ELSEVIER

Banking, debt, and currency crises in developed countries: Stylized facts and early warning indicators☆

CrossMark

Jan Babecký [a,*], Tomáš Havránek [a,b], Jakub Matějů [a,c], Marek Rusnák [a,b], Kateřina Šmídková [a,b,1], Bořek Vašíček [a]

[a] *Czech National Bank, Research Department, Na Prikope 28, 115 03 Prague 1, Czech Republic*
[b] *Charles University, Institute of Economic Studies, Prague 1, Opletalova 26, 110 00 Prague 1, Czech Republic*
[c] *CERGE-EI, Politickych veznu 7, 111 21 Prague 1, Czech Republic*

ABSTRACT

We construct and explore a new quarterly dataset covering crisis episodes in 40 developed countries over 1970–2010. First, we present stylized facts on banking, debt, and currency crises. Using panel vector autoregression we find that banking and debt crises are interrelated and both typically precede currency crises, but not vice versa. Banking crises are the most costly in terms of the overall output loss, and output takes about six years to recover. Second, on a reduced sample we try to identify early warning indicators of crises specific to developed economies, accounting for model uncertainty by means of Bayesian model averaging. The most consistent result across the various specifications and time horizons is that significant growth of domestic private credit precedes banking crises, while rising money market rates and global corporate spreads are also leading indicators worth monitoring. For currency crises, we also corroborate the role of rising domestic private credit and money market rates and detect the relevance of domestic currency overvaluation. The role of other indicators differs according to the type of crisis and the warning horizon selected, but it mostly seems easier to find reliable predictors at a horizon shorter than two years. Early warning indicators of debt crises are difficult to uncover due to the low occurrence of such episodes in our dataset. We also employ a signaling approach to derive the threshold value for the best single indicator (domestic private credit), and finally we provide a composite early warning index that further increases the usefulness of the model.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Although the literature on crises and early warning is extensive, the research on the occurrence and early warning indicators of economic crises in developed countries is still relatively thin.

Nevertheless, recent experience has demonstrated the relevance of the topic for developed economies. Our paper presents stylized facts on crisis occurrence and establishes which early warning indicators are relevant for developed countries by utilizing a new quarterly data set and by employing an advanced technique to overcome model uncertainty.

The literature on crises has traditionally been focused on emerging markets (Frankel and Rose, 1996; Kaminsky et al., 1998; Kaminsky and Reinhart, 1999, among others). More recently, large samples of countries, including both developing and developed economies, have been explored (Rose and Spiegel, 2011; Frankel and Saravelos, 2012). While currency crises were the subject of investigation in the pioneering studies, the recent literature has tried to encompass more types of costly events, including various types of banking and debt crises (Laeven and Valencia, 2012; Levy-Yeyati and Panizza, 2011; Reinhart and Rogoff, 2011).

The literature has suggested that all types of crisis can be very costly and that there are possible causal relationships between various types of crises (Kaminsky and Reinhart, 1999; Reinhart and

Rogoff, 2011). While output losses are induced by disruptions of the credit supply in the case of banking crises (Dell'Ariccia et al., 2008), the massive devaluations inherent to currency crises are detrimental to trade flows (Kaminsky and Reinhart, 1999). Debt crises in turn mostly increase the cost of sovereign borrowing (Borensztein and Panizza, 2009) and are usually followed by austerity measures, which usually have benign effects on the borrowing cost and an adverse impact on domestic demand.[2]

The literature has also proposed various early warning indicators, such as depletion of international reserves, real exchange rate misalignment or excessive domestic credit growth for currency crises in emerging markets (Frankel and Rose, 1996; Kaminsky et al., 1998; Bussiere, 2013a,b), rapid growth in domestic credit and monetary aggregates for both banking and currency crises (Kaminsky and Reinhart, 1999), a sharp increase in private indebtedness for banking crises (Reinhart and Rogoff, 2011), growth in global credit for costly asset price bubbles (Alessi and Detken, 2011), a large real GDP decline for debt crises (Levy-Yeyati and Panizza, 2011), the level of central bank reserves and real exchange rate appreciation for costly events such as the recent financial crisis (Frankel and Saravelos, 2012), and a combination of several indicators into composite indices for banking crises (Borio and Lowe, 2002). Alternatively, it has been proposed that each crisis is by its nature idiosyncratic and it is difficult to find reliable indicators to predict them (e.g. Berg and Pattillo, 1999). Recently, Rose and Spiegel (2011) have expressed skepticism about the possibility of explaining the cross-country incidence of the recent global financial crisis.

