

Intergrated Financial Crises Database – Technical Note

Boris Fisera¹ – David Hojdan¹ – Maria Siranova^{1*} – Karol Zelenak^{2,3}

Current version: November, 2020₄

¹ Institute of Economic Research, Slovak Academy of Sciences.

² National Bank of Slovakia.

³ Faculty of Social and Economic Sciences, Comenius University in Bratislava.

⁴ Siranova and Zelenak acknowledge support from the APVV Science Foundation under grant APVV-17-0551. Siranova also gratefully acknowledges kind hospitality provided by the IES FSS, Charles University. We are thankful for extraordinary research assistance provided by Tifany Kajbova.

* corresponding author, maria.siranova@savba.sk

Introduction

This document presents the comprehensive database of financial crises integrating the most prominent and widely-used partial databases as produced by various economists and institutions. The need to create such a comprehensive database is driven by the necessity to provide a more comprehensive insight into the various aspects of financial crises, as demonstrated by the most recent experience of 2008 financial crisis as well as its long-lasting consequences. This database was compiled in order to serve as the source of data for research activities related to the project APVV-17-0551 titled “Balancing out the imbalances: Redefining the view on macroeconomic imbalances under the European governance framework”. **When using data from this database, please, always cite the original source of data.** We do not own the data compiled by the original sources.

Old version (January 2020) includes papers that predominantly focus on databases dealing with fiscal and banking crises as two of the most recently live-through events. New update (November 2020) incorporates wider list of publications identifying external (balance of payments) and currency crises. In the future it is envisioned to also include events characterized by significant financial markets pressures. Nevertheless, the database might also serve as the limited source of external and currency crisis events due to the fact, that some of the databases already account for these types of events. In particular cases, some authors refer to a broad category of financial crisis, or to systemic crisis notion. In this database, these two cases are both labelled as the financial crisis.

Structure of the database

The database distinguishes among five broad categories of crises - sovereign, banking, currency, external and financial. This taxonomy represents an amalgam of possible categorization found in several studies incorporated in this database. However, since each of the included papers and sources work with their customized definition of crisis event we advise the user to consult technical note provided in this paper or in the excel (stata) file.

The database covers the period 1800-2017, as the two most comprehensive databases up to this date (Reinhart and Rogoff, 2009 and Reinhart and Rogoff, 2011) choose this year as their starting point. Given the fact, that these two centuries have seen creation and establishment of plentiful new sovereign states, we provide information on year of the establishment for all countries included into the sample. We draw upon two relevant sources - for the pre-1940 period we use Reinhart and Rogoff (2009), for the post-1940 period Iltetzki et al. (2018). For few missing countries we provide our own identification. By default, we set “no observation available” marker in all country-year-study combinations before the year of establishment.

The database covers 194 countries. If the country was not included in the original study the marker “no observation available” is imputed.

In general, studies investigating crisis events identify the beginning of the crisis event or the entire duration of the crisis events. From this reason we also provide taxonomy of original sources distinguishing between two types of studies (beginning, duration). If the original source identifies only the starting year of an event, this particular county-year observation is set to “one” with the consequent years reset back to “zero”. If, however, the original source also estimates the duration of the crisis event, all the relevant country-year observations are coded as “one”. In the case when original source does not identify precisely the beginning or the duration of the event, we subjectively assign crisis events to country-year observations that embodies the verbal definition used by authors as best as possible (i.e. mid-80ies are assigned to years 1983-1987). In this case the database includes two separate variables, one with the zero/one identification and one with the verbal identification of events.

For two databases (Becker and Mauro, 2006; Ortiz et al., 2007) crises events were identified according to the specification provided by the original source. Data were taken from the official sources (IMF, World Bank), as of August 2020.

Overview of relevant sources

The very well-known paper that includes the database of fiscal crises is “This Time is Different: Eight Centuries of Financial Folly “(**Reinhart and Rogoff, 2009**)⁵, where the authors bring the comprehensive historical review of international debt and banking crises, inflation, currency crashes and debasements. Within the paper authors have identified 215 sovereign default episodes covering the 66 countries (including 17 later EU countries) in all around the world. This database has been composed of various databases, as well as the authors’ analyses. The authors have distinguished between the external and domestic crises. While external crisis was defined as a sovereign default, what is understood as a failure to meet a principal or interest payment on the due date or within the specified grace period. These kinds of episodes also include cases where rescheduled debt is ultimately extinguished in terms less favorable than the original obligation. For the domestic crisis, the definition applied for the external crisis applies, with reservation that this type of crisis usually does not involve external creditors. In these types of crises, the domestic part of the debt is usually subject of suspension of payments (or in extreme case defaulted), or is often relegated to footnotes. The freezing of bank deposits and or forcible conversions of such deposits from foreign to local currency could take a part, too. The debt data covers the central government public debt. The authors have identified for 21 later EU countries 25 fiscal crises since year 1900. Within their analysis Reinhart and Rogoff argue against opinion that external defaults are less likely in the present period because governments are now relying more on domestic debt. According to their findings, the domestic debt is comparatively as significant as external debt in meeting emerging market financing needs and defaults on domestic debt appear to be associated with similar magnitudes of output loss as defaults on external debt. They also found that the median duration of defaults during the 1800-1945 period was twice length longer in comparison with those in the post-World War II period (6 years vs. 3 years). They also conclude that global economic factors, such as commodity prices and interest rates, play a major role in precipitating sovereign debt crises.

