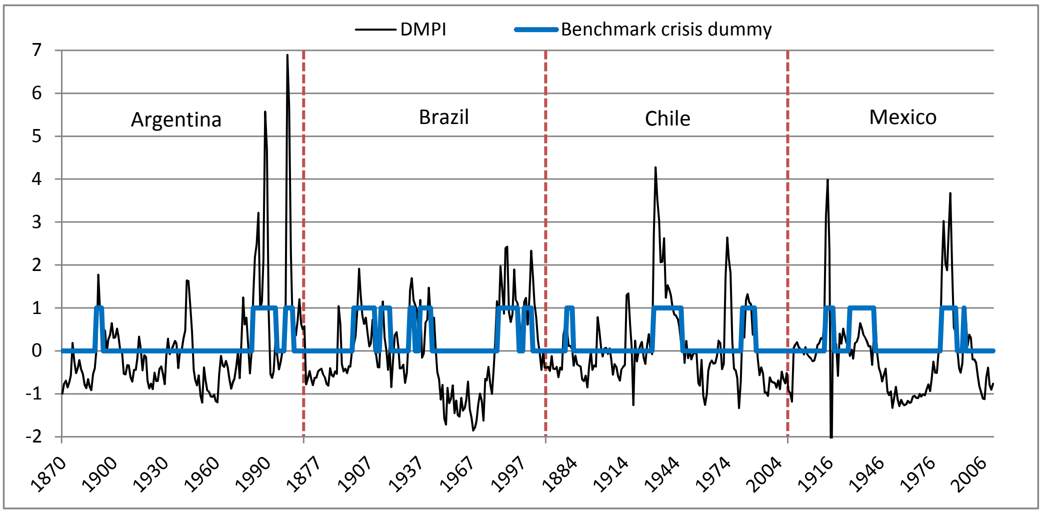
	Standard & Poor's (Borensztein and Panizza, 2009)	Manasse and Roubini (2009)	Combined
	Sovereign debt defaults	IMF financial assistance	Sovereign debt crises
Argentina	1890-1893, 1982-1993, 2001-2005	1995	1890-1893, 1982-1995, 2001-2005
Brazil	1898-1901, 1902-1910, 1914-1919, 1931-1933, 1937-1943, 1983-1994	1998-1999, 2001-2002	1898-1910, 1914-1919, 1931-1933, 1937-1943, 1983-1994, 1998-2002
Chile	1880-1883, 1931-1947, 1983-1990	-	1880-1883, 1931-1947, 1983-1990
Mexico	1866-1885, 1914-1922, 1928-1942, 1982-1990	1995	1914-1922, 1928-1942, 1982-1990, 1995

Note. Descriptions of the definitions can be found in Appendix A.

5 Results

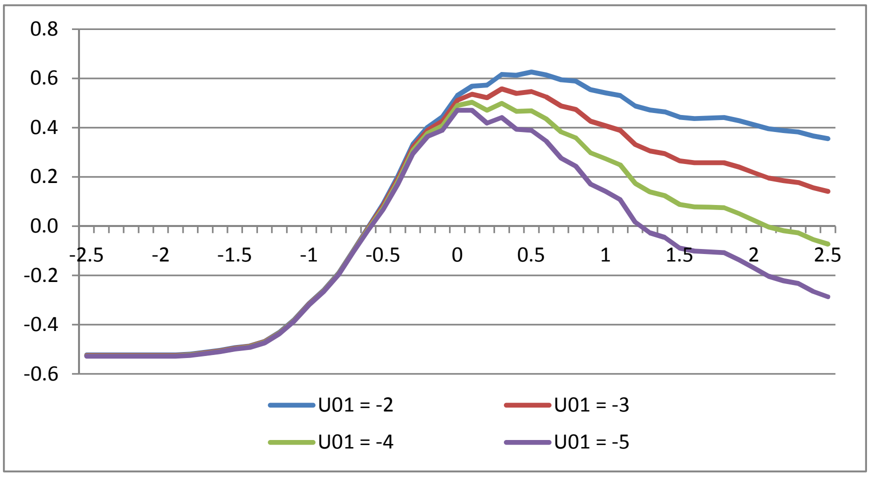
For the DMPI index both the utility and the Youden index select the same combination of indicators as the optimal one: the external interest spread, the debt-to-GDP ratio and the ratio of exports to imports. The selected indicators are confirmed by the sudden stop model: a high debt-to GDP ratio makes a country vulnerable for debt crises, and the current account reverses when a crisis unfolds. External spread increases in times of debt crises, which is in accordance with Arellano (2008). Government expenditures, the fiscal budget, the terms of trade, and (changes in) the political system do not contribute to a better performance of the debt crisis indicator. For the four countries Figure 2 shows the DMPI and the benchmark crisis dummy. The benchmark crisis dummy is 1 if there is a debt crisis according to the "broad" definition. A peak in the DMPI implies increased pressure on the debt servicing. We can see that our debt crisis indicator shows peaks at the time of the debt crises, except the Mexican debt crisis in the 1930s. We also observe that our indicator has peaks that are not associated with debt crises, such as Argentina in the 1940s and Chile in the 1970s.

Figure 2: DMPI and benchmark debt crisis dummy



In the overall utility of the classification as shown in Equation (2) in Section 3.3 we use $U_{11} = 1$, $U_{00} = 1$, $U_{10} = -1$, and a range for U_{01}: $-1, -2, -3, \ldots, -10$. The motivation behind this non-symmetric treatment is that we assume that missed crises are more costly than false alarms. The more negative U_{01}, the more a missed crisis is punished compared to false alarms. Figure 3 shows the utility value for different values of U_{01}.

