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Learning from the Past to Predict the Future: Three Essays on Banking Crises

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Die Datenbank des vierten Kapitels und die Daten des dritten Kapitels stehen unter www.quantfinhistory.org zur Verfügung.

In dedication and in deep gratitude to
Iván Alves

&

in loving memory of
my father.

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Chapter 1

Introduction

Banking crises are recurring phenomena of capitalist financial systems. The economically advantageous flexibility of credit-money systems that allows for a dynamic expansion and reduction of the money supply in response to aggregate demand brings with it an inherent instability that can end in disaster (Mehrling, 2010). Banking distress ultimately originates in the "maturity mismatch" between banks' main assets (long term loans) and main liabilities (short-term deposits) which can give rise to bank runs with self-fulfilling characteristics (Diamond & Dybvig, 1983). A change in expectations—regardless of whether justified by fundamentals or not—induces a sudden shift in the demand for money which can bring banks to the limit of what they can pay out to their depositors as most of their assets can not readily, or only at high costs, be liquidated. Fortunately for our well-being and unfortunately for scholars of the matter, banking crises are rare. In fact, they are so rare that a typical citizen often experiences only one or two of these events during her life time. To study banking crises and to make universal statements about their nature, researchers thus must either extend their analysis far into the cross-section or into the time dimension to gather a sufficient amount of observations from which they can derive stable empirical patterns. Adopting the latter approach, I delve into the history of banking crises in the following chapters.

For the purpose of this dissertation, I define banking crises as substantial disturbances to the financial intermediation by or among banks within a specific country and time period. Banking crises can be accompanied by bank runs—whereby it does not matter whether there are physical queues outside of bank buildings or the run on deposits happens invisible to most observers in the interbank market—but they do not have to be. In fact, as I explain in chapter 4, many banking crises are "quiet" and often unfold without too

much attention from the general public, which unfortunately does not make these types of banking crises less dangerous to the economy. I further see banking crises as one of four sub-categories of financial crises along the lines of Claessens & Kose (2013). The other three sub-categories of financial crises are currency crises, public debt crises, and sudden stops, which, although occasionally touched upon, are not the center piece of this work.

The devastation caused by the Global Financial Crisis has re-kindled interest in the topic of banking crises within macroeconomics and catapulted the topic from the sidelines right onto the mainstream agenda. While there was a multitude of banking crises in the decades leading up to 2007—for example in East Asia, Scandinavia, and Latin America—the generally benign economic environment of the Great Moderation directed a lot of interest in macroeconomics away from credit and crises towards the optimal management of the "new" business cycle. Economic historians and outcast economists with the right theories made their way back to the center stage of modern macro after the subprime bubble burst in the United States. The author of this dissertation, too, developed his interest in the matter in the shadow of one of the most menacing financial crises in the history of capitalism. By the early 2010s, Minsky's (1986) Financial Instability Hypothesis and Kindleberger & Aliber's (2015) famous account of historical crises had made their way from the fringes of the discipline into the introductions of many a highest-rank journal publication. Simultaneously, the increasing availability of historical data and records on-line paved the way for a new interest in the quantitative economic history of credit, crises, and crashes with the seminal contribution of Schularick & Taylor (2012).

Now, more than twelve years after the collapse of Lehman Brothers on 15 September 2008, much has been learned from history. Reinhart & Rogoff (2009) and Baron et al. (2021) have provided comprehensive databases of banking crises spanning the time of centuries, Schularick & Taylor (2012) have shown that historically many banking crises are "credit booms gone bust" and that they can be predicted by closely following the development of credit aggregates, Reinhart et al. (2016) have found that for the past 200 years or so financial crises are associated with the ebb and flow in global commodity and capital flow cycles, and Schularick et al. (2016) have shown that, unlike in the past, the overwhelming majority of debt outstanding today in developed economies is household mortgage debt with increasing links to financial stability risks. In response to the recent global crisis, macro-prudential supervision divisions sprang up at oversight bodies and central banks around the world

and substantial effort was put into the development of early-warning systems (Kauko, 2014) and into the estimation of financial cycles and private credit-to-GDP gaps (Drehmann et al., 2012). Most of these early-warning models of banking crises capture domestic financial imbalances using, among others, credit aggregates and asset prices, while financial cycles are typically estimated using one-sided medium-term filters applied to the ratio of private credit to the non-financial sector over GDP. These techniques have satisfactory predictive abilities although their estimation is typically limited by the availability of data and the resulting fact that many of the available crisis observations within countries are related to the 2008 event.

With so much historical data uncovered and regular patterns established, what is left to say about the historical record of banking crises? As it turns out, quite a lot. Despite some recent signs of literature saturation, many open avenues for research remain unaddressed in between the cornerstones the aforementioned scholars have rammed. This dissertation contributes to the intersection of three research areas: financial stability, macro-finance, and quantitative economic history. Tackling a major limitation of the literature, I investigate in three cumulative essays (forming a chapter each) the causes and the prediction of banking crises over a very long time horizon. In particular, I explore sources and causes of financial instability other than those of domestic credit built-ups and of asset price bubbles and their changing behavior over time.

I find that, historically, the majority of banking crises (65%) are *not* credit booms gone bust but instead are the result of a much wider range of causes. While banking systems have become more resilient towards shocks from the real economy with advancing economic development, the share of banking crises of purely financial origin has risen continuously over the past 150 years. Contagion through various types of financial flows is responsible for a quarter of banking crises in modern times. Especially, the asset-side exposure of domestic banks to fragile foreign banking systems is a potent channel of international crisis transmission that is active irrespective of domestic financial conditions. Beyond credit aggregates and asset prices, I find that sudden reversals in corporate securities issuance are another helpful predictor of bank distress previously neglected. This dissertation additionally contributes to the literature by making available new historical data. It provides a new comprehensive database on the causes of banking crises for 46 countries from 1870–2016 which is accompanied by narrative summaries of all bank distress events in some major countries to showcase the attention to detail with which

the database was produced. Additionally, I present new historically consistent quarterly U.S. data of corporate securities issuance and bank loans which were previously unavailable.

Chapter 2 introduces a new transmission channel of banking crises where sizable cross-border bank claims on foreign countries with high domestic crisis risk enable contagion to the home economy. This asset-side channel opposes traditional views that see banking crises originating from either domestic credit booms or from cross-border borrowing. I propose a combined model that predicts banking crises using both domestic and foreign factors. For developed economies, the channel is predictive of crises irrespective of other types of capital flows, while it is entirely inactive for emerging economies. I show that policy makers can significantly enhance current early warning models by incorporating exposure-based risk from cross-border lending.

Using new quarterly U.S. data for the past 120 years, I show in chapter 3 that sudden reversals in equity and credit market sentiment approximated by several measures of corporate securities issuance are highly predictive of banking crises and recessions. Deviations in equity issuance from historical averages also help to explain economic activity over the business cycle. Crises and recessions often occur independently of domestic leverage, making the credit-to-GDP gap a deficient early-warning indicator historically. The fact that equity issuance reversals predict banking crises without elevated private credit levels, suggests that changes in investor sentiment can trigger financial crises even in the absence of underlying banking fragility.

In chapter 4, Matthew Baron and I systematically reassess the economic historiography of banking crises for 46 countries over the past 150 years to document how their main causes have developed over time. Banking systems have become more resilient against shocks to the real economy with economic development, making financial shocks the prevalent cause of crises today. However, only about 40% of all banking crises with widespread bank failures are credit booms gone bust, making an increasing share of banking crises the result of international contagion. Prior to the 1970s, bank equity returns proxying for banking stability are sensitive to trade, commodity, and domestic GDP shocks, but less so to past real estate returns and credit booms—whereas the reverse is true afterwards.

I conclude the dissertation in chapter 5 where I provide an overview over the main findings of the three essays and the overall contributions of this thesis. I further discuss the relevance of my findings for policy makers.

Chapter 2

Cross-Border Lending and the International Transmission of Banking Crises

2.1 Abstract

This chapter introduces a new transmission channel of banking crises where sizable cross-border bank claims on foreign countries with high domestic crisis risk enable contagion to the home economy. This asset-side channel opposes traditional views that see banking crises originating from either domestic credit booms or from cross-border borrowing. I propose a combined model that predicts banking crises using both domestic and foreign factors. For developed economies, the channel is predictive of crises irrespective of other types of capital flows, while it is entirely inactive for emerging economies. I show that policy makers can significantly enhance current early warning models by incorporating exposure-based risk from cross-border lending.

2.2 Introduction

Over a decade ago, the Global Financial Crisis shook the world economy to its core. From its epicenter in the United States it quickly spread around the globe. While the crisis saw a major part of the developed world economy struggle with systemic banking crises and subsequent political upheaval, a significant number of small open economies weathered the storm with not much more than a scratch (Lane & Milesi-Ferretti, 2011). These nations had

to endure adverse effects due to the subsequent collapse in global trade and economic activity, but a banking crisis itself never reached their domestic banking systems. In this chapter, I propose a new channel of international banking crisis transmission that explains the resilience of these small open economies, and develop an early warning model that can help policy makers to account for the systemic risk of banking crises from abroad that arises through this channel. I present a combined model of domestic and exposure-based risk that outperforms traditional approaches both in and out-of-sample.

In contrast to the existing and ample literature on banking crisis transmission, I emphasize a cross-border bank *lending* channel of contagion that works from banks in countries borrowing money to the banking system in a country that lends to these banks.[1] When a banking crisis unfolds in a foreign economy to which the home banking system has lent significantly, foreign banks may default on their loans and thus bring home banks into jeopardy. This stands in opposition to the cross-border bank *borrowing* channel á la Kaminsky & Reinhart (2000), Schnabl (2012), and Bruno & Shin (2015), in which banking crises spread from lending countries to recipient countries through a devaluation of the home currency in case the debt is foreign-denominated or through a negative credit supply shock from abroad. Recently, the borrowing channel has been put into question by Karolyi et al. (2018) who find that heightened bank flows are actually associated with improved financial stability in a recipient country's banking system.

Another strand in the literature considers domestic causes of financial instability and sees banking crises as the result of Minskyan domestic boom-bust dynamics. Schularick & Taylor (2012) among many others have convincingly shown that banking crises are often triggered by credit booms gone bust. The pattern of crisis incidence of the Global Financial Crisis, however, poses a puzzle: Countries without domestic credit booms—like Germany or Switzerland—experienced banking crises, while highly leveraged and capital-importing economies such as Australia or Canada did not. These observations can neither be explained by Minskyan dynamics nor by a bank *borrowing* channel. This open flank of the financial stability literature is further accentuated

[1] Importantly, I confine my analysis to the question of banking crisis incidence. Economies that have no exposure to the proposed channel of crisis propagation may still be affected in the aftermath of a banking crisis abroad when the real side of the economy is affected, and trade and foreign demand are inhibited. This secondary transmission channel is not subject of my study. I am purely interested in how countries are "infected" with banking crises from abroad, which have first-round adverse economic effects on the home economy. Second-round effects may occur additionally when trade with the infecting country collapses due to the banking crisis there.

by the fact that the role of net financial flows is not clear in explaining banking crises: The current account balance is an ambiguous crisis predictor (Frankel & Saravelos, 2012; Kauko, 2014). In this study, I resolve the puzzle through the introduction of the cross-border bank lending channel, and I further shed light on the role of the current account.

To show how the asset-side exposure to a foreign banking system functions as a channel of contagion, I develop a model that combines domestic risk of banking crisis with exposure-based risk. The domestic model uses standard multivariate logistic regressions with a binary banking crisis classifier as dependent variable and a set of macro-financial indicators as independent variables. The exposure-based model employs a weighted sum of domestic crisis probabilities in foreign countries on which the home economy has bank claims. As weights, I use the volume of the home country's cross-border asset-side exposure in relation to the size of its economy. The estimated crisis probabilities are measured against a threshold value that minimizes a loss function which considers the policy maker's preference for type I over type II errors (Detken et al., 2014). Whenever the threshold is breached a warning signal is issued.

I find that economies with low domestic financial risk still experienced banking crises at home if their banking system had accumulated large claims (in terms of GDP) towards banks in countries with high domestic risk. Conversely, some small open economies with elevated domestic instability demonstrated resilience because their banking systems had not lent heavily to banks in other high-risk countries. Combining both approaches significantly enhances the predictive ability of a model that considers domestic risks alone and showcases the significance of cross-border bank lending as a mechanism of crisis transmission. The combined system is tested in a recursive out-of-sample setting and outperforms both individual models.

To the best of my knowledge, this study is the first to propose an asset-side channel of banking crisis transmission and reverse the direction of the liability-side channel that has been prevalent in the literature. Methodologically, I build on the pioneering work of Lang (2018) who recently introduced exposure-weighted foreign variables into a multivariate logistic regression model set-up. The contributions of this chapter are highly relevant for policy makers as the combined model laid out here significantly enhances their monitoring abilities of systemic risk built-up by factoring in domestic risks abroad and weighing it with their home banking system's asset-side exposure to these risks.

Relatively few studies have previously integrated financial linkages into an early warning setting. Rose & Spiegel (2010) model both national and

international causes of the Global Financial Crisis within a multiple indicator multiple cause model. The international aspect is characterized by a real channel that consists of trade linkages and by a financial channel that reflects exposure to U.S. (or other high-risk countries') assets. The authors find little evidence, however, that either of the international factors matter in predicting the difference in crisis incidence. Minoiu et al. (2015), on the other hand, find that financial interconnectedness is a useful early warning indicator. The authors employ a classifications algorithm on network connectedness measures to predict systemic banking crises. They find that a country's own higher connectedness and lower connectivity among its direct financial partners both predict higher crisis probabilities. A binary regression model that includes connectivity measures outperforms a model that uses domestic macroeconomic factors alone. Aldasoro et al. (2018) add a total cross-border claims-to-GDP ratio to a set of credit and asset price indicators and find that it improves the predictive capabilities of a standard early warning model of banking crises. The ratio's predictive power intensifies the closer the forecasting horizon is set to the crisis event. The cross-border claims fare better than foreign-currency debt as ab indicator which underlines the importance of considering the role of international lending as opposed to international borrowing in propagating banking crises.

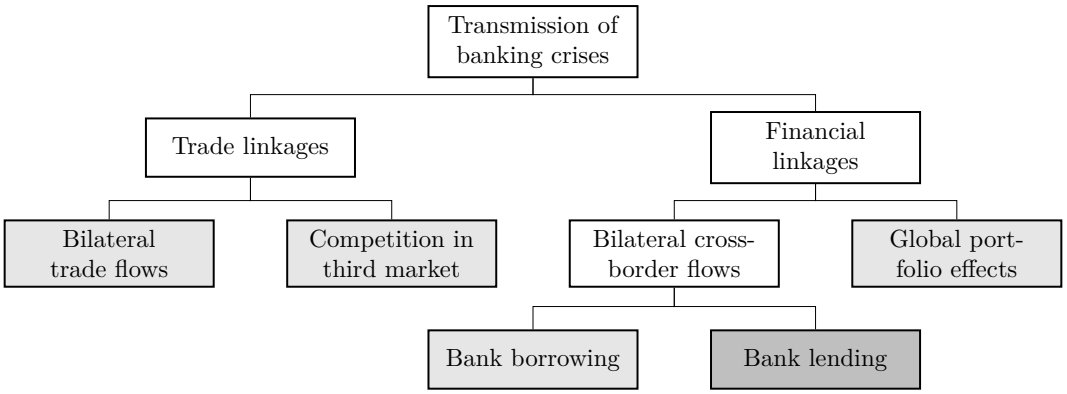
The remainder of the chapter is structured as follows. The upcoming section describes the proposed transmission channel in detail and presents supporting stylized facts. Section 2.4 discusses the data set and explains the methodology. Section 2.5 presents the main results, both in-sample and out-of-sample. In section 2.6, I discuss crisis incidence and the role of cross-border bank lending during the Global Financial Crisis. I conclude and offer policy advice in section 2.7.

2.3 Cross-border bank lending and banking crises

Banking crises generally arise from two different origins: economic and financial imbalances in the domestic economy, or disturbances abroad that are transmitted to the home economy. I refer to the latter channel broadly as contagion or the international transmission of banking crises. In their seminal study, Kaminsky & Reinhart (2000) distinguish between two types of linkages with two different channels each, through which financial crises can transmit

from abroad to the home economy.[2] Figure 2.1 summarizes the taxonomy of transmission channels and places the new lending channel (marked in light grey) within that framework.

Figure 2.1: Channels of international banking crisis transmission.



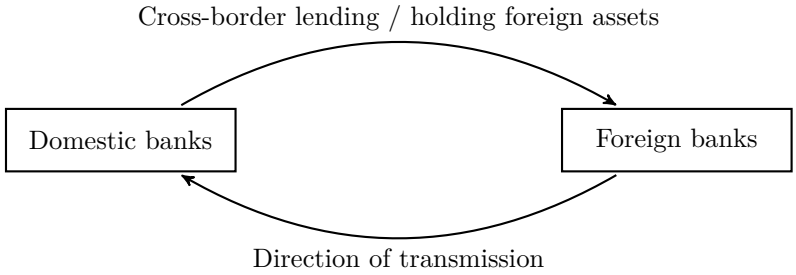
First, trade linkages between countries facilitate the propagation of shocks either through *bilateral trade exposure* or through *competition in a common third market*. Direct bilateral trade links matter in terms of contagion especially after a crisis unfolded in the foreign economy. The consequential downturn in economic activity abroad depresses demand for export goods at home and weakens the domestic real economy to the extend that it might bring banks at home in danger, potentially triggering a banking crisis at home. The second channel involves competition between the foreign and home country in a common third country and is based on a story of competitive devaluation. In case a banking crisis develops in the foreign economy its currency will devalue making its goods cheaper vis-à-vis the third country. The home country, which competes with the foreign economy in exports for the same good to the third country, may choose to devalue its own currency to remain competitive. This devaluation may bring banks at home into jeopardy that previously had borrowed heavily in foreign currency as they will find it much harder to repay their outstanding debts, potentially triggering a domestic banking crisis.

Second, less well-studied financial linkages enable the transmission of crises either through *bilateral cross-border bank flows* or through *global portfolio effects*. The currency crisis literature has long emphasized a channel of contagion through bilateral cross-border flows from a foreign country lending

[2] I distinguish between a financial crisis and a banking crisis in so far as that the latter is a sub-category of the former. I follow Claessens & Kose (2013) and distinguish between banking crises, currency crises, sudden stops, and debt crises. Importantly, I do not discuss the incidence of currency crises in this chapter as long as they do not coincide with a banking crises (twin crises).

significant funds denominated in the foreign currency to the home economy (Kaminsky & Reinhart, 1999). More recently, Schnabl (2012) and Bruno & Shin (2015) have confirmed contagion from a foreign, lending economy to a domestic, borrowing banking system as the direction of effect. Karolyi et al. (2018), however, revisit this channel and find that sizable flows from foreign to home banks actually increase financial stability in the recipient country. In this study, I reverse the direction of the bilateral cross-border flow channel and hypothesize a bank *lending* channel through which banking crises are transmitted from a foreign, borrowing economy to the domestic, lending economy. The global portfolio channel, lastly, refers to the exchange of non-bank financial assets across borders. While a foreign country experiencing a banking crisis will likely be affected by massive sales of its financial assets due to its deteriorating economic prospects, third-party international investors may be liquidity-constrained such that they may be unable to sell foreign assets at a price sufficient for meeting their cash flow requirements and may thus be forced to sell assets of the home economy, which they hold on their balance sheets, to free up cash. This will depress prices at home and could lead to a significant weakening of domestic banks' balance sheets, increasing the probability of a banking crisis at home.

Figure 2.2: The cross-border bank lending channel



In this study, I focus narrowly on the cross-border bank channel and specifically introduce an asset-side view of cross-border bank *lending* to the well-developed literature on contagion that focuses entirely on (foreign-denominated) cross-border bank *borrowing* (from the perspective of the infected or home country). It is important to note that, from an accounting perspective, outstanding loans to abroad on a domestic bank's balance sheet are equivalent to holding liabilities of foreign banks, such as mortgage backed securities, at home or maintaining deposits at banks abroad—they all show up as positions on the asset-side of the domestic bank owed to a foreign entity. This is why I occasionally refer to the bank lending channel more generally as the asset-side channel of cross-border banking. Figure 2.2 illustrates the channel and the

direction of ts effect.

Theoretically, the cross-border bank lending channel can be decomposed into three sub-channels which each explain a distinct process of how a banking crisis can be triggered in the home country when a foreign economy, to which the home country has lent heavily, experiences a banking crisis itself. First, a banking crisis in the foreign economy could cause foreign banks to go bankrupt which then would default on their international liabilities, bringing the banks in the home economy into jeopardy and potentially triggering a banking crisis at home. Second, foreign banks may remain solvent but find themselves unable to access liquidity because of a banking panic or general loss in confidence. The foreign banks may find it difficult to acquire the liquidity to pay back the loans they owe to the home country's banking system thereby inducing financial instability at home. Third, depressed real economic activity abroad resulting from a banking crisis (i.e. second-round effect) lowers the demand for credit in the home economy which previously had lent heavily to the now adversely affected foreign economy. This could endanger home banks' profitability and increase the probability of banking crisis at home.

While the Global Financial Crisis of the last decade wreaked economic havoc around the globe, there were important differences in crisis incidence among developed and emerging economies as well as between them (Rose & Spiegel, 2011; Lane & Milesi-Ferretti, 2011; Berkmen et al., 2012). A closer look at the developments following the crisis reveals that some countries fared remarkably well despite the sudden halt in global trade and the severe disruptions in international financial markets. Australia, Canada, Chile, the Czech Republic, Israel, New Zealand, and Poland were among these resilient economies which did not experience systemic banking crises at home and also exhibited considerably lower output losses. Contrarily, the U.S. subprime crisis triggered systemic banking crises in Denmark, Germany, Hungary, Norway, Spain, Sweden, and Switzerland, among others.[3]

The Minsky-Kindleberger-Fisher boom-bust narrative (Minsky, 1986; Kindleberger & Aliber, 2015; Fisher, 1933) has been prevalent in the discussion of the Global Financial Crisis (e.g. Schularick & Taylor, 2012; Eggertsson & Krugman, 2012; Brunnermeier & Sannikov, 2014) but cannot sufficiently explain the observed crisis incidence. Countries like Australia and Canada were domestically highly leveraged, exhibited house price hikes but did not experience banking crises, while unleveraged economies with flat property price devel-

[3] A structured approach to dating and identifying historical banking crises is discussed in the next section.

opments like Switzerland and Germany suffered from systemic bank failures and saw government-led bailouts. I address this deficiency by augmenting the story of domestic built-up of imbalances by an approach that incorporates the transmission of systemic risk from abroad. Figure 2.3 illustrates this exposure-based view by depicting bilateral cross-border bank claims in relation to GDP among several important economies at the onset of the recent crisis in the first quarter of 2007. The displayed weights are calculated as

$$w_i^j = \frac{\text{bank claims}_i^j}{\text{GDP}_i}$$

where bank claims_i^j are the bank claims of home country i on the foreign economy j.[4] This exposure measure is then divided by the home country's GDP. In short, the figure displays a home economy's cross-border exposure against foreign countries in relation to its GDP. During the estimation process of the exposure-based model the weights are then further multiplied by the foreign countries' estimated domestic crisis probability to retrieve an exposure-based index of foreign-induced risk of financial instability. Grey fields in the figure indicate the non-availability of data.

The central role of London as a center of global finance is immediately visible from the prominent position of Great Britain as a counterparty with which many economies maintain high levels of cross-border exposure. This exposure can take various forms—such as loans to, deposits at, or financial assets emitted by British banks. Switzerland, the Netherlands, Ireland, and—to a lesser extend—Belgium and Norway exhibit high levels of exposure to Great Britain. All these nations were subsequently hit by domestic banking crises. Paradoxically, the direct exposure of these countries to the United States did not matter as much. The exposure of Great Britain, in turn, to the United States was substantial. This stylized fact gives a first impression of how the crisis may have spread from the United States to the British Banking System and from there to various developed economies in relative close geographical proximity. On the other hand, countries like Canada, Australia, Israel, or New Zealand were not exposed to British assets and—due to the resulting unimportance of the asset-side transmission channel—did not experience banking crises at home, either.

Irrespective of their domestic macro-financial conditions, some countries effectively were financial islands in the storm that was the recent crisis, because

[4] As is described in more detail in the following section, these bank claims of country i are often approximated through the liability-side of counterparty countries $\{1, ..., J\}$ as not all countries in the sample report their cross-border exposures.

Figure 2.3: Cross-border claims at the onset of the Global Financial Crisis

they maintained no significant exposures to the U.S. subprime market or to third countries which themselves had significant exposures and turned out to develop their own banking crises.[5] In the following section, I propose a methodology to combine the domestic risk of banking crisis with the exposure-based risk of being subject to destabilizing spill-over effects from abroad.

2.4 Methodology and data

My general idea to show that the cross-border bank lending channel matters for the transmission of banking crises is to factor in exposure-based risk into a model that otherwise only considers domestic imbalances as a source of financial instability. I expect this combined model to clearly outperform a purely domestic one in predicting banking crises as it additionally considers the risk of instability that stems from abroad. Taken to the historical data, the com-

[5] It is interesting to note that many of the developed economies that proved resilient are those that have a consistent and long history of remarkable financial stability. The question whether the asset-side channel could also be helpful in explaining why banking systems in Canada, New Zealand, or Australia were historically largely resistant to contagion I leave for future research.

bined model should further be able to predict the incidence of banking crises in individual countries during the recent global crisis period out-of-sample.

I compute three distinct models: A domestic model (DM), an exposure-based model (EM), and a combined model (DEM). The general approach of all three models closely follows the established early-warning literature.[6] This proximity is important since the model can be useful for policy makers wishing to enhance current approaches to predicting banking crises. All three models produce probability estimates and a corresponding threshold value that emits a warning signal of imminent crisis when it is breached. The DM uses standard multivariate logistic regressions with a binary banking crisis classifier as dependent variable and a set of macro-financial indicators as independent variables. The EM employs the GDP-weighted sum of domestic crisis probabilities in foreign countries on which the home economy has bank claims. Effectively, the EM measures a home country's exposure to risk of banking crisis in foreign countries based on the size of claims the home country's banking system maintains with these foreign countries. The home country's exposure to each foreign country is then multiplied by the foreign country's own estimated domestic crisis probability. Lastly, The DEM includes the weighted foreign risk measure into the logistic regression equation of the DM. The estimated crisis probabilities of all models are measured against respective threshold values that minimize a loss function which considers the policy maker's preference for type I over type II errors. Whenever a threshold is breached a warning signal is issued.

The dataset consists of two components: first, an unbalanced panel of national macro-financial variables and banking crisis observations, and second, a network of cross-border bank assets and liabilities. The data have quarterly frequency and coverage begins in the 1970s for major countries and ends with the second quarter of 2019. Table 2.1 gives a comprehensive overview of data availability and banking crisis dates. The national macro-financial variables come from the OECD and the BIS. Banking crisis dates are determined by a structural and quantitative approach based on bank stock price data, as discussed in the following section. The cross-border banking data is calculated from the Locational Banking Statistics (LBS) published by the BIS. Unfortunately, not all nations report their asset-side cross-border exposure to the LBS. For countries which do not, the exposure is approximated by the liability-side of their counterparties that do report.

[6] Frankel & Saravelos (2012) and Kauko (2014) provide excellent literature overviews and comprehensive reviews of the predictive power of various banking crisis indicators.

Table 2.1: Data availability and crisis observations

Country	**Size**		**Type**		**Indicator Data**	**LBS data**	**Banking crises**	
	Small	Large	Emerg.	Dev.	Start	Start	Start	End
Australia	X			X	1974q1	1977q4	1990q1	1992q1
Austria	X			X	2003q1	1977q4	2008q3	2011q4
Belgium	X			X	1995q1	1977q4	2008q3	2009q4
Brazil		X	X		2004q1	1996q1	1985q3	1986q4
							1994q3	1997q4
Canada	X			X	1973q1	1977q4	1982q3	1985q4
Chile	X		X		2005q1	1983q1	1975q2	1977q4
							1981q3	1984q4
China		X	X		2008q2	1985q4	1998q1	1998q4
Czech Republic	X		X		2011q1	1993q4	1994q2	1999q1
							2000q2	2001q4
Denmark	X			X	1993q1	1977q4	1992q2	1995q1
							2008q3	2013q4
Finland	X			X	1975q1	1977q4	1991q3	1994q2
France		X		X	1995q1	1977q4	1991q3	1995q1
							2008q3	2009q4
Germany		X		X	1973q1	1977q4	2008q3	2010q2
Great Britain		X		X	1977q4	1977q4	1973q1	1975q4
							1991q3	1994q2
							2008q3	2011q4
Greece	X		X		2013q1	1977q4	2011q3	2014q4
Hungary	X		X		2010q4	1977q4	1991q1	1995q4
							1997q1	1997q4
							2008q3	2010q3
Ireland	X			X	1990q1	1977q4	2008q3	2009q4
							2010q4	2012q4
Israel	X			X	1997q1	1990q4	1983q4	1985q4
Italy		X		X	1988q1	1977q4	1991q3	1995q1
							2011q3	2013q4
							2016q1	2019q4
Japan		X		X	1985q1	1977q4	1990q3	1996q4
							1997q4	2000q4
							2001q2	2005q2
Mexico		X	X		2008q1	1980q4	1982q3	1982q4
							1994q4	1997q4
Netherlands	X			X	1982q1	1977q4	2008q3	2009q2
New Zealand	X			X	1987q1	1977q4	1988q3	1990q4
Norway	X			X	1994q3	1977q4	1991q4	1994q2
							2008q3	2009q4
Poland	X		X		2013q1	1992q1	1992q1	1996q4
Portugal	X			X	2013q1	1977q4	2008q3	2012q4
Russia		X	X		2004q1	1995q2	1995q3	1995q4
							1998q3	1999q4
							2008q3	2009q4
South Africa		X	X		1969q1	1977q4		
South Korea		X	X		1984q1	1977q4	1997q4	1998q4
Spain		X		X	1990q1	1977q4	1978q1	1981q4
							2008q3	2012q4
Sweden	X			X	1982q1	1977q4	1992q3	1997q2
							2008q3	2009q2
Switzerland	X			X	1973q1	1977q4	1992q3	1997q2
							2008q3	2009q2
Turkey		X	X		2013q1	1986q1	1983q4	1984q4
							1994q2	1994q4
							2000q4	2001q4
United States		X		X	1973q1	1977q4	1984q1	1986q4
							1991q1	1992q2
							2007q3	2010q4

Notes: The start date for indicator data refers to the first date for which all indicators are available for model estimation. The start date for LBS data refers to the first data for which either LBS asset-side data is available or for which asset-side data can be proxied by liability data of reporting counterparties. Emerg. refers to emerging economy. Dev. refers to developed economy.

The total panel includes 33 countries. To ensure data availability and quality at quarterly frequency, all nations are either members, accession candidates, or key partners of the OECD and report their national data to the organization. Selecting the countries poses a challenge as the results of this study shall be generalizable. I, thus, aim to include all major developed economies and further all nations large enough to function as key influential players either globally or locally (i.e. the United States, Japan, and China). A second consideration is to balance developed with emerging economies, larger with smaller nations, and account for geographical variation, as well. Nations I would have liked to include but for which I had difficulties to obtain correct data at a high enough frequency were Hong Kong and Singapore (regional financial centers); Iceland (highly exposed prior to the recent crisis); and Colombia and Argentina (virtually unaffected by the Global Finanical Crisis).

I categorize economies as large if their population exceeds 50 million, and as small otherwise. I am interested in investigating whether the impact of the cross-border bank lending channel on financial instability differs from smaller countries to larger ones. It is conceivable that smaller economies may face a bigger threat from foreign exposure as their financial systems might quickly outgrow the size of their domestic economies like in Iceland, Ireland, Switzerland, or Luxembourg. Conversely, larger economies are more likely to have a high number of internationally active banks which would increase their cross-border exposure in relation to smaller, non-international banking systems. I further define two country subsets of emerging and developed economies for which I use the classification of major finance company MSCI that is common in financial market practice.[7] Since the currency crisis literature has long stressed—what I call—the cross-border bank *borrowing* channel of crisis transmission, i.e. through the exposure to foreign(-denominated) liabilities, I investigate whether the asset-side (or lending) channel also applies to emerging economies or is rather a phenomenon of more developed economies. I estimate all models separately for the four country subsets and once for the entire sample.