The continuation of research by significantly expanding the scope of crisis events is presented in the **Reinhart and Rogoff (2011)** paper. The new version incorporates data on not only debt, but also banking and currency crashes related events. Dataset covers 70 countries over the period 1800-2009 and includes 290 banking crises and 209 sovereign default episodes. Aside from the three traditionally documented crisis types, authors collect information on the periods of elevated inflation rates (medium to high or hyper-inflation) and term these events as inflation crisis. As they argue, the inflation and currency crises are often coupled together and serve as a tool to debase value of the accumulated (private and public) debt. Due to the long time span and highly limited supply of relevant historical data, use of quantitative indicators to identify onset and duration of banking crisis becomes a very difficult task. From this reason, the identification strategy is heavily based on qualitative assessment that specifies crisis event when there is a bank run present, or important financial institution(s) is subject to closure, merge, take-over or large-scale government intervention, an event which further triggers adverse shock transmitted to other financial institutions. According to the key findings, the prevalent chain of causal events originates in rapidly risking private indebtedness preceding banking crisis which, in turn, often signalize increase likelihood of a sovereign crisis.⁶

⁵ With an update of the data in the database, May 2013.

⁶ The data used in this integrated database are collected from the most recent update of Reinhart and Rogoff (2009), Reinhart and Rogoff (2011) and other relevant sources which is available at the official webpage of the

Another paper that presents the database of fiscal crises is an IMF paper named “Fiscal Crises (**Gerling et al. 2017**). Authors construct a new database of fiscal crises, by identifying the periods of fiscal stress when governments were not able to handle with large fiscal imbalances what led them to the adoption of extreme measures, such as e.g. debt default or monetization of the deficit. For identification of the fiscal stress or crises periods the authors have defined 4 criteria on credit event, exceptionally large official financing, implicit domestic public default and loss of market confidence. According to formulated criteria they have reviewed 188 countries during the period of years 1970-2015 and identified 436 fiscal crisis episodes with countries facing on average two crises during the 1970 and 2015 with the highest frequency in low-income developing countries (LIDCs, 3.4) and lowest in advanced economies (0.7). While more than 80% of crises were classified as pure fiscal crises, 5% were accompanied by banking crises and 11% by currency crises. In 3% of events the crises were combination of fiscal, banking and exchange rate crises. Surprisingly, the decline in GDP growth during the crisis periods was lower in LIDCs (decline by 0.5 percentage points)⁷ and larger in advanced economies (decline by 4.3 percentage points). Advanced economies thus face greater turbulence (growth declines sharply in the first two years of the crisis), with half of them experiencing economic contractions. According to findings of the authors, the fiscal policy usually acts pro-cyclically, since governments are forced to curtail the expenditure growth due to weaken economic activity. Authors’ findings showed that a fiscal crisis tends to be preceded by a loose fiscal policy. Countries seek the IMF support to find a help to manage the crisis when facing twin (fiscal and external) deficits.

One of the most comprehensive databases of crisis events, including sovereign debt crises, is encompassed in the **Laeven and Valencia (2018)**⁸ paper “Systemic Banking Crises Revisited”. Within this paper the authors investigate the systemic banking crises episodes by compiling the detailed database of the crises, information on crisis dates, policy responses to resolve banking crises, and the fiscal and output costs of crises. Starting with the 2013 update, the newest version of the database includes banking, sovereign as well as currency crisis events. In total, they identify 461 (151 banking, 236 currency, 74 sovereign) crises all around the world during the period of years 1970-2017. Within the number, 75 crises were classified as sovereign debt crises, 11 of which took place since 2007. Within reviewed period, 5 sovereign debt crises have occurred in 5 later EU countries. Authors classify the sovereign debt crisis an event (year) when sovereign default to private creditors and/or restructuring has occurred. If public debt was restructured without a suspension of payments, the sovereign crisis year is recorded as the year of the restructuring. Authors also found that banking crises in high-income countries tend to last longer and be associated with higher output losses, lower fiscal costs, and more extensive use of bank guarantees and expansionary macro policies than crises in low- and middle-income countries.