Figure 3: DMPI: Utility (vertical axis) under different penalty values for missed crises, with the threshold on the horizontal axis



Choosing the penalty for missed crisis is arbitrary. We apply two criteria: (i) the threshold should not be negative, and (ii) the cost of a missed crisis should be higher than the cost of a false alarm.

We find two optimal thresholds for different penalties for a missed crisis:

1. Mild penalty for missed crises (U_{01} = -2): the optimal threshold is 0.5 times the standard deviation. This results in the following contingency table.

	Realisation	
DMPI index (model)	Crisis	No crisis
Crisis	93 (17.0%)	45 (8.2%)
No crisis	39 (7.1%)	370 (67.6%)

2. Strong penalty for missed crises (U_{01} = -4, -5): the optimal threshold is 0.1 times the standard deviation.

	Realisation	
DMPI index (model)	Crisis	No crisis
Crisis	120 (21.9%)	107 (19.6%)
No crisis	12 (2.2%)	308 (56.3%)

Comparison of the contingency tables shows that increasing the threshold decreases the number of false alarms, but at the cost of an increase in the number of missed crises. The performance of DMPI against the benchmark for debt crises is shown in Table 3. Column (2) lists the identified debt crises for a relatively high penalty for missed crises, and column (3) for a relatively mild penalty for missed crises.

In our analysis of the results we will focus on a threshold of 0.5 (the last column of Table 3). The crisis signals are to a large extent similar to the published benchmark crisis dummies (the combination of S&P and IMF assistance). Our index does not miss any crisis period, although in various crises our constructed dummy does not identify the entire debt crisis period; particularly the first years of the Mexico 1928–1942 crisis are not picked up.

The false alarms occur in periods with high volatility in the region or major political events. The sovereign debt crisis in Argentina in 1890 (Barings crisis) caused increased pressure from international investors on the entire region, including Brazil. In the late 1890s Brazil experienced a debt crisis which affected Argentina and Chile. With the dip in international trade after the outbreak of WW I Chile suffered as its primary commodity (nitrate) had become obsolete and was only slowly replaced by copper. Turmoil in revolutionary Mexico and a debt crisis in Brazil also contributed to the sit-

Table 3: Constructed DMPI and benchmark debt crises; threshold: 0.1 resp. 0.5 standard deviation

Country	Benchmark	DMPI	
Threshold		*0.1*	*0.5*
Argentina	—	1876	—
Argentina	1890-1893	1891-1903	1891-1894, 1899-1902
Argentina	—	1915	—
Argentina	—	1932-1937	—
Argentina	—	1941-1946	1943-1945
Argentina	—	1975-1979	1976-1978
Argentina	1982-1995	1982-1991, 1995	1982-1991
Argentina	2001-2005	2001-2012	2001-2012
Brazil	—	1889-1890	1889-1890
Brazil	1898-1910	1898-1909	1900-1905, 1909
Brazil	1914-1919	1914-1916	1914-1915
Brazil	—	1922-1923	—
Brazil	1931-1933, 1937-1943	1930-1945	1931-1945
Brazil	1983-1994, 1998-2002	1981-2006	1982-2005
Chile	1880-1883	1878-1882	1879-1880
Chile	—	1898-1899	1898
Chile	1931-1947	1915-1950	1915-1917, 1931-1946
Chile	—	1969-1977	1973-1976
Chile	1983-1990	1983-1991	1983-1988
Mexico	—	1896-1897	—
Mexico	1914-1922	1909-1927	1913-1918, 1924
Mexico	1928-1940	1931-1943	1934-1935, 1943
Mexico	1982-1990	1982-1990	1982-1989
Mexico	1995	1995-1999	1995-1996

uation in Chile. In Argentina a period of frauds in the 1930s was followed by revolutionary reforms in the Peronist era starting in 1943. In the mid 1970s both Argentina and Chile experienced military coups, started market reforms experiments and suffered from (very) high inflation (Ocampo and Ros, 2009).

We now turn to the debt default index, DMPI–. Both the utility and the Youden index select the same optimal combination of indicators: the debt-to-

GDP ratio and the ratio of exports to imports. Compared to the debt crisis index DMPI, the external spread does not play a significant role any more. This confirms the findings of Pescatori and Sy (2007), because the additional crisis periods (IMF assistance) occur since the mid 1990s when emerging countries enter the international capital markets and the defaults diminish, while debt service difficulties do not decrease. The optimal threshold is 0.2 times the standard deviation—for penalties for missed crises (U_{01}) between -2 and -10. The contingency table reads[3]

	Realisation	
Indicator (model)	Crisis	No crisis
Crisis	84 (15.4%)	133 (24.3%)
No crisis	48 (8.8%)	282 (51.6%)

6 Applications

An advantage of a continuous index as opposed to a binary variable is that more information is included in the index. Furthermore, it enables testing for endogeneity or causality between sovereign debt crises and economic growth and/or business cycles, and between sovereign debt crises and currency and banking crises. We also see opportunities to use the DMPI indices in Early Warning System approaches. We discuss two applications of our continuous sovereign debt crisis index. As a first application we analyse the relation between business cycles and sovereign debt crises for four Latin American countries, and show impulse response functions based on a two-variable VAR

[3]The performance of DMPI– with a threshold of 0.2 is comparable to the performance of DMPI with a threshold of 0.1. There is a great overlap in crisis and default periods. Results available upon request.