[7] https://www.msci.com/market-classification, accessed January 2020. Israel was moved into the developed economy category in 2010. Classifying Israel for the purpose of this chapter instead as an emerging economy reduces the size of the standard errors for the emerging market subset somewhat but does not alter the general results—neither in terms of sign or of significance of the estimated coefficients.

2.4.1 Dating banking crises

A binary dummy serves as the independent variable of all three models and is set to one whenever a systemic banking crisis is ongoing in a specific country at a specific point in time, and to zero otherwise. The identification and dating of banking crises is no easy matter and lively discussions have revolved around the correct methodology. Thus, several competing databases exist (Demirgüç-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999; Bordo et al., 2001; Reinhart & Rogoff, 2009; Jordà et al., 2017; Lo Duca et al., 2017; Romer & Romer, 2017; Laeven & Valencia, 2020). Recently, Baron et al. (2021) have proposed a promising method to consolidate and restructure these often narrative-based approaches and introduced a novel dataset of historical bank stock prices for 46 countries over the past 150 years to date periods of bank distress. Whenever a country's bank stock index drops by at least 30 percent the event is considered, and the literature is systemically scanned for evidence of widespread bank failures and panics, i.e. bank runs or heavy disturbances in the interbank market. With this approach the authors are able to detect previously unknown crisis episodes, confirm well-known events, and discard several spurious crises that were prominent in the literature but otherwise left little evidence in the data. Based on Baron et al. (2021), Baron & Dieckelmann (2021) build a comprehensive database of banking crises that extends the current dataset by adding post-crisis GDP, bank credit, and public debt measures; by quantifying policy responses, such as liquidity provision, bank holidays, liability guarantees, or bank nationalizations; and by providing narrative summaries for more than 150 bank distress events.

In this study, I build on the advanced crisis dating methodology of the forthcoming database. Specifically, I employ a three-step process to identify periods of significant bank distress and date the quarter of their beginning and end. First, I select all events from the database that are identified to have exhibited widespread bank failures. Widespread, hereby, is defined as either more than five banks or at least one major bank. Second, I choose the quarter in which a panic occurred as the starting date for these distress episodes. The panic date refers to the month in which bank runs, the collapse of interbank markets, or the failure of a systemic institution occurred. Not all periods of widespread bank failures exhibit a panic. These episodes Baron et al. (2021) call "quiet crises" because they are often resolved without much knowledge of the public, but still can—as the authors show—significantly impair economic activity. Third, if no panic is recorded, I resort to the excellent databases of Laeven & Valencia (2020) and Lo Duca et al. (2017) as they offer precise

dating of the beginning, and in the latter case, of the end of distress periods. In the rare case that the two sources do not agree with Baron & Dieckelmann's (2021) dating method and do not record dates for the respective events, I use the quarter in which the bank stock prices drop by at least 30 percent as the starting date of the crisis. Table 2.10 in the appendix illustrates the result of the dating process in detail.

2.4.2 The domestic model

To predict the probability of a banking crisis resulting from domestic imbalances, I choose a standard method—a pooled multivariate logistic regression model—from the tool set of the early warning literature to ensure economic interpretatability and tractability. First, I define a baseline model of the form

$$logit(\pi^d) = \ln \frac{\pi^d}{1-\pi^d} = \beta_0 + \beta_1 X + \epsilon \tag{2.1}$$

where π^d is the probability of occurrence of a banking crisis within a certain range of upcoming quarters, called pre-crisis horizon.[8] X is a vector of independent variables. I evaluate the estimated probability $\hat{\pi^d}$ against a threshold value. If $\hat{\pi^d}$ breaches that threshold a warning signal is issued. For readability, time indexes are dropped from the notation above. The pre-crisis horizon is set to a range of 3 to 12 quarters and is motivated by the stylized facts provided further below in Figure 2.4 where credit growth tends to peak between three to five quarters before a crisis and house prices peak earlier at around eight to twelve quarters prior. This range is also well in line with pre-crisis horizons set by Holopainen & Sarlin (2017, five to twelve quarters) and Detken et al. (2014, four to twenty quarters).[9]

Bussiere & Fratzscher (2006) report the existence of a post-crisis bias when observations enter the model estimation process at time points when crises are unfolding (crisis periods) or being resolved (post-crisis periods). Including these observations can distort model results as they present states of the economy where adjustment processes are taking place and macro-financial indicators are thus severely distorted. I account for the post-crisis bias by

[8] Strictly speaking, I am not predicting crisis observations but pre-crisis periods. The idea here is to give governments and monetary authorities sufficient time to react to an impending crisis.

[9] Altering the pre-crisis horizon within four years prior to crisis events does not significantly alter the results presented in the next section. It is important, however, to set the horizon long enough to account for the lead peak of house and share prices over private credit. An upper bound of less than ten quarters has proven to be insufficient.

dropping crisis observations from the training data set. I ensure that crisis periods are dated in such a way that a crisis is considered to be over only when the respective economy has re-entered its normal state. I can thus forgo defining a special post-crisis horizon.

Table 2.2: Confusion matrix

	Crisis	No crisis
Signal	True positive	False positive (type I)
No signal	False negative (type II)	True negative

To assess the model's predictive abilities, I define a confusion matrix as depicted in Table 2.2 where the occurrence of a crisis 3 to 12 quarters after a signal has been issued is counted as a true positive; and as a false positive if no crisis follows. Equally, if no crisis occurs 3 to 12 quarters after no signal has been issued (the default) the count of true negatives is increased by one. If, however, an unforeseen crisis ensues, a false negative is recorded. Whenever the estimated crisis probability breaches a certain optimal threshold, a warning signal is issued. Next, I construct a linear grid of $n = 1000$ evenly distributed possible threshold values $v \in [0, 1]$ and loop through all potential threshold values to find the one value that minimizes Alessi & Detken's (2011) policy maker's loss function of the form

$$L = \phi \underbrace{\frac{FN}{TP + FN}}_{\text{type II error rate}} + (1 - \phi) \underbrace{\frac{FP}{FP + TN}}_{\text{type I error rate}}$$

where TP and FP are the total number of true and false positives over the entire sample given a certain threshold v, and TN and FN are the total number of true and false negatives, respectively. The policy maker sets $\phi \in (0, 1)$ according to her preference for issuing a false alarm over missing a crisis without an alarm. ϕ thus represents the model's sensitivity to issue a warning signal. A higher value of ϕ will result in a more conservative prediction result that prefers a wrong signal over missing a crisis. The choice of the policy parameter influences how low or high the threshold bar will be set. Whether a domestic crisis probability of p^d is tolerable or is a reason for concern ultimately depends on the policy maker's risk aversion and policy preference.

I collect five common macro-financial indicators as independent variables for the domestic model that are endorsed by the literature: Total private credit to the non-financial sector, the private debt-to-GDP ratio, residential property

prices, stock prices, and the current account-to-GDP ratio.[10]

Table 2.3: Independent variables

Indicator	**Transformation**	**Source**
Private credit to the nonfinancial sector	3-year real growth rate	BIS
Private credit to the nonfinancial sector	to-GDP ratio	BIS
Residential property price index	3-year real growth rate	BIS
Equity price index	3-year real growth rate	OECD
Current account balance	to-GDP ratio	OECD

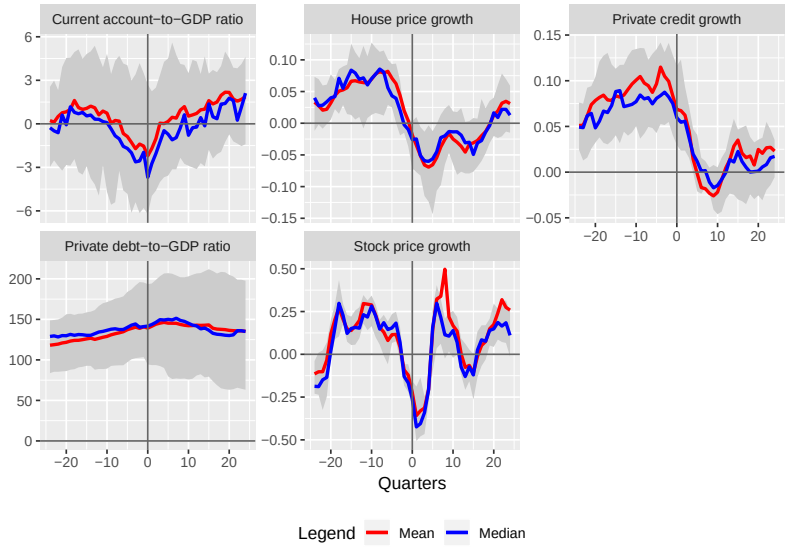
The independent variables receive several transformations that are motivated by stylized facts and findings of other studies. According to a now rich literature, financial instability is connected to medium-term cycles in private credit and asset prices whose peaks are closed related to and predictive of financial crises (e.g. Borio & Lowe, 2002; Drehmann et al., 2012; Aikman et al., 2015; Strohsal et al., 2019). It has thus become a standard approach in the early warning literature to extract a medium-term deviation from trend from private credit and asset prices to capture the built-up of macro-financial risk. Most commonly, the filtering techniques proposed by Hodrick & Prescott (1997, HP) or Christiano & Fitzgerald (2003, CF) are used for extraction of those deviations (e.g. Detken et al., 2014; Babecký et al., 2014; Lang, 2018). Schüler (2018) and Hamilton (2018) have recently criticized the use of the HP filter because of its tendency to induce spurious cycles. Hamilton (2018) proposes a regression of the variable on its four most recent values as a remedy. Other very common and simple alternatives are moving averages or rolling growth rates over a window of several years to capture the medium-term characteristics of the financial cycle (e.g. Schularick et al., 2016; Dell'Ariccia et al., 2016; Aikman et al., 2017; Lang et al., 2019). For reasons of simplicity, the baseline model in this study uses 3-year growth rates as the standard transformation for private credit, house prices, and equity prices.[11] Table 2.3 displays the list of indicators, their baseline transformations, and their respective source.

Figure 2.4 displays event studies that show the mean and median development of the five indicators 26 quarters prior to and after the start of a crisis event. The grey band represents 50% of total observations that lie within the

[10] I have also used a larger set of indicators including inflation, policy rate, U.S. dollar exchange rate, and government debt. The qualitative results of this study—especially with regard to the functioning of the cross-border lending channel—remain unchanged, however.

[11] For robustness, I also employ one-sided HP filters and the Hamilton (2018) procedure to extract the medium-term component of these series. The general results, however, do not change substantially.

Figure 2.4: Behavior of indicator variables around crisis observations



Notes: This figure presents event studies of indicator variables 25 quarters before and after the beginning of a banking crisis event. Shaded areas indicate range between lower and upper quartile.

lower and upper quartile (25^{th} and 75^{th} percentiles) of the respective indicator across all countries and periods. All growth rates are yearly and computed in real terms. The figure confirms established facts about macroeconomic developments around banking crises. Growth in private credit to the nonfinancial sector increases steadily up until very close to the onset of the crisis. House and stock price hikes precede banking crises. Also, house prices tend to peak on average five to six quarters before the onset of the crisis which is in line with findings by Schudel (2015). Stock prices, on the other hand, reach their height up to ten quarters prior to the beginning of a crisis. There is some indication that a worsening of the current account balance precedes crises which I examine further in the following section.

2.4.3 The exposure-based model

Building on the baseline domestic model applied to foreign countries (FCs), the exposure-based model captures the foreign-induced risk of banking crisis in a banking system abroad. The following approach is influenced by the recent pioneering work of Lang (2018) but differs in the way the foreign-induced risk is aggregated and ultimately combined with the domestic model. I define the

exposure-based model as

$$logit(\pi^e) = \beta_0 + \beta_1 \frac{1}{C_i} \sum_{j}^{C_i} \hat{\pi}_j^d \underbrace{\frac{\text{bank claims}_i^j}{\text{GDP}_i}}_{w_i^j} + \epsilon. \tag{2.2}$$

The exposure of a home country (HC) i is measured by the total outstanding bank claims$_i^j$ of its banking system against foreign countries divided by the HC's GDP, as described in section two. These cross-border exposure weights w_i^j are then multiplied by the respective domestic model probability $\hat{\pi}_j^d$ of those foreign economies C_i that are connected with the HC i. These exposure-weighted crisis risk estimations are finally summed up for each HC and divided by C_i. The resulting number represents a weighted risk index of foreign-induced banking crises. This index is then plugged into a simple logistic regression model with a constant term to ensure an output between 0 and 1.

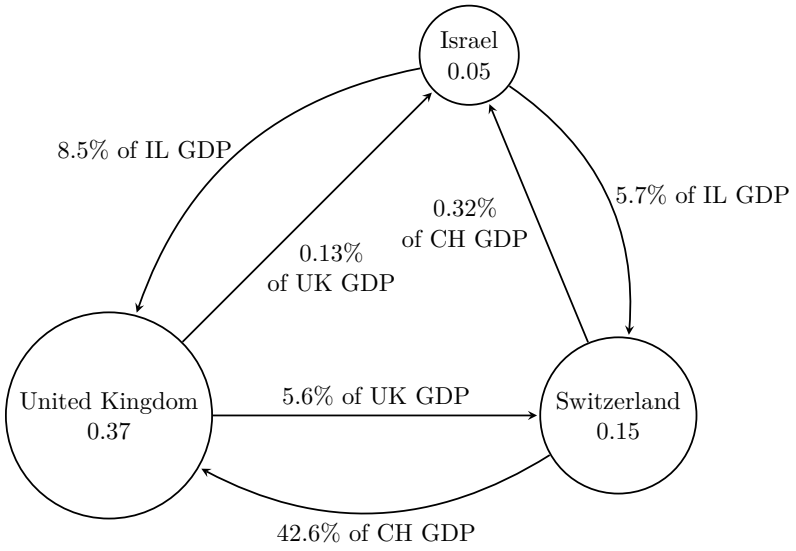
The Locational Banking Statistics (LBS) contain data on outstanding assets and liabilities of banks located in 47 reporting countries vis-à-vis banks located in over 200 counterparty countries. The LBS capture around 95% of cross-border banking activity worldwide.[12] To fully assess an HC's risk stemming from financial linkages to banks in other countries, I consider the total number of the HC's bank claims (asset side) against these foreign countries. The underlying assumption, as described by Lang (2018) and outlined in the previous section, is that an HC may find itself in a state of financial instability regardless of its own domestic risk if it has lent heavily—i.e. holds foreign assets—in relation to the size of its economy to banks in foreign countries experiencing a banking crisis, making them prone to fall short of their debt obligations.[13] Unfortunately not all countries report their cross-border bank claims (assets) directly to the BIS. Thus, I have to rely on the reporting countries' liability side for these economies. If data coverage was complete and data quality was perfect, a reporting country's liability vis-à-vis a country of interest should equal that country's claims (assets) vis-à-vis the same reporting country. Naturally, this is currently not the case. However, the patterns within the liability time series are consistent and, for the purpose of this chapter, report-

[12] https://www.bis.org/statistics/about_banking_stats.htm, accessed in January 2020.

[13] It is important to note here that, unlike the currency crisis or sudden stop literature, I am not interested in the inflow of capital into—or the lending to—the HC. These two processes represent another type of transmission channel of financial instability, especially if the flows are suddenly reversed. Here, the focus is on capturing foreign-induced banking crises and thus the HCs are modeled as lenders instead of borrowers of international funds.

ing countries' liabilities towards HCs must suffice as proxies for cross-border financial linkages where asset-side data is not available. As we will see further on, these approximations already yield highly informative results.

Figure 2.5: Illustration of the exposure-based model



Notes: The figure displays an excerpt of the cross-border network of bank claims. The number inside the circles are predicted domestic crisis probabilities and the arrows represent the volume of cross-border bank claims (pointing towards the debtor) in relation to the lending country's GDP.

The model's general idea is illustrated in Figure 2.5. The graph depicts a small segment of the network of cross-border bank claims that involves the two smaller countries Israel and Switzerland, and the large United Kingdom at the end of the first quarter of 2007. The numbers inside the nodes correspond to the predicted crisis probability of the country's respective domestic model out-of-sample on the basis of training data up until the end of 2006.[14] The labels adjacent to the edges indicate the amount of outstanding bank claims in relation to GDP from the point of view of the lending country. The arrows point from the lender to the borrower. It is immediately visible that Israel exhibits only a marginal probability of a domestically-induced banking crisis, Switzerland faces elevated risk, and the United Kingdom is confronted with a 37% probability of imminent banking crisis over the next 3 to 12 quarters. Unlike Israel, Switzerland has large exposure to the banking system of the United Kingdom of almost 43% of its GDP and thus faces a much larger threat of foreign-induced financial instability. Switzerland's aggregated index of foreign-induced crisis risk for the entire network will likely be much

[14] The depicted model is estimated separately for small and large economies. I discuss the results of the estimation and evaluation process in the following section.

higher than Israel's, and consequently the exposure-based model would predict a higher probability of foreign-induced crisis for Switzerland than for Israel. Since Israel is at the time of writing not reporting to the LBS, the assets and liabilities of Israel vis-à-vis Switzerland and the United Kingdom are not present in the source data. Israel's cross-border bank claims are proxied by the total bilateral liabilities reported by Switzerland (5.7% of Israeli GDP) and the United Kingdom (8.5% of Israeli GDP).

While the idea of an exposure-based early warning model originates from Lang (2018), my implementation differs substantially in the way the individual weights are aggregated as well as in how the domestic and exposure-based models are merged into a combined model. Lang (2018) uses the weights to compute exposure-based independent variables that are fed simultaneously with the domestic independent variables into a combined model. I deliberately choose to issue two distinct crisis probabilities to be able to distinguish between the impact of domestic and of foreign-induced crisis risk during the Global Financial Crisis. The policy maker's loss function and threshold optimization work exactly like described above for the domestic model.

2.4.4 The combined model

In a third step, the weighted risk index of foreign-induced banking crisis is plugged into the domestic model. The combined model takes the form

$$logit(\pi^e) = \beta_0 + \beta_1 X + \beta_2 \underbrace{\frac{1}{C_i} \sum_{j}^{C_i} \hat{\pi}_j^d \frac{\text{bank claims}_i^j}{\text{GDP}_i}}_{\text{crisis risk-weighted exposure index}} + \epsilon \tag{2.3}$$

and is estimated for small, large, emerging, developed, and all countries separately. In a slight variation, I estimate a second model for each country set that contains an interaction term between the current account balance and the foreign-induced risk index. Since the current account balance signals whether a country is a net capital importer (deficit) or exporter (surplus), it is related to the concept of cross-border bank flows which are one type of international capital flows. The inclusion of the interaction term allows for distinguishing the unconditional effect of the current account balance on financial instability from the effect that is conditional on high exposure to foreign crisis risk. The literature has found at best moderate evidence that a current account deficit, i.e. sustained foreign capital imports, is a predictor of banking crisis (Kauko, 2014), which corresponds to the conventional view that capital inflows can

lead to financial instability. With the cross-border bank *lending* channel, however, it is the exposure to foreign assets, not foreign liabilities, that drives up the risk of banking crisis, and I would thus expect—by tendency—a current account *surplus* to precede banking crises in case they are induced through foreign asset exposure. The interaction term helps to test this hypothesis.

The comparison between the domestic and the combined model gives an indication on whether the inclusion of banks' cross-border asset-side exposure matters for the explanation of financial instability in addition to the well-known domestic factors. An increase in the predictive ability of the domestic model after including the foreign-induced risk index is interpreted as evidence that the cross-border bank lending channel matters for financial instability and represents a hitherto missing puzzle piece in the macroeconomic understanding of international crisis transmission.

2.4.5 Evaluation

I evaluate the models' predictive abilities in-sample and out-of-sample. For the latter, I run two exercises: First, I use cross-validation, for which the sample is randomly split into equally sized parts, and where one part alternately functions as the testing data set while the rest of the data is used to train the system. The accumulated performance measures are then averaged over all runs. Second, I compute all three models recursively to corroborate the recursive exercise. This means that for every successive quarter the entire model specification is re-estimated on the basis of the observations that are available up until the respective point in time. The accumulated predicted crisis probabilities are thus out-of-sample at the point in time where the model was estimated. As a result, the optimal thresholds vary over time as the grid optimization process is reiterated with every additional quarter.

The literature knows several informative tools to evaluate a model's predictive abilities (Candelon et al., 2012; Sarlin, 2013). In this chapter, I use the popular Area Under the Receiver Operator Curve (AUROC) to assess my models' performance in-sample and out-of-sample. The AUROC is closely related to the concepts of the confusion matrix and the policy maker's loss function introduced earlier. The Receiver Operator Curve (ROC) is a two-dimensional graph that plots the sensitivity against the specificity for a range of considered threshold values (in this case $n = 1000$). Sensitivity—or alternatively the true positive rate (TPR)—is the ratio of the correctly signaled crisis events over all crisis observations; and specificity—or alternatively the true negative rate

(TNR)—is the fraction of correctly identified non-crisis events in all non-crisis events. Formally,

$$\text{Sensitivity} = TPR = \frac{TP}{TP + FN} = 1 - \text{type II error rate},$$

$$\text{Specificity} = TNR = \frac{TN}{TN + FP} = 1 - \text{type I error rate}.$$

The ROC then plots all TPR-TNR combinations for the grid of considered threshold values. Connecting these pairs results in a frontier curve that can be summarized in one measure by computing the area underneath. The policy maker's preference then takes the form of indifference curves that are tangent to the frontier which results in different optimal TPR-TNR value pairs and thus different optimal thresholds depending on the choice for the preference parameter ϕ.[15] The AUROC assumes values between 0 and 1, where a value of .5 corresponds to a coin toss and every value higher than .5 indicates a predictive ability of the classification system better than a random guess. The larger the AUROC, the better the predictive ability of the model.

2.5 Results

The estimation results of the domestic model presented in Table 2.4 hold no surprises and are well in line with the literature, as expected. Private credit matters for the prediction of financial instability for all country sets—be it as a growth rate or in the form of the debt level. While credit growth seems to be the slightly more relevant indicator across all country sets, it is only the level of private debt that is relevant for large economies. Asset valuations, as represented by house and share prices, are strong predictors, as well, with the interesting observation that for smaller economies house price growth is not statistically significant. Evidence on the current account balance is mixed, which is mirrored well in the literature that finds, at best, a moderate role for a current account deficit as a predictor of banking distress (Kauko, 2014). For smaller economies, a current account *surplus*, i.e. sustained capital exports, is predictive of banking distress at 5% confidence, while for emerging economies a current account *deficit* matters, even if only at an 11.9% confidence level. The current account coefficient estimates for the remaining country sets are not significantly different from zero. I interpret the opposite sign directions as first evidence that my proposed distinction of a cross-border banking channel

[15] Detken et al. (2014) provide a very clear and intuitive explanation of the AUROC and its relation to the policy maker's loss function in section 2.2 of their paper.

of crisis transmission into an asset side and a liability side meets evidence in the data. Cross-border *claims* of smaller nations with large banking sectors quickly become large in relation to the size of their real economy and thus change the direction of the economy's current account, turning it into surplus. Contrarily, the negative sign and the coefficients' sufficiently high statistical significance confirm the established finding from the currency crisis literature that sizable cross-border *liabilities* are predictive of banking crises in emerging economies.

Table 2.4: Domestic model estimations

Variable	**Country Set**				
	Small	Large	Emerging	Developed	All
(const.)	−5.508***	−4.837***	−8.114***	−3.836***	−4.640***
	(0.465)	(0.407)	(1.376)	(0.303)	(0.266)
Private credit, 3-year real growth rate	3.860***	0.674	11.000***	1.098*	1.708***
	(0.768)	(0.580)	(2.107)	(0.591)	(0.441)
Private debt-to-GDP ratio	0.007***	0.013***	−0.005	0.002	0.007***
	(0.002)	(0.003)	(0.008)	(0.002)	(0.001)
House prices, 3-year real growth rate	−0.086	2.819***	−5.559***	2.838***	1.738***
	(0.897)	(0.614)	(1.905)	(0.621)	(0.485)
Share prices, 3-year real growth rate	1.772***	0.796***	1.371***	1.418***	1.160***
	(0.230)	(0.193)	(0.411)	(0.174)	(0.138)
Current account-to-GDP ratio	0.048**	−0.032	−0.112	−0.005	−0.006
	(0.023)	(0.030)	(0.072)	(0.018)	(0.016)
Observations	1,515	1,331	716	2,130	2,741
Pseudo R2	0.695	0.541	0.902	0.501	0.610
AUROC	0.897	0.719	0.960	0.791	0.781
In-sample results					
Threshold ($\phi = 0.5$)	0.069	0.170	0.067	0.080	0.074
Sensitivity	0.840	0.469	1.000	0.773	0.682
Specificity	0.836	0.951	0.915	0.745	0.768
Threshold ($\phi = 0.8$)	0.038	0.012	0.067	0.053	0.040
Sensitivity	0.968	1.000	1.000	0.878	0.891
Specificity	0.635	0.067	0.915	0.550	0.481

Notes: The table displays estimation results from a pooled logistic regression model for various country sets. *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The Pseudo R^2 is computed following McFadden (1974). Sensitivity refers to the true positive rate (TPR), specificity refers to the true negative rate (TNR).

The optimal thresholds are computed for two different policy preference scenarios: indifferent ($\phi = 0.5$) and conservative ($\phi = 0.8$). Due to the high costs involved in missing an actual crisis event, the latter can be seen as the more plausible in an applied setting. All five model estimations exhibit at least satisfactory in-sample performance. Both McFadden's (1974) Pseudo R^2 and the AUROC point to strong predictive abilities. While the proposed domestic model yields good results for large and developed economies at AUROCs of 0.719 and 0.791, respectively, it performs exceptionally well for small and

emerging economies with values of 0.897 and 0.960. The pooled estimation has good predictive power at an AUROC of 0.781, as well. These results are robust to different growth rate horizons or to whether the medium-term component in credit and asset prices was computed via HP filter or Hamilton procedure, as is shown in the appendix. I thus interpret the better fit of the model for smaller and less developed economies such that their risk of financial instability largely stems from domestic sources. I hypothesize that for larger and more developed economies there is a greater role for the cross-border bank lending channel to induce financial instability. While I expect the domestic model's performance to improve for all country sets after the inclusion of the exposure-based risk, I assume that the increase will be most significant for larger and more developed economies, bringing AUROCs across the various country sets to higher, and more uniform levels.

Table 2.5: Exposure-based model

Variable	**Country Set**				
	Small	Large	Emerging	Developed	All
(const.)	-3.151^{***}	-3.284^{***}	-2.906^{***}	-3.094^{***}	-3.113^{***}
	(0.101)	(0.129)	(0.135)	(0.093)	(0.076)
Crisis risk-weighted exposure index	0.233^{***}	0.525^{***}	0.072	0.273^{***}	0.364^{***}
	(0.021)	(0.058)	(0.125)	(0.023)	(0.028)
Observations	2,648	1,864	1,487	3,025	4,512
Pseudo R^2	0.094	0.105	0.000	0.087	0.076
AUROC	0.643	0.609	0.358	0.696	0.628
In-sample results					
Threshold ($\phi = 0.5$)	0.064	0.064	0.053	0.067	0.060
Sensitivity	0.483	0.475	0.538	0.564	0.503
Specificity	0.825	0.820	0.586	0.791	0.762
Threshold ($\phi = 0.8$)	0.042	0.001	0.052	0.001	0.043
Sensitivity	1.000	1.000	1.000	1.000	1.000
Specificity	0.056	0.000	0.106	0.000	0.028

Notes: The table displays estimation results from a pooled logistic regression model for various country sets. *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The Pseudo R^2 is computed following McFadden (1974). Sensitivity refers to the true positive rate (TPR), specificity refers to the true negative rate (TNR).

In an intermediate step, I estimate the exposure-based model for the same country sets as above. Results are reported in Table 2.5. Using a logistic model with only the crisis risk-weighted exposure index as an independent variable ensures that the prediction outcome will be standardized between 0 and 1 and that it can, in this way, be compared to the output of the domestic model. The model performs best for developed economies with an AUROC of 0.696, which is only somewhat lower than the value for its domestic counterpart. I interpret this as evidence that asset-side cross-border exposure is on equal footing with domestic imbalances when explaining financial instability for developed

nations. For emerging economies, on the other hand, the crisis risk-weighted exposure index does not explain the incidence of banking crises and the AUROC consequently drops to 0.358. I conclude that the proposed asset-side transmission channel does not work for economies with less developed banking systems. As the currency crisis literature states, the international transmission of banking crises to these countries works through the liability side of banks' balance sheets, i.e. by borrowing from abroad. Country size does not affect the lending channel. The country subsets for small and large economies as well as the pooled set all exhibit similar moderate performances with AUROCs above the critical threshold of 0.5, but with significant coefficient estimates with positive signs for the exposure index, as expected.

Now, one could rightfully suspect that a banking system's asset-side exposure is highly correlated with its liability-side exposure, meaning that domestic banks engaged in lending to a specific country are also more likely to, for example, take deposits from the same country. As a result, the above results could be criticized such that they, in fact, do not capture the workings of the asset-side channel *over and above* the impact of the liability-side channel, but are rather the result of the correlation between the two channels. In a robustness check in Table 2.9 in the appendix, I control for the liability-side channel and for the interaction of the two channels by including a crisis-risk weighted liability-side exposure index, which is constructed by the same methodology as the asset-side index but with data for the liability side and reverse direction of effect, and by including an interaction term of both indices multiplied by foreign crisis risk into the exposure-based model. The results show that, for the sample of large and developed economies, the asset-side channel is active alongside and independently of the liability-side channel, while it is inactive for emerging and small economies. The liability-side channel, on the other hand, is active independently for all country sets which simply confirms the findings of the well-established currency crisis literature. The results of this robustness check strongly support my interpretation of the exposure-based model results, confirming that there is indeed an asset-side channel of crisis transmission which is active in advanced economies but not in emerging economies.