Similar time span as in previous paper covers **Baldacci et al. (2011)** in their analysis “Assessing Fiscal Stress”, where they provide database of 176 events of fiscal stress. They have analyzed 29 advanced economies and 52 emerging economies within the period of years 1970-2010. They defined the fiscal stress episode as a period of extreme government funding difficulties that may appear as a result of one or multiple of following events: public debt build-up, contingent liabilities that become outright fiscal costs, negative revenue shocks, or unaddressed demographic-related spending pressures. For identification of these events the authors combine the debt default and restructuring data obtained from Standard and Poor, information on exceptional IMF-supported programs, and data on spreads of

Behavioral Finance & Financial Stability Project, Harvard Business School (<https://www.hbs.edu/behavioral-finance-and-financial-stability/data/Pages/global.aspx>).

⁷ Pre-crisis period covers from t-3 to t-2 years before the crisis, while post-crisis period covers years from t to t+2.

⁸ This paper is an update of its earlier versions published in 2008 and 2013.

long-term domestic bond spreads relative to comparable U.S. bonds, 5-year credit default swap (CDS) spreads. They differ the definition of fiscal stress episode for advanced economies and emerging economies. Within 20 later EU countries they have identified 38 periods of fiscal stress, two third of which had duration up to two years. In the paper the authors have constructed the fiscal stress index that depends on a set of fiscal indicators, aggregated using the approach proposed by Kaminsky et al. (1998). The index is used to assess the buildup of fiscal stress over time since the mid1990s in advanced and emerging economies reflecting. Their results show that while in advanced countries the top predictors of fiscal stress are indicators of gross financing needs and fiscal solvency risks, in emerging economies, as the best predictors of fiscal stress serve risks associated with public debt structure and exposure to spillovers from financial markets.

One of the first databases compiled in the literature on banking crisis is that of **Caprio et al. (2003)** which updates the work by Caprio and Klingebiel (1996, 1999). Instead of using any pre-determined automatic algorithm for crisis identification the database is based on narrative approach gathering qualitative information from numerous sources. As a consequence, authors acknowledge that there are likely to exist several smaller events that might not have been present in their dataset. The expert judgment has to be applied especially when deciding about the timing of bank insolvencies. From these reasons and, contrary to other newer sources, in many instances one does not find exact country-year specification of crisis outburst or termination but only a period-based wording.

Paper by **Schularick and Taylor (2012)** belongs to studies that focus on narrow (country coverage) and long (period coverage) perspective. New dataset for 14 developed countries spans over 140 years (1870-2008). The identification approach detects crisis events that might be considered systemic meaning that the significant part of the banking sector must have been affected. During this severe stress periods, country's banking sector must experience bank run, increase in default rates associated with drop in capital leading to public intervention as well as forced mergers or individual bankruptcies. Altogether, the database identifies 79 major banking crises in 14 developed countries. According to the results, the costs of banking crises have not, surprisingly, been diminished over time despite the presence of more active policy makers' response. This finding might be potentially explained by the substantial increase in financial sector size and leverage which, in turn, makes any turbulence more costly. As a follow-up, the identification of systemic financial crisis is further included in the newest version of a database incorporating also information on other relevant real sector data (**Jorda et al., 2017**).

Another comprehensive database is constructed by **Babecky et al. (2014)**. Contrary to other studies, authors present data on higher frequency (quarterly) which enables them to investigate performance of set of early warning indicators aiming at signaling the income crisis events. The database covers crisis episodes in 40 developed countries over 1970–2010 and distinguishes among three types of crises: banking, debt and currency crises. In terms of the crisis event specifications, authors rely on concepts and approaches presented by comprehensive list of other, already published, studies. The cross-validation of dataset is further done by opinions of country experts. As authors conclude, not only there exists the substantial variation in definitions used by various studies, the data also show higher discrepancy in the determination of crisis endpoints compared to crisis onsets. On top of that banking and debt crises are interrelated and both typically precede currency crises, but not vice versa.

In his work, **Jing (2015)** argues that identification of banking crisis should be based on the idea of observed liquidity shortage in the money market rather than ad-hoc specifications used in many event studies. Given this perspective author constructs the money market pressure index (MPI), similar to that in von Hagen and Ho (2007), which combines two elements, the central bank reserves and nominal money market interest rate. The selection of countries is similar to those covered by Laeven

and Valencia (2008, updated in 2018) and covers 109 countries from 1975 to 2009. This approach identifies more banking crisis events than those included in the database of Laeven and Valencia (2008, updated in 2018). According to author, this is due to the fact that Laeven and Valencia (2008, updated in 2018) neglects events characterized by less systemic risk or those that reflect increased stress in the banking system that has not yet materialized into the system-wide severe adverse shock.

Long time series on banking crisis for 46 countries covering the period 1870-2016 are collected in **Baron et al. (2018)**. Contrary to other event-based studies, banking crises are identified as periods characterized by bank equity crashes. Authors argue that this approach provides an objective, quantitative, and theoretically-motivated measure of crisis events. This identification strategy has a benefit of uncovering the outburst of potential crisis sooner than other schemes based on credit spreads or nonfinancial equity measures, hence expanding the available databases of by newly identified crisis as well as purifying them of spurious events. Final findings show that depth of banking crisis tends to be more severe than that usually reported by other sources.