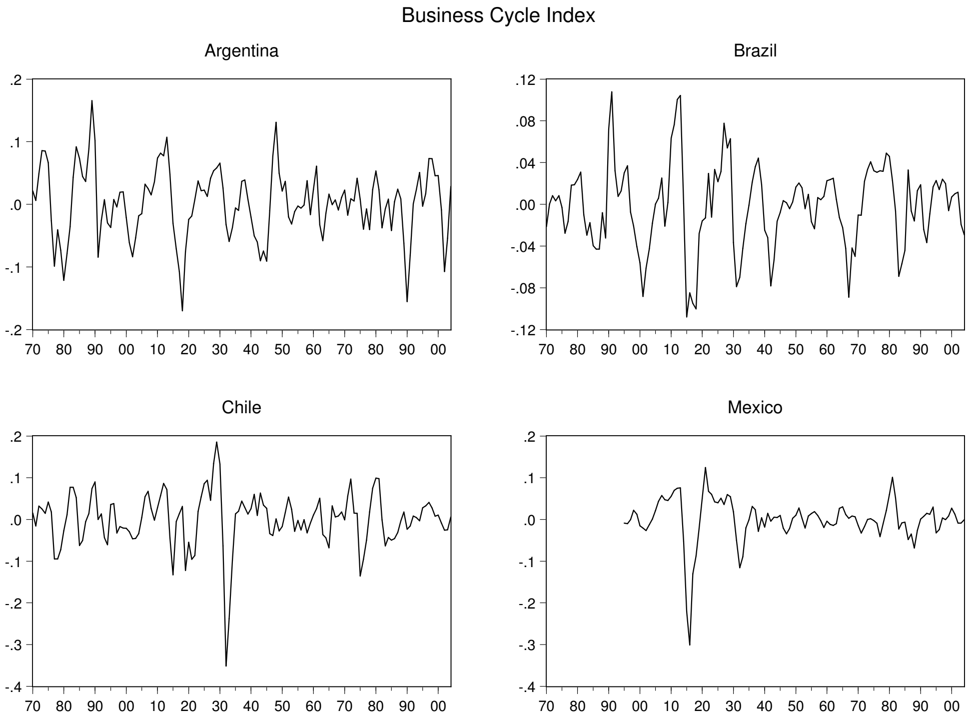
model. Granger causality tests indicate that the business cycle Granger-causes debt crises at the 5% significance level.

In the second illustration we apply the methodology of constructing a DMPI—using the same indicators as we do for the Latin American countries—to a number of European countries that face sovereign debt problems some years after the burst of the housing bubble in the United States in 2007. To do this we select the same indicators as we do for the Latin American countries. Our index shows a sharp increase for Portugal, Ireland and Greece after 2008, which are the countries that received assistance from the IMF and the ECB.

6.1 Sovereign debt crises and business cycles

As mentioned in the Introduction an advantage of a continuous index as opposed to a binary variable is that it enables additional analysis, e.g. testing for endogeneity or causality between sovereign debt crises and economic growth and/or business cycles, and between sovereign debt crises and currency and banking crises. We perform an econometric analysis for the relation between debt crises and the short business cycle indicator of Aiolfi *et al.* (2011) as shown in Figure 4. We did not update the indicator, so the comparison is for the period 1870 until and including 2004. We determine the DMPI for this shorter time horizon and find that the same combination of indicators performs best in resembling its benchmark. For the threshold we choose 0.4 times the standard deviation, which corresponds to a mild penalty for missed crises: the cost of a missed crisis is two to three times the cost of a false alarm. The correlation coefficient between the business cycle indicator and the DMPI is -0.388.