Lastly, I investigate how well the combination of both sources of risk explains the incidence of banking crises. The estimation results of the combined model are displayed in Table 2.6. As expected, the overall in-sample performance improves in comparison to the domestic model and a more uniform pattern of AUROC values emerges across all country sets. The cross-border bank lending channel represents an external source of risk of financial insta-

Table 2.6: Combined model estimations

Variable	**Country Set**									
	Small		Large		Emerging		Developed		All	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(const.)	−5.521***	−5.517***	−5.369***	−6.956***	−18.139***	−24.127***	−4.109***	−4.109***	−4.625***	−4.658***
	(0.529)	(0.531)	(0.493)	(0.621)	(4.476)	(6.041)	(0.349)	(0.350)	(0.300)	(0.301)
Private credit, 3-year real growth rate	1.21	1.178	2.590***	3.315***	20.649***	21.639***	−0.631	−0.631	1.244**	1.349***
	(0.880)	(0.908)	(0.653)	(0.707)	(5.176)	(5.938)	(0.694)	(0.710)	(0.510)	(0.513)
Private debt-to-GDP ratio	0.004*	0.004	0.010***	0.016***	0.02	0.060***	0.002	0.002	0.004**	0.004**
	(0.003)	(0.003)	(0.003)	(0.004)	(0.014)	(0.020)	(0.002)	(0.002)	(0.002)	(0.002)
House prices, 3-year real growth rate	1.265	1.253	0.616	0.522	−13.741***	−11.987***	3.033***	3.033***	1.475***	1.500***
	(0.995)	(0.999)	(0.726)	(0.747)	(3.940)	(4.373)	(0.678)	(0.679)	(0.536)	(0.534)
Share prices, 3-year real growth rate	1.602***	1.600***	0.698***	0.785***	1.982***	2.767***	1.306***	1.306***	1.082***	1.089***
	(0.233)	(0.233)	(0.218)	(0.271)	(0.624)	(0.801)	(0.183)	(0.183)	(0.145)	(0.146)
Current account-to-GDP ratio	0.018	0.021	−0.055*	−0.376***	−0.374***	−1.023***	−0.041**	−0.041*	−0.026	−0.043**
	(0.027)	(0.035)	(0.033)	(0.059)	(0.126)	(0.265)	(0.019)	(0.022)	(0.017)	(0.021)
Crisis risk-weighted exposure index	0.243***	0.246***	0.516***	0.746***	5.946***	1.425	0.223***	0.223***	0.327***	0.304***
	(0.029)	(0.037)	(0.079)	(0.090)	(1.614)	(2.972)	(0.028)	(0.032)	(0.034)	(0.038)
Current Account * Exposure Index		−0.001		0.201***		1.512**		0.00001		0.007
		(0.005)		(0.029)		(0.614)		(0.004)		(0.005)
Observations	1,500		1,241		681		2,060		2,741	
Pseudo R^2	0.649	0.649	0.446	0.529	0.885	0.918	0.421	0.421	0.524	0.525
AUROC	0.900	0.899	0.812	0.847	0.979	0.989	0.836	0.836	0.837	0.843
Comparison										
AUROC DM	0.897		0.719		0.960		0.791		0.781	
AUROC EM	0.643		0.609		0.358		0.696		0.628	
In-sample results										
Threshold ($\phi = 0.5$)	0.078	0.073	0.060	0.048	0.127	0.172	0.071	0.071	0.095	0.077
Sensitivity	0.840	0.851	0.844	0.856	0.950	0.950	0.793	0.793	0.663	0.712
Specificity	0.901	0.890	0.740	0.726	0.955	0.982	0.772	0.772	0.903	0.862
Threshold ($\phi = 0.8$)	0.016	0.015	0.042	0.045	0.018	0.004	0.038	0.038	0.028	0.027
Sensitivity	0.979	0.979	0.889	0.867	1.000	1.000	0.921	0.921	0.929	0.946
Specificity	0.435	0.409	0.655	0.714	0.893	0.882	0.486	0.486	0.443	0.426

Notes: The table displays estimation results from two pooled logistic regression models for various country sets. *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The Pseudo R^2 is computed following McFadden (1974). Sensitivity refers to the true positive rate (TPR), specificity refers to the true negative rate (TNR).

bility and its inclusion improves the general prediction of banking crisis. How substantial this improvement is, however, depends greatly on the level of development of the home banking system and to a lesser extend on the size of the home economy.[16] The inclusion of the Crisis risk-weighted exposure index into the domestic model has the greatest effect for large economies with the AUROC improving by 0.09 (no interaction) and 0.13 (with interaction) to 0.812 and 0.847, respectively. The combined model also improves domestic model estimations reasonably well for developed economies (by 0.05 each) and the pooled country set (by 0.06 each). This is in line with my previous findings that exposure-based risk from the asset-side of banks' balance sheets is increasingly predictive of financial instability the higher the country's banking system is developed. The pooled set shows similar predictive abilities only because it predominately consists of developed economies. Importantly, and confirming previous findings, the inclusion of the exposure index only adds marginally to the predictive ability of the domestic model for emerging economies: The cross-border channel of banking crisis transmission does not work through the asset-side for emerging economies.[17] For small economies, the improvement is negligible, as well.

The coefficient estimates reveal several interesting patterns.[18] First, there seems to be a clear distinction in how residential property prices affect financial instability: While a decline in real house prices predict crises in emerging economies, it is the other way around for developed nations: here, house price *hikes* are related to banking crises. I conclude that while the Minskyan asset boom-bust story applies well to developed nations, we must consider less developed economies in a different light. I conjecture that it is rather episodes of deflation and capital retrenchment resulting in collapsing house prices that precede crisis in emerging economies, than bursting house price bubbles that trigger devaluations and fire sale cycles.

[16] In the appendix, I conduct a robustness test in which I estimate the exposure-based model interacting the exposure index with the private credit-to-GDP ratio—as a proxy for financial development (King & Levine, 1993; Ang, 2008). As Table 2.11 shows, the exposure-index is increasingly predictive of banking crises the higher a country is financially developed, confirming the above findings.

[17] To corroborate this finding, I compute marginal effects for the combined model in the appendix to assess the magnitude of the effect from including the exposure index into the domestic model. As Figure 2.9 shows, its inclusion adds positively to the probability of banking crisis in all country sets except for emerging economies, where the effect is absent and not statistically different from zero.

[18] The standard errors of the coefficient estimates presented in the Table 2.6 do not account for within-country correlation in the error term. Clustering the error terms on the country level, however, has no effect on the interpretation of the results. This holds especially for the (non-)significance of the crisis-risk weighted exposure index.

Second, the significance of capital retrenchments in emerging economies is also visible from the highly significant and negative coefficient estimate for the current account balance. The exposure index does significantly increase financial instability but when I interact the index with the current account its unconditional contribution becomes insignificant. It is thus only when the current account is in surplus that the exposure index explains banking crises. When the balance is in deficit the exposure does not matter for financial instability. I explain this observation by assuming that, for emerging economies, other types of cross-border capital flows must matter more than bank flows, which are the only type of flow that are represented by the exposure index. Foreign direct investments or foreign portfolio flows may be much more indicative of incumbent financial instability.

Third, while cross-border bank flows do not seem to affect the current account significantly in emerging economies, for small economies the picture looks different: While the domestic model previously found that a current account surplus, i.e. sustained capital outflows, is indicative of financial distress, this effect disappears once I control for the exposure-based risk and its interaction with the current account. The exposure index assumes the significance that was previously (positively) attributed to the current account balance. This means that cross-border bank claims have a tendency to become so large in relation to small country's GDP that they quickly determine the direction of the current account.

Fourth, the inclusion of the interaction term only really improves the predictive ability of the domestic model for large economies, making the unconditional current account balance coefficient highly significant again with a negative sign. This is in line with the argument made previously that the inclusion of the cross-border bank lending channel yields the best results for larger economies.

Fifth and last, the inclusion of the interaction term only changes results for emerging and large economies; all other country set estimations are virtually unaffected—be it with regard to the models' predictive ability or to the coefficient and standard error estimates. For both types of economies the current account balance remains a separate indicator of financial instability after controlling for the risk originating from cross-border bank claims. I already concluded that the negative sign and the high significance of the current account estimate most likely points towards the importance of the cross-border bank *borrowing* channel. For large economies, the explanation is not immediately clear: Considering that the inclusion of the interaction term makes the current

account estimate significant (with a negative sign) and keeps the unconditional exposure index estimate significant, I conclude that the cross-border lending channel works regardless of the direction of the current account but is exacerbated by sustained capital imports. The message here is, that even though a large country is an overall net capital importer, sizable cross-border bank claims (which are capital exports) are still a powerful mechanism to import banking crises from abroad, even if the bank claims are small in comparison to other types of capital flows that are headed in the opposite direction.

The findings discussed above shed new light on why the current account balance so far has been difficult to employ as an early-warning indicator of banking crises. Both directions of the balance matter for financial instability: While emerging economies are more susceptible to crisis spillovers when they run a sustained deficit, i.e. capital imports, developed countries seem to have a tendency to expose themselves to foreign risk by sustained surpluses, i.e. capital exports. Bank flows—as one form of cross-border capital flows—matter most for smaller economies but can play a significant role in larger economies, too.

For the combined model, the indifferent policy scenario yields satisfactory detection rates, i.e. sensitivity and specificity scores. The potentially preferable, conservative scenario generally suffers, however, from pronounced decreases in specificity in relation to little gain in terms of sensitivity. While results look promising for emerging economies and fair for large economies the specificity drops below 50% for the other country sets. This means that in the conservative scenario the majority of issued warning signals would be false positives in return for sensitivity scores of around or above 0.90, which still means that every tenth crisis will be missed. Figure 2.8 in the appendix displays the policy maker's trade-off between type I and type II errors against the preference parameter ϕ for the pooled combined model. It is visible that the type I error rate, i.e. issuing false positives, climbs up rapidly from a ϕ value greater than 0.7 in return for only small improvements to the type II error rate. Without imposing on the policy maker's risk aversion and considering the importance of avoiding false negatives, i.e. missing crises, it seems that a ϕ in the upper range of 0.5 to 0.75 is desirable for the pooled model.

2.5.1 Out-of-sample performance

A popular form of criticism towards recently developed crisis prediction models is that the Global Financial Crisis is responsible for the bulk of crisis ob-

servations in most samples, and that excluding this event would result in a severe loss of general validity. In this section, I present results of two out-of-sample evaluation exercises that underline the usefulness of the models I propose not only as a backward-looking explanation of crisis incidence but also as a forward-looking early-warning model of banking crises. First, I conduct cross-validation over the pooled sample and, second, I employ a recursive assessment of all three models in which the three models are continuously re-estimated for every subsequent observation in time.

Cross-validation is a systematic assessment technique of a model's out-of-sample performance. The pooled sample is randomly split into $k = 5$ parts of equal size (same number of observations), called folds.[19] $k - 1$ folds comprise the training data, while the randomly selected k'th fold serves as the testing data, and is, thus, not used for the model's estimation but for its validation. All k possible combinations of training and testing datasets are then individually estimated and evaluated. Due to the randomization, the resulting AUROC measures become themselves stochastic. The cross-validation is then repeated $n = 10$ times to give a more arithmetically averaged picture of the out-of-sample predictive ability of this study's dataset.

Table 2.7 shows the results of the cross-validation exercise. Most importantly, the AUROC estimators are all greater than 0.5 at statistical significance. Thus, they have general predictive power out-of-sample. The exposure-based model performs out-of-sample worse than its in-sample counterpart, which is not surprising. Encouragingly, the domestic model's cross-validated AUROC is not different than its in-sample estimate at 99.8% confidence. The cross-validated combined model is statistically different from its in-sample counterpart only at 83.6% confidence. Also its estimate of 0.835 is not much lower than its in-sample counterpart. In summary, the combined model does not fare much worse—and at 16.4% confidence even equally as good—out-of-sample as it does in-sample, which is an extraordinary result and evidence of its general applicability.[20] Lastly, the combined out-of-sample performance is statistically greater than the domestic estimation, reconfirming the relevance of the cross-border lending channel.

The recursive exercise begins in the fourth quarter of 2004, as it is the

[19] I choose $k = 5$ because it is in the range of commonly used number of folds and is large enough to ensure the presence of sufficient crisis observations in the training set for the model to be estimated properly. I experiment with other values for k but they do not change the generally positive outcome of the validation process.

[20] Cross-validating a dataset naturally destroys the relevance of the data's time dimension due to random slicing. The second out-of-sample assessment using a recursive estimation accounts, however, accounts for the chronology of observations.

Table 2.7: Out-of-sample cross-validation results

Measure	**Model**		
	Domestic	Exposure-based	Combined
AUROC mean	0.798	0.587	0.835
AUROC standard deviation	0.036	0.060	0.039
Degrees of freedom	49	49	49
Pooled I-S estimation	0.781	0.628	0.843
T-test p-values:			
H0: Different from 0.5	0.000	0.000	0.000
H1: Different from I-S estimation	0.998	0.000	0.836
H2: Not Different from I-S estimation	0.002	1.000	0.164
H3: AUROC different from DM		0.000	0.000

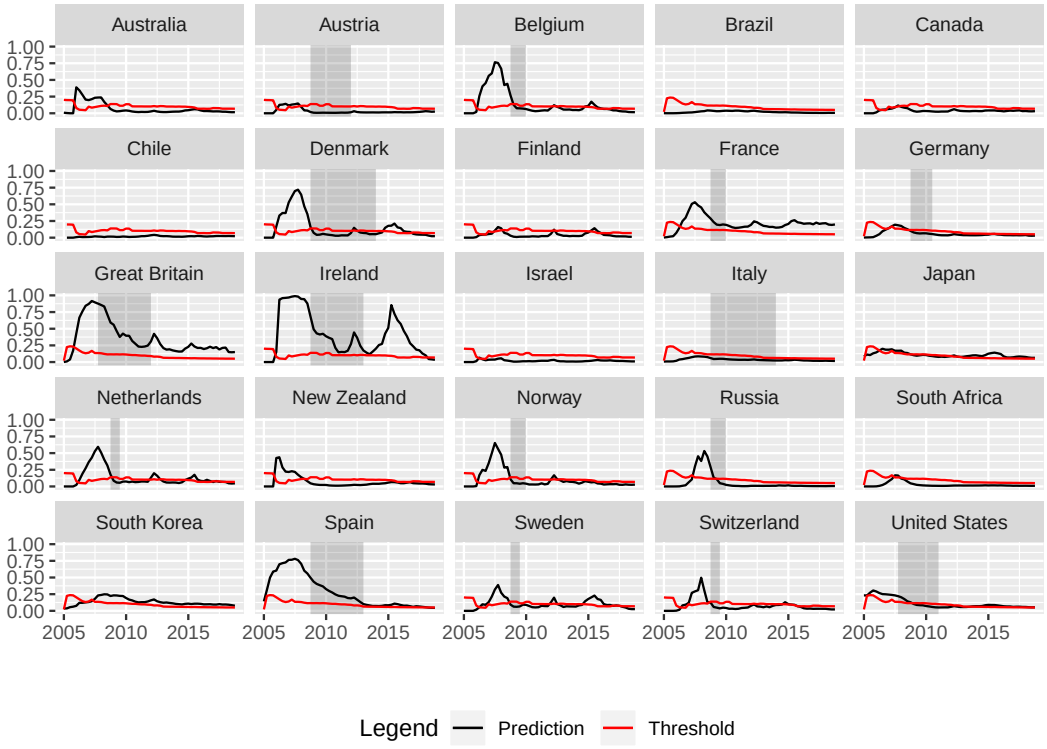
Notes: Cross-validation is computed with $k = 5$, $n = 10$, $\phi = 0.5$ on the pooled dataset without including the interaction term. Including the interaction term does not alter the results. I-S stands for in-sample. To account for non-equal variances when comparing two samples I employ Welch's (1947) t-tests.

earliest possible date for which sufficient balanced panel data is available for all country subsets and for which the estimation algorithm of the logistic regression model converges. I continuously re-estimate all three models for each successive quarter up until the end of data coverage in the third quarter of 2018. By computing the model predictions subsequently with information that is known at each respective time point alone, I prevent a look-ahead bias. Starting in 2004 means that the first recursive model estimation already factors in a number of crisis observations, for instance the Japanese crisis or the Scandinavian crises in the early 1990s. Again, I separate between small, large, developed, and emerging economies, and consider a pooled dataset, as well. I compute sensitivity and specificity measures after running the exercise for each country subset and compare their relative performances.[21]

Figure 2.6 displays the development of the estimated crisis probabilities and thresholds over time for the combined model and for all countries with sufficient data available. It is evident that for many countries which experienced domestic banking crises the crisis probability rises above the threshold well before the beginning of the respective crisis, as indicated by the shaded areas. This is an impressive result considering that it excludes all crisis observations during the Global Financial Crisis from the training data as they were no

[21] For this exercise, AUROCs cannot be used as an assessment of predictive ability. Effectively, there is no overall threshold choice anymore over which an AUROC could be computed. Each quarter has already been assigned its optimal threshold considering the data available at the time. The optimal threshold value for the entire recursive exercise is thus time-varying. However, we can compute the sensitivity and specificity based on these optimal thresholds and the respective crisis probability predictions at each quarter.

Figure 2.6: Recursive out-of-sample exercise of the combined model



Notes: The figure displays recursively estimated out-of-sample crisis probabilities and respective time-varying thresholds for a subset of countries with sufficient data. Shaded areas represent periods of banking crises. The combined model is estimated for small and large economies separately without using the interaction term between the crisis-risk weighted exposure index and the current account balance.

known at the time of the prediction. Especially, the domestic crises in Belgium, Denmark, France, Great Britain, Ireland, Netherlands, Norway, Russia, Spain, Sweden, and Switzerland could have been predicted out-of-sample if the model had been in place before 2008. It further succeeds in forecasting that Brazil, Canada, Chile, Finland, Israel, and South Africa remain resilient with their predicted probabilities not—or only briefly—breaching the threshold. Contrarily, the out-of-sample prediction of resilience would not have worked for Australia, New Zealand, and South Korea. Lastly, the picture is a little more mixed with the correct predictions that were less clearly above the thresholds as for Austria, Germany, and the United States. Here the model would have nonetheless issued warning signals, but a much clearer outcome—especially with regard to the United States as the global crisis' epicenter—would have been preferable.

In summary, however, the out-of-sample performance gives not only credibility to the methodology in terms of its potential as an early-warning model, but it also makes a case against the argument that it is only the observations

of the Global Financial Crisis that drive the good in-sample performance. Excluding this event all together would have still yielded very good prediction results and further supports my argument of the general applicability of the cross-border lending channel beyond the Global Financial Crisis.

Table 2.8: Out-of-sample recursive results

Measure	**Country Set**		
	Small / Large	Emerg. / Dev.	All
Domestic model			
Sensitivity	0.731	0.692	0.692
Specificity	0.662	0.752	0.773
Exposure-based model			
Sensitivity	0.736	0.607	0.567
Specificity	0.775	0.757	0.684
Exposure-based model IT			
Sensitivity	0.736	0.607	0.567
Specificity	0.775	0.757	0.684
Combined model			
Sensitivity	0.800	0.731	0.273
Specificity	0.837	0.838	0.806
Combined model IT			
Sensitivity	0.792	0.746	0.258
Specificity	0.850	0.792	0.737

Notes: Emerg. refers to emerging economies. Dev. refers to developed economies. IT refers to the inclusion of the interaction term between the current account balance and the crisis-risk weighted exposure index.

Table 2.8 summaries the results of the recursive exercise quantitatively by displaying the actual sensitivity and specificity scores over the entire time span for the individual models and country sets. One of the main findings of this chapter—namely that the inclusion of exposure-based risk from cross-border bank flows increases the predictive ability of purely domestic early warning models—is reconfirmed: The combined model's sensitivity and specificity scores are higher than those of their domestic counterparts for the model specifications where small and large, or emerging and developed economies, respectively, are estimated separately. Interestingly, this does not hold for the pooled approach. Here, the recursive exercise lets the sensitivity collapse way below 0.5. The exclusion of the Global Financial Crisis for the estimation of the majority of crisis events in the sample underlines the importance of distin-

guishing between the economic characteristics of the countries in question.

Summarizing the results from both exercises, a clear picture emerges: The model arguably has predictive power out-of-sample and qualifies for application in a policy setting. Although the majority of crisis observations in the sample occur during the Global Financial Crisis, the proposed combined model still produces very satisfactory prediction results with sensitivity and specificity scores around or above 0.8 if trained recursively. Similarly, the exposure-based model exhibits scores (well) above 0.6, indicating predictive power. This supports the notion that it is not just the recent major crisis event that enables the cross border lending channel in the model, but that it is a general phenomenon that was at work before.

2.6 The Global Financial Crisis

We saw that accounting for foreign-induced crisis risk originating from cross-border bank claims improves the performance of a model that considers domestic risks alone. Now, I turn back to the puzzle of crisis incidence during the Global Financial Crisis that I laid out in the introduction. Figure 2.7 shows the in-sample performance of the three models from a perspective of issued warning signals between the first quarter of 2006 and the first quarter of 2013. Lime green boxes stand for true positive predictions (as subsequently determined) and dark green ones for true negatives in the respective quarter. False negatives (missed crises) are assumed to be more costly than false positives (erroneous warnings) and are thus colored in red while false positives are represented in orange. The dark blue boxes indicate actual crisis periods while the light blue stands for the gap between the beginning of a crisis and the lower bound of the pre-crisis horizon (i.e. three quarters) where predictions are too close time-wise to the subsequent event to be useful for the policy maker. However, in none of the cases presented did it occur that a signal would only be issued one or two quarters ahead of a crisis event. Lastly, grey boxes indicate the absence of data.

We observe that the domestic model is unable to explain crisis incidence in Italy and German, while the exposure-based model fails to predict distress in Hungary and Greece. The domestic model further issues false warnings for South Africa, New Zealand, Finland, and Australia. This is an expected outcome, as all these countries experienced a significant built-up of private credit and house prices in the years preceding the Global Financial Crisis, inducing

Figure 2.7: Warning signals around the Global Financial Crisis

expectations of domestic imbalances and a Minskyan boom.[22]. However, none of these countries actually experienced a banking crisis. The key to why this may have been the case, lies in the results of the exposure-based model for

[22] Source: https://stats.bis.org/statx/srs/table/h2 and https://stats.bis.org/statx/srs/table/j?m=C, accessed June 2020.

these economies: With the exception of Finland, the model signals low exposure to high-risk banking systems abroad and, thus, consequently issues no warning signal, resulting in true negatives. For Finland, however, the proposed model does not work.

Now, combing domestic imbalances with exposure-based risk from cross-border lending yields a much better picture: The combined model predicts crisis incidence perfectly, if we consider, in the case of Italy, four consecutive quarters of warning signals as a sufficient indication of impending crisis.[23] Also, the combined model correctly issues warning signals for Germany: The country experienced negative real house price growth and no significant built-up of private credit, but, nonetheless, a severe banking crisis developed from banks' exposure to British and American liabilities, i.e. subprime mortgages. In predicting resilience, the combined model is a little weaker as it would have falsely issued consistent warning signals for South Korea, South Africa, Japan, and Finland. The important take away is, however, that even though the incidence of resilience may not have been conclusively addressed, the incidence of banking crisis can be explained by the combination of the domestic and the exposure-based channel.

In summary, large exposure to highly leveraged foreign banking systems is the missing puzzle piece in the Minskyan narrative of the Global Financial Crisis. The combination of the two sources of financial instability together explain crisis incidence perfectly within the sample of this study. Conversely, low asset-side exposure on the balance sheets of domestic banks seem to have been a major factor in explaining the resilience of many, often highly-leveraged economies, outside of Europe and the United States.

2.7 Conclusion

This chapter contributed to the literature threefold. First, it introduces and provides evidence for a new channel of international banking crisis transmission working through banks' cross-border asset-side exposure. Sizable cross-border bank claims on foreign countries with high probability of domestic systemic risk function as a channel of contagion to the home economy. The cross-border bank lending channel stands in contrast to traditional views that see banking

[23] The case of Italy is somewhat special: Baron & Dieckelmann (2021) argue that contrary to the assessment of Laeven & Valencia (2020), Italy's banking crisis did not start until 2010, as its banking system was initially not heavily impacted through its exposure to foreign liabilities in high-risk countries, but later because of its massive holdings of sovereign bonds of southern European countries threatened by default.

crises either as a result of domestic boom-bust dynamics or of cross-border borrowing in foreign currency. Second, I present a significantly improved early-warning technique to capture both domestic and foreign-induced risk of banking crisis, that incorporates the exposure to at-risk foreign banking systems in a network setting. The presented model outperforms traditional approaches that consider purely domestic risks considerably, both in and out-of-sample. Third, this study provides evidence that the proposed channel is dependent on the level of financial development. While it is active and highly predictive of banking crisss in developed countries, no evidence can be found for its effectiveness in emerging economies. Here, the classical cross-border *borrowing* narrative applies. The inclusion of the international bank lending channel in an early warning setting, as also recently proposed by Aldasoro et al. (2018) and Lang (2018), stands in contrast to the established notion of international borrowing as an external source of financial instability that is well known from the currency crisis and external debt crisis literatures (Frankel & Rose, 1996; Reinhart et al., 1998; Reinhart & Rogoff, 2009)

The early-warning system in this study combines into a single system a domestic model—which uses standard multivariate logistic regressions with a binary banking crisis classifier as dependent variable and a set of macro-financial indicators as independent variables—with an exposure-based model—which employs a weighted sum of domestic crisis probabilities in foreign countries on which the home economy has bank claims. As weights, I use the volume of the home country's cross-border asset-side exposure in relation to the size of its economy. The model is set up in such a way that it issues warning signals in a pre-crisis period of 3 to 12 quarters before a predicted banking crisis to allow for the policy maker to apply counter measures.

As mentioned in the introduction, the incidence of banking crises in countries around the globe poses a puzzle to macro-finance and the banking crisis literature. The prevalent narratives of Minskyan boom-bust cycles or contagion through borrowing can not explain why highly leveraged economies like Australia and New Zealand were not affected, while low-risk economies like Germany and Switzerland were. A first of four major findings solves this puzzle: Including domestic banks' asset-side exposure to foreign banking systems in high-risk countries into a model of domestic imbalances explains crisis incidence. During the Global Financial Crisis economies with low cross-border exposure proved resilient towards the incidence of systemic banking crises. Although these countries may have exhibited domestic imbalances, like in the case of Australia, the low exposure shielded them from spill-overs from the United

States, the United Kingdom, and other adversely affected economies. Conversely, economies without large domestic imbalances, like Switzerland or Germany, still suffered from banking crises as their international exposure made them vulnerable to the imbalances within foreign banking systems. Overall, small open economies with low exposure to high-risk economies, such as Australia, Canada, Israel, Finland, and New Zealand, were spared from the effects of the Global Financial Crisis through the cross-border banking channel.[24]

A second major finding of this study is that the relevance of the lending channel increases with financial development. The channel is relevant only for developed banking systems, while the borrowing channel remains relevant for less developed banking systems. I reckon that this may have to do with insufficient domestic saving levels in emerging economies that result in funds being allocated through banks at home rather than abroad. Various forms of financial repression or a higher rate of return from domestic lending than from foreign lending may also play a role.

In a third finding, the chapter addresses why the current account has hitherto been such an unreliable predictor of banking crisis. While the currency crisis literature finds that current account deficits precede financial crises, the evidence for general banking crises is mixed at best (Frankel & Saravelos, 2012; Kauko, 2014). The results in this study show that for emerging economies, a current account deficit is predictive of banking crises, while for smaller developed economies a surplus tends to be predictive. This disparity seems convincing if one considers that the typical victims of currency crises are emerging economies.

Fourth and last, the functioning of the cross-border lending channel is independent of the current account balance, except for emerging economies. For developed economies, outward bank flows are predictive of financial instability regardless of the direction of net capital flows. For emerging economies, the situation is reversed. I conclude that looking at net flows alone is not sufficient to grasp the full picture of potential external sources of instability. Bank lending can induce financial instability in financially developed economies irrespective of the size and direction of other types of financial flows.[25]

I recognize several avenues for future research. Using the asset-side of the Locational Banking Statistics for all countries in the sample would enhance

[24] Naturally, these economies were still affected in the aftermath by the global collapse in confidence, trade and resource prices.

[25] Which is not to say that these flows may pose their own dangers to financial instability. Their assessment, however, is beyond the scope of this chapter.

the accuracy of the cross-border exposure measures. For this, more nations would have to start reporting their data to the BIS. Also, prolonging quarterly data on house prices and on the current account and for several countries with limited coverage would give a more complete picture of the factors that made the difference in crisis incidence during the recent crisis. Adding more emerging economies to the sample would bring down the standard errors in the regression coefficient estimates and provide a more complete picture on the channel and its relationship with financial development. In the same vain, it may be interesting to set-up an exposure-based model from the liability side to test the workings of the cross-border borrowing channel. Last, investigating in how far the cross-border bank lending channel has been active historically would add greatly to its consideration in the literature but may be challenging because of the current lack of historical cross-border bank data.

The findings of this chapter are particularly valuable for policy makers in developed economies. Macroprudential units should monitor the built-up of domestic imbalances in foreign countries that their own country has financial ties with. Large amounts of outstanding cross-border bank claims in relation to the home country's GDP against foreign countries with elevated risk of banking crises can become disastrous even regardless of the conditions at home. The early warning system proposed in this chapter constitutes a significant improvement over conventional early warning systems that focus solely on the domestic channel of banking crises, and represents a valuable contribution that will greatly enhance policy makers' capabilities and that will help preventing financial catastrophes in the future.

2.8 Appendix

Table 2.9: Exposure-based model with asset and liability-side channels

Variable	**Country Set**				
	Small	Large	Emerging	Developed	All
(const.)	-3.989^{***}	-3.602^{***}	-3.223^{***}	-3.550^{***}	-3.559^{***}
	(0.146)	(0.155)	(0.172)	(0.117)	(0.098)
Asset-side exposure index	0.072	0.611^{***}	0.428	0.192^{***}	0.217^{***}
	(0.048)	(0.116)	(0.344)	(0.050)	(0.056)
Liability-side exposure index	0.537^{***}	0.327^{***}	0.349^{***}	0.335^{***}	0.470^{***}
	(0.053)	(0.083)	(0.075)	(0.046)	(0.053)
Crisis risk-weighted interaction of indices	-0.660^{***}	-2.900^{***}	-11.869^{**}	-0.636^{***}	-0.806^{***}
	(0.095)	(1.001)	(5.104)	(0.131)	(0.151)
Observations	2,648	1,864	1,487	3,025	4,512
Pseudo R^2	0.181	0.125	0.033	0.128	0.114
AUROC	0.792	0.654	0.590	0.781	0.720
In-sample results					
Threshold ($\phi = 0.5$)	0.053	0.081	0.042	0.064	0.070
Sensitivity	0.750	0.517	0.875	0.759	0.583
Specificity	0.751	0.866	0.347	0.772	0.819

Notes: The table displays estimation results from a pooled logistic regression model for various country sets. *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The Pseudo R^2 is computed following McFadden (1974). Sensitivity refers to the true positive rate (TPR), specificity refers to the true negative rate (TNR).

In this robustness check, I control for the liability-side channel and for the interaction of the two channels in the estimation of the effect of the asset-side channel on crisis transmission. I include a crisis-risk weighted liability-side exposure index, which is constructed by the same methodology as the asset-side index but with data for the liability side and reverse direction of effect, and an interaction term of both indices multiplied by foreign crisis risk.

The estimation results show that, for the sample of large and developed economies, the asset-side channel is active alongside and independently of the liability-side channel, while it is inactive for emerging and small economies as the respective insignificant coefficient estimates show. The liability-side channel, on the other hand, is active independently for all country sets which simply confirms the findings of the well-established currency crisis literature. The results of this robustness check strongly support my interpretation of the baseline exposure-based model results in Table 2.5, confirming that there is indeed an asset-side channel of crisis transmission which is active independently of the liability-side channel in advanced economies but not in emerging economies.