Database by **do Luca et al. (2018)** focuses solely on European countries and covers the period of 1970-2016. While limited in country coverage, this database provides a uniquely comprehensive insight into the occurrence of four basic subtypes of financial crisis (banking, sovereign, currency, asset price corrections) along with estimates of their duration, costs of crises measured by absolute output losses and its relevance for utilization of macroprudential measures. The database also specifically distinguishes particular periods related to transition process in many CEE countries. As such, the identification strategy combines both, the quantitative approach relying on financial stress index calculation as well as assessment provided by country experts. As a novelty, authors control for source of stress periods, originating either in domestic environment or being transmitted to domestic economy due to materialization of external shocks. As in the case of other relevant databases, authors aim to primarily detect systematically important events rather than small scale negative shocks. However, the information on residuals events is also provided as part of the database. Addressing the post-crisis bias (Bussiere and Fratzcher, 2008), databases distinguishes between two phases of post-crisis transition process, the acute one (between start of the crisis and end of crisis management) and the back-to-normal period (return to sustainable level of growth). In total, authors identify 50 systemic crises and 43 residual events, while 16 events have not been previously recognized in the relevant sources (Laeven and Valencia, 2008). All the above mentioned features makes this database one of a kind source of information for all relevant parties involved, therefore should represent the state-of-the art example for future research aiming at expanding the, rather limited, country coverage.

Becker and Mauro (2006) represent an early and extensive study that studied output drops. Using the data for all available countries, the authors first identified and studies output drops. Afterwards, this initial analysis was augmented by the more in-depth analysis of output drops between 1970 and 2001 (again for all available countries). For this in-depth analysis, the authors related the output gaps to various types of shocks. The financial and macroeconomic shocks included currency crisis, banking crisis, debt crisis and sudden stop in capital flows. While banking and debt crises were identified based on other datasets (and thus the definition of these types of shocks is not identical), the currency crises were identified as large devaluations/depreciations (exceeding 25 percent) when the rate of depreciation/devaluation increased by at least 10 percent. A sudden stop episode was identified as a year-on-year deterioration of the financial account of the balance of payments by at least 5 percent of GDP. Apart from financial and macroeconomic shocks, the authors also distinguished country-specific external shocks (i.e. terms of trade shocks), socio-political shocks, global shocks, and boom-bust cycles. Having identified the shocks, the authors focused on quantifying the expected costs for each type of the shock. According to the key findings, the level of economic development plays a key role in

determining, which shocks are costliest. For emerging markets, the sudden stops were found to be the costliest type of shocks, while for developing economies, the shocks to country's terms of trade were found to be most expensive.

Bordo et al. (2010) represent a study, which focused on studying sudden stops in an earlier period. The study included 20 emerging economies over the years 1880-1913. The authors distinguished three different definitions of sudden stops: i) a sudden stop episode occurred in situations when net capital inflows dropped by at least two standard deviations below the mean year-on year or the drop in net capital flows exceeded 3 percent of GDP in less than 4 years, ii) additionally, a drop in real GDP occurred during or right after the sudden stop episode, or iii) on the top of the first definition of sudden stop, there was a drop in real GDP growth rate during or right after the sudden stop episode. These three definitions of sudden stops yielded 63, 63 and 34 sudden stops episodes, respectively. Having identified the sudden stop episodes, the authors focused on studying the determinants of sudden stops. The empirical findings demonstrated that the level of hard currency debt to GDP, trade deficits represented strong predictors of sudden stops. On the other hand, trade openness and higher reserve ratios were found to reduce the probability of sudden stops.

Another study, by **Calvo et al. (2004)** also focused only on sudden stops episodes. Calvo et al. (2004) used monthly data for 32 emerging and developed economies over the years 1990-2001. The authors identified sudden stops as situations when the year-on-year fall in capital flows (measured based on financial account flows) lied at least two standard deviations below its sample mean – with the beginning and end of the episode being determined by a threshold of one standard deviation below the sample mean. Furthermore, the sudden stop episode had to occur during a period of output drop. This approach identified 21 sudden stop episodes – particularly around the time of East Asian (1997) and Russian (1998) crises. Having identified the sudden stop episodes, the authors further concentrated on identifying the determinants of sudden stops. They found that large real exchange rate fluctuations and significant domestic liability dollarization (i.e. large proportion of external liabilities denominated in foreign currency) were key determinants of the probability of sudden stops. However, this only applied to emerging economies. Sudden stops were also found to be accompanied by large interest rate increases, decreases in foreign exchange reserves current account adjustments.