Figure 4: Business cycle index for four Latin American countries, 1870–2004

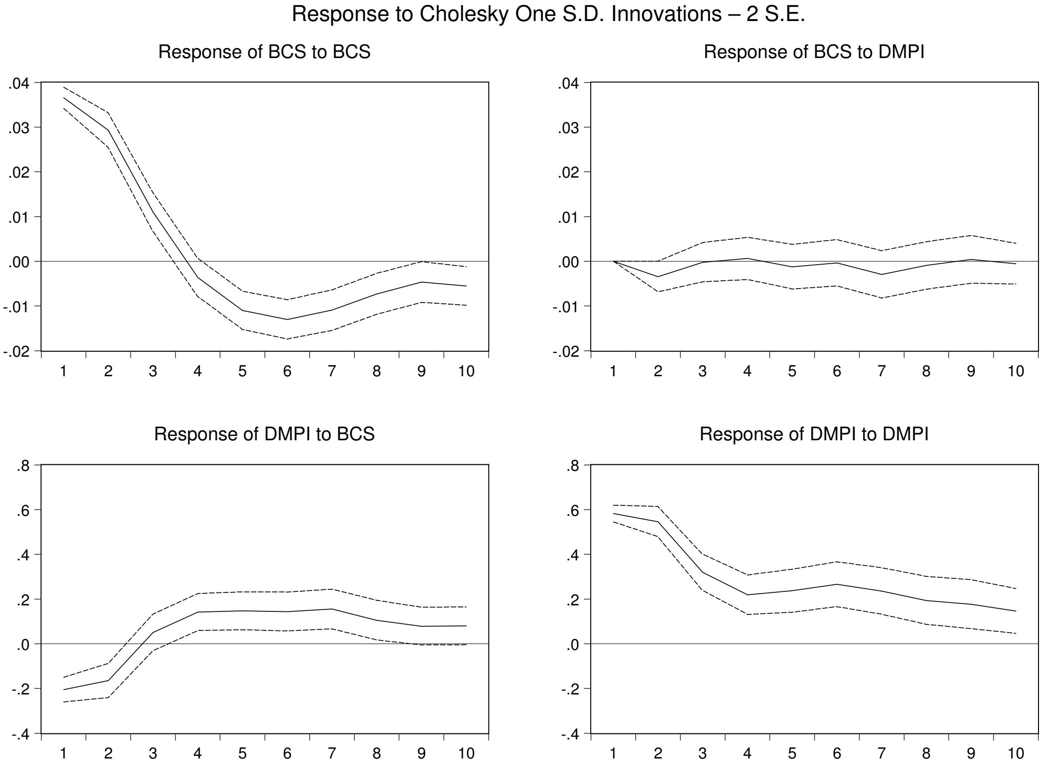


To gain more insight in the relationship between the debt crisis index (DMPI) and the business cycle (BCS) we construct a VAR and analyse the impulse response functions (i.e. responses to one unit reduced form innovations) derived from the moving average or Wold representation of the reduced form model. The number of lags based on the likelihood ratio test is eight, which is about the average length of a sovereign debt crisis.[4]

The two-variable VAR with eight lags is stable which implies that the impulse response functions are valid. According to the block exogeneity Wald

[4]Experimenting with different lags, or including exogenous variables like the US long-term interest rate and US real GDP growth yields similar impulse response functions.

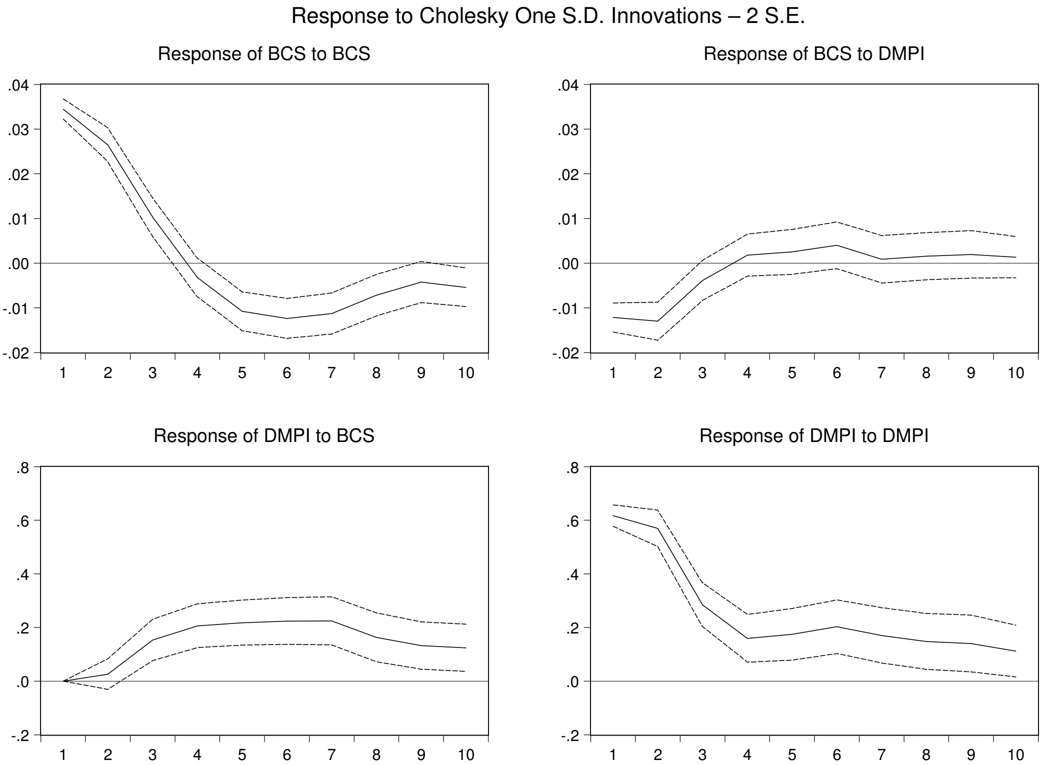
Figure 5: Impulse response functions for DMPI and the business cycle index (BCS). Cholesky ordering: BCS−DMPI



(Chi-square) test Granger causality is uni-directional at a level of significance of 5%. Accordingly, we assume that contemporaneous Granger causality runs from business cycle index disturbance to a debt crisis index disturbance and not the other way around (this implies a recursive order on the reduced form disturbances, also known as a Cholesky decomposition).

Figure 5 shows that a one standard deviation shock to BCS lowers DMPI for two periods, and this increases DMPI in periods 4-7. So, a positive shock to economic activity reduces the probability of a debt crisis for two years. After about four periods the debt crisis index increases while at the same time the business cycle experiences a downturn. A one standard deviation shock to the DMPI lowers BCS in the second period after the shock, and remains unchanged thereafter. The DMPI itself slowly returns to neutral.

Figure 6: Impulse response functions for DMPI and the business cycle index (BCS). Cholesky ordering: DMPI−BCS



According to the Granger causality test Granger causality is bi-directional at a 10% level of significance, so we present a sensitivity analysis with a reversed Cholesky ordering in which contemporaneous Granger causality runs from debt crisis index disturbance to a business cycle index disturbance. The impulse responses are shown in Figure 6.

Reversing the Cholesky ordering leads to the conclusion that a one standard deviation shock to BCS increases DMPI after the second period. The increase in the debt crisis index shock peaks in period seven when the economy is in a downturn. A one standard deviation shock to DMPI lowers BCS in the first two periods, but this response is short-lived.