Figure 2.8: Policy maker's preference trade-off

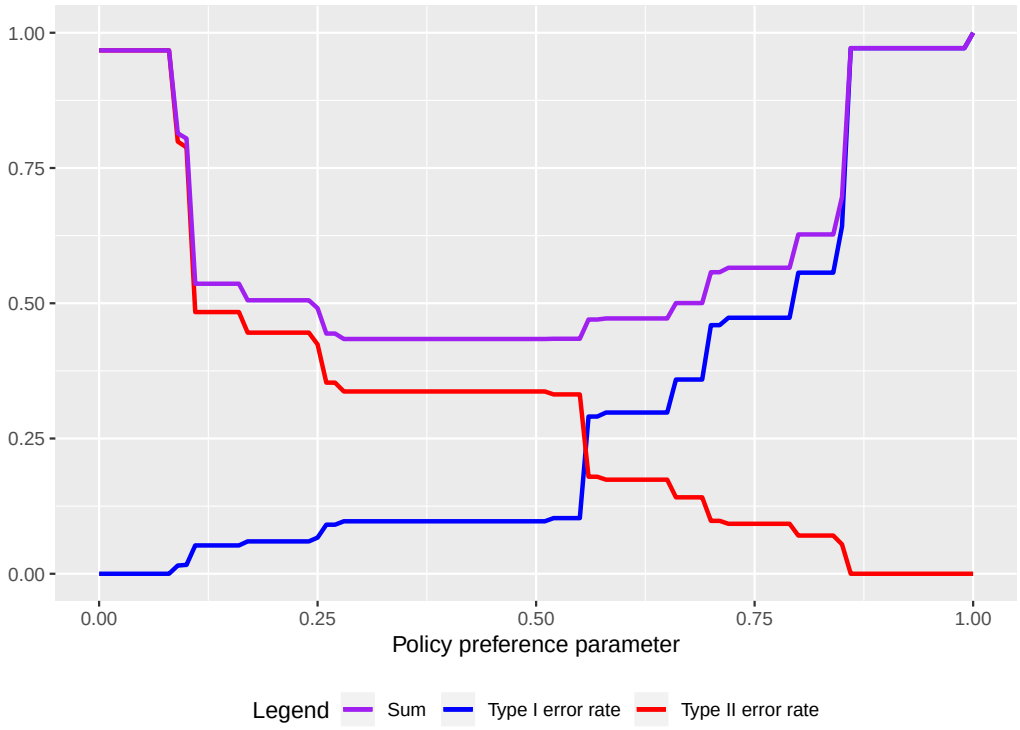
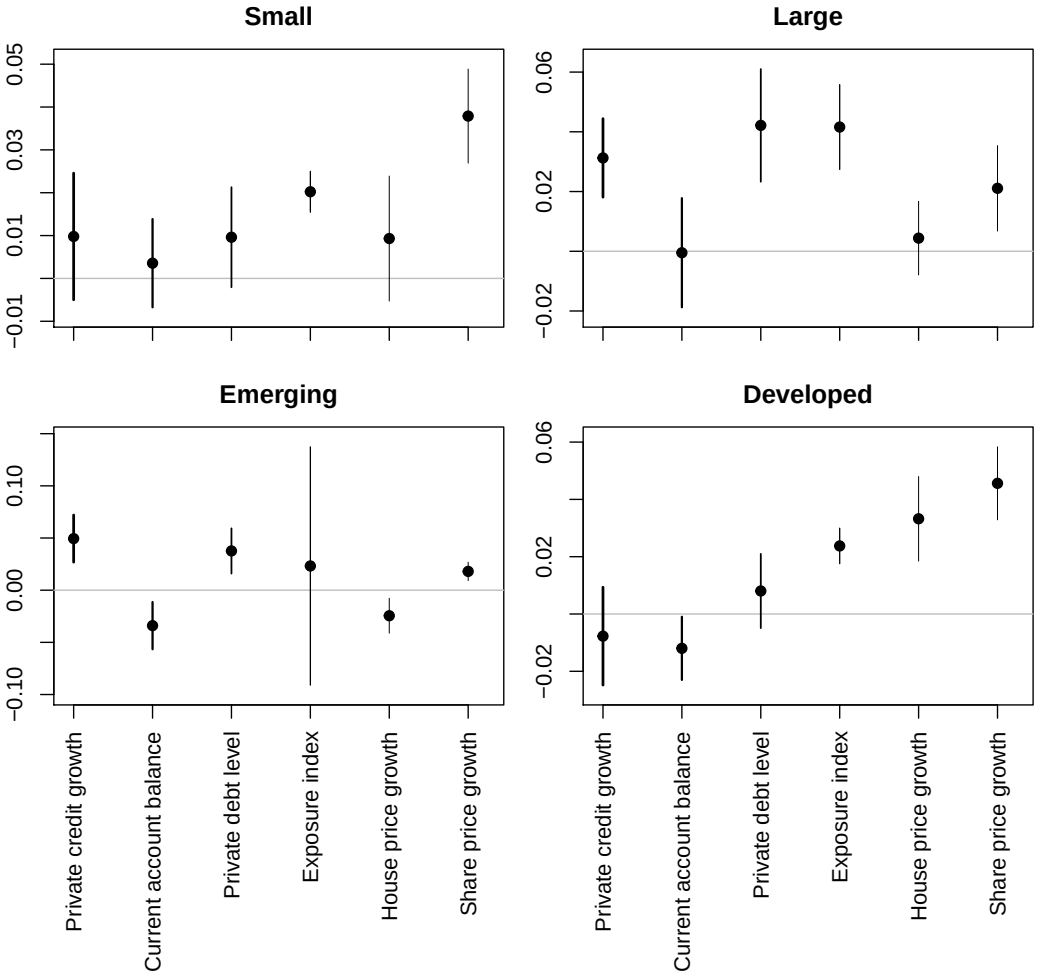


Figure 2.9: Marginal effects of the combined model



Notes: Displayed above are marginal effects of the combined model, computed for the separate country sets including the interaction term between the exposure index and the current account balance. All observations of each explanatory variable are standardized to a mean of 0 and a standard deviation of 1 to ensure comparability of the marginal effects. Thus, the displayed marginal effects are the expected change in crisis probability in response to a one-standard deviation shock to the respective variable. It is visible from the plots that for all country sets except for emerging economies the exposure index adds positively and significantly to a higher probability of banking crisis. For emerging economies, the effect's standard errors are large and contain the zero, from which no positive effect on financial instability can be derived. This corroborates the study's finding that the cross-border lending channel of banking crisis transmission is not active for emerging economies. For all other country sets its contribution to probability is substantial, positive, and significantly above zero, which means that the inclusion of the exposure index is the factor that increases the AUROC in comparison to the domestic model. The slight increase of the combined model's AUROC for emerging economies is thus due to randomness.

Table 2.10: Dating of banking crises

Country	**Crisis observation databases**							**Result**	
	L & V (2018)	R & R (2009)	K & R (1999)	R & R (2017)	BVX (2020)	ESRB (2017)	JST (2017)	Start	End
Australia	0	1989-1992†	NA	0	1989	NA	1989	1989q3	1992q1
Australia	0	0	NA	2008q1-2009q2	0	NA	0	0	0
Canada	0	1983-1985†	NA	0	1983	NA	0	0	0
Canada	0	0	NA	2007q3-2009q4	0	NA	0	0	0
Chile	1976	1976-1977	NA	NA	1976	NA	NA	1976q?	1977q?
Chile	1981q4-1985	1981-1984	1981q3, peak: 1983q1	NA	1981	NA	NA	1981q4	1984q4
Czech Republic	1996q2-2000*	1991-?	NA	NA	1991; 1996	1997q2-1999q1	NA	1997q2	1999q1
Denmark	0	1987-1992	1987q1, peak: 1990q2	0	1987	1987q1-1995q1	1987	1987q1	1992q4
Denmark	2008q3-2009	2008-2014	NA	2008q3-2012q4	2008; 2011	2008q1-2013q4	2008	2008q3	2013q4
Hungary	1991-1995	1991-1995	NA	NA	1991	1991q1-1995q4	NA	1991q1	1995q4
Hungary	2008q3-2012	2008-2014	NA	NA	2008	2008q3-2010q3	NA	2008q3	2010q3
Israel	0	1977-1983	NA	NA	0	NA	NA	0	0
Israel	1983-1986	1983q4	1983q4, peak: 1984q2	NA	1983	NA	NA	1983q4	1985q4
New Zealand	0	1987-1990†	NA	0	1987	NA	NA	0	0
New Zealand	0	0	NA	2007q3-2010q4	2008	NA	NA	0	0
Norway	1991q4-1993	1987-1993	1988q4, peak: 1990q2	1991q3-1994q2	1987	1988q3-1994q2	1988	1988q3	1994q2
Norway	0	0	NA	2007q3-2009q4	2008	2008q3-2009q4	0	2008q3	2009q4
Poland	1992-1994	1991-1995	NA	NA	NA	1992q1-1996q4	NA	1992q1	1996q4
Sweden	1991q3-1995	1991q4-1994	1991q4, peak: 1992q3	1992q3-1993q2	1991	1991q1-1997q2	1991	1991q3	1997q2
Sweden	2008q3-2009*	2008-2010†	NA	2007q3-2009q2	2008	2008q3-?	2008	2008q3	2009q2
Switzerland	0	0	NA	0	1991	NA	1991	0	0
Switzerland	2008q3-2009*	0	NA	2007q3-2009q2	2008	NA	2008	2008q2	2009q2
Austria	2008q3-2012	2008-2011	NA	2008q3-2010q2	2008; 2011	2008q1-2016	NA	2008q3	2011q4
Belgium	2008q3-2012	0	NA	2008q3-2009q4	2008; 2011	2007q4-2012q4	2008	2008q3	2009q4
Finland	1991q3-1995	1991q3-1994q4	1991q4	1992q1-1994q2	1991	1991q3-1996q4	1991	1991q3	1994q2
Greece	2008q3-2012	2008q3-2014q4	NA	2008q3-2012q4	2008; 2010	2010q2-?	NA	2008q3	2012q4
Ireland	2008q3-2012	2007q3-2013q2	NA	2008q3-2012q4	2007; 2011	2008q3-2013q4	NA	2008q3	2012q4
Netherlands	2008q3-2009	2008q3-2014q4	NA	2008q3-2009q2	2008; 2011	2008q1-2013q1	2008	2008q3	2009q2

Country	Crisis observation databases							Result	
	L & V (2018)	R & R (2009)	K & R (1999)	R & R (2017)	BVX (2020)	ESRB (2017)	JST (2017)	Start	End
Portugal	0	0	NA	0	0	1983q1-1985q1	0	0	0
Portugal	2008q3-2012	2008q3-2014q4	NA	2008q1-2012q4	2008; 2011; 2014	2008q4-2015q4	2008	2008q3	2012q4
United States	1988 (borderline)	0	0	1990q1-1992q2	1984; 1990	NA	1984	1984q1	1992q2
United States	2007q4-2011	2007q3-2010q4	NA	2007q3-2010q4	2007	NA	2007	2007q3	2010q4
France	0	0	0	1995q1-1997q4	1994	1991q3-1995q1	0	0	0
France	2008q3-2009	2008q3-2014q4	NA	2007q3-2012q2	2008; 2011	2008q2-2009q4	2008	2008q3	2009q4
Germany	0	0	NA	2003q1 (borderline)	2003	2001q1-2003q4	0	0	0
Germany	2008q3-2009	2008q3-2010q4	NA	2007q3-2010q2	2008; 2011	2007q3-2013q2	2008	2008q3	2010q2
Italy	0	0	0	1997q1-1997q2	1990	1991q3-1997q4	1990	0	0
Italy	2008q3-2009	2008q3-2014q4	NA	2008q1-2012q4	2008; 2011	2011q3-2013q4	2008	2008q3	2012q4
Spain	1977-1981	1977q1-1985q4	1978q4	0	1977	1978q1-1985q3	1977	1978q1	1981q4
Spain	2008q3-2012	2008q3-2014q4	NA	2008q1-2012q4	2008; 2010	2009q1-2013q4	2008	2008q3	2012q4
Great Britain	0	0	0	0	1974	1973q4-1975q4	1974	1973q4	1975q4
Great Britain	0	0	0	0	0	1991q3-1994q2	1991	0	0
Great Britain	2007q3-2011	2007q3-2014q4	NA	2007q3-2014q4	2007	2007	2007	2007q3	2011q4
Japan	1997q4-2001	1992q1-2001q4	NA	1990q3-2005q2	1990; 1997; 2001	NA	1997	1992q1	2001q4
China	1998	1992-1999	0	NA	NA	NA	NA	0	0
Brazil	0	1985-1986	1985q4	NA	0	NA	NA	0	0
Brazil	1990-1994 (borderline)	1991-1992	0	NA	1990	NA	NA	0	0
Brazil	1994-1998	1994-1997	1994q4	NA	1994	NA	NA	1994q4	1997q4
South Korea	0	1985-1988	NA	NA	1983	NA	NA	0	0
South Korea	1997q3-1998	1997-2000	NA	NA	1997	NA	NA	1997q3	1998q4
Mexico	1981	1981-1982	1982q3	NA	1981	NA	NA	1981q2	1982q4
Mexico	1994q4	1993-1997	1992q4	NA	1994	NA	NA	1994q4	1997q4
Russia	1998q3-1999	1998	NA	NA	1998	NA	NA	1998q3	1999q2
Russia	2008q3 (borderline)-2009	2008-2014	NA	NA	2008	NA	NA	2008q3	2009q4
South Afirca	0	1977-1978	NA	NA	0	NA	NA	0	0
South Africa	0	0	NA	NA	1984	NA	NA	0	0
South Africa	0	1989	NA	NA	0	NA	NA	0	0
Turkey	1982-1984	1982q1-1985	0	0	1982	NA	NA	1982q1	1984q4
Turkey	0	1991 (not systemic)	1991q1	0	0	NA	NA	0	0
Turkey	2000q4-2001	2000-2001	NA	2001q1-2003q4	2000	NA	NA	2000q4	2001q4

Sources: L&V: Laeven & Valencia (2020). R&R (2009): Reinhart & Rogoff (2009), K&R: Kaminsky & Reinhart (1999). R&R (2017): Romer & Romer (2017). BVX (2020): Baron et al. (2021). ESRB: Lo Duca et al. (2017). JST: Jordà et al. (2017). Notes: * indicates a borderline case and † indicates a non-systemic banking crisis. NA indicates that no data during this period was available in the respective source and 0 indicates that data was available but no crisis is dated.

Table 2.11: Interacting the exposure index with financial development

Variable	**Models**	
	(1)	(2)
Constant	-3.393^{***}	-3.086^{***}
	(0.153)	(0.184)
Crisis risk-weighted exposure index	0.310^{***}	0.022
	(0.026)	(0.110)
Private debt-to-GDP ratio	0.003^{**}	0.0003
	(0.001)	(0.001)
Exposure index × private debt ratio		0.002^{***}
		(0.001)
Observations	4,512	4,512
Log Likelihood	−1,014.249	−1,010.242
Akaike Inf. Crit.	2,034.498	2,028.484

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. Depicted are the estimations of two augmented exposure-based model specifications over the pooled sample including the private debt-to-GDP ratio as a proxy for financial development (King & Levine, 1993; Ang, 2008). The interaction term between the exposure index and the private debt-to-GDP ratio assumes the entire significance of both conventional coefficients when included: The exposure index's predictive power of banking crises is positively dependent on financial development. Its independent contribution is insignificant.

Chapter 3

Market Sentiment, Financial Fragility, and Economic Activity: The Role of Corporate Securities Issuance

3.1 Abstract

Using new quarterly U.S. data for the past 120 years, I show that sudden reversals in equity and credit market sentiment approximated by several measures of corporate securities issuance are highly predictive of banking crises and recessions. Deviations in equity issuance from historical averages also help to explain economic activity over the business cycle. Crises and recessions often occur independently of domestic leverage, making the credit-to-GDP gap a deficient early-warning indicator historically. The fact that equity issuance reversals predict banking crises without elevated private credit levels, suggests that changes in investor sentiment can trigger financial crises even in the absence of underlying banking fragility.

3.2 Introduction

Banking crises tend to occur after credit booms go bust (Schularick & Taylor, 2012). The business cycle, too, is fundamentally at the mercy of the ebb and flow of private credit (Gilchrist & Zakrajšek, 2012). What, however, drives these credit booms? Several well-known propositions have been made includ-

ing technological shocks (Minsky's (1986) displacement), credit supply shocks (Mian et al., 2017), financial deregulation (Favara & Imbs, 2015), "irrational exuberance" (Shiller, 2016), or "new era" thinking (Reinhart & Rogoff, 2009). Many of these propositions involve—implicitly or explicitly—a radical shift in agents' expectations about future income and profit opportunities towards the better. As the behavioral finance literature shows, this shift in sentiment can be so forceful that it pushes investors' expectations beyond numbers that can be justified by fundamentals. In this case, the result is an upward spiral of increased borrowing and booming asset prices feeding off each other through rising collateral values. Whether we look at economic activity or financial fragility, investors sentiment plays a pivotal role. It is thus all the more surprising that while a substantial number of empirical studies have looked into the role of market sentiment for economic activity (Greenwood & Hanson, 2013; López-Salido et al., 2017; Milani, 2017), its impact on financial fragility, and the assessment of its predictive power for banking crises, has largely been neglected. This study seeks to fill this void.

I present new quarterly data spanning 120 years of securities issuance in the United States as a proxy for investor sentiment in corporate debt and equity markets to assess its usefulness in explaining economic activity and financial fragility. Specifically, I investigate how sudden shifts in sentiment can be used for the prediction of banking crises and recessions ahead of time. Previous assessments of this question were constrained by historical data availability only at annual frequency (Philippon, 2015; López-Salido et al., 2017; Krishnamurthy & Muir, 2017) or by small sample sizes due to the availability of higher frequency data only well after World War II (Gilchrist & Zakrajšek, 2012; Mian et al., 2017).

Assuming "limits to arbitrage" (Shleifer & Vishny, 1997), I approximate investor sentiment with issuance activity in corporate debt and equity markets and find that sudden reversals in market sentiment are highly predictive of impending banking crises over an average time horizon of six months and of future recessions up to two years ahead of time. Issuance activity outperforms the private credit-to-GDP gap in its capacity to predict banking fragility in and out of sample. Deviations in equity issuance from historical averages also help to explain economic activity over the business cycle. Crises and recessions often occur independently of domestic leverage, making the credit-to-GDP gap a deficient early-warning indicator in historical application. The fact that equity issuance reversals predict banking crises without elevated private credit levels, suggests that changes in investor sentiment can trigger financial crises even in

the absence of underlying banking fragility. A recently proposed triggers-plus-vulnerabilities interpretation of the credit cycle by López-Salido et al. (2017) seems less likely to hold in light of my findings, as financial fragility measures based on credit aggregates perform poorly in predicting the economy's susceptibility to shocks, putting a much stronger focus on the strength of triggers than on the vulnerabilities induced by private sector leverage. Novel quarterly data on bank lending further supports the interpretation that not the built-up of private credit is responsible for financial fragility and bank distress, but its sudden retraction.

The remainder of this chapter is structure as follows. Section 3.3 briefly reviews the literature on market sentiment, presents the data, and explains how I approximate sentiment through several different measures of corporate securities issuance. Section 3.4 discusses the relationship between financial fragility and the credit cycle, computes a historically consistent credit-to-GDP gap, and predicts banking crises using the data and methodology introduced before. Section 3.5 applies my market sentiment proxies to the business cycle and assesses their ability to predict recessions. The conclusion in section 3.6 summarizes the main contributions, discusses avenues for further research, and outlines policy advice.

3.3 Market sentiment and securities issuance

Recently, several studies have revisited the impact of credit and equity market sentiment on macroeconomic performance from empirical (Baker & Wurgler, 2007; Greenwood & Hanson, 2013; López-Salido et al., 2017) and theoretical viewpoints (Shleifer & Vishny, 2010; Greenwood et al., 2016; Bordalo et al., 2018). While the ability of the Treasury yield curve—i.e. the 10-year-to-3-months term spread in U.S. government bonds—to predict recessions ahead of time is well-known (Estrella & Mishkin, 1998), this study looks at issuance activity in corporate securities markets—i.e. corporate bonds and stocks—to proxy investor sentiment and explain macroeconomic performance. In particular, I explore the informational content of several measures of gross equity and debt issuance to forecast future stock returns and the future term spread, respectively, as proxies for investors' sentiment in equity and credit markets and their ability to predict banking crises, economic growth, and recessions.

In their seminal study on sentiment in the stock market, Baker & Wurgler

(2007) define "investor sentiment, [...] broadly, [...as] a belief about future cash flows and investment risks that is not justified by the facts at hand" (p. 129), and lay out two now well-established assumptions of the behavioral finance literature: First, market participants are subject to sentiment (De Long et al., 1990); and second, betting against sentiment—i.e. forcing asset prices back to their fair values justified by fundamentals—is costly and risky, inducing "limits to arbitrage" (Shleifer & Vishny, 1997). Managers of corporations may exploit this deviation from rationality by issuing stocks when prices are high relative to fundamentals due to buoyant sentiment and by repurchasing stocks when prices are low. On a market-wide scale this means that sentiment can be well proxied by the variation in aggregate stock issuance. In the following, I adopt this line of reasoning and extend it to the market of corporate debt securities, as well, assuming that corporations issue new debt when prices are high—i.e. when payable interest rates are low—in comparison to what would be justified by the companies' fundamentals.

3.3.1 Approximating sentiment

This study follows large parts of the literature in assuming that corporate securities issuance activity is a suitable proxy for market sentiment. This assumptions has widely been accepted for both stock (Baker & Wurgler, 2000) and bond markets (Greenwood & Hanson, 2013), and has been used successfully to predict economic activity (López-Salido et al., 2017) and recessions (Estrella & Mishkin, 1998).[1] The link between corporate securities issuance and banking crises, however, has largely been neglected. This study seeks to step into this breach. The intuition behind using corporate securities issuance to proxy investor sentiment when assessing financial fragility is that, first, elevated issuance activity soaks up liquidity that will be unavailable to market participants in case cash flows fall short, thereby increasing the risk of bankruptcies, and second, that it allows economic agents to over-extend their funding beyond what would be attainable in a more sober market environment. These excess means will then engage in investment as well as in speculation, driving sentiment up even higher, reinforcing the destabilizing mechanism. A more encompassing review of the theoretical literature on the link between

[1] Derrien & Kecskés (2009) cautions against the use of equity issuance as a proxy for invest sentiment and argues that, when controlled for accurately measured fundamentals, the effect of investor sentiment on the issuance of corporate stocks is relatively small. Their findings, however, are based on firm-level regressions, and the authors do not control for times of elevated *aggregate* sentiment that may temporarily overrule the otherwise fundamentals-based valuation of corporate equity.

sentiment and banking crises and economic activity, respectively, is discussed at the end of this section. First, I introduce my issuance measures and explain the methodology for approximating sentiment using these measures.

To the best of my knowledge, this study is the first to present quarterly data on debt and equity issuance in the United States for the past 120 years. An influential study by Baker & Wurgler (2000), which argues that high ratios of equity-to-debt issuance—interpreted as a sentiment proxy—predict low stock market returns, uses annual data beginning in 1927 only. Based on my data, I present three variables which I use to compute my sentiment proxies for credit and equity markets:[2]

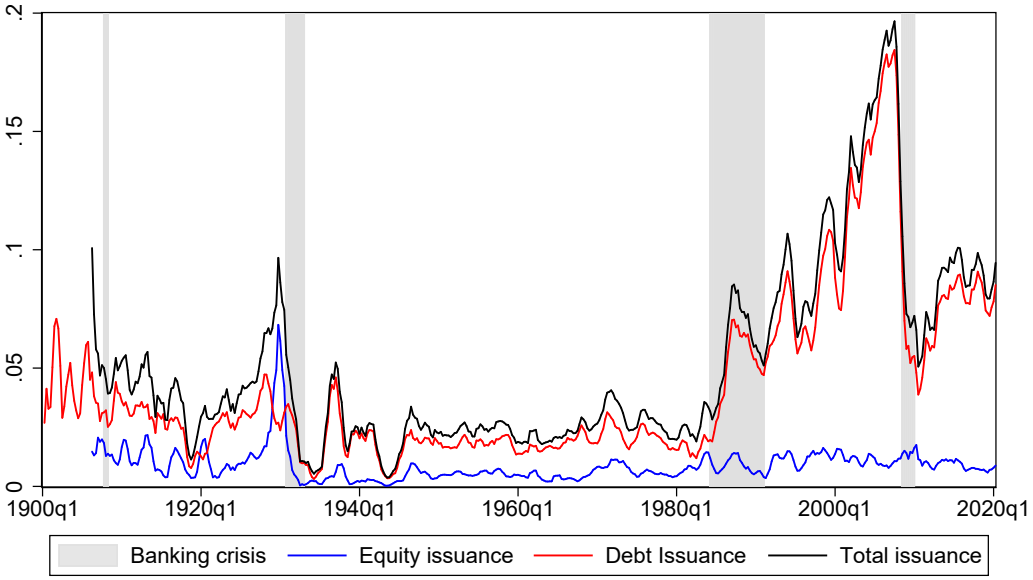
$$\begin{aligned}
\text{Issuance-to-GDP ratio} &= \frac{\text{equity issuance} + \text{debt issuance}}{\text{GDP}} = \frac{E+D}{GDP} \\
\text{Equity share} &= \frac{\text{equity issuance}}{\text{equity issuance} + \text{debt issuance}} = \frac{E}{E+D} \\
\text{High yield share} &= \frac{\text{high yield debt issuance}}{\text{debt issuance}} = \frac{HY}{E+D}
\end{aligned}$$

where equity issuance E refers to the gross amount of corporate stocks issued within one quarter and debt issuance D is the gross amount of corporate bonds issued over the same period. HY is the gross issuance volume of high yield bonds. GDP is the nominal gross domestic product at the end of the respective quarter. When gross issuance is negative for equities in the source data (only buybacks) the number is set to zero. All figures are in million U.S. Dollars and in current prices. The construction of the figures and their sources are explained in detail in Table 3.8 in the appendix. Figure 3.1 plots data for companies' gross equity and debt issuance relative to GDP with periods of banking crisis shaded in grey, while Figure 3.2 displays the equity and high yield share.

As can be seen from Figure 3.1, total securities issuance in relation to GDP accelerates before periods of banking crises and drops sharply very shortly—i.e. one to several quarters—before the onset of the crises. I employ data and narrative evidence from Baron & Dieckelmann (2021) to determine the beginning and end of banking crisis periods in the United States. A beginning is dated

[2] In Figure 3.9 in the appendix, I discuss a fourth measure of issuance activity: the equity issuance-to-price ratio. This measure is highly illustrative of the ability of issuance activity to predict banking crises but does not add informational content to the three measures and their respective application in computing the sentiment proxies. I discuss the reason for the measure's exclusion in more detail in the appendix.

Figure 3.1: Corporate securities issuance relative to GDP, 1900–2020

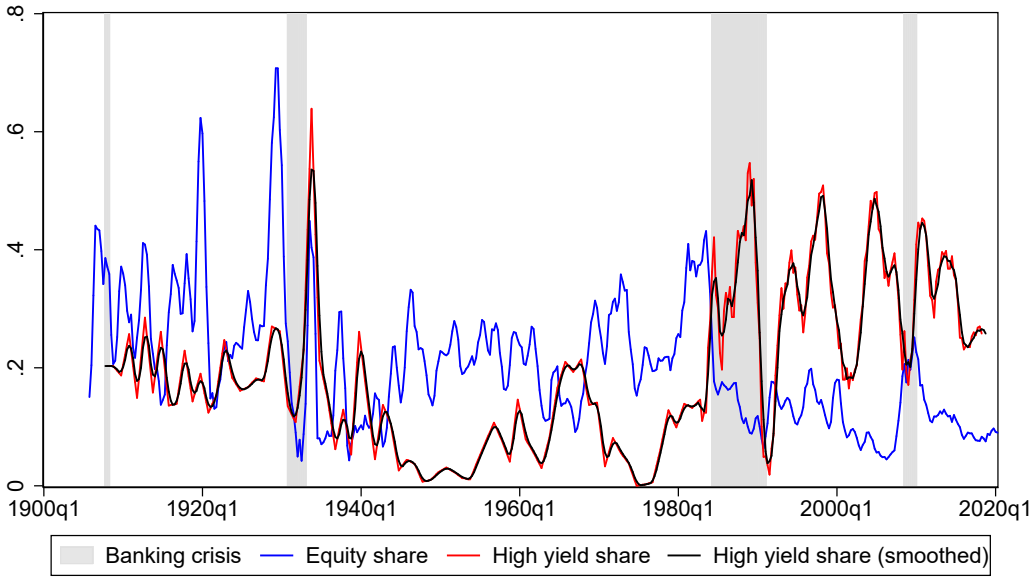


Notes: The lines represent annualized four-quarter averages of gross corporate securities issuance in relation to nominal GDP. Shaded areas in grey represent periods of banking crises according to Baron & Dieckelmann (2021).

to the quarter of a panic event, such as bank runs or large failures, at which the banking crisis becomes systemic: The drop in copper prices that triggered bank runs and the failure of Knickerbocker Trust in October 1907, the Great Depression's first wave of bank failures in October 1930, the run on Continental Illinois National Bank in May 1984, and the collapse of Lehman Brothers in September 2008. In comparison to its historical average, the issuance of corporate debt securities explodes in the mid-1980s: a trend that arguably can be attributed to the deregulation at the time. Except for the years preceding the Great Depression, equity issuance remains largely constant in relation to the size of the economy albeit exhibiting oscillating behavior (Covas & Den Haan, 2011; Baron, 2020). Equity and debt issuance flattens out almost entirely in the aftermath of the Great Depression.

In Figure 3.2 we observe that the equity share has a tendency to shoot up before periods of bank distress within a range of several years to a few quarters prior. The picture for the high yield share looks somewhat different: An increase in the relative issuance of high yield bonds followed by a subsequent reversal tend to precede banking crises. The timing, however, is much less precise than with the equity share or the total issuance-to-GDP ratio, and thus maybe hold less predictive power. Parallel to the volume of debt issuance, in the 1980s, a structural break occurs after which the high yield share seems to follow a cyclical pattern closely related to the business cycle and mirrored in the findings of Greenwood & Hanson (2013), who show that the credit quality

Figure 3.2: Equity and high yield bond shares, 1900–2020



Notes: Equity share refers to the ratio of the volumes of issued shares over corporate bonds per quarter. High yield share refers to ratio of bonds categorized as high yield by rating agencies over the total volume of corporate bonds issued. Data from 1980 is quarterly and presented as a four-quarter moving average, whereas previous data is annual. A centered four-quarter moving average is used to smooth the full series. Shaded areas in grey represent periods of banking crises according to Baron & Dieckelmann (2021).

of corporate debt issuers deteriorates—i.e. the high yield share increases—during credit booms, pointing towards overheating as a recurring feature of the credit cycle. The sharp uptake of the high yield share and equity share in the wake of the Great Depression should be interpreted with great caution, as they coincide with virtually no issuance of new corporate securities in absolute terms, as shown above.

The stylized facts presented here motivate my investigation of the usefulness of corporate securities as proxies for investor sentiment and as early-warning indicators of banking sector distress. Methodologically, I follow the approach of López-Salido et al. (2017) and use a two-step regression to compute forecasts of future credit spreads and equity returns, respectively, as proxies of sentiment. First, I regress credit spreads or equity returns on their lagged values and on a combination of the corporate securities issuance measures presented above. Then, in the following sections, I use the fitted values—alongside credit aggregate measures—to explain and predict the incidence of recessions and banking crises. For out-of-sample predictions, I estimate the first-step regression on a recursive basis, ensuring that fitted values only incorporate information that was available at the time of the fitted value. Following Greenwood & Hanson (2013) and López-Salido et al. (2017), I interpret the fitted values of the first-step regression as fluctuations in investor sentiment in

corporate debt and equity markets.

Now, why exactly do I believe that this methodology captures market sentiment? I follow López-Salido et al.'s (2017) line of argument and hypothesize that when *expected* (i.e. forecasted) returns of corporate bonds are unusually low—or in the case of equity returns, unusually high—in comparison to historical averages, then this is a sign of elevated sentiment. Following the assumption that there are "limits to arbitrage", these buoyant expectations then would be reflected in elevated issuance activity as managers seek to profit from the abnormally high prices that exalted investors are willing to pay. I, thus, regress future returns on credit or equity on the indicators of issuance activity presented above and on an auto-regressive factor. In the following, I discuss the estimations of the respective market sentiment proxies in detail.

3.3.2 Stock market sentiment

To derive an indicator of investor sentiment in the stock market, I forecast future quarterly stock returns r^e with lagged values of historical stock returns and of the issuance measures presented above—namely, the total corporate securities issuance-to-GDP $\frac{E+D}{GDP}$, the equity share $\frac{E}{E+D}$, and, additionally, the interaction of the two former variables, the equity-issuance-to-GDP ratio $\frac{E}{GDP}$.[3] I include the last four quarters as lagged values for each of these variables to capture sudden changes.[4] Although I am estimating a stock market sentiment proxy, the inclusion of the *total* issuance activity is deliberate as I want to disentangle the predictive effect of issuance in equity markets from aggregate investor sentiment. I estimate a simple ordinary least squares (OLS) regression model of the form

$$r^e = \beta_0 + \sum_{i=1}^{4} \beta_1^i r^e_{t-i} + \sum_{i=1}^{4} \beta_2^i (\frac{E+D}{GDP})_{t-i} + \sum_{i=1}^{4} \beta_3^i (\frac{E}{E+D})_{t-i} + \sum_{i=1}^{4} \beta_4^i (\frac{E}{GDP})_{t-i} + \epsilon \tag{3.1}$$

where I interpret the estimated forecast of the future growth rate of the equity index as equity sentiment $s^e = \widehat{r^e}$. Table 3.1 displays the estimation results.

[3] Note that $\frac{E+D}{GDP} \times \frac{E}{E+D} = \frac{E}{GDP}$.

[4] I choose four lags as the result of a trade-off consideration between a sufficiently long horizon to observe the unfolding of reversals in issuance activity and a sufficiently low number of coefficients to not over-identify the model. The choice of four lags is also informed by the inspection of the styled facts above, showing that reversals in issuance activity tend to occur only shortly before periods of banking crises and unravel over very short time spans of a few quarters.