This study was further extended by **Calvo et al. (2008)**, who also used monthly data over the years 1990-2001. However, Calvo et al. (2008)'s dataset is much more comprehensive and consists of 21 developed and 89 developing countries. Furthermore, the authors also extended their definition of sudden stop episodes – apart from the year-on-year fall in capital flows laying at least two standard deviations below its sample mean, a sudden stop episode had to occur during a period systemic turmoil, which was measured by change in Emerging Markets Bonds Index spread over U.S. Treasury bonds yields being at least two standard deviations above its mean. These episodes were called systemic sudden stops by the authors. In contrast with Calvo et al. (2004) output drops were no longer required to identify a sudden stop episode. Using this approach, the authors identified 77 systemic sudden stops episodes. The authors argued that the shocks are initially triggered by exogenous factors – however, country-level characteristics determine, whether the shock turns into a systemic sudden stop episode. The empirical evidence also confirmed that large fluctuations in real exchange rates, domestic liability dollarization as well as a small supply of tradable goods are key determinants of systemic sudden stops. Thus, the authors conclude that while sudden stops may be triggered by external events, it is the country-level characteristics (determined by domestic policies) that enhance the vulnerability to sudden stops. Additionally, with increasing levels of financial integration, the probability of sudden stops initially increases but starts to decrease later – being close to zero for very high levels of financial integration.

Another study by **Galego and Jones (2005)** also uses similar definition of sudden stops. These authors only focused on 14 emerging economies over the years 1990-2003. Actual sudden stops were identified based on the fall in capital flows exceeding two standard deviations from its mean and on a period of market disruption. This approach yielded 12 sudden stops episodes. The authors also distinguished potential sudden stops, which were identified based on spreads of high yield debt. The authors found that the exchange rate flexibility does not change during the potential sudden stops. The main empirical findings of the paper indicate that countries with floating exchange rates are less vulnerable to sudden stops. Furthermore, less flexible exchange rates during the potential sudden stops were found to increase the likelihood of actual sudden stops.

Cavallo and Frankel (2008) further extended the definition of sudden stops – when compared to the definitions of previously mentioned authors. Cavallo and Frankel (2008) included all countries with available data over the years 1970-2002 – using annual data. Such a dataset consists of 142 countries. The authors classified sudden stops as situations in which financial account surplus falls at least two standard deviations below the sample mean, current account deficit falls by any amount and GDP per capita falls by any amount as well. The advantage of this approach is that it excludes episodes when the reduction in current account balance is the result of a boom – by setting all sudden stops episodes to be disruptive (i.e. the condition for the simultaneous fall in GDP per capita). Using this definition, the authors identified 86 sudden stops episodes. After identifying sudden stop episodes, the authors study the role of trade openness in determining the probability of sudden stops – finding that lack of economic openness indeed does increase the probability of a sudden stop.

Another paper, by **Honig (2008)** also used a similar definition of sudden stops. Sudden stop episodes were therefore classified as situations with large and unexpected fall in net capital flows, accompanied by a reduction in current account deficit and a contraction in output. Based on this definition, current account deficit and output could fall by any amount, while the fall in net capital flows (measured by financial account balance) had to exceed two standard deviations below its sample mean. Using this approach and a sample of 154 countries, the author identified 85 sudden stops over the years 1982-2004. The author finds that there exists a non-linear relationship between the government quality and the incidence of sudden stops. Namely, at lower levels of government quality, the increase in government quality increases the probability of sudden stops. However, an increase in government quality at higher levels of government quality indeed does reduce the likelihood of sudden stop episodes.

A slightly different approach to identifying the sudden stops was used by **Hutchinson and Noy (2006)**. The authors argued that the previous literature had previously not examined the linkages between capital flow reversals and currency crises. The authors further argued that the analysis of sudden stops that occurred alongside currency crises could help to explain why some currency crises are associated with large output losses. Sudden stops were identified as situations when there was a contemporaneous occurrence of a currency crisis and a capital account reversal. A currency crisis episode was identified as a situation when the index of currency pressure (measured based on real exchange rate changes and international reserves losses in percentages) exceeded its mean by at least two country-specific standard deviations – provided that it also exceeded 5 %. A capital account reversal was identified as a positive change in current account surplus by at least 3 % - as current account reversals are argued to be highly correlated with capital account reversals. Using the dataset covering the years 1975-1997 and comprising 24 emerging market economies, the authors identified 24 sudden stop episodes. The main empirical findings indicated that sudden stop crises have large and negative short-term effect on output growth – an effect that was much larger than the relatively small effect of currency crises, which did not occur alongside a sudden stop crisis.

On the other hand, **Hutchinson et al. (2010)** used a different approach to identify sudden stops when compared to Hutchinson and Noy (2006). They followed the similar approach taken by other studies in defining sudden stop episodes as situations when there was a decrease in the financial account balance by at least 2 standard deviations below the country-specific mean (i.e. a significant reversal of capital inflows), coupled with any reduction in current account deficit. The authors argued that this approach is superior as it does not set any arbitrary thresholds. Furthermore, since the authors aimed at focusing on many different output paths, they did not include any condition related to output drop in their definition of sudden stops – as opposed to many previous studies. Using data for 66 non-OECD countries over the years 1980-2003, the authors identified 83 sudden stops. The empirical results of the paper indicated that tighter monetary and fiscal policy lead to a more significant output drops following a sudden stop. On the other hand, expansionary monetary policy was not found to limit the output drop following the sudden stop, while expansionary fiscal policy was found to reduce the output losses after the sudden stop. Therefore, the authors concluded that the optimum policy response to the sudden stop was neutral monetary policy and expansionary fiscal policy.