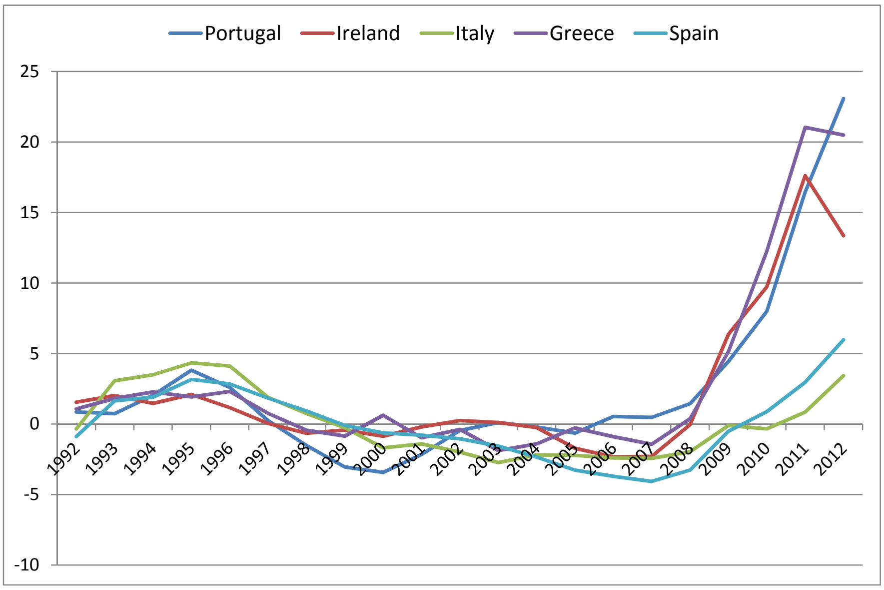
6.2 What about Europe?

In the Introduction we mentioned that the sovereign debt crisis in Europe has renewed interest in sovereign debt crises. So, what can we learn from our analysis for Europe? The selection of indicators and the estimation of the threshold that signals a crisis is based on the rich history of debt crises in Latin America. Applying the same methodology to European countries is difficult because European countries have had only a few debt crises in the past. This implies that we can not use the utility approach to determine the selection of indicators simultaneously with the threshold. However, we can construct a DMPI for European countries—as in Equation (1)—assuming that the same indicators play a role as in Latin American countries. These indicators are debt-to-GDP, imports-to-exports, and the external spread.

To illustrate what this European DMPI looks like in the period 1992–2012, and whether the index shows an increase after 2008, we calculate the standards deviation of the indicators for the period 1992–2007. In this way the weights are not affected by the current crisis episode. The countries we have selected are the four weakest countries in the periphery of Europe, Portugal, Italy, Greece and Spain, and Ireland. Three countries, notably Greece in the period 2010–2012, and Ireland and Portugal in the period 2011–2012 needed assistance from the IMF and the ECB.

Figure 7 shows the debt crisis indexes for these countries.[5] The European DMPIs are generally higher than the Latin American DMPIs as shown in Figure 2 for at least two reasons. First, the weights of the indicators, i.e. the standard deviations, are much lower because the 1992–2007 period in Europe shows less volatility than the 1870–2012 period in Latin America. Second, towards the end of the period all three indicators move in the same direction in European countries, whereas before the GFC high values of two indicators are typically off-set by changes in the third indicator.

Figure 7: The DMPI for five European countries, 1992–2012



[5]Sovereign debt for these European countries is measured in domestic currencies. We compared the 10 year government bond yield with the German government bond yield.

The graph clearly shows that the index signals debt servicing problems in three out of five countries, namely Portugal, Ireland and Greece. These are the same countries that indeed needed assistance. In Portugal and Greece the index drops in 2012, whereas in Portugal it is increasing. In Italy and Spain the index also increases, but the level is much lower than in the other three countries. Therefore, the same indicators that have been identified to be important for debt servicing problems in Latin America also seem to be relevant for the European countries.

7 Conclusion

We construct a continuous sovereign debt crisis index for four large Latin American countries for the period 1870–2012, similar to indices for currency crises, and more recently for banking crises. Applying the Receiver Operating Characteristic (ROC) curve we determine the optimal sovereign debt crisis index and the threshold. For a "broad" definition of a debt crisis (DMPI) the optimal combination is debt-to-GDP ratio, external interest rate spread, and exports-to-imports ratio. The benchmark for this index consists of default according to Standard and Poor's, complemented by periods when IMF assistance was required. The optimal threshold is 0.5 times the standard deviation when missed crises have a relatively lower cost (defined as 2 times the costs of a false alarm), or 0.1 when missed crises have a relatively high cost (defined as 4 to 5 times the costs of a false alarm). For a "narrow" definition of a debt crisis (DMPI–) the optimal combination is debt-to-GDP ratio, and exports-to-imports ratio. The benchmark for this index is default as defined by Standard and Poor's. The optimal threshold is 0.2 times the standard deviation.

The indicators we select are similar to the ones that feature in the models of Arellano (2008) and Calvo (2003). The probability of default is positively correlated with the interest rates, and thus interest rate spread. In sudden stops, debt-to-GDP ratio tend to be high. This debt overhang will remain high until the debt is restructured, which typically last long. Furthermore, in a sudden stop capital inflows reverse, which is reflected by an increase in exports relative to imports.

The DMPI index performs well in terms of missed crises: it does not miss any debt crisis period, although in various crises our constructed crisis dummy does not identify the entire debt crisis period. Our index generates many false signals, yet all these periods can be traced down to high volatility in the region (debt crises in neighboring countries), sharp drops in commodity prices or major political events (military coups).

In this paper we illustrate the relationship between the business cycle index and the debt crisis index in a two-variable VAR model. The impulse responses show that a positive shock to economic activity reduces the probability of a debt crisis for two years.