Our paper is focused on stylized facts and early warning indicators relevant for developed countries. We define developed economies as the EU and OECD countries, which allows us to assemble a crisis database for 40 countries.[3] The empirical early warning model is based on a reduced, albeit more homogeneous sample, as we typically do not have enough data coverage for countries in the developing stage.[4] The findings of the previously quoted literature may or may not be applicable to developed economies for various reasons. For example, the sources of stress and propagation of crises in emerging and developed economies may differ due to different levels of financial development and intermediation and to differences in the term structure of debt contracts (short- versus long-term) and their currency denomination (Mishkin, 1997). Therefore, stylized facts on crisis occurrence in developed economies should be compiled from a panel consisting of these economies only. Also, the lack of significant early warning indicators may be due to the large country heterogeneity of the previously analyzed samples.

Our main contributions to the literature are the following. First, we construct and make available a quarterly database of the occurrence of banking, debt, and currency crises (or, alternatively, balance of payment crises) for a panel of 40 countries currently regarded as developed, over 1970–2010. To code crisis episodes, we compile the data from various published studies, transform the data into quarterly frequency, and then validate the country-specific coding of crises with the help of country experts' opinions, based on our survey. The data demonstrates that there is substantial variation in the definition of crises across the published studies. Importantly, one can observe greater discrepancy in the determination of crisis endpoints compared to crisis onsets. To cross-check and validate the timing of crisis periods, we conduct a comprehensive survey among country experts (mostly from central banks) from all countries in the sample. The final database of crisis occurrence is provided in the online appendix.[5]

Second, the new database allows us to examine stylized facts for developed economies, such as possible causal links between individual types of crises on the one hand, and between crisis occurrence and economic activity on the other hand.[6] To address the simultaneity issue and interactions between crises and economic activity, we employ a panel vector autoregression (PVAR) model that is well suited to studying the dynamic dependencies among the variables when limited time coverage can be complemented by the cross-sectional dimension (Canova and Ciccarelli, 2009; Ciccarelli et al., 2010). To identify the effects of the different types of crises (discrete dummy variable) on economic activity (continuous variable) in the PVAR framework, we combine the dummy-variable approach applied in the literature investigating the effects of monetary policy (Romer and Romer, 1994) and fiscal shocks (Ramey and Shapiro, 1998; Ramey, 2011) with the common recursive VAR identification. Our results suggest that in developed economies, currency crises are typically preceded by banking and debt crises and not vice versa, while banking and debt crises are interrelated. In terms of the overall output loss, banking crises rank among the most costly, followed by debt crises. It takes about six years for output to recover after a typical banking crisis in a developed economy.

Third, this paper attempts to identify early warning indicators of banking, debt, and currency crises onsets specific to developed countries. We apply the Bayesian model averaging (BMA) technique (Madigan and Raftery, 1994; Raftery, 1995, 1996) in order to select the most useful early warning indicators among the set of all available variables. In particular, we test around 30 potential early warning indicators in two time windows: from 5 to 8 quarters, and from 9 to 12 quarters before crisis occurrence. BMA also has the advantage of minimizing the impact of the authors' subjective judgment on the selection of early warning indicators. We find that the onsets of banking and currency crises in developed economies are typically preceded by booms in economic activity. Growth of domestic private credit, rising money market rates and rising global corporate spreads are common leading indicators of banking crises. For currency crises, we corroborate the role of rising domestic private credit and money market rates and detect the relevance of domestic currency overvaluation. Regarding debt crises, their low occurrence in the sample of developed countries makes it difficult to establish consistent early warning indicators. The relatively low proportion of crises (in particular, debt crises) is traded off for relative sample homogeneity.

Finally, we apply signaling analysis to evaluate the performance of early warning indicators of banking crises in terms of the trade-off between Type I (missed crises) and Type II (false alarms) errors (Kaminsky and Reinhart, 1999; Alessi and Detken, 2011, among

---

[2] Furthermore, inherent to every crisis are negative effects stemming from an increase in the overall uncertainty (Bloom, 2009; Fernandez-Villaverde et al., 2011).

[3] There are alternative definitions of a 'developed' economy. For the sake of simplicity, we consider all EU and OECD members as of 2011 (see Annex I.1). It follows that some countries graduated from the emerging or transition category into the developed economy category between 1970 and 2010.

[4] EU and OECD membership and related changes in national data availability are useful to limit and homogenize the data sample. Indeed, the national data needed for the early warning exercise typically become available only after a country matures from its previous emerging status. This applies, for example, to the transition countries of central Europe in the late 1990s (see Annex I.1).

[5] The EU-27 survey was conducted within the ESCB MaRs network (in this case, all the country experts were from central banks). The remaining OECD member countries were contacted directly by us (in this case, the country experts were from central banks, international institutions, and universities). To download the database, visit Section A of the project page at http://ies.fsv.cuni.cz/en/node/372.

[6] The quarterly database is further explored in Babecký et al. (2013), in which the risk factors behind the effect of crises on the real economy are assessed.