Jeanne and Rancier (2006) focused on 34 middle income economies during the years 1975-2003 in their empirical analysis. The authors used a relatively simple approach to identify sudden stop episodes – identifying sudden stops as situations when the ratio of capital inflows to GDP falls by at least 5 percent of GDP year-on-year. The authors identified 80 episodes of sudden stops. In their study, the authors focused on designing a model of the optimal level of international reserves for a small and open economies that is vulnerable to sudden stops. The empirical analysis conducted by the authors did support the findings of the model.

Another study that focused on sudden stops was **Ortiz et al. (2007)**. These authors concentrated on the effectiveness of various policy responses to sudden stops. The authors argued that identifying sudden stops as situations when the capital inflows fell by 5 percent of GDP year-on-year would also yield situations when there was a positive terms of trade shock or when there was an idiosyncratic crisis. Consequently, the authors focused on sudden stops that originated from exogenous financial turmoil. These episodes were referred to as systemic sudden stops, which the authors associated with very high interest rate spreads and collapsing capital inflows. In order for these episodes to be systemic, they had to occur during a period when such systemic sudden stops hit a large set of emerging economies. As a result, the authors identified the systemic sudden stops as episodes when the fall in capital flows in a country exceeded two standard deviations below its mean (with the window starting when the fall exceeded one standard deviation and ending when the fall was smaller than one standard deviation) that overlapped at any point with an aggregate-spread window. The aggregate-spread window occurred when the aggregate Emerging Market Bond Index (EMBI) spread exceeded two standard deviations from its mean (with the window starting when the spread exceeded one standard deviation and ending when the spread turned smaller than one standard deviation). The authors identified 2 such aggregate-spread windows during the studied period – one in early 1990s (i.e. time of Tequila crisis) and in late 1990s (i.e. time of 1997 Asian crisis and 1998 Russian crisis). Using monthly data over the years 1990-2006 for 31 emerging economies, the authors identified 22 systemic sudden stops episodes. The empirical investigation conducted by the authors found that countries that tightened their monetary and fiscal policy stances during the systemic sudden stops episodes experienced greater drops in output than countries that did not tighten their monetary and fiscal policies.

Rothenberg and Warnock (2007) used a novel approach to identify sudden stops episodes. In fact, these authors argued that the sudden stops identified by other authors could be further divided into

what the authors referred to as sudden flight and true sudden stops. Rothenberg and Warnock (2007) first identify the sudden stops episodes using the standard approach – later separating these episodes into sudden flights and true sudden stops episodes. Consequently, sudden stops are standardly identified as situations when the net capital inflows fall at least two standard deviations below its mean – with the sudden stop episode starting when the fall exceeds one standard deviation and ending when the fall is less than one standard deviation. After identifying sudden stops episodes, the authors define the episodes of sudden flight as situations when the increase in gross capital outflows exceeds the decrease in gross capital inflows (that is local residents are sending money abroad). Conversely, the true sudden stops were identified as situations when the fall in net capital flows was caused by actions of foreign investors – that is the decrease in gross capital inflows exceeds the increase in gross capital outflows. The authors found evidence that a substantial portion of traditionally defined sudden stops are in fact sudden flights. Using the data for a set of 28 emerging economies over the years 1989-2005, the authors identified 70 sudden stops episodes. Due to missing data on gross capital flows, this set of sudden stops was reduced to 55 episodes – with 24 being the sudden flight episodes and 34 being the true sudden stops. Main empirical findings of this study indicate that the true sudden stops are associated with greater declines in output and higher rates of currency depreciation. Furthermore, true sudden stops are more likely to occur in several countries during the same time period.

The relationship between the sudden stop period and the real exchange rate changes was examined by **Terada-Hagiwara (2005)**. By utilizing the cumulative impulse response function and variance decomposition analysis, an asymmetric response was found in changes in the real exchange rate between tranquil and sudden stop periods. These results were obtained by analyzing quarterly data from eight emerging economies between 1980 and 2000. Terada-Hagivara (2005) defined sudden stops in two ways. Sudden stop occurs if the reduced net capital flows is less than the sample mean and persists for another two quarters or if the decline in the financial account is larger than the sample standard deviation. Sample mean and standard deviation are taken for the panel of countries.