As a second illustration we show that using the same indicators that have been selected for Latin American countries indicate that for Portugal, Ireland and Greece the index sharply increased after 2008. These countries indeed experienced a sovereign debt crisis in 2010 and 2011. For Spain and Italy the sovereign debt crisis index also increases, but the level in the period 2010–2012 is much lower compared to Portugal, Ireland and Greece.

Acknowledgements

We thank Xiaoli He for excellent research assistance, Elmer Sterken for helpful discussions, Rodrigo Caputo, Ana Maria Chirinos, Laurie Reijnders, Greetje Frankena, Fernando Rosas and participants at the LAMES 2013 conference in Mexico City, and seminars at the University of Groningen and Universidad de Guadalajara for comments and suggestions.

References

Aguiar, M. and G. Gopinath (2006), "Defaultable debt, interest rates and the current account", *Journal of International Economics*, **69**, 64–83.

Aiolfi, M., L.A.V. Cat ao, and A. Timmermann (2011), "Common factors in Latin America's business cycles", *Journal of Development Economics*, **95**, 212–228.

Arellano, C. (2008), "Default risk and income fluctuations in emerging economies", *American Economic Review*, **98**, 690–712.

Baker, S.G. and B.S. Kramer (2007), "Peirce, Youden, and receiver operating characteristic curves", *The American Statistician*, **61(4)**, 343–346.

Berge, T.J. and Ò. Jordà (2011), "Evaluating the classification of economic activity into recessions and expansions", *American Economic Journal: Macroeconomics*, **3**, 246–277.

Borensztein, E. and U. Panizza (2009), "The costs of sovereign default", *IMF Staff Paper* 56, International Monetary Fund, Washington, DC.

Calvo, G.A. (2003), "Explaining sudden stop, growth collapse, and BOP crisis: The case of distortionary output taxes", *IMF Staff Papers* 50, International Monetary Fund, Washington, DC.

Ciarlone, A. and G. Trebeschi (2005), "Designing an early warning system for debt crises", *Emerging Markets Review*, **6**, 376–395.

Das, U.S., M.G. Papaioannou and C. Trebesch (2012), "Sovereign debt restructurings 1950–2010: Literature survey, data, and stylized facts", *IMF Working Paper* 203, International Monetary Fund, Washington, DC.

Eaton, J. and M. Gersovitz (1981), "Debt with potential repudiation: Theoretical and empirical analysis", *Review of Economic Studies*, **48(2)**, 289–309.

Eichengreen, B., A. K. Rose, and C. Wyplosz (1995), "Exchange rate mayhem: The antecedents and aftermath of speculative attacks", *Economic Policy*, **21**, 251–312.

Furceri, D. and A. Zdzienicka (2012), "How costly are debt crises?", *Journal of International Money and Finance*, **31**, 726–742.

Girton, L. and D. Roper (1977), "A monetary model of exchange market pressure applied to the postwar Canadian experience", *American Economic Review*, **4**, 537–548.

Jordá, Ò. and A.M. Taylor (2009), "The carry trade and fundamentals: nothing to fear but FEER itself", *NBER Working Paper* 15518, National Bureau of Economic Research, Washington, DC.

Kaminsky, G. L. and C. M. Reinhart (1999), "The twin crises: The causes of banking and balance-of-payments problems", *American Economic Review*, **89**, 473–500.

Krugman, P. (1996), "A country is not a company", *Harvard Business Review*, 40–44, 48–50.

Lestano and J.P.A.M. Jacobs (2007), "Dating currency crises with ad hoc and extreme value-based thresholds: East Asia 1970-2002", *International Journal of Finance and Economics*, **12**, 371–388.

Lobo, J.M., A. Jimenez-Valverde, and R. Real (2008), "AUC: a misleading measure of the performance of predictive distribution models", *Global Ecology and Biogeography*, **17**, 145–151.

Manasse, P. and N. Roubini (2009), "Rules of thumb for sovereign debt crises", *Journal of International Economics*, **78**, 192–205.

Manasse, P., N. Roubini, and A. Schimmelpfennig (2003), "Predicting sovereign debt crises", *IMF Working Paper* 221, International Monetary Fund, Washington, DC.

Minsky, Hyman P. (1992), "The financial instability hypothesis", *Hyman P. Minsky Archive* 74, Levy Economics Institute of Bard College, New York.

Minsky, Hyman P. Ph.D. (1986), "Stabilizing an unstable economy", *Hyman P. Minsky Archive* 144, Levy Economics Institute of Bard College, New York.

Ocampo, J.A. and J. Ros (2011), "Shifting paradigms in Latin America's economic development", in J.A. Ocampo and J. Ros, editors, *Oxford Handbook of Latin American economics*, Oxford Handbooks in Economics, Oxford University Press, Oxford, 1–23.

Pescatori, A. and A.N.R. Sy (2007), "Are debt crises adequately defined?", *IMF Staff Papers* 54(2), International Monetary Fund, Washington DC.

Reinhart, C. M. and K. S. Rogoff (2009), *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press, Princeton and Oxford.

Reinhart, C. M. and K. S. Rogoff (2010), “From financial crash to debt crisis”, *NBER Working Papers* 15795, National Bureau of Economic Research, Cambridge, MA.

Sy, A.N.R. (2003), “Rating the rating agencies: Anticipating currency crises or debt crises?”, *Working Papers* 122, International Monetary Fund, Washington DC.

von Hagen, J. and T. Ho (2007), “Money market pressure and the determinants of banking crises”, *Journal of Money, Credit and Banking*, **39(5)**, 1037–1066.

Youden, W.J. (1950), “Index for rating diagnostic tests.”, *Cancer*, **3**, 32–35.