Table 3.1: Estimating the stock market sentiment proxy

	(1) r^e	(2) r^e	(3) r^e	(4) r^e	(5) r^e	(6) r^e
L.r^e	0.025	0.022	0.000	−0.008	0.013	0.009
	(0.046)	(0.047)	(0.046)	(0.048)	(0.047)	(0.048)
L2.r^e	0.045	0.038	0.030	0.022	0.036	0.015
	(0.046)	(0.047)	(0.046)	(0.049)	(0.048)	(0.049)
L3.r^e	0.123***	0.109**	0.126***	0.115**	0.104**	0.092*
	(0.046)	(0.047)	(0.046)	(0.049)	(0.048)	(0.049)
L4.r^e	−0.115**	−0.113**	−0.100**	−0.091*	−0.093**	−0.063
	(0.046)	(0.047)	(0.046)	(0.047)	(0.046)	(0.047)
L.(E+D)/GDP		0.023		−0.266		2.190
		(1.202)		(1.209)		(1.605)
L2.(E+D)/GDP		0.896		0.766		−3.797**
		(1.361)		(1.357)		(1.903)
L3.(E+D)/GDP		0.275		0.020		2.859
		(1.368)		(1.369)		(1.907)
L4.(E+D)/GDP		−1.552		−1.654		−2.051
		(1.197)		(1.205)		(1.598)
L.E/(E+D)			−0.016	−0.026		0.073
			(0.048)	(0.049)		(0.071)
L2.E/(E+D)			−0.076	−0.070		−0.248***
			(0.055)	(0.056)		(0.078)
L3.E/(E+D)			0.020	0.014		0.130*
			(0.054)	(0.055)		(0.077)
L4.E/(E+D)			−0.083*	−0.105**		−0.110
			(0.047)	(0.048)		(0.069)
L.E/GDP					−5.183	−10.508*
					(3.387)	(5.493)
L2.E/GDP					5.270	20.146***
					(3.707)	(6.182)
L3.E/GDP					−3.508	−12.108*
					(3.717)	(6.164)
L4.E/GDP					−6.753**	−0.214
					(3.389)	(5.448)
Constant	0.012***	0.017**	0.044***	0.065***	0.035***	0.060***
	(0.005)	(0.008)	(0.010)	(0.014)	(0.007)	(0.017)
Observations	477	477	477	477	477	477
R^2	0.030	0.035	0.061	0.074	0.068	0.098
Adjusted R^2	0.022	0.019	0.045	0.050	0.052	0.067

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. $(E+D)/GDP$ symbolizes total issuance-to-GDP ratio, with E referring to equity issuance and D to debt issuance, respectively. Consequently, $E/(E+D)$ signifies the equity share. E/GDP is the equity issuance-to-debt ratio and simultaneously the interaction term between the total issuance-to-GDP ratio and the equity share. L stands for a one-quarter lag, while L followed by a number refers to a variable lagged by n quarters.

I generally find that the addition of corporate securities issuance measures improves the performance of an otherwise auto-regressive process with four lags (model one). Baker & Wurgler's (2000) finding that a higher equity share forecasts lower stock returns is confirmed in models three, four, and six at high

significance. Interestingly, the total issuance-to-GDP ratio becomes a negative predictor of future stock returns even when I include the equity issuance-to-GDP ratio in model six, increasing the adjusted R^2 by 0.017. This lets me conclude that aggregate sentiment adds to the predictability of future stock returns on top of sentiment in the equity market. In summary, the sum of the lagged coefficients of each variable tend to be negative, indicating that elevated issuance activity and a higher equity share, representing buoyant sentiment, are typically followed by lower future stock returns.

Relying on a large literature that has established that stock returns predict investment (Morck et al., 1990), I conclude that periods of buoyant sentiment and above-average issuance activity are followed by lower stock returns, and thus, in response, by lower investment, inducing a decline in economic activity. Further, the fact that a higher equity share is predictive of lower stock returns can be interpreted such that managers acting upon inside knowledge make use of the still optimistic market environment to raise additional equity in anticipation of an economic slowdown or a deterioration of their business activity in the future. Markets will react to these developments with a lag, and when stock prices ultimately fall, investment decisions will be postponed on an aggregate level, initiating or exacerbating the economic slowdown.

3.3.3 Credit market sentiment

To derive a sentiment proxy for credit markets, I regress the absolute future difference in the corporate term spread—defined as the difference between the yield of BAA-rated corporate bonds with 10-year maturity and the yield of three-month commercial paper—between two consecutive quarters ΔCTS on lagged values of the level of the term spread, of the total issuance-to-GDP ratio $\frac{E+D}{GDP}$, of the equity share $\frac{E}{E+D}$, of the high yield share $\frac{HY}{D}$, and of the debt issuance-to-GDP ratio $\frac{D}{GDP}$.[5] For each variable I use four quarters of lagged values and estimate a simple OLS regression model of the form

$$\begin{aligned}\Delta CTS = \beta_0 + \sum_{i=1}^{4} \beta_1^i CTS_{t-i} + \sum_{i=1}^{4} \beta_2^i (\frac{E+D}{GDP})_{t-i} + \sum_{i=1}^{4} \beta_3^i (\frac{E}{E+D})_{t-i} \\ + \sum_{i=1}^{4} \beta_4^i (\frac{HY}{D})_{t-i} + \sum_{i=1}^{4} \beta_5^i (\frac{D}{GDP})_{t-i} + \epsilon\end{aligned} \tag{3.2}$$

[5] Note that the debt issuance-to-GDP ratio is the interaction term between the total-issuance-to-GDP ratio and the equity share with an inverse sign.

where I interpret the estimated forecast of the future corporate term spread as credit sentiment $s^c = \Delta\widehat{CTS}$. I choose the corporate *term* spread over the *credit* spread because the former is known to have better predictive capabilities in terms of economic activity (Stock & Watson, 2003). The estimation results are displayed in Table 3.2.

Table 3.2: Estimating the corporate credit market sentiment proxy

	(1) ΔCTS	(2) ΔCTS	(3) ΔCTS	(4) ΔCTS	(5) ΔCTS	(6) ΔCTS	(7) ΔCTS
L.CTS	0.195***	0.185***	0.182***	0.186***	0.174***	0.176***	0.172***
	(0.045)	(0.045)	(0.045)	(0.047)	(0.045)	(0.046)	(0.048)
L2.CTS	−0.506***	−0.485***	−0.503***	−0.495***	−0.485***	−0.490***	−0.491***
	(0.068)	(0.068)	(0.068)	(0.071)	(0.069)	(0.069)	(0.072)
L3.CTS	0.490***	0.476***	0.506***	0.486***	0.492***	0.495***	0.489***
	(0.068)	(0.068)	(0.069)	(0.071)	(0.069)	(0.069)	(0.073)
L4.CTS	−0.256***	−0.256***	−0.270***	−0.261***	−0.267***	−0.269***	−0.262***
	(0.045)	(0.045)	(0.046)	(0.048)	(0.046)	(0.046)	(0.050)
L.(E+D)/GDP		−0.066			−0.078	−0.265	−0.234
		(0.073)			(0.074)	(0.288)	(0.302)
L2.(E+D)/GDP		−0.086			−0.094	0.166	0.074
		(0.085)			(0.086)	(0.312)	(0.331)
L3.(E+D)/GDP		−0.010			0.001	−0.258	−0.163
		(0.085)			(0.086)	(0.312)	(0.331)
L4.(E+D)/GDP		0.201***			0.201***	0.631**	0.649**
		(0.073)			(0.074)	(0.285)	(0.300)
L.E/(E+D)			−0.005		−0.005	−0.003	−0.002
			(0.003)		(0.003)	(0.005)	(0.005)
L2.E/(E+D)			0.001		−0.000	−0.003	−0.005
			(0.004)		(0.004)	(0.005)	(0.005)
L3.E/(E+D)			0.001		0.001	0.005	0.003
			(0.003)		(0.003)	(0.005)	(0.005)
L4.E/(E+D)			−0.000		0.000	−0.005	−0.004
			(0.003)		(0.003)	(0.004)	(0.005)
L.HY/D				−0.008			−0.007
				(0.011)			(0.011)
L2.HY/D				−0.002			−0.002
				(0.017)			(0.018)
L3.HY/D				0.015			0.012
				(0.017)			(0.018)
L4.HY/D				−0.003			−0.003
				(0.011)			(0.011)
L.D/GDP						0.247	0.138
						(0.345)	(0.369)
L2.D/GDP						−0.344	−0.152
						(0.386)	(0.422)
L3.D/GDP						0.356	0.199
						(0.387)	(0.422)
L4.D/GDP						−0.538	−0.514
						(0.344)	(0.369)
Constant	0.002***	0.002***	0.003***	0.002***	0.002**	0.003**	0.003**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	472	472	472	433	472	472	433
R^2	0.161	0.180	0.166	0.170	0.186	0.193	0.200
Adjusted R^2	0.154	0.166	0.152	0.154	0.165	0.164	0.161

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. Δ is the difference operator and CTS stands for the credit term spread. L symbolizes a one-quarter lag, while L followed by a number refers to a variable lagged by n quarters.

I find that future changes in the term spread are well predicted by lagged

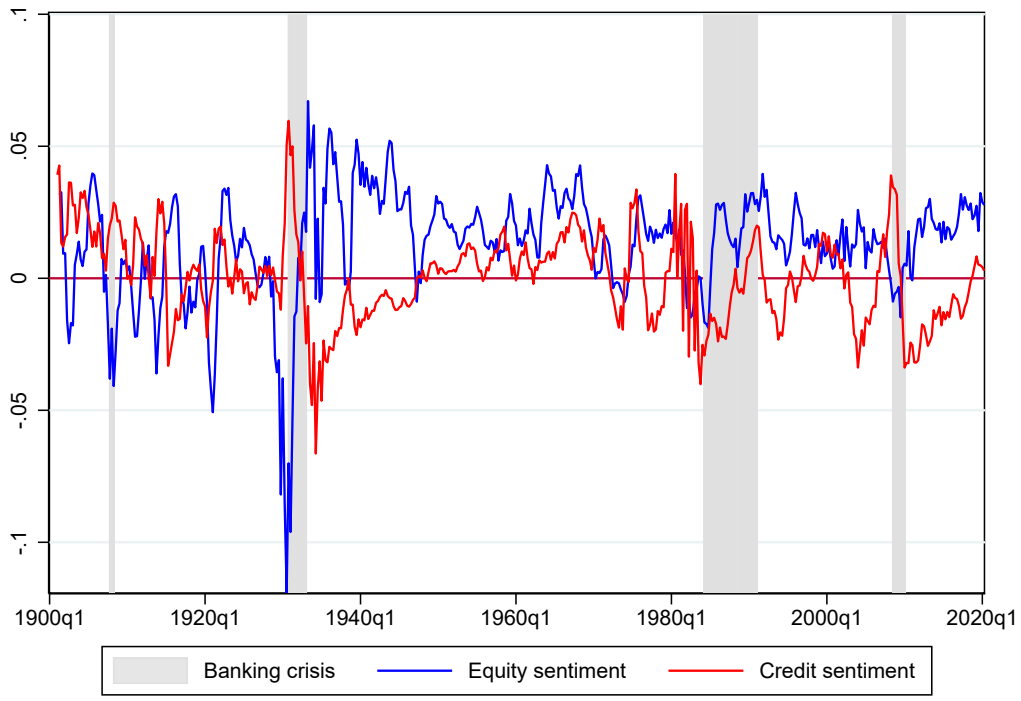
values of the term spread with a adjusted R^2 of 0.154 in model one.[6] The addition of the high yield or equity share adds no or even slightly reduces predictive power, while the inclusion of total issuance in model two increases the adjusted R^2 by 0.012. While all four lagged values of the term spread are significant, only the positive coefficient of the fourth lag of the total issuance-to-GDP ratio is significant, as well. Aggregate issuance activity clearly forecasts a positive change in the term spread, indicating that elevated market sentiment tends to be followed by economic downturns, as rising spreads typically occur during or prior to recessions. In contrast to Greenwood & Hanson (2013) who find that the high yield share is a good proxy for credit sentiment which soars during credit booms, I find that the high yield share performs poorly in my setting, adding virtually no predictive power in comparison to the other issuance measures. I explain this with the fact that I investigate a much longer time horizon and use data of higher frequency than Greenwood & Hanson (2013) which brings to light that the predictive ability of a deterioration of issuer quality—i.e. a rising high yield share—for future bond returns and for credit market overheating is a phenomenon that only occurs since the 1980s. This is nicely visible from Figure 3.2 in the previous section.

Intuitively, the link between the term spread and market sentiment is captured by the fact that decreasing term spreads represent a deterioration in investors' perception of interest rate risk. The lower the term spread, the more aggressively is long term credit priced in comparison to short term credit of comparable issuer quality. The increasing price of long term credit relative to short term credit—i.e. the relatively declining financing costs—caused by investors' overly optimistic risk perception is then exploited by managers through increased corporate bond issuance. This is why, I assume that buoyant credit sentiment can be approximated by elevated issuance activity. The results in Table 3.2 show that this increased issuance activity will then lead to rising term spreads, lending itself well to Arif & Lee's (2014) finding that periods of over-investment caused by overly favorable market conditions are typically followed by a slowdown in economic activity.

The adjusted R^2 of the full model for forecasting term spreads is more than double than that of the respective full model for the forecasts of stock returns in Table 3.1. However, the inclusion of corporate securities issuance

[6] While this number seems relatively small, it is well in line with similar results in (López-Salido et al., 2017). Considering how many macroeconomic and global factors influence the U.S. term spread (for which I do not control), the fact that I am able to explain around 16% of the variation in the future term spread by autoregressive factors alone is actually quite astonishing.

Figure 3.3: Sentiment proxies for equity and credit markets, in-sample, 1901–2020



Notes: Sentiment proxies refer to in-sample predictions of future growth in stock prices or the absolute future change in the corporate term spread, respectively. Positive values for the equity sentiment proxy and negative values for the credit sentiment proxy, respectively, indicate buoyant sentiment, while the reverse signals overly pessimistic sentiment. Shaded areas in grey represent periods of banking crises according to Baron & Dieckelmann (2021).

measures had a much bigger impact on predictive ability in forecasting future stock returns than in predicting changes in the future term spread, indicating that the approximation of sentiment through issuance activity might be slightly more relevant for equity markets than for credit markets. Figure 3.3 shows the estimated forecasts on the basis of model six from Table 3.1 and of model six from Table 3.2, respectively, which I interpret as proxies for market sentiment in equity and credit markets.[7]

Credit sentiment—proxied by the forecasted absolute change in the term spread—shows a clear pattern of cyclicality. This stylized fact has recently received considerable attention with studies investigating the role of sentiment in driving the business cycle and, more concretely, focusing on the role

[7] I choose model six over model seven from Table 3.2 and, thus, exclude the high yield share from the ultimate credit sentiment proxy estimation for several reasons. First, my high yield share data starts only in 1908 and the estimation would exclude the important panic of 1907. Second, the inclusion of the high yield share actually decreases the adjusted R^2 relative to model 6 and, thus, does not add predictive power to the estimation. And third, I achieve consistency through the exclusion as both ultimate sentiment proxies are estimated using the autoregressive factor, the total issuance-to-GDP ratio, the equity share, and the (inverse) interaction of the latter two.

of credit sentiment as a driver of a potential credit cycle at business cycle wavelengths (e.g. López-Salido et al., 2017). Equity sentiment—proxied by the forecasted percentage change in equity prices—deteriorates sharply shortly before episodes of banking crises, while credit sentiment improves during banking crises but has a tendency to collapse shortly before their outbreak. Note that, as the credit sentiment proxy captures investors' forecast of the future change in the term spread, a positive value is associated with the expectation of widening spreads and, thus, with a shift towards pessimistic sentiment. The reverse applies to the equity sentiment proxy where a positive value refers to the expectation of positive future stock returns on the basis of issuance activity and, thus, indicates buoyant sentiment. I interpret these pronounced swings before periods of bank distress as a sign that the sharp reversal of sentiment has a triggering effect. Bordalo et al. (2018) come to a similar conclusion and write "that crises occur when good news stops coming, so that excess optimism reverts" (p. 223). Not all sharp reversals are followed by banking crises, however. In section III, I investigate under which conditions these sudden shifts in sentiment are followed by the outbreak of banking crises.

3.3.4 Theoretical background

In the following, I briefly discuss the link between market sentiment and banking crises and economic activity, respectively. I begin with reviewing the literature on sentiment, banking crises, and financial fragility, and its relation to the credit cycle. I then move on to theoretical explanations of the relationship between sentiment and economic activity and recessions.

Theorists of banking crises have long stressed the importance of sentiment in their formation: "Animal spirits" (Keynes), "irrational exuberance" (Greenspan, Shiller), and "euphoria" (Minsky) all refer to buoyant collective emotional states during periods of persistent deviation from asset price valuations and volumes of external finance justifiable by fundamentals or desirable from the perspective of a social planner. Market participants buy assets based on overly confident beliefs about future profits, while corporations leverage up by discounting over-optimistic forecasts of future cash flows. When the toxic combination of rising asset prices and ballooning private debt reaches its apex, the "Minsky moment" sets in and euphoria turns into panic. The sharp reversal in sentiment triggers a cascade of fire sales in a scramble for cash where not fundamentals or rational expectations of future profits take the helm, but the sheer fear of ending up the hindmost whom the devil takes.

Attempting to flesh out the narrative above, several studies have investigated the link between sentiment and banking crises from a theoretical perspective. Shleifer & Vishny (2010) propose a formal three-period model in which banks make, securitize, distribute, and trade loans, and are influenced by investor sentiment. During good times—i.e. when prices for securitized assets are high—banks extend their balance sheets and borrow short-term to engage in the very profitable business of securitizing loans. This over-leveraging leaves them with little means in bad times which increases the risk of them having to liquidate their portfolios. Bank profits and real investments become highly cyclical and swings in investor sentiment are transmitted through the banking system to the real economy. Greenwood et al. (2016) present a model of credit market sentiment in which investors extrapolate past defaults in the bond market. A feedback loop between sentiment and market outcomes arises endogenously and several well-documented features of credit-driven boom-bust cycles can be explained. Ultimately, elevated sentiment covers up the deterioration of fundamentals before crises and, thus, artificially prolongs credit booms, creating an environment of "calm before the storm" that is consistent with historical narratives. Bordalo et al. (2018) develop a model of credit cycles in which expectations form by overweighting "future outcomes that become more likely in light of new data" (p. 199) and credit spreads turn out to be overly volatile and their reversals to be predictable. As a result, "crises occur when good news stops coming, so that excess optimism [i.e. buoyant sentiment] reverts" (p. 223).

Empirically, market sentiment and banking crises have also received fresh attention recently, using both narrative and quantitative approaches. Reinhart & Rogoff (2009) famously argue that banking crises tend to be preceded by "new era"-thinking according to which over-optimistic expectations of future incomes are seemingly justified, because "this time is different". Greenwood & Hanson (2013) find that credit market sentiment can be well approximated by a combination of bond credit spreads relative to their historical means and of the high yield share of bond issuance. The so-measured deterioration in issuer quality induced by investors' elevated sentiment can be a better predictor of credit overheating and subsequent economic decline than rapid credit growth. López-Salido et al. (2017) find that buoyant credit market sentiment is followed by a decline in economic activity two to three years later, and by a change in the composition of external finance: An increasing equity share in the issuance of corporate securities points towards the role of negative credit supply shocks. The authors do not, however, narrow down their analyses of periods of declining economic activity to those of financial recessions or banking crises. Baker

& Wurgler (2000) show that the equity share in total corporate securities issuance is a strong predictor of lower future stock market returns. The authors rule out efficient market explanations, and thus López-Salido et al. (2017) use the equity share as a proxy for stock market sentiment but find that it has no predictive ability for economic growth. They come to a similar conclusion when using Shiller's (2000) cyclically adjusted price-earnings ratio as a proxy for stock market sentiment. Regarding banking crises, however, Shiller (2016) provides a popular narrative of sentiment-driven asset price bubbles that have a tendency to end in major bank distress focusing on technological, economic, political, and cultural factors inducing over-optimism.

Much more well-established is the literature on investor sentiment and economic activity according to which periods of buoyant sentiment lead to a predictable decline in economic output in the near future. The observation of mean-reverting sentiment as a major driving force behind fluctuations in the real economy is consistent with the business cycle literature.

Arif & Lee (2014) find that corporate investment peaks during periods of high sentiment which is followed both by lower equity returns and lower economic growth, lending itself to an interpretation of over- and under-investment during booms and busts, respectively. The authors employ several proxies of investor sentiment—household surveys, fund flow data, and a composite sentiment index—and find their results to be robust to the choice of sentiment approximation. Milani (2017) finds that above 40% of business cycle fluctuations are driven by psychological factors in markets, and particularly by sentiment related to future investment expectations. Using annual U.S. data going back to 1929, López-Salido et al. (2017) report that elevated credit market sentiment is associated with a decline in economic activity after two to three years. Investors sentiment is suspect to a predictable mean reversion which induces a widening of credit spreads that, in turn, are associated with economic contractions.

Into a similar vain fits the long-established literature around the prediction of recessions using bond spreads, and particularly the difference between the yield of 3-month U.S. Treasury bills and the yield of 10-year U.S. Treasury bonds.[8] Narrow *credit* spreads—i.e. the difference between yields of different quality (as represented by rating classes) but equal maturity—in comparison to their historical averages reflect elevated sentiment and precede economic recessions (López-Salido et al., 2017). Assuming that the risk of default stays

[8] For an introduction to the use of the yield curve as a recession predictor in practice, see https://www.newyorkfed.org/research/capital_markets/ycfaq.html.

constant over time, as approximated by the restriction to one specific credit rating level (e.g. BAA), the time-variation in spreads of corporate debt then represent changes in investor sentiment. Intuitively, aggressively priced corporate credit reflects expectations of an overly low risk of default. In turn, this increases lending activity and firms' leverage making the aggregate economy more susceptible to adverse shocks and increasing economic and financial fragility. Better suited for the prediction of recessions are, however, *term* spreads—i.e. the difference between yields of different maturity but equal quality—turning negative, as a vast literature has shown (Estrella & Mishkin, 1998). Very narrow or even negative term spreads mean that short-term yields start to exceed longer-term yields for the same debtor, indicating that market participants are increasingly willing to pay a premium for a more long-term fixed investment to weather an anticipated economic slowdown and the associated rise in economic uncertainty.

3.4 Financial fragility and the credit cycle

The idea that the economy can fluctuate between a state of financial stability and fragility dates back to Minsky (1986) and Kindleberger & Aliber (2015), but can also be found in earlier works of Schumpeter (1934), Fisher (1933) and even before in the writings of John Stuart Mill, Knut Wicksell, and Adam Smith (Kindleberger & Aliber, 2015, p. 16). No uniform definition of financial fragility exists in the literature but it is usually roughly referred to as an economy's state in which relatively small and otherwise less important shocks can have large and potentially disastrous macroeconomic effects by being able to trigger banking crises or deep recessions. What all discussions—old or new—of financial fragility have in common, however, is the focus on (private) credit.

Does credit have an effect on macroeconomic outcomes? And if yes, is it positive or negative? As one of the core themes of macroeconomics, this question has received vast attention both historically and recently. While the positive post-World War II experience led economist to investigate the so-called finance-growth nexus, confirming that credit was good for growth (Levine, 2005; Ang, 2008), the Global Financial Crisis of 2008 reignited an older debate that looked into the opposite direction and found that excessive credit growth and leverage is and always has been associated with deep recessions and

banking crises (Schularick & Taylor, 2012; Baron & Xiong, 2017). López-Salido et al. (2017) recently introduced a distinction of the respective literature into two strands: theories of financial frictions that explain why economies exhibit financial vulnerabilities (Bernanke & Gertler, 1989; Kiyotaki & Moore, 1997; Eggertsson & Krugman, 2012), and behavioral theories emphasizing market sentiment and expectations which give rise to sudden reversals of overoptimism, thereby functioning as recession or crisis triggers (Minsky, 1986; Greenwood et al., 2016). These two strands play out over different time horizons. The former covers a medium-term time span that could be related either to the frequency of the business cycle but also to longer waves of credit cycles of 15 to 30 years as has been shown in the financial cycle literature (Drehmann et al., 2012; Borio, 2014; Strohsal et al., 2019).[9] The latter strand takes on a more short-term perspective with investors' sentiment changing rapidly over the course of months, weeks, or even days. Covas & Den Haan (2011, 2012) provide evidence for cyclicality in equity and credit markets that revolves around the business cycle.

3.4.1 The credit-to-GDP gap

Financial fragility is commonly approximated by high domestic leverage. In particular, it has been common practice since the Global Financial Crisis to look at private credit aggregates—such as outstanding bank loans, household debt, or total credit to the private non-financial sector. Especially, the so-called credit-to-GDP gap has risen to a position of great prominence during the implementation of the Basel III regulatory framework in the aftermath of the crisis. It is defined as the difference between the ratio of credit to the private non-financial sector to GDP and the ratio's long-term trend (Drehmann & Tsatsaronis, 2014). The Basel Committee on Banking Supervision (2010) precisely defines this long-term trend as the trend component of the private credit-to-GDP ratio extracted by an one-sided HP filter (Hodrick & Prescott, 1997) with a smoothing parameter of $\lambda = 400,000$. The resulting gap informs the built-up of countercyclical capital buffers according to which national banks must ramp up their capital reserve in response to increasing leverage in the domestic economy. The idea is to have high capital ratios in boom times, so

[9] There is a remarkable amount of disagreement and ambiguity on the time horizon of the credit cycle. However, two main camps emerge from the literature: one that sees the credit cycle revolving around the business cycle as presented by the view of López-Salido et al. (2017), and one that sees the credit cycle playing out over time horizons of up to 30 years, as best presented by the financial cycle-view of the BIS (Drehmann et al., 2012; Borio, 2014). Future research should explicitly address these ambiguities.

that eventual bank losses in the downturn are first met by writing down the capital buffers.

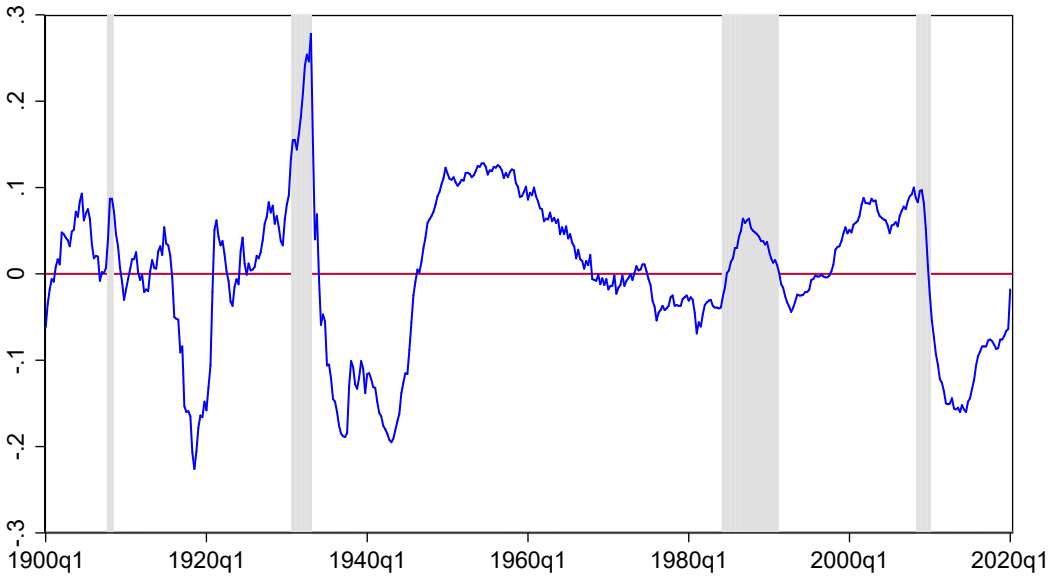
The Bank for International Settlements (BIS) publishes credit-to-GDP gaps according to the above definition and collects private credit and GDP data for more than 40 countries at quarterly frequency. The BIS' definition of the private non-financial sector consists of households, non-profit organizations, and private and public non-financial businesses as debtors. It considers bank loans and debt securities but not equities, investment fund shares, insurance and pension schemes, financial derivatives, trade credit, and other accounts payable or receivable. (Dembiermont et al., 2013, p. 67).

For this study, I reconstruct the BIS' private credit series as best as possible using my new consistent time series of credit components available at quarterly frequency from 1900–2020: outstanding corporate debt securities, commercial paper, bank loans, and—in the post-WWII era—various types of asset-backed securities. A consistent time series for non-bank, non-securitized lending can unfortunately not be constructed and is thus omitted from the private credit series I present in this chapter. Figure 3.10 in the appendix plots the BIS' estimation of the credit-to-GDP gap in comparison to the one that is based on my historical data. I mirror the construction of the gap with my own data one-to-one. As can be seen from the graph, the two data series yield very similar results with two peaks in the late 1980s and around 2008.

Figure 3.4 displays the estimation of the credit-to-GDP gap using my data over the whole time horizon. While the raw series begins in 1900, I backward extrapolate the private credit series to the first quarter of 1890 using growth rates of total loans by national banks and railroad bonds outstanding which are available at quarterly frequency before 1900. This allows the gap to start at the first quarter of 1900 using the proxy data for the first ten years. From the graph, we observe that the forward-looking gap estimate exhibits five pronounced peak periods—around 1905, in 1931, in the 1950s, in the late 1980s, and in 2008—and three marked troughs—after WWI, during the Great Depression, and after the Global Financial Crisis. As is indicated by shaded areas in the graph, four out of these five peaks coincide with periods of banking crises according to the definition of Baron & Dieckelmann (2021). The troughs occur either in the aftermath of the two most severe banking crises—the Great Depression and the Global Financial Crisis—or during times of war.

What drives peaks and troughs over the medium-term credit cycle? Sharp uptakes in economic growth like during the war economies of world wars I and II drive down the credit-to-GDP ratio abruptly and thus create an acute de-

Figure 3.4: Private credit-to-GDP gap, 1900–2019



Notes: The blue line depicts the credit-to-GDP gap based on my historically consistent series for total credit to the private non-financial sector divided by GDP. The gap is computed as the deviation from the series' medium-term trend using a one-sided HP-filter with a smoothing parameter of $\lambda = 400,000$. Shaded areas in grey represent periods of banking crises according to Baron & Dieckelmann (2021).

viation from trend, causing the credit-to-GDP gap to fall. Additionally, sharp credit contractions caused by major banking crises cause the ratio's numerator to collapse and put the ratio on a below-trend trajectory. From the 1930s to the first half of the 1940s, both of these phenomena occur successively, causing the HP filter to produce a far-below-trend gap estimate. The healthy economic development after World War II characterized by stable and sustainable growth in credit and GDP then induces a sharp reversal of the gap estimation into above-trend territory which causes a false warning in the 1950s and 1960s if we interpret the credit-to-GDP as an indicator of financial fragility. Sudden and substantial movements in the credit-to-GDP ratio can induce spurious movements in the gap estimation that have no informational content for the degree of financial fragility.

The ongoing global economic crisis caused by the COVID-19 pandemic may have a similar effect: A rapid contraction of GDP with a simultaneous large-scale extension of private credit to bridge the adverse economic effects of lock-downs will ramp up the credit-to-GDP ratio suddenly and move the gap estimate most likely onto an above-trend trajectory. Naturally, the COVID-19 crisis poses a threat to financial stability and, thus, a shooting up of the credit-to-GDP gap could be seen as a desirable signal to inform a policy maker of heightened financial fragility—I will argue, however, that this is a false signal

as it does exactly not represent the gradual built-up of fragility brought about by an over-extension of credit that the gap was designed to capture, but rather is caused by a sudden change in economic conditions that should be reflected by indicators of López-Salido et al.'s (2017) second strand of the credit cycle literature that captures market sentiment and sudden changes in expectations, as I explained in the previous section.

Thus, the historical record not only shows that, first, large crisis events can distort the informational content of the credit-to-GDP gap as an indicator of financial fragility, but also that, second, we may be on the verge of receiving yet another such distorted signal due to extraordinary consequences of the COVID-19 pandemic. Third, we have seen that the ability of the credit-to-GDP gap to measure financial fragility works well in hindsight but may depend significantly on at what point in time the estimation commences.[10] Last, it is not immediately visible form the stylized facts whether the credit-to-GDP can be useful for the correct timing of crisis events. While its recent popularity is explained by the fact the it would have worked well before the collapse of Lehman Brothers in 2008, the picture is less clear with regard to the Great Depression or the Savings and Loan crisis of the 1980s. In the following, I turn to securities issuance-based proxies of credit and equity market sentiment to investigate the possibility of more precise and timely warning signals of imminent crises.