Calvo et al. (2006) examined the effect of sudden stops on relative price volatility. Based on the analysis of conditional variance, wholesale and consumer price ratios, they found that Sudden Stops and potential balance sheet effects are the key determinants of relative price volatility. In their analysis, they used the ARCH panel model on monthly data between 1990 and 2001 in 15 developing and 17 developed economies. According to the authors, a systematic sudden stop occurs if the financial account falls by at least 2 standard deviations below its mean and at the same time if the change in the aggregate bond spread (for example, Emerging Market Bond Index spread over US Treasury bonds) is at least two standard deviations below the mean.

A historical look at the periods of the sudden stop crises was addressed by **Catao (2007)**. The author compiled a database of incidences of sudden stops between 1870-1913 for 16 countries. In his study, he worked with two definitions of sudden stop episodes. A crisis occurs when the change in the financial account is at least 2 standard deviations below zero. The second condition when a sudden stop occurs is if the decline in the financial account is at least 3% of GDP. However, it is not necessary for both conditions to apply at the same time. Catao (2007) defines not only the beginning of the crisis but also its end. Sudden stop occurs if the FA attains its peak and ends when the financial account starts rising relative to trend without falling back to its lowest level within a four-year period.

The hypothesis that surge in reserves represents a form of self-insurance that countries have taken against the future sudden stops has been tested by **Durdu et al. (2009)**. The authors used a dynamic stochastic general equilibrium approach and data from 17 emerging markets during 1985-2004. They found that financial globalization and Sudden Stop risk can explain the surge in reserves. In their study,

they did not work with a specific definition of sudden stop, but used episodes of sudden stops, which were identified by Calvo et al. (2004), Cavallo and Frankel (2008) and Rothenber and Warnock (2006). These definitions are already specified in more detail in this text.

Joyce and Nabar (2009) highlighted the importance of the domestic banking sector in countries pursuing financial globalization. Based on data on emerging markets for 1976-2002, they found that if the domestic banking sector did not face a systemic crisis, then a sudden stop was not associated with a significant decline in investment. The sudden stop episode was defined in two steps. In the first, based on Calvo et al. (2006), they defined a "capital flow window" that occurs when the change in the balance of the financial account is at least 2 standard deviations below the mean. In the second step, they defined a sudden stop as a period when the GDP of the economy declined during the "capital flow window".

Sula, et al. (2010) created a database of sudden stops on an annual basis, which contains 38 emerging markets between 1990-2003. According to the definition used, the sudden stop period occurs when the reduced capital inflows are at least 4 percent of GDP compared to the previous year and the financial account balance is in deficit in the year of the sudden stop. The study reveals that a surge in capital inflows significantly increases the probability of a sudden stop and if it is accompanied by a high current account deficit or an appreciated real exchange rate is more likely to be associated with a sudden stop.

References

1. Babecky, J., Havranek, T., Mateju, J., Rusnak, M., Smidkova, K., and Vasicek, B. 2014. Banking, debt, and currency crises in developed countries: Stylized facts and early warning indicators. *Journal of Financial Stability*, No. 15, pp. 1-17.
2. Baldacci, E., I. Petrova, N. Belhocine, G. Dobrescu, and S. Mazraani. 2011. Assessing Fiscal Stress. IMF Working Paper No. 11/100 (International Monetary Fund).
3. Baron, M., Verner, E., and Xiong, W. 2018. Identifying Banking Crises, Princeton University manuscript.
4. Becker, T., and Mauro, P. 2006. Output Shocks and the Shocks That Matter. IMF Working Paper No. 06/172.
5. Bordo, M., Cavallo, A., and Meissner, C. 2010. Sudden Stops: Determinants and Output Effects in the First Era of Globalization, 1880-1913", *Journal of Development Economics*, Vol. 91, No. 2, pp. 227-241.
6. Bussière, M., and Fratzscher, M. 2008. Low probability, high impact: Policy making and extreme events, *Journal of Policy Modeling*, Vol. 30, No 1, pp. 111-121.
7. Calvo, G., Izquierdo, A. and Loo-Kung, R. 2006. Relative price volatility under sudden stops: the relevance of balance sheet effects. *Journal of International Economics*, Vol. 69 No. 1, pp. 231-54.
8. Calvo, G., Izquierdo, A., and Mejia, L. 2004. On the Empirics of Sudden Stops: The Relevance of Balance-Sheet Effects. NBER Working Paper No. 10520.
9. Calvo, G., Izquierdo, A., and Mejia, L. 2008. Systemic Sudden Stops: The Relevance of
10. Balance-Sheet Effects and Financial Integration. NBER Working Paper No. 14026.
11. Caprio, G., and Klingebiel, D. 1996. Bank Insolvencies: Cross-Country Experience, World Bank Policy Research Working Paper No. 1620, July 1996.
12. Caprio, G., and Klingebiel, D. 1999. Bank Insolvencies: Cross-Country Experience, World Bank Policy Research Working Paper, update.
13. Caprio, G., Klingebiel, G., Laeven, L., and Noguera, G. 2005. Appendix: Banking Crisis Database. In Patrick Honohan and Luc Laeven (eds.), *Systemic Financial Crises: Containment and Resolution*. Cambridge, U.K.: Cambridge University Press.