A Debt crisis definitions[6]

- Moody's defines a default when (i) a missed or delayed disbursement of interest and/or principal, even if the delayed payment is made within the grace period; or (ii) when the issuer offers a new security that leads to a diminished financial obligation (e.g. lower coupon or par value).

- Standard and Poor's rates sovereign issuers in default if a government fails to meet principal or interest payment on external obligation on due date, or when a rescheduling of principal and/or interest is at less favorable terms than the original obligation.

- Beim and Calomiris (2001) define a crisis when all or part of interest and/or principal payments due were reduced or rescheduled. They consider bonds, supplier's credit, and bank loans to sovereign nations and exclude intergovernmental loans.

- Detragiache and Spilimbergo (2001) define a debt crisis if (i) there are arrears of principal or interest on external obligations towards commercial creditors (banks or bondholders) of more than 5 percent of total commercial debt outstanding; or (ii) there is a rescheduling or debt restructuring agreement with commercial creditors as listed in the World Bank's Global Development Finance.

- Manasse, Roubini, and Schimmelpfennig (2003) not only consider as a debt crisis outright default, but also situations where default was avoided through the provision of large scale official financing by the

[6]This section is partially based on Pescatori and Sy (2007).

IMF. They define a debt crisis if (i) Standard and Poor's definition of a debt default, or (ii) if the country receives a large non-concessional IMF loan, defined as access in excess of 100 percent of quota.

- Ciarlone and Trebeschi (2005) define a country default if one of five conditions occur, including the receipt of a large assistance package from the IMF, and a debt restructuring or rescheduling agreement with an official and/or commercial creditor. In most, but not all cases, restructurings occur after a default, but it is also possible that a restructuring occurs prior to a probable default, which is labeled as a "preemptive debt restructuring" (Das *et al.* , 2012).

- In Sy (2003) a debt crisis occurs when bond spreads are trading 1,000 basis points or more above U.S. Treasuries. The threshold is chosen as it is considered a psychological barrier for investors. The problem is that the data do not always fit this rigid definition: some Asian countries did not even exceed the threshold in the Asia crisis, while various Latin American countries exceed the threshold also in tranquil times. As an alternative, they take the 90th percentile, acknowledging that countries without debt problems will also be included.

- Pescatori and Sy (2007) define debt crises as events occurring when either a country defaults or when its bond spreads are above a critical threshold. For the critical threshold they use a rate of 1,000 basis points, based on Extreme Value Theory and the Kernel Density estimation, with the 90th percentile of the fitted distribution.

B Currency and banking crisis indicators

Currency crises: Exchange Market Pressure Index

Based on the Girton and Roper (1977) model, Eichengreen, Rose and Wyplosz (1995) develop an Exchange Market Pressure Index ($EMPI$) based on changes in the nominal exchange rate, foreign currency reserves and interest rates—see equation (B.1). The index is used to identify currency crises—including non-successful attacks.

$$EMPI_t^i \equiv \frac{1}{\sigma_{e_t^i}} \frac{\Delta e_t^i}{e_t^i} - \frac{1}{\sigma_{rm_t^i}} \left(\frac{\Delta rm_t^i}{rm_t^i} - \frac{\Delta rm_t^{US}}{rm_t^{US}} \right) + \frac{1}{\sigma_{r_t^i}} \Delta \left(r_t^i - r_t^{US} \right), \quad \text{(B.1)}$$

where i refers to country i, t refers to time, Δ is the difference operator, e is the nominal exchange rate, rm is the ratio of foreign reserves to M1, r is the nominal interest rate, σ_e, σ_{rm} and σ_r are the standard deviations from $\frac{\Delta e}{e}$, $\left(\frac{\Delta rm}{rm} - \frac{\Delta rm^{US}}{rm^{US}}\right)$, and $\Delta \left(r - r^{US}\right)$ respectively. The index US is the reference country, in this case USA.

When the index exceeds a predetermined threshold (two standard deviations above the mean), then a crisis is identified. Kaminsky and Reinhart (1999) made an adjusted version, and later various variations emerged (for an overview see Lestano and Jacobs, 2007).

Banking crises: Money Market Pressure Index

Von Hagen and Ho (2007) develop a similar index, to capture banking crises. This Money Market Pressure Index ($MMPI$) is based on changes in the banking sector's aggregate demand for central bank reserves and the short term interest rate:

$$MMPI_t^i \equiv \frac{\Delta rd_t^i}{\sigma_{\Delta rd_t^i}} + \frac{\Delta s_t^i}{\sigma_{\Delta s_t^i}}, \tag{B.2}$$

where i refers to country i, t refers to time, Δ is the difference operator, rd is the ratio of central bank reserves to total bank deposits, s is the short-term real interest rate, $\sigma_{\Delta rd}$ and $\sigma_{\Delta s}$ are the standard deviations from Δrd and Δs respectively. To identify a banking crises Von Hagen and Ho (2007) use two criteria: the $MMPI$ exceeds the 98.5 percentile of the sample for the country under study, and the increase of the $MMPI$ compared to the previous period is at least 5%.