3.4.2 Predicting banking crises

Considering the limited usefulness of the de-trended credit aggregate to predict periods of bank distress, I question its ability to proxy financial fragility. If fragility is defined as a state of high susceptibility to external shocks we would expect sudden reversals in market sentiment during periods of high domestic leverage in comparison to historical averages to function as crisis triggers. This is the triggers-plus-vulnerabilities hypothesis of López-Salido et al. (2017). In the following, I test this hypothesis by regressing pre-crisis periods on the credit and equity sentiment proxies s^e and s^e, on the credit-to-GDP gap c, and on interaction terms of the former two with the latter.[11] A pre-crisis period is

[10] This phenomenon is known to the financial cycle literature as the "starting-point bias" (Geršl & Seidler, 2012; Drehmann & Tsatsaronis, 2014). The BIS' credit-to-GDP gap does not indicate any above-trend leverage prior to the 1980s as the data coverage starts only in 1952. Using longer data starting in 1900, however, induces a spurious positive value throughout the post-WWII era, as I have shown previously.

[11] Recall that the sentiment proxies are estimated forecasts of future stock returns or term spreads, respectively, on the basis of measures of past securities issuance activity.

defined as the four quarters prior to the starting quarter of a banking crisis. Since this independent variable is coded as a dummy variable, I use a logistic regression function of the form

$$logit(\pi^p) = \ln \frac{\pi^p}{1-\pi^p} = \beta_0 + \beta_1 s^e + \beta_2 s^c + \beta_3 c + \beta_4 (s^e \times c) + \beta_5 (s^c \times c) + \epsilon \quad (3.3)$$

where π^p is interpreted as the probability of an impending banking crisis within the next four quarters. Table 3.3 presents the estimation results.

Table 3.3: Financial fragility and market sentiment

	(1) Pre-crisis	(2) Pre-crisis	(3) Pre-crisis	(4) Pre-crisis	(5) Pre-crisis	(6) Pre-crisis
Equity sentiment s^e	−26.94***			−25.76***	−25.34***	−24.82***
	(5.13)			(5.43)	(5.62)	(6.08)
Credit sentiment s^c		222.79**		146.38*	137.20	130.64
		(92.91)		(88.85)	(88.20)	(79.80)
Credit-to-GDP gap c			5.10**		2.47	0.85
			(2.36)		(2.46)	(2.00)
$s^e \times c$						14.20
						(47.68)
$s^c \times c$						2716.19**
						(1084.05)
Constant	−3.43***	−3.56***	−3.47***	−3.53***	−3.56***	−3.82***
	(0.29)	(0.31)	(0.27)	(0.32)	(0.33)	(0.37)
Observations	477	473	481	472	471	471
Pseudo R^2	0.173	0.051	0.020	0.195	0.198	0.234

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The table shows estimations for logistic regressions of pre-crisis periods, which refer to the four quarters prior to the start of banking crisis events. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

The general take-away from the regression results in Table 3.3 is that sentiment proxies clearly outperform the credit aggregate in explaining periods of financial fragility, as defined by four consecutive pre-crisis quarters.[12] With a pseudo R^2 of 0.02, the credit-to-GDP gap is a very weak predictor of fragility in comparison to equity sentiment (pseudo $R^2 = 0.173$) and credit sentiment (pseudo $R^2 = 0.051$). Although the coefficient is positive and significant, indicating that excessive leverage is indeed followed by bank distress, the low coefficient of determination indicates that many other periods of high leverage are not followed by crises. As expected, a deterioration in both equity and credit sentiment is predictive of bank distress. [13] Thus, it is no wonder that

[12] These results are robust with regard to longer pre-crisis horizons and other credit aggregate measures, such as a credit gap computed from bank loans instead of from total credit or conventional credit-to-GDP ratios.

[13] Recall that a positive value for the *equity* sentiment proxy indicates buoyancy while a positive value for the *credit* sentiment proxy—as it refers to an expected widening of term spreads—represents a shift towards pessimism.

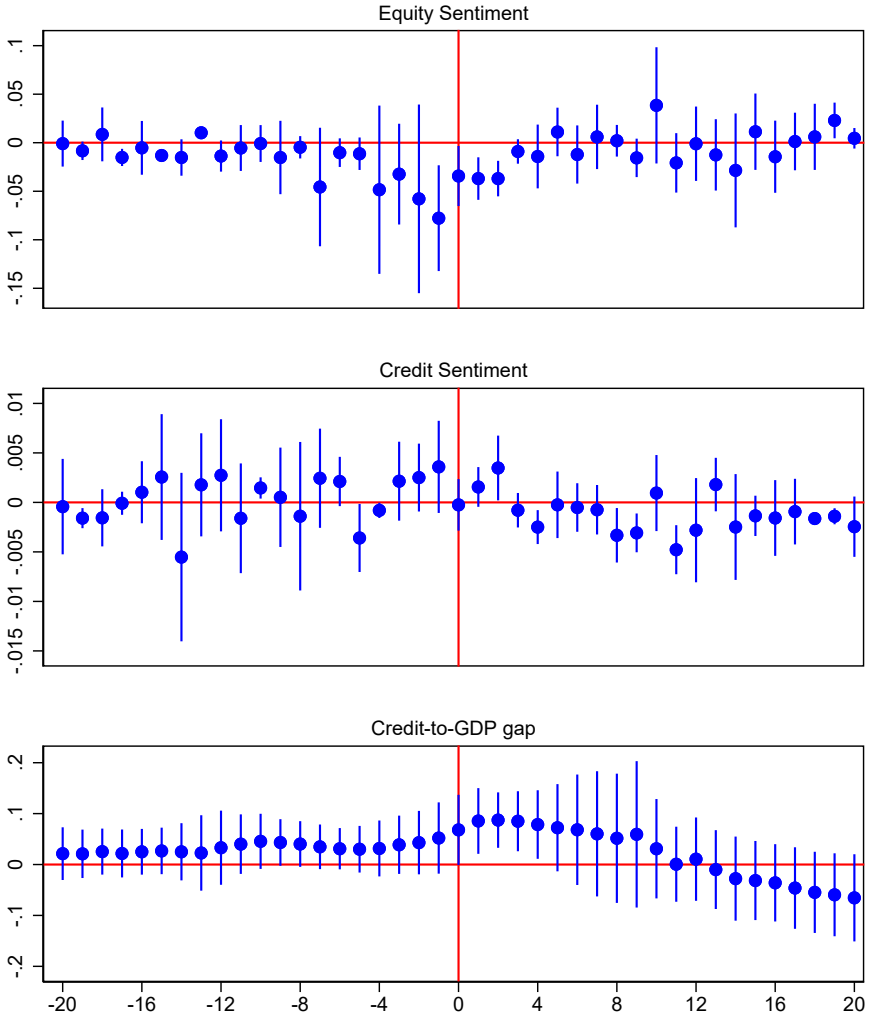
taking sentiment proxies and the credit aggregate together in model five only marginally increases the predictive ability of model four which includes sentiment measures only. The coefficient of the credit gap becomes insignificant, too. Interacting both sentiment proxies with the credit aggregate in model six, however, yields an interesting result: While the contribution to predictive ability of equity sentiment remains largely unchanged, and importantly remains significant only independently of the credit-to-GDP gap, credit sentiment becomes highly significant when interacted with the credit gap. This means that equity sentiment is a predictor of bank distress irrespective of credit aggregates—a result that goes along nicely with recent findings by Baron et al. (2021) who show that substantial bank equity declines are predictive of banking crises. Contrarily, a deterioration of credit sentiment is predictive of bank distress *only if* it is accompanied by high leverage, returning some credibility to López-Salido et al.'s (2017) trigger-plus-vulnerabilities hypothesis.

Next, I take on a slightly longer-term perspective and investigate how sentiment and the credit aggregate evolve twenty quarters before and after crisis periods. The idea is, first, to shed some light on the question whether sentiment builds up alongside credit and could thus be a potential driver of credit booms, and, second, to investigate the horizon over which reversals of sentiment prior to crises play out. For this, I regress the sentiment proxies and the credit-to-GDP gap on twenty lags, twenty leads, and the contemporaneous value of the banking crisis starting date dummy. I include the constant in the regressions but exclude it from the graphs and plot the coefficient estimates and their confidence intervals as event studies in Figure 3.5.[14]

The first plot in Figure 3.5 shows the average development of the equity sentiment proxy 5 years before and after the start of banking crises. It is immediately visible that around four quarters before the start of a crisis equity sentiment declines drastically to below zero, even though only the estimate for the last quarter before the beginning of the crisis is significant at the 95% level. This is matched by a deterioration of credit sentiment three quarters prior, as indicated by a borderline significant and positive surge in the foretasted corporate term spread. The credit-to-GDP gap, being the credit-based proxy for financial fragility, shows no interesting behavior with the exception that its value is slightly above zero on average but not significantly. The forward-looking credit gap estimate is only significantly different from zero and positive four quarters into to the crisis which I attribute mainly to a stronger decline

[14] I use a robust estimation method for the standard errors to achieve variance over time in the event studies.

Figure 3.5: Event studies around banking crises



Notes: Depicted are coefficient estimates from regressing the variables on 20 leads and lags of the banking crisis start dummy. Vertical bars represent 95% confidence intervals. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

in GDP than in total credit occurring during the crises in the sample. The observed behavior of the credit gap is fundamentally different from what we would expect from the perspective of a vulnerabilities-interpretation of the credit cycle according to which fragility builds up a gradually to very high levels prior to crises, as proxied by high domestic leverage in comparison to its historical trend.

Along the same lines fits the observation that buoyant market sentiment does not seem to be persistently sustained in the medium-term run-up to banking crises. Neither equity nor credit sentiment follow statistically significant non-zero trajectories prior to crises. Since neither the credit gap consistently surges prior to crises, nor buoyant sentiment is sustained over a sufficiently

long time horizon, I can rule out the hypothesis that market sentiment is a driver of credit booms that end in banking crises. Furthermore, equity sentiment has a tendency to quickly return to (around) the value of zero after five to ten quarters, displaying mean-reverting behavior which is in line with the literature (De Long et al., 1990; López-Salido et al., 2017). The key message from Table 3.3 is mirrored in these findings, namely that it's not the excessive built-up of credit on potentially irrational grounds that predict banking crises, but instead the sudden reversal of such buoyant sentiment. The fact that equity issuance reversals predict banking crises without elevated private credit levels, suggests that changes in investor sentiment can trigger financial crises even in the absence of underlying banking fragility. I thus give much more weight to the triggers-aspect of López-Salido et al.'s (2017) interpretation of the credit cycle than to the vulnerabilities-side. I interpret the evidence in such a way that it is not the built-up of leverage that causes banking crises, it is the moment when external finance stops coming which causes the system to fold.

In light of this interpretation, I argue for revisiting the definition of financial fragility as a state of susceptibility to shocks and the use of credit aggregates as its main measure. The results presented above show that banking crises unfold irrespective of a long-term built-up of leverage—and thus, potentially independently of the state of financial fragility, as it is currently defined. Naturally, this interpretation has several important caveats. First, it rests on the approximation of market sentiment through measures of corporate securities issuance. It remains an open question whether other proxies confirm the important role of sentiment in a banking crises setting. Second, all results are obviously limited to the United States. Having a rather market-based financial system is certainly an important factor in explaining why corporate securities issuance is such a well-functioning predictor. Third, due to the lack of quarterly data prior to World War II, credit by financial intermediaries other than banks is excluded from the analysis. As a final exercise, I test the discovered predictive capabilities of the sudden sentiment proxy reversals in a pseudo-real-time setting and move the analysis out of sample.

3.4.3 Out-of-sample analysis

To test the usefulness of this section's findings for policy makers, I move the analysis from an ex post to an ex ante perspective and assess the predictive capabilities of my corporate securities issuance measures for banking crises out-

of-sample. Importantly, this means that the previously estimated sentiment proxies cannot be used for this exercise since the respective fitted values are estimated over the entire sample size and time horizon. Instead, I estimate the sentiment proxies recursively using only observations that were available at each point in time. The credit-to-GDP gap is already a forward-looking measure and can thus be kept. Otherwise, I use the same logistic regression model (3) as in the previous subsection and estimate this model through the first quarter of 2005 such that the pre-crisis observations of the subsequent Subprime Crisis are excluded from the model estimation. I then compute predicted values out-of-sample for the second quarter of 2005 through the second quarter of 2009. The start of the banking crisis is dated to when it became systemic after the collapse of Lehman Brothers in the third quarter of 2008 in accordance with Baron & Dieckelmann (2021). Model estimation results are presented in Table 3.4.

Table 3.4: Model estimation for out-of-sample exercise, 1900–2005q1

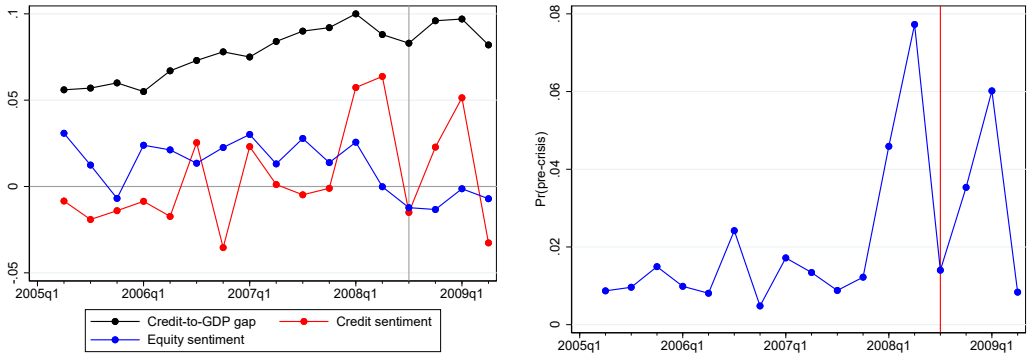
	(1) Pre-crisis	(2) Pre-crisis	(3) Pre-crisis	(4) Pre-crisis	(5) Pre-crisis	(6) Pre-crisis
Recur. equity sentiment s_R^e	−21.32***			−20.48***	−21.21***	−19.90***
	(4.73)			(5.31)	(5.19)	(5.61)
Recur. credit sentiment s_R^c		170.47*		118.49	128.99	138.80
		(97.86)		(97.11)	(87.85)	(94.13)
Credit-to-GDP gap c			1.25		−2.79	−3.72*
			(2.53)		(2.24)	(1.90)
$s_R^e \times c$						29.38
						(37.91)
$s_R^c \times c$						1328.08*
						(815.35)
Constant	−3.73***	−3.57***	−3.55***	−3.71***	−3.72***	−3.78***
	(0.40)	(0.34)	(0.30)	(0.38)	(0.38)	(0.36)
Observations	397	392	421	392	392	392
Pseudo R^2	0.219	0.042	0.001	0.237	0.242	0.257

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The table shows estimations for logistic regressions of pre-crisis periods, which refer to the four quarters prior to the start of banking crisis events. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

From Table 3.4 we can confirm that the recursively estimated sentiment proxies behave very similarly to their full-sample counterparts. Significance levels and coefficient signs are comparable to those presented in Table 3.3. Since the proxies themselves represent forecasts of future equity returns or corporate term spreads, respectively, it is not surprising that their predictive ability for banking crises does not change in an ex ante scenario. A second and very important finding is that, with a pseudo R^2 of 0.001, the credit-to-GDP gap is totally unrelated to banking crises when the Subprime crisis is removed from the sample. This adds to the poor performance previously reported in

Table 3.3: The de-trended credit aggregate alone is a poor predictor of banking crises and, thus, by definition also a poor proxy for financial fragility. When adding the interaction terms in model six, an even more striking finding comes to light: An above-trend value of the credit-to-GDP gap significantly reduces financial fragility when it is not associated with buoyant sentiment in credit markets. Recalling the insignificance of the standalone credit gap coefficient in model six of the full-sample exercise in Table 3.3, I conclude that if aggregate leverage is not accompanied by buoyant sentiment it also does not induce financial fragility. This stands in opposition to López-Salido et al.'s (2017) triggers-plus-vulnerabilities interpretation of the credit cycle, as my findings suggest that credit booms themselves are irrelevant for financial fragility if they are not accompanied by buoyant sentiment. It is thus not leverage itself that induces fragility, but it is the deterioration in sentiment from a formerly over-optimistic market environment that induces crises: Again, it is not credit that causes crises, it is when credit stops coming that turmoil breaks loose.

Figure 3.6: Out-of-sample prediction for the 2008 Subprime Crisis



Notes: Recursively predicted and forward-looking probabilties of impending banking crisis from 2005 to the beginning of 2009. The start of the banking crisis is dated to the collapse of Lehman Brothers in the third quarter of 2008, as indicated by the vertical line. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

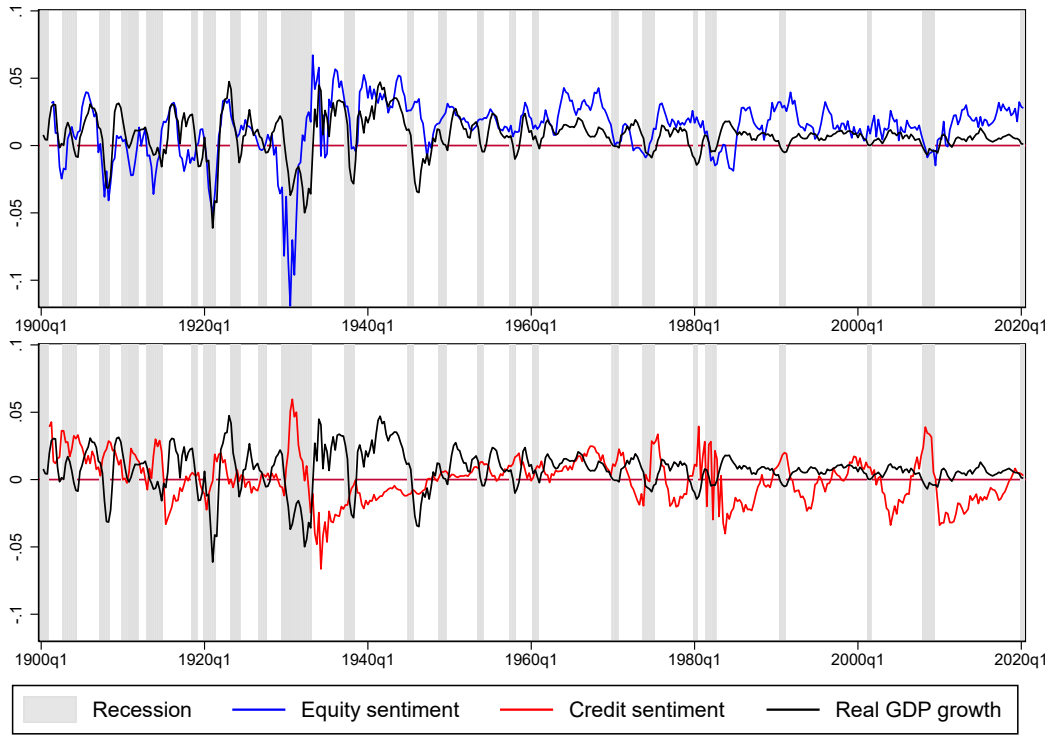
In the following, I use model six from Table 3.4 to compute fitted values out of sample and derive forward-looking banking crises probabilities. The input variables are plotted in the left plot of Figure 3.6, and the out-of-sample predictions are displayed on the right-hand side. The credit-to-GDP gap is at elevated levels during the run-up to the Subprime crisis. The forward-looking proxy for equity sentiment is optimistic up until the beginning of 2008 and then deteriorates into pessimistic territory in the second quarter of 2008. Credit sentiment moves from buoyancy in 2005 and 2006, into a neutral zone in 2007, and ultimately reverses rapidly in the first and second quarter of 2008. The reversal of sentiment is mirrored in the out-of-sample predictions.

In the six months before the collapse of Lehman Brothers, the model exhibits a drastic surge in the predicted probability of banking crisis within the next four quarters. In line with results from the events studies in Figure 3.5, sudden reversals in sentiment contain significant predictive information of impending banking crises, and a respective sentiment-based model trained with 100 years of historical data up until 2005 would have issued a warning signal half a year ahead of time.

3.5 Economic activity and recessions

The second major field of analysis of this study is the role of market sentiment proxied by corporate securities issuance in explaining real economic activity. In particular, I test its ability to predict future real GDP growth and recessions. I start out by plotting real GDP growth against my sentiment proxies in Figure 3.7 to inspect the sentiment dynamics over the business cycle.

Figure 3.7: Sentiment and the business cycle, 1900–2020



Notes: The sentiment proxies refer to in-sample predictions on the basis of model estimations (3.1) and (3.2). Shaded areas in grey represent periods of recessions according to the National Bureau of Economic Research. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

In a first inspection of Figure 3.7, we observe that an expected decline in stock prices—as indicated by a negative value of the equity sentiment proxy—

is associated with economic slowdowns. Particularly, recessions seem to follow after periods of declining equity sentiment, even though the forecasted return may not be negative. An expected widening of credit spreads—as indicated by a positive value of the credit sentiment proxy—tends to coincide with declining economic activity and recessions. After the end of recessions, credit sentiment takes on rather low values indicating the expectation of a lower term spread in the future. Further, recessions tend to occur after long periods of buoyant credit sentiment which is in line with one of the main findings of López-Salido et al. (2017). From these stylized facts, both equity and credit sentiment seem to exhibit pro-cyclical behavior.

In a simple vector auto-regressive (VAR) model, I analyze this observation in more detail: I regress real GDP growth, nominal total credit growth,[15] equity sentiment, and credit sentiment individually on lags of each of the other variables. Formally,

$$Y_t = c + \sum_{i=1}^{p} \boldsymbol{A}_i Y_{t-i} + e_t \tag{3.4}$$

where c is a k-dimensional vector of constants and Y_t is a four-dimensional vector of time series—namely real GDP growth, total credit growth, the equity sentiment proxy, and the credit sentiment proxy. $\boldsymbol{A}_i$ are $k \times k$ matrices of coefficients, e_t is the error term vector, and p is called the order of the VAR and corresponds to the number of lags included for each variable and is set according to a majority of standard information criteria to $p = 7$.[16]

The estimation of model (4) is displayed in the appendix in Table 3.9. After estimating the VAR model, I use Wald tests to check for Granger causality between economic growth, credit growth, and the respective market sentiment proxies. Specifically, I test for each of the four variables, first, the null hypothesis that the estimated coefficients of the lagged values of *each* explanatory variable are jointly zero and, second, an alternative null hypothesis that estimated coefficients of the lagged values of *all* explanatory variables are jointly zero. If a null hypothesis cannot be rejected at a certain confidence level, this is equivalent to saying that Granger causality cannot be rejected. It is important to highlight that Granger causality of course does not imply actual causation but rather showcases the usefulness of lagged values of a certain variable (or of all variables jointly) for predicting one of the four variables specified in the VAR model. The Wald test results are shown below in Table 3.5.

[15] The results hold when using real credit growth instead.

[16] The order of the model fits well with the general time horizon of up to two years over which asset prices generally have been found to be predictive of economic activity (Stock & Watson, 2003).

Table 3.5: Wald tests for Granger causality

	χ^2	df	p
Δ*(GDP/CPI)*			
Δ(total credit)	13.162	7	0.068
Equity sentiment	27.785	7	0.0002
Credit sentiment	7.210	7	0.407
ALL	52.597	21	0.0002
Δ*(total credit)*			
Δ(GDP/CPI)	22.003	7	0.003
Equity sentiment	10.441	7	0.165
Credit sentiment	1.088	7	0.993
ALL	33.898	21	0.037
Equity sentiment			
Δ(GDP/CPI)	30.081	7	0.00009
Δ(total credit)	13.581	7	0.0592
Credit sentiment	48.173	7	3.29×10^{-8}
ALL	99.544	21	3.47×10^{-12}
Credit sentiment			
Δ(GDP/CPI)	21.650	7	0.003
Δ(total credit)	11.537	7	0.117
Equity sentiment	41.757	7	5.79×10^{-7}
ALL	101.878	21	1.34×10^{-12}

Notes: χ^2 refers to the test statistic, *df* denotes degrees of freedom, and p is the p-value indicating statistical significance. Δ is the one-quarter growth operator. The respective recipient variables of Granger causality are printed in *italics*. ALL refers to a test of Granger causality originating from the lagged values of all remaining variables jointly.

The results in Table 3.5 reveal some interesting facts: At 99% confidence, equity sentiment and economic activity exhibit strong bidirectional Granger causality, implying that while equity sentiment contains predictive information for economic growth, the reverse holds true as well. This in line with findings of Stock & Watson (2003). Summing over the estimated coefficients in Table 3.9 clearly yields a positive value and, thus, shows that buoyant sentiment in stock markets is predictive of future economic activity and vice versa. Interestingly, this does not hold for credit sentiment. The forecast of future corporate term spreads is not predictive of Real GDP at any reasonable confidence level ($p = 0.407$). The reverse direction, however, is. The immediate conclusion from this finding is that credit sentiment—as proxied by corporate securities issuance—cannot be a driver of economic activity and, thus, cannot lead the business cycle. One potential channel through which credit sentiment could drive the business cycle is the credit cycle (López-Salido et al., 2017). When we examine the Granger causality properties of nominal credit growth,

we observe that credit sentiment holds virtually no predictive information for the credit aggregate ($p = 0.993$). While total credit alone Granger-causes real GDP at about 93% confidence, no role for sentiment can be found in this context. While this does not speak directly against a business-cycle interpretation of the credit cycle, as suggested by López-Salido et al. (2017), it rules out, however, the interpretation that the driving force behind a credit-based business cycle is market sentiment. In summary, I find that equity sentiment performs well in forecasting economic activity while this cannot be said for credit sentiment. In the following subsection, I investigate whether sudden changes in either sentiment proxy are helpful in predicting economic decline, i.e. recessions.

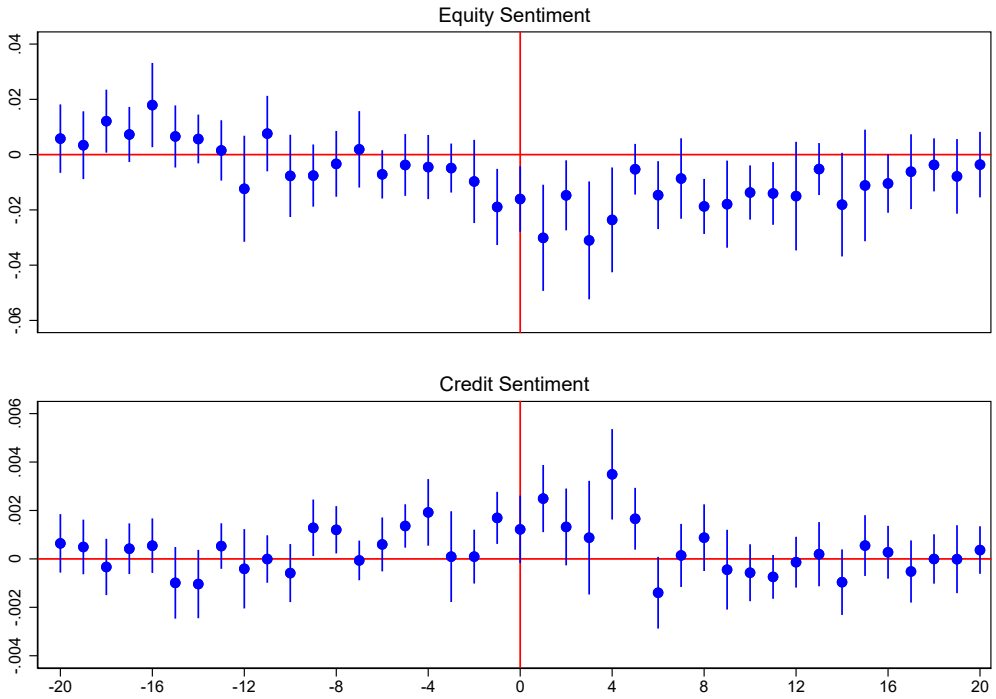
3.5.1 Predicting recessions

To better understand how sentiment dynamics evolve around recessions, I again compute event studies and regress both sentiment proxies on twenty lags, twenty leads, and the contemporaneous value of the recession starting date dummy. Recessions are dated according to the National Bureau of Economic Research.[17] Event studies are depicted in Figure 3.8.

The main take-away from both plots in Figure 3.8 is that both sentiment proxies signal future recessions by diverging from zero at 95% confidence ahead of time. Equity sentiment starts deteriorating two to three quarters prior to a crisis, although only the quarter directly prior to the business cycle peak is statistically significant. This explains why López-Salido et al. (2017) do not find that their equity sentiment proxies predict economic downturns: They use annual data and are unable to detect the historically persistent effect at higher frequencies. The picture is different for credit sentiment, however: Here, we observe that a statistically significant deterioration of sentiment occurs up to nine quarters ahead of the beginning of a recession. My credit sentiment proxy seems to be particularly useful in predicting recessions over a horizon of nine to four quarters ahead of business cycle peaks. I can thus confirm López-Salido et al.'s (2017) finding that elevated credit sentiment two years prior is associated with economic decline. It is, however, not buoyant sentiment that predicts the recession but rather the rapid and significant deterioration of sentiment starting up to two years prior that heralds the beginning of the

[17] The NBER dates recessions such that they start at the peak of a business cycle and end at the trough. My recession starting dummy thus corresponds to the quarter at which the business cycle is at its peak. See https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions, accessed on November 11, 2020.

Figure 3.8: Event studies around recessions



Notes: Depicted are coefficient estimates from regressing the variables on 20 leads and lags of the recession start dummy. Vertical bars represent 95% confidence intervals. Recessions are dated according to the National Bureau of Economic Research. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

downturn.

Before I go deeper into analyzing how sentiment is connected to recessions and how this relationship can be exploited for their prediction, I can already establish that, while credit sentiment performs poorly in forecasting GDP growth, it excels at predicting recessions. There is preliminary evidence that equity sentiment is useful in predicting both, but on rather short notice. Further, and similar to what I discussed previously with regard to banking crises, it seems that particularly the reversal of sentiment is the defining characteristic that contains the predictive information. Next, I set up a logistic regression model similar to model (3) in the previous section to test the in-sample performance and the forecasting horizon of the two sentiment proxies in predicting recessions. The model takes the form

$$logit(\pi^p) = \ln \frac{\pi^p}{1-\pi^p} = \beta_0 + \sum_{i=0}^{j} \beta_1^j s_{t-i}^e + \sum_{i=0}^{j} \beta_2^j s_{t-i}^c + \epsilon \tag{3.5}$$

where π^p is interpreted as the probability of recession, and j is the number of included lags, which I set to four and eight, respectively. Estimation results are displayed in Table 3.6.

Table 3.6: Recessions and market sentiment

	(1) RS	(2) RS	(3) RS	(4) RS	(5) RS	(6) RS
Equity sentiment	−7.28	−8.67			−6.36	−8.70
	(5.86)	(6.09)			(6.41)	(6.96)
L.Equity sentiment	−11.55*	−11.55			−13.07**	−15.82**
	(6.82)	(7.67)			(6.48)	(7.25)
L2.Equity sentiment	−5.32	−5.97			−7.46	−17.10*
	(7.11)	(8.69)			(7.98)	(9.37)
L3.Equity sentiment	10.38**	11.54*			13.58**	10.08
	(4.58)	(6.04)			(5.55)	(7.99)
L4.Equity sentiment	8.65	9.98			11.49*	20.90*
	(7.22)	(8.48)			(7.04)	(11.23)
L5.Equity sentiment		3.76				16.82**
		(8.09)				(8.32)
L6.Equity sentiment		−3.48				−3.90
		(7.71)				(9.40)
L7.Equity sentiment		6.99				0.48
		(10.25)				(11.44)
L8.Equity sentiment		−2.52				−3.97
		(8.17)				(8.25)
Credit sentiment			31.08	40.71	0.65	−13.26
			(63.75)	(69.37)	(62.51)	(68.93)
L.Credit sentiment			63.77	18.17	6.72	−64.92
			(55.87)	(54.98)	(63.39)	(64.00)
L2.Credit sentiment			−39.79	−114.95**	−22.12	−108.76*
			(50.30)	(48.60)	(52.98)	(61.97)
L3.Credit sentiment			−47.68	−103.91	5.99	30.30
			(79.29)	(92.52)	(77.44)	(110.09)
L4.Credit sentiment			106.30*	121.88*	165.34**	294.96***
			(64.92)	(67.33)	(68.69)	(81.05)
L5.Credit sentiment				89.26		192.56**
				(63.49)		(89.94)
L6.Credit sentiment				54.16		33.22
				(68.91)		(78.61)
L7.Credit sentiment				−31.95		−147.57*
				(48.89)		(78.49)
L8.Credit sentiment				15.82		−81.42
				(68.37)		(91.85)
Constant	−3.00***	−3.14***	−3.05***	−3.13***	−3.12***	−3.30***
	(0.24)	(0.31)	(0.23)	(0.24)	(0.28)	(0.34)
Observations	473	469	465	457	464	456
Pseudo R^2	0.026	0.035	0.025	0.043	0.054	0.098

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. The table shows estimations for logistic regressions of quarters that mark the beginning of a recession RS, according to the NBER's methodology. Positive equity sentiment values represent buoyancy while positive credit sentiment values indicate pessimism.