14. Catao, L. 2007. Sudden stops and currency drops: a historical look. In *The Decline of Latin American Economies: Growth, Institutions, and Crises*, edited by Edwards, S., Esquivel, G. and Márquez, G. (Eds). NBER Books, Cambridge, MA, pp. 243-90.
15. Cavallo, E., and Frankel, J. 2008. Does Openness to Trade Make Countries More Vulnerable to Sudden Stops or Less? Using Gravity to Establish Causality. *Journal of International Money and Finance*, Vol. 27, No. 8, pp. 1430-52.
16. Durdu, C., Mendoza, E. and Terrones, M. 2009. Precautionary demand for foreign assets in sudden stop economies: an assessment of the new mercantilism. *Journal of Development Economics*, Vol. 89, No. 2, pp. 194-209.
17. Gallego, F., and Jones, G. 2005. Exchange Rate interventions and Insurance: Is 'Fear of Floating' a Cause for Concern? Central Bank of Chile Working Paper No. 326.
18. Gerling, K., Medas, P., Poghosyan, T., Farah-Yacoub, J. and Xu, Y. 2017. Fiscal Crises. IMF Working Paper No. 17/86.
19. Honig, A. 2008. Do Improvements in Government Quality Necessarily Reduce the Incidence of Costly Sudden Stops? *Journal of Banking and Finance*, Vol. 32, No. 3, pp. 360-373.
20. Hutchison, M., and Noy, I. 2006. Sudden Stops and the Mexican Wave: Currency Crises, Capital Flow Reversals and Output Loss in Emerging Markets. *Journal of Development Economics*, Vol. 79, pp. 225-248.
21. Hutchison, M., Noy, I., and Wang, L. 2010. Fiscal and Monetary Policies and the Cost of Sudden Stops. *Journal of International Money and Finance*, Vol. 29, No. 6, pp. 973-987.
22. Ilzetzki, E., Reinhart, C. M., and Rogoff, K. S. 2017. Exchange Arrangements Entering the 21st Century: Which Anchor Will Hold? NBER Working Paper No. 23134, February 2017, National Bureau of Economics Research.
23. Jeanne, O. and Ranciere, R. 2006. The Optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications. IMF Working Paper No. 229.
24. Jing, Z. 2015. Banking crises: identification, propagation, and prediction. Groningen: University of Groningen, SOM research school.
25. Jorda, O., Schularick, M., and Taylor, A. M. 2017. Macrofinancial History and the New Business Cycle Facts. In *NBER Macroeconomics Annual 2016*, volume 31, edited by Martin Eichenbaum and Jonathan A. Parker. Chicago: University of Chicago Press.
26. Joyce, J. and Nabar, M. 2009. Sudden stops, banking crises and investment collapses in emerging markets. *Journal of Development Economics*, Vol. 90 No. 2, pp. 314-22.
27. Kaminsky, G., Lizondo, S., and Reinhart, C. 1998. Leading Indicators of Currency Crisis, IMF Staff Papers, Vol. 45, No. 1, pp. 1-48.
28. Laeven, L. and Valencia, F. 2018. Systemic Banking Crises Revisited. IMF Working Paper No. 18/206.
29. Lo Duca, M., Koban, A., Basten, M., Bengtsson, E., Klaus, B., Kusmierczyk, P., Lang, J. H., Detken, C., and Peltonen, T. 2017. A new database for financial crises in European countries. ECB/ESRB EU crises database. Occasional Paper Series No 13/July 2017. ESRB.
30. Ortiz, A., Ottonello, P., Sturzenegger, F., and Talvi, E. 2007. Monetary and Fiscal Policies in a Sudden Stop: Is Tighter Brighter? Harvard University Working Paper No. rwp07-057.
31. Reinhart, C., and Rogoff, K. S. 2009. This time is different: Eight centuries of financial folly. Princeton, NJ: Princeton University Press.
32. Reinhart, C. M., and Rogoff, K. S. 2011. From Financial Crash to Debt Crisis. *American Economic Review*, No. 101, pp. 1676-1706.
33. Rothenberg, A., and Warnock, F. 2007. Sudden Flight and True Sudden Stops. The Institute for International Integration Studies Discussion Paper Series No. 187.
34. Schularick, M., and Taylor, A. M. 2012. Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008. *American Economic Review*, 102(2), 1029-1061.

35. Sula, O. 2010. Surges and sudden stops of capital flows to emerging markets. *Open Economies Review*, Vol. 21 No. 4, pp. 589-605.
36. Terada-Hagiwara, A. 2005. Explaining the real exchange rate during sudden stops and tranquil periods. Discussion Paper No. E-15, Institute for Monetary and Economic Studies, Bank of Japan, Tokyo.
37. Von Hagen, J., and Ho, T. K. 2007. Money market pressure and the determinants of banking crises. *Journal of Money, Credit and Banking*, No. 39, pp. 1037–1066.