C Data

Variable	Definition	Source
Exports	Exports, in millions of USD	1870–2003: ACT2011, 2004–2012: IFS
Imports	Imports, in millions of USD	1870–2003: ACT2011, 2004–2012: IFS (Brazil and Mexico: 1948-2012: IFS)
Export volume	Exports volume index, 2000 = 100	1870–2003: ACT2011, 2004–2012: IFS (Argentina and Brazil), growth from WDI (Chile and Mexico)
Import volume	Imports volume index, 2000 = 100	1870–2003: ACT2011, 2004–2012: IFS (Argentina and Brazil), growth from WDI (Chile and Mexico)
Terms of trade	Terms of trade, index: 2000 = 100	1870–2003: ACT2011, 2004–2012: calculation: ToT = [exports / export volume] / [imports / import volume]
Inflation	Consumer Price Inflation (CPI), annual, geometric change	1870–2003: ACT2011, 2004–2012: IFS
External spread	Interest difference between USA and domestic government; difference in yield on 10 year government bonds denominated in USD	Argentina, Brazil and Chile 1870–2004: ACT2011, 2004–2012: Bloomberg; Mexico 1996–2012: Bloomberg
Government expenditure	Government expenses, in constant 1995 local currency; index: 1995 = 100	1870–2004: ACT2011, 2005–2012: WEO (adjusted for structural break)
Government revenues	Government revenues, in constant 1995 local currency; index: 1995 = 100	1870–2004: ACT2011, 2005–2012: WEO (adjusted for structural break)
Gross debt to GDP	Central government (external and domestic) debt to GDP	1870–2009: RR2011, 2010–2012: Ministerio de Economia (Argentina), Tesouro Nacional (Brazil), Banco de Chile (Chile), Secretaria de Hacienda y Finanzas Publicas (Mexico)
Polity2	Polity2 index: -10 (autocracy) to +10 (democracy)	1870–2012: Polity IV project, Center for Systemic Peace
BC index	Business Cycle Indicator	1870–2004: ACT2011

Notes:

ACT2011: Aiolfi, Catão and Timmermann (2011)

IFS: International Financial Statistics, from IMF

RR2011: Reinhart and Rogoff (2011)

WDI: World Development Indicators, from WB

WEO: World Economic Outlook, from IMF

List of research reports

12001-HRM&OB: Veltrop, D.B., C.L.M. Hermes, T.J.B.M. Postma and J. de Haan, A Tale of Two Factions: Exploring the Relationship between Factional Faultlines and Conflict Management in Pension Fund Boards

12002-EEF: Angelini, V. and J.O. Mierau, Social and Economic Aspects of Childhood Health: Evidence from Western-Europe

12003-Other: Valkenhoef, G.H.M. van, T. Tervonen, E.O. de Brock and H. Hillege, Clinical trials information in drug development and regulation: existing systems and standards

12004-EEF: Toolsema, L.A. and M.A. Allers, Welfare financing: Grant allocation and efficiency

12005-EEF: Boonman, T.M., J.P.A.M. Jacobs and G.H. Kuper, The Global Financial Crisis and currency crises in Latin America

12006-EEF: Kuper, G.H. and E. Sterken, Participation and Performance at the London 2012 Olympics

12007-Other: Zhao, J., G.H.M. van Valkenhoef, E.O. de Brock and H. Hillege, ADDIS: an automated way to do network meta-analysis

12008-GEM: Hoorn, A.A.J. van, Individualism and the cultural roots of management practices

12009-EEF: Dungey, M., J.P.A.M. Jacobs, J. Tian and S. van Norden, On trend-cycle decomposition and data revision

12010-EEF: Jong-A-Pin, R., J-E. Sturm and J. de Haan, Using real-time data to test for political budget cycles

12011-EEF: Samarina, A., Monetary targeting and financial system characteristics: An empirical analysis

12012-EEF: Alessie, R., V. Angelini and P. van Santen, Pension wealth and household savings in Europe: Evidence from SHARELIFE

13001-EEF: Kuper, G.H. and M. Mulder, Cross-border infrastructure constraints, regulatory measures and economic integration of the Dutch – German gas market

13002-EEF: Klein Goldewijk, G.M. and J.P.A.M. Jacobs, The relation between stature and long bone length in the Roman Empire

13003-EEF: Mulder, M. and L. Schoonbeek, Decomposing changes in competition in the Dutch electricity market through the Residual Supply Index

13004-EEF: Kuper, G.H. and M. Mulder, Cross-border constraints, institutional changes and integration of the Dutch – German gas market

13005-EEF: Wiese, R., Do political or economic factors drive healthcare financing privatisations? Empirical evidence from OECD countries

13006-EEF: Elhorst, J.P., P. Heijnen, A. Samarina and J.P.A.M. Jacobs, State transfers at different moments in time: A spatial probit approach

13007-EEF: Mierau, J.O., The activity and lethality of militant groups: Ideology, capacity, and environment

13008-EEF: Dijkstra, P.T., M.A. Haan and M. Mulder, The effect of industry structure and yardstick design on strategic behavior with yardstick competition: an experimental study

13009-GEM: Hoorn, A.A.J. van, Values of financial services professionals and the global financial crisis as a crisis of ethics

13010-EEF: Boonman, T.M., Sovereign defaults, business cycles and economic growth in Latin America, 1870-2012

13011-EEF: He, X., J.P.A.M Jacobs, G.H. Kuper and J.E. Ligthart, On the impact of the global financial crisis on the euro area

13012-GEM: Hoorn, A.A.J. van, Generational shifts in managerial values and the coming of a global business culture

13013-EEF: Samarina, A. and J.E. Sturm, Factors leading to inflation targeting – The impact of adoption

13014-EEF: Allers, M.A. and E. Merkus, Soft budget constraint but no moral hazard? The Dutch local government bailout puzzle

13015-GEM: Hoorn, A.A.J. van, Trust and management: Explaining cross-national differences in work autonomy

13016-EEF: Boonman, T.M., J.P.A.M. Jacobs and G.H. Kuper, Sovereign debt crises in Latin America: A market pressure approach www.rug.nl/feb