The results confirm the key findings of the event studies. Equity sentiment deteriorates with statistical significance one to two quarters before the business cycle peaks, indicating that reversals in equity issuance activity signal recessions two to three quarters ahead of time.[18] Credit sentiment is predictive

[18] Note that at time t, the sentiment proxies contain historical data only, as equations

of downturns, too, but at a longer time horizon: As model specifications three to six show, a sudden deterioration of sentiment—indicated by a relatively large and positive coefficient estimate—four to five quarters before the peak of the business cycle significantly increases the probability of an impending recession. Thus, corporate debt issuance activity contains predictive information of impending downturns up to two years ahead of time, which is in line with what López-Salido et al. (2017) find using their own credit sentiment proxy.

The fact that I use higher frequency data, however, reveals an important distinction from what is already known about sentiment and recessions. The estimation results in Table 3.6 do not allow for an interpretation where recessions occur after long periods of buoyant equity and credit sentiment. Instead, the only statistically significant feature that produces the proxies' predictive power are the sudden reversals of sentiment that play out over a time horizon of a few quarters. It is thus—similar to what I find with regard to financial fragility—not periods of overly optimistic market sentiment that drive the business cycle but it is its sudden reversal that induces the end of the boom. In line with Bordalo et al. (2018) it is when "good news stop coming" that economies slow down. This proposition further lends itself very well to the commonly accepted observation that there is little regularity to the business cycle (which is why business *cycle* is such a notorious misnomer). Notwithstanding the well-established role of rational expectations and exogenous shocks for the business cycle, my results show that shifts in market participants' irrationally formed expectations—that is, investors decisions disconnected from fundamentals—also play a significant role in perturbing economic activity and in inducing downturns.

My analysis shows that equity market sentiment has predictive power for both economic activity and economic downturns. I, thus, suggest that investors sentiment in equity markets is indeed a potential driver of the business cycle. This, however, does not hold for credit sentiment. Credit sentiment is only predictive of recessions but not of economic growth, and I thus rule out the hypothesis that a *sentiment-driven* credit cycle is a major driver of the business cycle. Not the quantity of credit determines economic activity, but the sudden absence of credit will send the economy down the drain. Policy makers would do well in looking at issuance activity in corporate securities markets to complement their tools for growth and recession forecasts.

(3.1) and (3.2) include one to four lags but no contemporaneous values of the corporate securities issuance measures.

3.6 Conclusion

This study investigates the role of corporate securities issuance in approximating investor sentiment in credit and equity markets and the role of sentiment in explaining economic activity and financial fragility. In particular, I contribute to the existing literature in four distinct ways.

First, I present new historical U.S. data at quarterly frequency from 1900–2020 on the gross issuance of equities and corporate debt securities, and a historically consistent estimate of total private credit mainly based on quarterly data of outstanding corporate debt and total bank loans. Second, I use several measures of corporate securities issuance to forecast future equity returns and corporate term spreads, respectively. Following López-Salido et al. (2017), I interpret these forecasts as sentiment proxies and investigate their role in explaining and predicting financial fragility, banking crises, economic activity, and recessions at quarterly frequency. Third, I provide a historical assessment of credit aggregates—and particularly of the one-sided credit-to-GDP gap—and their role in proxying financial fragility as well as their ability to predict banking crises in real time. Fourth, I present policy makers with a complement to their tool box for predicting recessions and banking crises by proposing to harness the informational content in higher-frequency data on corporate securities issuance whereby sudden reversals of issuance activity signal a sudden drop in investors sentiment that is highly predictive of impending recessions and banking crises several quarters ahead of time.

The main finding of this chapter is that in the United States from 1900–2020 sudden reversals in equity and credit market sentiment proxied by corporate securities issuance are highly predictive of impending banking crises over an average time horizon of six months and of future recessions up to two years ahead of time. Issuance activity outperforms the private credit-to-GDP gap in its capacity to predict banking fragility in and out of sample. Deviations in equity issuance from historical averages also help to explain economic activity over the business cycle. Crises and recessions often occur independently of domestic leverage, making the credit-to-GDP gap a deficient early-warning indicator in historical application. I do not find convincing evidence that credit market sentiment is a driver of the business cycle or that it induces the built-up of financial fragility in the form of above-trend private credit levels. The fact that equity issuance reversals predict banking crises without elevated private credit levels, suggests that changes in investor sentiment can trigger financial crises even in the absence of underlying banking fragility. A

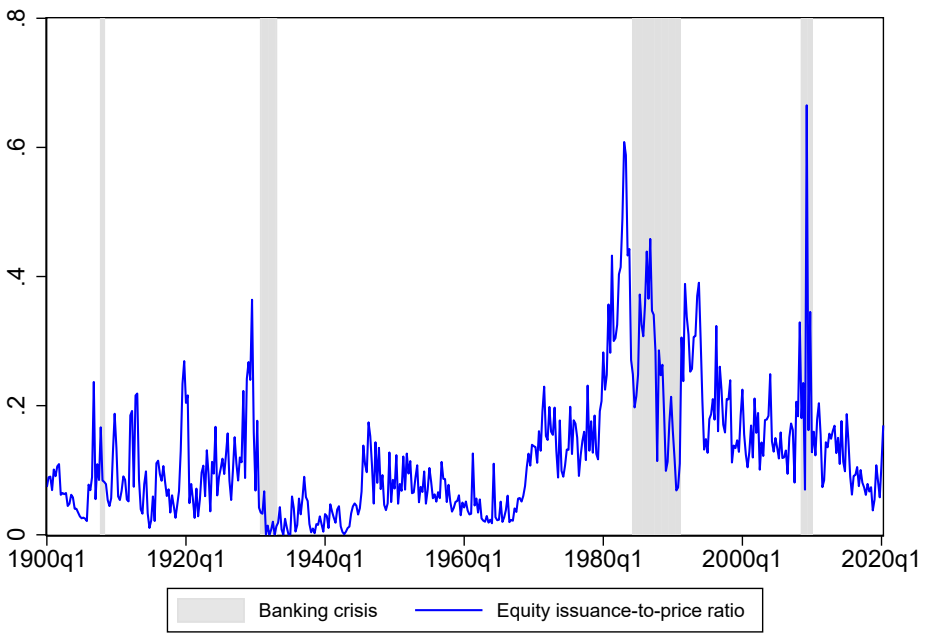
recently proposed triggers-plus-vulnerabilities interpretation of the credit cycle by López-Salido et al. (2017) seems less likely to hold in light of my findings, as financial fragility measures based on credit aggregates perform poorly in predicting the economy's susceptibility to shocks, putting a much stronger focus on the strength of triggers than on the vulnerabilities induced by private sector leverage. In my sample, periods of sustained buoyant sentiment only rarely precede crises and recessions. The evidence rather points towards short moments of drastic reversal in issuance activity—and thus, in sentiment—that serve as triggers. Novel quarterly data on bank lending further supports the interpretation that not the built-up of private credit is responsible for financial fragility and bank distress, but its sudden retraction. In line with Bordalo et al. (2018), I conclude that it is "when good news stop coming" that the economy falters.

My findings are highly relevant for policy makers concerned with the prediction of recessions and banking crises. First, my results should be seen as a reason for caution in the application of the credit-to-GDP gap when determining the counter-cyclical capital buffers under the Basel accords. Its prominence rests mainly on its strong predictive performance prior to the Global Financial Crisis, but my historical assessments casts doubt on its general applicability and usefulness. Second, policy makers should add the surveillance of gross issuance activity in corporate securities markets at high frequencies to their macro-prudential tool set. The informational content in sudden reversals of issuance activity is predictive of crises and recessions several quarters ahead of time.

As an avenue for further research, the predictive ability of corporate securities issuance should further be investigated by expanding this analysis to more countries at similar time spans and frequencies. Finding the necessary data for this undertaking is certainly no easy endeavor but will shed light on the important question whether this study's findings hold in less market-centered and more bank-focused financial systems, as well.

3.7 Appendix

Figure 3.9: Additional measure: equity-issuance-to-price ratio, 1900–2020

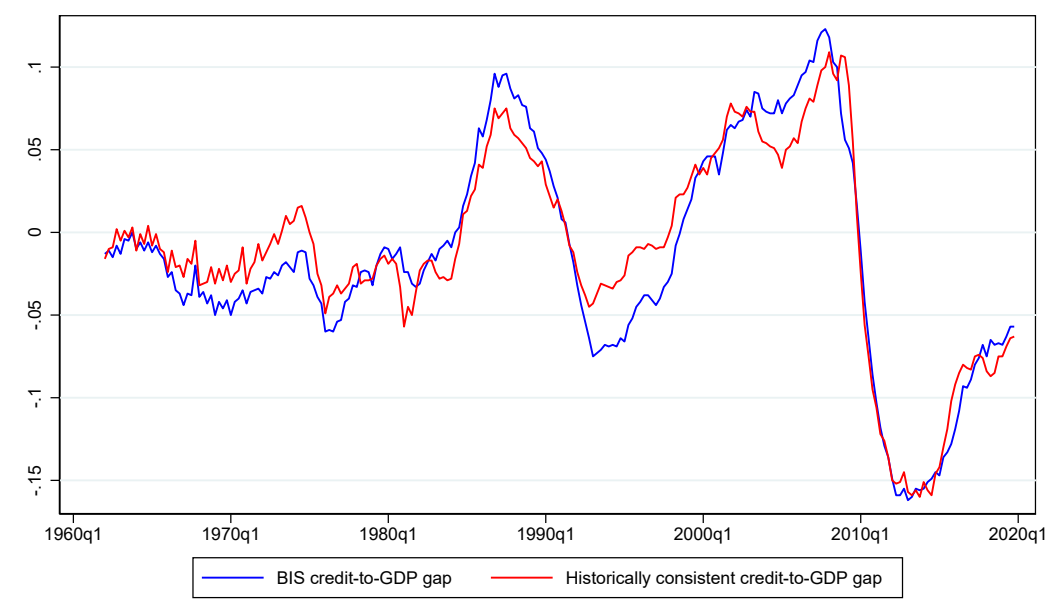


Notes: This measure is defined as $\frac{\text{equity issuance}}{\text{equity index level}}$, the division of gross equity issuance per quarter by the accumulated quarterly returns of the Dow Jones Industrial Average since the first quarter of 1900 at the end of the same quarter. Due to the unit mismatch between nominator (millions of U.S. dollars) and denominator (index points), the resulting ratio is not interpretable in levels but only in growth rates. Shaded areas in grey represent periods of banking crises according to Baron & Dieckelmann (2021).

The equity issuance-to-price ratio can be interpreted as managers' anticipation of future capital needs. I interpret sudden increases in gross equity issuance in comparison to the equity price level as managers making use of a buoyant investment environment to raise new capital expectation of impending commercial hardship. Managers exploit informational asymmetries in the equity market to raise capital while investors are not aware of the expected decline in profits to which they would of course react by selling stocks, resulting in falling prices. From the graph, it is visible that the ratio tends to shoot up shortly before periods of bank distress—like in 1907, in the 1930s, or in the 1980s—or of general financial instability—like at the outbreak of World War I in 1914 or in the early 1920s. To the most recent banking crisis, however, managers reacted too late, indicating that the downturn was unexpected by managers and investors alike.

For the purpose of estimating the sentiment proxies, I exclude the equity-issuance-to-price ratio as it adds virtually no new informational content to the regression: variation from equity issuance and lagged stock returns is already captured by other variables. The ratio is depicted here to underline the usefulness of issuance data for crisis prediction.

Figure 3.10: Credit-to-GDP gap comparison, 1952–2019



Notes: The red line represents the forward-looking gap estimate with my historically consistent total credit series. The blue line is the official credit-to-GDP gap estimate based on more complete data as published by the BIS.

The BIS' private credit data for the United States starts in the first quarter of 1952 and the trend is estimated for the first time after 10 years of continuous data coverage such that the first estimation is for the first quarter of 1962. The HP filter is applied one-sidedly which means that it is re-estimated recursively with every successive quarter to include only data which are available up to the point in time of the estimation and to prevent a look-ahead bias.

Table 3.7: New historical U.S. data

Quarter	Bank loans	Equity issuance	Debt issuance
1900q1	5.9595	0.0741	0.1398
1900q2	6.0930	0.0741	0.2873
1900q3	6.2505	0.0741	0.0826
1900q4	6.3072	0.0741	0.1837
1901q1	6.7964	0.1074	0.5099
1901q2	6.9140	0.1074	0.6982
1901q3	7.0887	0.1074	0.1627
1901q4	7.1655	0.1074	0.1182
1902q1	7.5149	0.0628	0.1830
1902q2	7.6640	0.0628	0.2143
1902q3	7.8189	0.0628	0.2830
1902q4	8.0896	0.0628	0.3295
1903q1	8.2178	0.0432	0.3309
1903q2	8.2570	0.0432	0.3578
1903q3	8.3813	0.0432	0.0640
1903q4	8.3538	0.0432	0.1665
1904q1	8.4712	0.0302	0.2232
1904q2	8.5450	0.0302	0.2666
1904q3	8.9297	0.0302	0.1144
1904q4	9.0273	0.0302	0.4878
1905q1	9.3725	0.0313	0.4804
1905q2	9.5400	0.0313	0.4952
1905q3	9.8169	0.0313	0.1643
1905q4	10.0738	0.0313	0.0861
1906q1	10.2533	0.1141	0.6435
1906q2	10.4420	0.0914	0.2607
1906q3	10.6341	0.1279	0.1011
1906q4	11.0181	0.3383	0.0867
1907q1	11.1400	0.0669	0.4586
1907q2	11.3190	0.1325	0.3987
1907q3	11.2995	0.0872	0.1212
1907q4	10.9680	0.1476	0.1108
1908q1	10.4436	0.0861	0.1965
1908q2	10.7630	0.0901	0.3821
1908q3	11.0449	0.0954	0.1620
1908q4	11.2247	0.0696	0.3715
1909q1	11.4271	0.0578	0.4837
1909q2	11.5480	0.0789	0.2916
1909q3	11.8441	0.1927	0.1710
1909q4	12.1617	0.2813	0.3177
1910q1	12.7047	0.1829	0.4858
1910q2	12.7660	0.0733	0.3676
1910q3	12.8724	0.0646	0.0794
1910q4	12.7577	0.0844	0.2004

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1911q1	13.1086	0.1144	0.4685
1911q2	13.2280	0.1107	0.3991
1911q3	13.3839	0.0628	0.2169
1911q4	13.4179	0.0641	0.2150
1912q1	13.9298	0.2465	0.4948
1912q2	14.1240	0.2637	0.5230
1912q3	14.3917	0.1063	0.1390
1912q4	14.5120	0.2868	0.2401
1913q1	14.8443	0.2678	0.5629
1913q2	14.8210	0.0970	0.2656
1913q3	15.1336	0.0478	0.1725
1913q4	14.8706	0.0391	0.1666
1914q1	15.3182	0.0975	0.3438
1914q2	15.5020	0.1198	0.6159
1914q3	15.4110	0.0362	0.1225
1914q4	15.2630	0.0117	0.1112
1915q1	15.4480	0.0280	0.4201
1915q2	15.6580	0.0863	0.3539
1915q3	16.1013	0.0403	0.1122
1915q4	17.4816	0.2271	0.2986
1916q1	17.6660	0.2210	0.5534
1916q2	17.9800	0.1736	0.3709
1916q3	18.5141	0.1782	0.2077
1916q4	19.3770	0.2088	0.3530
1917q1	20.0736	0.1610	0.5104
1917q2	20.5220	0.1189	0.3253
1917q3	20.8766	0.1220	0.3049
1917q4	21.4480	0.0527	0.0880
1918q1	21.7358	0.0971	0.1223
1918q2	22.3740	0.0762	0.0871
1918q3	22.9002	0.0459	0.3329
1918q4	23.4082	0.0786	0.2581
1919q1	22.5305	0.1240	0.4280
1919q2	24.6900	0.2870	0.2480
1919q3	26.4839	0.5380	0.2760
1919q4	28.8115	0.5960	0.1720
1920q1	29.5281	0.4340	0.4000
1920q2	30.7320	0.4050	0.5360
1920q3	31.3482	0.0840	0.3290
1920q4	30.9923	0.1170	0.4870
1921q1	29.4069	0.0860	0.5290
1921q2	28.9270	0.0370	0.6320
1921q3	28.2056	0.1050	0.3330
1921q4	27.8823	0.0480	0.5010

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1922q1	27.4345	0.1010	0.5690
1922q2	27.6270	0.1850	0.7930
1922q3	27.7963	0.2130	0.5130
1922q4	28.9031	0.1220	0.4560
1923q1	29.7145	0.2780	0.8440
1923q2	30.2720	0.1700	0.5930
1923q3	30.3782	0.0660	0.3400
1923q4	30.7360	0.2230	0.6530
1924q1	31.1080	0.1820	0.6280
1924q2	31.4090	0.3330	0.7500
1924q3	32.0847	0.1300	0.5810
1924q4	32.2850	0.2230	0.6960
1925q1	32.8157	0.2480	0.9360
1925q2	33.7290	0.3190	0.7640
1925q3	34.6187	0.2790	0.5700
1925q4	35.6320	0.4000	0.7040
1926q1	35.4377	0.4560	0.9030
1926q2	36.0350	0.2650	0.9410
1926q3	36.3850	0.1760	0.6480
1926q4	36.7350	0.3234	0.8597
1927q1	36.2124	0.4997	1.2776
1927q2	37.2080	0.3809	1.3639
1927q3	37.5190	0.3425	0.7444
1927q4	38.4220	0.5005	1.3821
1928q1	37.3321	0.4949	1.2544
1928q2	39.4640	0.9691	0.9909
1928q3	39.6710	0.4346	0.4423
1928q4	40.7630	1.4973	0.7434
1929q1	40.5570	1.7068	0.8583
1929q2	41.5120	1.6537	0.8203
1929q3	42.2010	2.5827	0.5368
1929q4	41.8980	0.8139	0.4046
1930q1	40.6860	0.4050	1.2280
1930q2	40.6180	0.8260	1.0990
1930q3	39.7150	0.1780	0.6760
1930q4	38.1350	0.1170	0.4280
1931q1	36.8130	0.1155	0.7968
1931q2	35.3840	0.2085	0.7498
1931q3	33.7500	-0.0035	0.3438
1931q4	31.3050	0.0225	0.1378
1932q1	29.5695	-0.0105	0.1500
1932q2	27.8340	0.0065	0.1190
1932q3	26.9850	0.0295	0.2330
1932q4	26.0630	-0.0015	0.1180

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1933q1	24.1530	0.0145	0.0675
1933q2	22.2430	0.0375	0.1075
1933q3	22.5164	0.0835	0.0455
1933q4	22.0540	0.0165	0.0065
1934q1	21.7263	-0.0145	0.0350
1934q2	21.3060	0.0485	0.2030
1934q3	20.9020	0.0215	0.1510
1934q4	20.4390	-0.0205	0.0670
1935q1	20.3940	-0.1223	0.1115
1935q2	20.2130	0.1448	0.7935
1935q3	19.9047	0.1128	0.6925
1935q4	20.3020	0.0148	0.5185
1936q1	20.0407	0.0490	1.0070
1936q2	20.6360	0.1830	1.3070
1936q3	20.9975	0.1100	0.6660
1936q4	21.3590	0.2100	1.0460
1937q1	21.6949	0.3463	0.6465
1937q2	22.4100	0.2043	0.5735
1937q3	22.2375	0.1673	0.2505
1937q4	22.0650	0.0423	0.2025
1938q1	21.6891	0.0083	0.2420
1938q2	20.9820	0.0273	0.4310
1938q3	20.9024	0.0073	0.6790
1938q4	21.2610	0.0533	0.6890
1939q1	21.0845	0.0420	0.2493
1939q2	21.3200	0.0770	0.6013
1939q3	21.6195	0.0510	0.6183
1939q4	22.1690	0.0150	0.5103
1940q1	22.2121	0.0980	0.4783
1940q2	22.3400	0.0730	0.4683
1940q3	23.0455	0.0290	0.5623
1940q4	23.7510	0.1280	0.9263
1941q1	24.3220	0.0920	0.7175
1941q2	25.3110	0.0680	0.5515
1941q3	26.1870	0.0490	0.6885
1941q4	26.6160	0.0900	0.3615
1942q1	26.4089	0.0905	0.2705
1942q2	25.0810	0.0275	0.3345
1942q3	24.4985	0.0095	0.1715
1942q4	23.9160	0.0015	0.1365
1943q1	23.0785	0.0138	0.1033
1943q2	22.2410	0.0308	0.2443
1943q3	22.9210	0.0368	0.2153
1943q4	23.6010	0.0928	0.3223

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1944q1	22.8476	0.1263	0.3308
1944q2	25.4210	0.1493	0.3588
1944q3	25.7180	0.1373	0.7608
1944q4	26.0150	0.0993	1.1498
1945q1	23.4502	0.1308	0.7240
1945q2	27.0790	0.2288	1.0430
1945q3	28.7170	0.5188	1.7050
1945q4	31.5910	0.4348	1.4160
1946q1	33.0025	0.4000	0.6005
1946q2	34.4656	0.7400	1.4165
1946q3	37.5149	0.5440	1.0035
1946q4	41.0430	0.3890	1.4155
1947q1	42.8101	0.1773	0.8488
1947q2	44.5932	0.5253	1.2018
1947q3	48.4412	0.2953	0.9728
1947q4	50.6810	0.5043	1.7428
1948q1	51.8292	0.2590	1.3153
1948q2	53.4486	0.3620	1.2533
1948q3	56.1452	0.1710	1.0823
1948q4	57.6620	0.1400	1.3483
1949q1	56.5171	0.1778	1.1505
1949q2	57.0889	0.4408	2.0015
1949q3	58.9449	0.1908	0.7585
1949q4	60.8720	0.3518	0.9795
1950q1	62.3921	0.3048	1.2335
1950q2	63.9165	0.5328	1.6005
1950q3	69.6733	0.2248	0.9465
1950q4	74.6580	0.3828	1.1395
1951q1	77.8974	0.3493	1.4763
1951q2	79.0565	0.6083	1.7023
1951q3	82.4152	0.3923	1.1783
1951q4	84.8000	0.7003	1.3343
1952q1	85.3420	0.5278	1.5053
1952q2	88.7190	0.6468	2.2623
1952q3	90.7800	0.3598	1.8173
1952q4	95.3820	0.3958	2.0163
1953q1	96.7080	0.5135	1.9895
1953q2	99.4290	0.5965	1.9715
1953q3	101.9460	0.2745	1.1645
1953q4	102.7550	0.4305	1.9575
1954q1	102.6480	0.4155	1.3253
1954q2	105.5900	0.6755	1.8493
1954q3	108.2220	0.3585	2.3253
1954q4	111.9460	0.5795	1.9883

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1955q1	114.9950	0.8755	1.6630
1955q2	121.8110	0.7675	1.6480
1955q3	127.0690	0.5455	1.7740
1955q4	132.9630	0.6315	2.3350
1956q1	135.7780	0.5428	1.6775
1956q2	141.5670	0.6718	2.3115
1956q3	144.8330	0.5578	2.1525
1956q4	148.8560	1.1648	1.8605
1957q1	149.8160	0.8513	2.7308
1957q2	154.7470	0.8973	2.3918
1957q3	157.0750	0.4783	2.4938
1957q4	159.6260	0.6973	2.3408
1958q1	158.7540	0.4773	2.8375
1958q2	162.9600	0.3553	2.5535
1958q3	164.5340	0.4573	2.4875
1958q4	171.1760	0.6153	1.7735
1959q1	173.0230	0.6505	1.6465
1959q2	181.5450	0.8125	1.8405
1959q3	188.2600	0.3945	1.6315
1959q4	195.8980	0.7005	2.0705
1960q1	197.8450	0.5388	1.7438
1960q2	204.1990	0.6818	1.8368
1960q3	207.6260	0.4508	2.0668
1960q4	212.7160	0.4018	2.4338
1961q1	213.8390	0.4553	1.5415
1961q2	218.6600	1.7803	3.5775
1961q3	223.6800	0.6583	1.9105
1961q4	232.1000	0.8503	2.3905
1962q1	233.4540	0.5028	1.8608
1962q2	241.4690	0.6358	2.5988
1962q3	248.4460	0.3028	1.8648
1962q4	259.2290	0.2948	2.6448
1963q1	261.7340	0.2858	2.4135
1963q2	272.8290	0.4248	3.2095
1963q3	281.3210	0.2858	2.1485
1963q4	293.0670	0.3678	3.1005
1964q1	294.6550	0.2998	2.3225
1964q2	308.9940	1.8908	3.0845
1964q3	314.9870	0.4928	2.4325
1964q4	327.3400	0.4078	3.0265
1965q1	333.3690	0.4275	2.5783
1965q2	348.1010	0.9205	4.1223
1965q3	354.3090	0.3835	3.5293
1965q4	368.3960	0.5405	3.4903

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1966q1	371.9700	0.7343	4.3590
1966q2	387.1290	1.0903	4.0240
1966q3	387.7920	0.3143	3.8830
1966q4	396.3950	0.3743	3.2940
1967q1	394.6200	0.3903	5.0738
1967q2	405.4500	0.7263	5.4818
1967q3	410.6710	0.6783	6.1548
1967q4	432.2190	1.0493	5.2438
1968q1	424.5660	0.9893	4.1890
1968q2	438.8360	0.9553	4.7490
1968q3	446.9640	1.1653	3.9680
1968q4	465.5980	1.4733	4.4770
1969q1	469.2250	2.0223	4.1973
1969q2	486.6550	2.2673	5.0843
1969q3	490.7240	1.8003	4.5333
1969q4	503.8960	2.3063	4.5323
1970q1	497.3740	2.2288	5.8390
1970q2	508.9490	1.9188	8.2770
1970q3	518.0790	1.7508	6.9010
1970q4	531.2580	2.7818	9.2470
1971q1	533.0600	2.4313	9.4663
1971q2	553.2880	3.5093	7.8863
1971q3	568.9090	4.2053	5.9483
1971q4	589.1170	2.8153	8.8283
1972q1	601.4210	2.8553	7.2448
1972q2	629.6790	3.8013	7.7058
1972q3	651.7540	3.1423	6.3498
1972q4	686.3710	3.2623	7.5958
1973q1	713.9530	3.8710	4.3500
1973q2	750.0390	2.4020	6.2160
1973q3	776.4960	1.7350	4.6180
1973q4	799.5570	3.1140	7.0850
1974q1	811.6940	1.7335	7.6073
1974q2	848.9080	1.4915	7.8283
1974q3	869.3740	1.3425	6.4133
1974q4	884.8390	1.6795	10.2143
1975q1	872.6890	2.0878	13.1668
1975q2	884.1610	3.6008	12.0908
1975q3	892.7960	2.0518	7.5628
1975q4	913.7410	3.1228	9.9348
1976q1	916.1800	3.5550	10.2720
1976q2	948.7870	3.1160	10.8360
1976q3	970.9880	1.8630	9.5220
1976q4	1006.6420	2.5600	11.6310

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1977q1	1025.1270	2.7638	10.4223
1977q2	1070.4300	3.0208	10.3193
1977q3	1112.0000	2.0248	9.7703
1977q4	1157.5480	3.9678	11.5033
1978q1	1183.9810	2.0378	8.5470
1978q2	1241.2090	2.9748	10.0330
1978q3	1280.7820	2.2738	9.5680
1978q4	1328.8090	3.0718	8.6940
1979q1	1353.5100	2.2303	9.3473
1979q2	1408.4670	2.0333	12.7253
1979q3	1463.4760	3.4733	9.2493
1979q4	1498.9500	3.5883	8.8173
1980q1	1514.0290	4.5855	10.6318
1980q2	1507.2600	4.0285	20.4288
1980q3	1536.5530	4.7705	14.1168
1980q4	1586.1460	7.1045	8.0288
1981q1	1592.9580	5.8465	10.4853
1981q2	1636.6870	8.7255	13.2813
1981q3	1671.0860	5.2695	7.4103
1981q4	1716.9460	5.5075	13.4653
1982q1	1728.3080	5.5310	7.5695
1982q2	1764.4040	6.7670	10.5615
1982q3	1775.6680	7.6750	16.5875
1982q4	1787.4540	10.5890	18.5075
1983q1	1788.7460	14.2030	19.0010
1983q2	1826.8040	14.8460	20.5520
1983q3	1887.0390	11.0210	13.2380
1983q4	1944.2720	11.5090	15.5790
1984q1	2003.2720	6.5180	23.4675
1984q2	2103.9560	5.8150	20.7445
1984q3	2169.0920	4.9190	30.6215
1984q4	2247.8300	5.3760	35.0695
1985q1	2279.6540	6.4918	32.9948
1985q2	2334.5570	10.2678	45.8268
1985q3	2393.9760	8.9308	40.7208
1985q4	2462.1000	9.8248	46.2118
1986q1	2475.1690	13.3788	79.5508
1986q2	2518.2480	17.1528	83.3968
1986q3	2555.1350	13.3498	69.4928
1986q4	2656.4770	17.9488	81.0618
1987q1	2651.1980	16.5193	84.2470
1987q2	2716.0670	17.0263	73.2540
1987q3	2776.1000	15.2283	77.5230
1987q4	2822.8220	4.5753	66.3250

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1988q1	2859.3370	11.7333	88.5935
1988q2	2934.1690	10.9343	87.0375
1988q3	2981.8990	11.4963	76.0035
1988q4	3054.5490	8.2913	76.2295
1989q1	3073.3890	4.6893	72.4018
1989q2	3131.0790	5.7013	76.0528
1989q3	3169.3990	9.6553	67.3198
1989q4	3189.9080	12.1573	81.3398
1990q1	3193.9160	8.9915	59.1123
1990q2	3193.7300	6.9825	74.7863
1990q3	3179.9570	3.4815	60.2743
1990q4	3161.2280	3.9855	81.5873
1991q1	3111.0600	6.6470	91.4310
1991q2	3087.1370	18.3510	91.5420
1991q3	3037.5340	14.8330	89.2420
1991q4	3026.1220	25.4370	89.7560
1992q1	2976.6520	22.5900	106.1228
1992q2	2954.2680	21.2640	109.6448
1992q3	2945.1510	17.0770	119.5948
1992q4	2935.6490	17.5260	108.5488
1993q1	2896.8610	21.7465	158.8595
1993q2	2933.9950	22.3585	141.0825
1993q3	2953.6310	27.1725	157.7125
1993q4	2991.0580	30.2765	145.4645
1994q1	2980.3490	22.7183	139.1575
1994q2	3034.5510	15.4613	111.0585
1994q3	3103.2440	10.4733	99.5475
1994q4	3191.9640	11.7453	91.5235
1995q1	3252.1820	10.9025	104.1710
1995q2	3338.7630	16.8735	133.3730
1995q3	3400.1910	18.4765	120.3070
1995q4	3440.7020	22.2205	138.4450
1996q1	3462.9870	20.5873	117.3605
1996q2	3530.3470	37.7843	117.6505
1996q3	3610.8320	19.4943	101.1135
1996q4	3673.6800	34.6803	117.8385
1997q1	3705.9770	30.4710	158.0610
1997q2	3800.0670	27.0340	170.0100
1997q3	3845.9640	26.0100	183.6520
1997q4	3916.4410	34.3650	196.4650
1998q1	3945.0920	38.1175	223.7258
1998q2	4003.9650	44.2785	226.5448
1998q3	4062.6940	18.1345	217.3658
1998q4	4161.5170	26.2245	256.1348

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
1999q1	4161.5440	27.1470	260.4060
1999q2	4207.3500	33.1730	231.6470
1999q3	4319.1170	27.4270	198.5130
1999q4	4470.7180	43.8210	128.1170
2000q1	4555.0690	50.7270	209.4960
2000q2	4713.4630	33.6010	192.3630
2000q3	4804.9120	27.3020	204.7840
2000q4	4874.9450	23.2870	215.3690
2001q1	4902.6750	26.2330	360.4625
2001q2	4941.3530	36.7410	363.6565
2001q3	4960.4460	21.8790	286.4445
2001q4	5006.2130	43.7010	346.3155
2002q1	4988.4620	33.9420	299.6618
2002q2	5036.0100	36.0340	321.5108
2002q3	5162.5730	15.8150	292.9028
2002q4	5266.2040	24.6440	318.5428
2003q1	5309.5220	20.1590	379.8118
2003q2	5435.8990	32.9890	444.4108
2003q3	5524.0560	34.1990	367.5828
2003q4	5636.4170	39.7940	387.5058
2004q1	5745.0020	53.2460	418.6215
2004q2	5933.4690	31.1540	406.4245
2004q3	6095.3180	26.8160	470.7255
2004q4	6295.6220	33.3870	441.5705
2005q1	6399.0600	29.2600	489.1910
2005q2	6620.9080	25.0700	531.8260
2005q3	6823.7660	34.6120	561.7180
2005q4	6980.6810	26.3140	558.7610
2006q1	7132.7640	27.5378	574.5628
2006q2	7329.4660	30.0788	609.9198
2006q3	7475.2220	22.7768	528.6888
2006q4	7595.8200	38.7718	605.2078
2007q1	7623.0240	43.9970	644.5655
2007q2	7789.0360	44.9780	665.7735
2007q3	8049.2620	23.2160	416.7765
2007q4	8259.1640	56.4630	303.1325
2008q1	8384.2480	46.4960	230.6940
2008q2	8413.1600	77.1560	337.8440
2008q3	8495.6290	40.5140	133.6510
2008q4	8514.9200	42.6310	135.5860
2009q1	8376.3260	10.9970	244.7500
2009q2	8212.0040	116.0860	226.6740
2009q3	7962.7650	32.5260	164.3020
2009q4	7802.7530	74.3590	143.8030

Note: All figures are in million U.S. dollars at current prices.

Table 3.7: New historical U.S. data (continued)

Quarter	Bank loans	Equity issuance	Debt issuance
2010q1	8052.9770	28.6860	149.4700
2010q2	7948.2720	32.2570	102.5690
2010q3	7898.2870	27.4160	206.9530
2010q4	7891.3480	42.7740	220.3310
2011q1	7742.0900	51.8770	263.3230
2011q2	7761.0840	39.6700	244.1860
2011q3	7840.7640	16.6370	185.1210
2011q4	7964.0360	21.2950	178.8760
2012q1	7916.7680	39.1150	306.5010
2012q2	8016.1670	36.0530	244.6750
2012q3	8070.7220	43.4890	312.5480
2012q4	8206.7610	40.2760	341.5980
2013q1	8144.3190	48.5000	342.5470
2013q2	8221.1320	52.0460	288.4560
2013q3	8281.4020	39.5410	330.6470
2013q4	8421.7740	51.4260	335.3240
2014q1	8474.8000	37.2820	348.3470
2014q2	8670.2250	61.2180	396.0560
2014q3	8782.6130	39.8810	318.2710
2014q4	8996.5000	36.2190	359.8610
2015q1	9082.5780	68.6410	410.8680
2015q2	9286.9060	52.6170	461.8270
2015q3	9428.1130	30.3180	336.3120
2015q4	9666.5020	22.3920	301.8770
2016q1	9778.1080	33.3070	331.2620
2016q2	10004.0100	34.3590	420.5760
2016q3	10152.9000	39.6790	346.5730
2016q4	10268.6460	30.7580	305.8070
2017q1	10257.6660	42.8300	456.0510
2017q2	10430.4830	35.6780	436.6300
2017q3	10542.5270	33.9090	413.7020
2017q4	10708.4080	31.5790	408.5840
2018q1	10734.7830	39.2200	432.2870
2018q2	10909.2540	33.6300	423.1810
2018q3	11009.4220	40.2910	346.9480
2018q4	11270.4140	18.1860	286.2110
2019q1	11268.1450	29.2310	428.7000
2019q2	11462.3190	59.2110	415.0910
2019q3	11577.4080	45.9560	434.2110
2019q4	11727.0300	34.1990	348.3750
2020q1	12300.5190	49.4620	579.6130
2020q2	12331.8430	90.3590	796.0490

Note: All figures are in million U.S. dollars at current prices.

Table 3.8: Data construction and sources

Variable	Construction and Sources
Total credit	Sum of total bank loans, non-financial corporate bonds outstanding, non-financial commercial paper outstanding, and municipal bonds backed by corporations outstanding.
Bank loans	From 1945q4: Until 1951q4 interpolated from annual data on the basis of quarterly growth rates from "all bank data" and if not available from national bank data. Afterwards quarterly data directly from source. Source: Loans, all private depository institutions, from Z.1 financial accounts from the Federal Reserve available at https://fred.stlouisfed.org/series/BOGZ1FL704023005Q. Historical all bank data and national bank data from various Annual Reports of the Comptroller of the Currency, available at https://fraser.stlouisfed.org/title/annual-report-comptroller-currency-56, and various Fed Bulletins available at https://fraser.stlouisfed.org/title/federal-reserve-bulletin-62. From 1900q1 to 1945q3: Backward extended on the basis of total loans from all bank data (source see above). When all bank data was not available, resorting to Fed member bank data, and when that was not available, resorting to national bank data. Source for Fed member bank data: Board of Governors (1943, pp. 72–75, Table No. 18).
Corporate bonds	1900q1 to 1943q4: Hickman (1953, pp. 308–309, appendix A, Table A-13) available at https://fred.stlouisfed.org/series/M10083USM311NNBR. From 1944q1: Until 1951q4 interpolated from annual data, afterwards quarterly data. From Z.1 Financial accounts from the Federal Reserve available at https://fred.stlouisfed.org/series/CBLBSNNCB.
Commercial paper	From 1945q4: Until 1951q4 interpolated from annual data, afterwards quarterly data. From Z.1 Financial accounts from the Federal Reserve available at https://fred.stlouisfed.org/series/CPLBSNNCB. In 1945, commercial paper outstanding was less than 0.25% of total credit, it thus excluded for prior dates due to little importance and lack of reliable data.
Municipal bonds	Municipal bonds backed by corporations. From 1952q1: Quarterly data from Z.1 Financial accounts from the Federal Reserve. Available at https://fred.stlouisfed.org/series/MSLBSNNCB. Zero prior to 1971.
Gross domestic product	From 1947q1: Quarterly data from the U.S. Bureau of Economic Analysis available at https://fred.stlouisfed.org/series/GDP. Before: Backward extended on the basis of quarterly growth rates of gross national product data by Gordon (1986, appendix B) until 1890q1. Available at https://www.nber.org/research/data/tables-american-business-cycle.
Consumer price index	From 1913q1: Consumer Price Index for All Urban Consumers: All Items in U.S. City Average as reported by the U.S. Bureau of Labor Statistics. Available at https://fred.stlouisfed.org/series/CPIAUCNS. Before: Backward extension on the basis of quarterly growth rates of GNP deflator data by Gordon (1986, appendix B) until 1900q1.
Credit-to-GDP gap	One-sided HP-filter applied to total credit series divided by GDP series with smoothing parameter $\lambda = 400,000$ and first data point in 1900q1 based on further backward extended data from 1890q1. Backward extension on the basis of quarterly growth rates of interpolated annual data on railroad bonds outstanding from Hickman (1953, p. 252) and quarterly national bank loans from various annual reports of the Comptroller of the Currency available at https://fraser.stlouisfed.org/title/annual-report-comptroller-currency-56.

Table A.7: Data construction and sources *(continued)*

Variable	Construction and Sources
Corporate term spread	From 1984q1: BAA corporate bond yield as reported by Moody's and made available at https://fred.stlouisfed.org/series/BAA minus 3 month-commercial paper rate as reported by the Board of Governors of the Federal Reserve System before August 1997 under https://fred.stlouisfed.org/series/CP3M and afterwards the non-financial 3-month AA commercial paper rate available at https://fred.stlouisfed.org/series/CPN3M. From 1900q1 to 1983q4: corporate bond yield minus commercial paper rate as reported by Gordon (1986, appendix B).
Stock prices	From 1900q1: From daily closing price data of the Dow Jones Industrial Average by Samuel H. Williamson, available at https://www.measuringworth.com/datasets/DJA/.
Total issuance	Sum of equity and debt issuance.
Equity issuance	From 1900q1 to 1905q4: Interpolated from annual data on new listings of equity at NYSE from Warshow (1924, p. 27), thus an underestimation of total equity issuance. From 1906q1 to 1918q4: Corporate Issues, Stocks, Including Refunds, U.S., Canadian, and Foreign from the NBER Macrohistory database, available at https://fred.stlouisfed.org/series/M10029M144NNBR. The data description leads one to believe this must be an overestimate of the actual equity issuance activity. The data is however consistent with the annual series reported from 1910 in Carter et al. (2006, series Cj837) which is why I assume its accuracy. From 1919q1 to 1926q3: New securities issues, for new capital, domestic, preferred and common reported by Board of Governors (1943, p. 487). From 1926q4 to 2008q1: Baker & Wurgler (2000), updated in September 2008. From 2008q2: Financial and non-financial stock issues, U.S. corporations reported by the Federal Reserve in Table 1.46, available at https://www.federalreserve.gov/data/corpsecure/current.htm.
Debt Issuance	From 1900q1 to 1926q3: U.S. bond offerings, par value, all industries reported by Hickman (1953, pp. 324–325, appendix A, table A-15). Available under code m10071 at https://www.nber.org/research/data/nber-macrohistory-x-savings-and-investment. From 1926q4 to 2008q1: Baker & Wurgler (2000), updated in September 2008. From 2008q2: bonds, sold in the United States, U.S. corporations reported by the Federal Reserve in Table 1.46, available at https://www.federalreserve.gov/data/corpsecure/current.htm.
High yield share	From 1908q1 to 1943q4: Annual averages computed from Hickman (1958, p. 179, Table 34, classes X and above) used as quarterly averages and then four-quarter moving average applied for smoothing. From 1944q1 to 1982q4: Annual averages from Greenwood & Hanson (2013), method as before. From 1983q1 to 2015q4: Quarterly averages from Greenwood & Hanson (2013), smoothing as before. From 2016q1 to 2018q2: Quarterly averages from https://www.hbs.edu/behavioral-finance-and-financial-stability/data/Pages/sentiment.aspx, smoothing as before.
Recession	Quarter of business cycle peak based on NBER dating methodology. Source: https://fred.stlouisfed.org/series/USREC.
Banking crisis	First quarter of a banking crisis according to Baron & Dieckelmann (2021).

Table 3.9: VAR model estimation: Market sentiment, credit, and economic activity

	Δ(GDP/CPI)		Δ(total credit)		Equity sentiment		Credit sentiment	
L.Δ(GDP/CPI)	0.275***	(0.048)	0.196***	(0.055)	−0.036	(0.057)	−0.019***	(0.005)
L2.Δ(GDP/CPI)	−0.082*	(0.049)	−0.090	(0.057)	0.201***	(0.059)	−0.004	(0.006)
L3.Δ(GDP/CPI)	0.130***	(0.050)	−0.063	(0.057)	−0.120**	(0.059)	0.001	(0.006)
L4.Δ(GDP/CPI)	0.085*	(0.050)	−0.130**	(0.057)	−0.164***	(0.059)	0.002	(0.006)
L5.Δ(GDP/CPI)	−0.136***	(0.050)	−0.044	(0.057)	−0.093	(0.060)	0.011**	(0.006)
L6.Δ(GDP/CPI)	0.018	(0.050)	0.019	(0.058)	−0.042	(0.060)	0.003	(0.006)
L7.Δ(GDP/CPI)	−0.047	(0.048)	0.059	(0.056)	0.106*	(0.058)	0.008	(0.005)
L.Δ(total credit)	−0.001	(0.041)	0.150***	(0.047)	−0.078	(0.049)	−0.001	(0.005)
L2.Δ(total credit)	−0.030	(0.041)	0.057	(0.048)	−0.111**	(0.050)	0.007	(0.005)
L3.Δ(total credit)	−0.034	(0.041)	0.150***	(0.048)	0.061	(0.049)	0.004	(0.005)
L4.Δ(total credit)	−0.044	(0.042)	0.040	(0.048)	−0.060	(0.050)	0.007	(0.005)
L5.Δ(total credit)	0.052	(0.041)	0.128***	(0.047)	0.061	(0.049)	0.003	(0.005)
L6.Δ(total credit)	−0.103**	(0.042)	0.008	(0.048)	−0.007	(0.050)	0.001	(0.005)
L7.Δ(total credit)	0.088**	(0.041)	0.064	(0.047)	−0.024	(0.049)	0.003	(0.005)
L.Equity sentiment	0.117***	(0.040)	0.008	(0.046)	−0.053	(0.047)	−0.026***	(0.004)
L2.Equity sentiment	0.044	(0.041)	−0.018	(0.047)	0.376***	(0.049)	−0.002	(0.005)
L3.Equity sentiment	0.073*	(0.043)	0.091*	(0.049)	0.501***	(0.051)	0.016***	(0.005)
L4.Equity sentiment	−0.013	(0.046)	0.047	(0.053)	−0.024	(0.055)	0.006	(0.005)
L5.Equity sentiment	−0.042	(0.042)	0.034	(0.049)	−0.030	(0.050)	−0.004	(0.005)
L6.Equity sentiment	0.028	(0.039)	−0.005	(0.045)	−0.089*	(0.047)	−0.008*	(0.004)
L7.Equity sentiment	0.048	(0.038)	0.035	(0.043)	0.044	(0.045)	0.005	(0.004)
L.Credit sentiment	0.061	(0.395)	−0.064	(0.456)	−0.573	(0.474)	−0.259***	(0.045)
L2.Credit sentiment	0.106	(0.404)	−0.296	(0.466)	2.591***	(0.484)	−0.007	(0.046)
L3.Credit sentiment	0.968**	(0.410)	−0.369	(0.472)	1.853***	(0.490)	0.532***	(0.046)
L4.Credit sentiment	0.105	(0.437)	−0.066	(0.504)	1.012*	(0.523)	0.444***	(0.050)
L5.Credit sentiment	−0.484	(0.402)	0.246	(0.463)	−1.667***	(0.481)	0.127***	(0.046)
L6.Credit sentiment	−0.540	(0.405)	0.392	(0.467)	−1.668***	(0.485)	−0.107**	(0.046)
L7.Credit sentiment	−0.373	(0.397)	0.115	(0.457)	−1.513***	(0.475)	−0.274***	(0.045)
Constant	0.003*	(0.002)	0.004**	(0.002)	0.007***	(0.002)	−0.000	(0.000)
Observations	457		457		457		457	

Notes: *, **, *** indicate significance at the 10%, 5%, and 1% confidence level, respectively. Standard errors are printed to the right of the coefficient estimates in parentheses.

Chapter 4

Beyond Boom and Bust: Causes of Banking Crises, 1870–2016

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4.1 Abstract

We systematically reassess the economic historiography of banking crises for 46 countries over the past 150 years to document how their main causes have developed over time. Banking systems have become more resilient against shocks to the real economy with economic development, making financial shocks the prevalent cause of crises today. However, only about 40% of all banking crises with widespread bank failures are credit booms gone bust, making an increasing share of banking crises the result of international contagion. Prior to the 1970s, bank equity returns proxying for banking stability are sensitive to trade, commodity, and domestic GDP shocks, but less so to past real estate returns and credit booms—whereas the reverse is true afterwards.

4.2 Introduction

Banking crises are credit booms gone bust (Schularick & Taylor, 2012). While this proposition would have been vigorously contested among economists and economic historians before 2008, it has developed into a widely accepted truism in the profession ever since. In this study, we set out to challenge this perspective once again. It is, of course, not our intention to object to the

finding per se, but rather to adopt a somewhat more nuanced view of the long history of banking crises around the globe. Indeed, *many* banking crises are credit booms gone bust, but at the same time, a strikingly high number are not. We revisit the full economic historiography of banking crises for 46 countries over the past 150 years to investigate the causes of banking crises and their development over time. To the best of our knowledge, we are the first to attempt such a full country-by-country literature review to derive a universal statement about the causes of banking crises and their changing nature over time.

From our qualitative revision, we find that the share of banking crises caused by shocks to the real sector like natural disasters, wars, and recessions has declined significantly over time, making the financial sector the main origin of banking crises today. However, only 35% of all banking crises—and 40% of those with widespread bank failures—are domestic credit booms gone bust, making a large and increasing share of banking crises the result of international contagion. This finding fits well with our observation that banking crisis incidence tends to cluster regionally and globally. We augment our narrative results with quantitative analyses and find that real factors—such as global commodity prices, domestic GDP, and exports—are tightly linked to bank equity declines and, thus, to future bank distress prior to the 1970s, but not afterwards. Reversely, we show that financial factors—such as past credit or housing price growth—have become increasingly negatively correlated with bank equity returns, making them a primary precursor to banking crises today. We further discover an increasing association between net financial flows and bank equity declines, which supports our finding that international contagion as a source of domestic bank distress has become more important in recent decades. Overall, our quantitative analysis distinctly reaffirms our narrative findings.

While the literature on the history of banking crises is vast and several comprehensive works on banking crises *incidence* exist (Demirgüç-Kunt & Detragiache, 1998; Bordo et al., 2001; Caprio & Klingebiel, 2003; Reinhart & Rogoff, 2009; Schularick & Taylor, 2012; Lo Duca et al., 2017; Romer & Romer, 2017; Laeven & Valencia, 2020), only few studies have attempted to systematically aggregate information on their *causes* over a similarly large time span and panel size. Lindgren et al. (1996) investigate banking crises in 34 countries between 1980 and 1996, focusing on preceding macroeconomic political factors—such as monetary, exchange rate, and fiscal policies—as well as structural weaknesses in the banking sectors as causes. The authors also refer to

other aspects, such as natural catastrophes, capital flow reversals, and commodity price shocks, where applicable. Bordo et al. (2001) analyze banking crises in a panel of 21 countries from 1880–1997. They investigate whether inflation, capital controls, monetary expansion, the fiscal balance, and economic activity are predictive of banking crises. The authors find statistically significant evidence only for the lack of capital controls and for a decline in GDP per capita to precede banking crises. They are, however, cautious about interpreting these crisis determinants as causes. Further, Bordo et al. (2001) address the issue of direction of causality between crises and recessions. Using a simple two stage least squares logistic regression, they argue that crises cause more severe recessions rather than more severe recessions inducing crises.

Reinhart & Rogoff (2013) provide a bird's-eye view on the incidence, clustering, and common macroeconomic features of banking crises from 1800, building on the data from their 2009 book (Reinhart & Rogoff, 2009).[1] They find that banking crises tend to be preceded either by periods of sustained above-average inflows of foreign capital, by domestic credit booms (which can be fueled by these inflows), and by rising asset prices. They further note that banking crises tend to bunch and pose the interesting question whether this is due to common fundamentals or contagion. Unfortunately, neither do the authors investigate the different causes of banking crises further, nor do they attempt to answer the question regarding the reason for the clustering of crises. Grossman (2010, chapter 3) adopts an approach similar to ours, and relies on assessing large parts of the historical literature to formulate three main hypotheses on the causes of banking crises, which he uses in the appendix for a categorical coding of causal factors over a sample of 16 industrialized economies from 1800–1933 (pp. 297-316). Grossman (2010, pp. 61-82) distinguishes between boom-bust fluctuations,[2] structural weaknesses—such as excessive competition among banks—and adverse confidence shocks like wars and other political events. Kindleberger & Aliber (2015) famously analyze a wide, yet incomplete, range of historical banking crises from the perspective of Minsky's (1986) Financial Instability Hypothesis which views banking crises as credit-fueled and speculative asset booms gone bust. Notwithstanding the importance and well-deserved recognition of their contribution, their analysis remains limited in classifying all possible causes of banking crises, as the au-

[1] Note that Baron et al. (2021) and this study uncover several artifacts in Reinhart & Rogoff's (2009) banking crisis dating methodology.

[2] Although Grossman (2010) acknowledges the importance of the distinction between real and financial boom-bust dynamics, in the appendix, he often does not report in more detail whether a specific crisis was triggered rather by a contraction of the real economy or by a financial collapse which then resulted in a recession.

thors either constrain themselves to periods in which their framework works well, or try to fit banking crises to their angle, for which we, for example, find non-boom-bust causes.[3]

The remainder of this chapter is structured as follows. Section 4.3 describes our systematic approach of revisiting the literature on banking crises and the rationale behind our classification scheme of crisis causes. In section 4.4, we present our main findings and analyze particular long-term trends in detail. We dive deeper into the distinction between real and financial causes of banking crises and discuss the relevance of our findings in light of the ongoing global COVID-19 pandemic. We complement our analysis of narrative sources with quantitative data in section 4.5 and document how banking crises and their main causes have changed over time. We draw conclusions, discuss avenues for future research, and derive policy advice from our findings in section 4.6. In the appendix, we provide comprehensive summaries for all periods of bank distress since 1870 for major economies and sources for all remaining countries. The summaries contain curated information on the macroeconomic background, the main causes, the course of the crisis, policy responses, and economic and regulatory consequences.

4.3 Revisiting 150 years of banking crises

Identifying banking crises is no easy matter, and several databases and methodologies exist (see introduction). The recent major contribution to this literature by Baron et al. (2021, in the following abbreviated as BVX) serves as the groundwork for our approach. The authors examine historical banking crises through the lens of bank equity declines and construct a new dataset on bank equity returns and rudimentary narrative information on banking panics for 46 countries over the period of 1870–2016. They find that bank equity declines are predictive of banking crises. Further, they distinguish between banking crises with and without panics and find that although panics are an important amplifying mechanism, they are not necessary for banking crises. Panics tend to appear rather as a result than a cause of banking crises.

[3] For a comprehensive overview of Kindleberger & Aliber's (2015) coding of banking crises see their appendix (pp. 294-303). They identify—not unsimilar to our approach—for each period under review related political events, speculative assets, and the origin of a monetary expansion. Their framework, however, fails at explaining crisis incidence during the Great Depression for those countries which did not experience a credit-fueled asset boom or during the crises of the mid-1970s or mid-1980s, for which they inconspicuously change their classification scheme (p. 302).

In this study, we adopt the banking crisis dating methodology of BVX and massively extend their narrative information basis on both panic and non-panic banking crises. To do this, we systematically revisit the economic history literature—and at times primary sources—for the 46 countries and code the reported causes of the respective banking crisis periods along several different categories. In the process, we uncover artifacts in the existing historiography, discover new periods of bank distress, and take a stand on conflicting views on the causes of specific banking crises from the perspective of our framework. In the process of examining the literature, a set of categories of causes of banking crises emerges organically. Ultimately, we classify our crisis causes within their respective categories into binary schemes of (i) real or financial origin, (ii) of being exogenous or endogenous to the respective country's economy, and (iii) of representing a sudden shock versus a structural phenomenon.

In the appendix, we provide curated narrative summaries for every recorded bank distress event for a set of major countries with full coverage. Where no narrative summaries are (yet) available, we provide the main sources for our coding of causes. The country summaries represent the full set of information we gathered on each bank distress event curated in a condensed form. For each event, we provide information on the macroeconomic and political background at the time, the main causes of the crisis, the description of the crisis' main events, a summary of the recorded bank failures, the responses and countermeasures taken by the banking system and policy makers, and the economic and regulatory consequences. We list our main sources, as well. The work on the summaries is still on-going and the appendix contains its current state. Going forward, we will make the entire collection available on-line. Our ultimate goal is to provide scholars with a complete encyclopedia of banking crises for all 46 countries over the past century-and-a-half. Next, we present and discuss our methodology and categories of causes in detail.

4.3.1 Dating banking crises

BVX create a pool of bank distress episodes for country-year observations for which they find a bank equity decline of at least -30% or narrative evidence of bank distress either in crisis databases or in the secondary literature. From this pool of observations, they classify periods as *bank equity crises* which feature both said decline of bank equity and widespread bank failures. In turn, they define widespread bank failures as either the failure of at least five banks or the failure of at least one the five largest banks. Second, they define observations

from the pool as *panic banking crises* for which they find narrative evidence of "severe and sudden withdrawals of funding by bank creditors from a significant part of the banking system" (p. 1). Mirroring their dating methodology, we identify, for the purpose of this study, all periods as banking crises for which there is evidence either of a panic or of widespread bank failures.

Of the 46 countries featured in BVX, we are able to revisit the historiography over the *entire* time horizon for 30 countries. This is mostly due to the availability of secondary literature but partly also due to the fact that several countries in the greater sample were not capitalist market economies for the entirety of the time horizon. For the remaining 16 countries, coverage begins with the availability of narrative information. Table 4.4 in the appendix presents an overview of the countries covered, the beginning of their coverage, and the type of their economies.

4.3.2 Coding causes of banking crises

In this study, we take an organic approach to the causes of banking crises. Instead of trying to fit the historical observations to the vast theoretical literature, we are guided by the recurring types of causes that the historical literature ascribes to the banking crises of the past. From our systematic review of this literature, a very stable set of common causes of banking crises naturally emerges which is mostly mirrored in the theoretical literature, as well. Table 4.1 displays the main categories of banking crisis causes that emerge from our inspection of over 400 different sources. We identify 10 major categories of causes, of which some have associated sub-categories. Importantly, each bank distress event must have at least one but can have multiple causes. Multiple causes can be in multiple categories, can reside within one particular category, or both. The aforementioned classification scheme into three dimensions—type of cause, origin, and time horizon—is applied to each individual category and sub-category. Where no unambiguous application is possible and an association would depend on the individual circumstances of the crisis event in question, the cell value becomes simply "depends".

Credit booms are banking crises that are preceded by a period of sustained above-average growth in private credit—particularly bank credit—and a subsequent collapse of the boom. Closely related are *asset booms*, which are characterized by sustained and above-average growth in one or more types of specific assets. We distinguish between bonds, real estate and land, and stocks. Importantly, and to ensure the relevance as a cause of banking cri-

Table 4.1: Coding framework for causes of banking crises

Category of cause	Binary classifier		
	Type	Origin	Time horizon
Credit boom	financial	domestic	structural
Asset boom	financial	domestic	structural
Bonds	financial	domestic	structural
Real estate and land	financial	domestic	structural
Stocks	financial	domestic	structural
Commodity shock	real	foreign	sudden
Trade shock	real	foreign	sudden
Monetary gold shock	financial	depends	sudden
Financial flow shock	financial	depends	depends
Public finances	financial	domestic	structural
Exchange rate	financial	foreign	sudden
Private flows	financial	foreign	sudden
Interbank flows	financial	foreign	sudden
Natural disaster	real	domestic	sudden
War	real	depends	sudden
Political shock	depends	depends	depends
Miscellaneous	depends	depends	depends
Banking system structure	financial	domestic	structural
Bank governance	financial	domestic	structural
Domestic recession	real	domestic	sudden
Consumer price instability	real	domestic	structural

Notes: Specific causes of banking crises are categorized into the above categories and sub-categories. On the categorical level, these are further classified into three binary schemes of type, origin, and time horizon. Where no unambiguous classification can be done, the value becomes "depends". This, however, does not mean that it is impossible to classify the specific banking crisis unambiguously on a more granular level. The actual causes of banking crises within the above categories can be founds in the appendix in Table 4.7.

sis, domestic banks must be engaged in the trading in, holding of, financing of, or borrowing against one or more of these assets. *Commodity shocks* are sudden and drastic changes in international commodity prices with particular relevance to a country's economy. We also count bad harvests as commodity shocks. Global recessions and other shocks to international trade, such as tariffs or embargoes, we categorize as *trade shocks*. Occurring prior to the ultimate abandonment of the global (de facto) gold standard in 1971, *monetary gold shocks* were events of sustained in- or outflows of monetary gold or silver with relevance for banking stability. As *financial flow shocks*, we categorize a range of destabilizing events that are related to the in- and outflow of financial capital of both public and private nature. We further distinguish between four types of financial flow shocks. First, we record all flow shocks related to the state of public finances caused by imbalances ranging from high fiscal deficits

and debt levels to outright sovereign default. Second, we record exchange rate-related events that affect the flow of capital and banking stability, for example when banks borrow heavily in foreign currency. These events typically feature sudden, severe, and unexpected changes to a country's exchange rate and can also be outright speculative attacks.[4] Third, we subsume all other types of changes in private capital flows that are not direct interbank flows. Under this sub-category we collect sudden stops, periods of substantial capital retrenchment, and adversely affected foreign assets to which domestic banks maintain high exposures. Fourth, we collect all events of bank distress that are related to difficulties in international interbank markets, particularly when domestic banks find themselves unable to acquire desperately needed liquidity from foreign sources.

Bank distress that is directly related to a shock to the real economy originating from *natural disasters*—such as earthquakes, droughts, and storms—is classified in its separate category. Sudden outbursts of uncertainty or adverse shocks caused by *wars*—either at home or abroad, and including civil wars—are separately categorized, as well. All other types of political decisions of both sudden and structural nature are categorized as *political shocks* and range from reforms such as deregulation and financial liberalization to unexpected disruptions like revolutions or military coups. All remaining causes of banking crises are categorized under *miscellaneous*. Here, several sub-categories emerge organically. First, we subsume all causal factors related to the structure of the banking system, such as instability-inducing levels of competition or concentration among banks or weak supervision and regulation. Second, we categorize all events related to bad bank governance, such as failure to diversify the loan portfolio, attempted market manipulations, and outright fraud. In this sub-category we also include events in which insufficient capital or reserves of one or several banks induce a wider banking crisis. Third, we record all observations where banking crises are ascribed to domestic recessions or the collapse of one or more domestic industries under one sub-category.[5] Last, we subsume all evidence of disturbances to the consumer price level with relevance for banking stability—be it high inflation or deflation— in a separate sub-category.

[4] Many of the banking crises of this sub-category will naturally be characterized as currency crises, as well. We can safely assume that most of banking crises in this sub-category are so-called "twin crises" (Kaminsky & Reinhart, 1999).

[5] Non-domestic recessions that induce banking crises in a country are categorized as trade shocks if they are transmitted through the trade channel and as financial flow shocks if they are relayed to the home economy through financial exposures in banks' balance sheets.

4.4 Causes of banking crises

The results of our literature review and systematic coding, categorizing, and classifying of banking crisis causes is presented in condensed form in Table 4.2 further below and in Tables 4.5 and 4.6 in the appendix. We compute the share of banking crises belonging to at least one of our categories or sub-categories for the time spans of 1870–1913, 1914–1944, 1945–2016, 1870–2016, and for the pooled sample. For the concrete time horizons, only countries with full coverage over the entire time are considered. In contrast, the pooled column contains all crises observations put together, regardless of length of coverage. We also define three forms of banking crises: first, all bank distress events in our sample, as outlined in the previous section (Table 4.2); second, all banking crises that feature widespread bank failures (Table 4.5 in the appendix); and third, all bank distress periods that are strictly panics but do not exhibit bank failures (Table 4.6 in the appendix). Additional to the categories of causes, we display the shares of banking crises that belong to each of the three binary classification schemes of type, origin, and time horizon. The values for categories and sub-categories of causes in the upper part of the table are not mutually exclusive, while the classification shares in the lower part are. Where a bank distress observation cannot be unambiguously assigned to either one of the binary classifiers but there is at least one cause of each class, we label the classifier as "both". If we cannot classify the cause at all according to the framework laid out in Table 1 (for example, because all causes are recorded under categories classified as "depends"), we label it as "cannot be determined".

We begin the presentation of our findings by inspecting the shares of banking crisis causes in Table 4.2. In reference to the title of this chapter, we make our first observation that over the past 150 years only about 35% of banking crises were indeed credit booms gone bust. Even if we restrict the sample to crises with widespread bank failures this number does not exceed 40%. Interestingly, this observation is relatively stable over time, with the exception of the interwar years where only a somewhat surprisingly low number of countries actually exhibited credit booms prior to banking crises. A more detailed view of the development over time yields Figure 4.1 which plots the number of boom-bust banking crises against the inverse. Most banking crises that were credit booms gone bust occurred before 1900 or after 1985. Interestingly, the two most severe global banking crisis events in the sample—the Great Depression and the Global Financial Crisis—only feature a relatively small number of countries that actually experienced domestic credit-driven boom-bust dynamics. Both crises have their origins in an unsustainable domestic credit boom

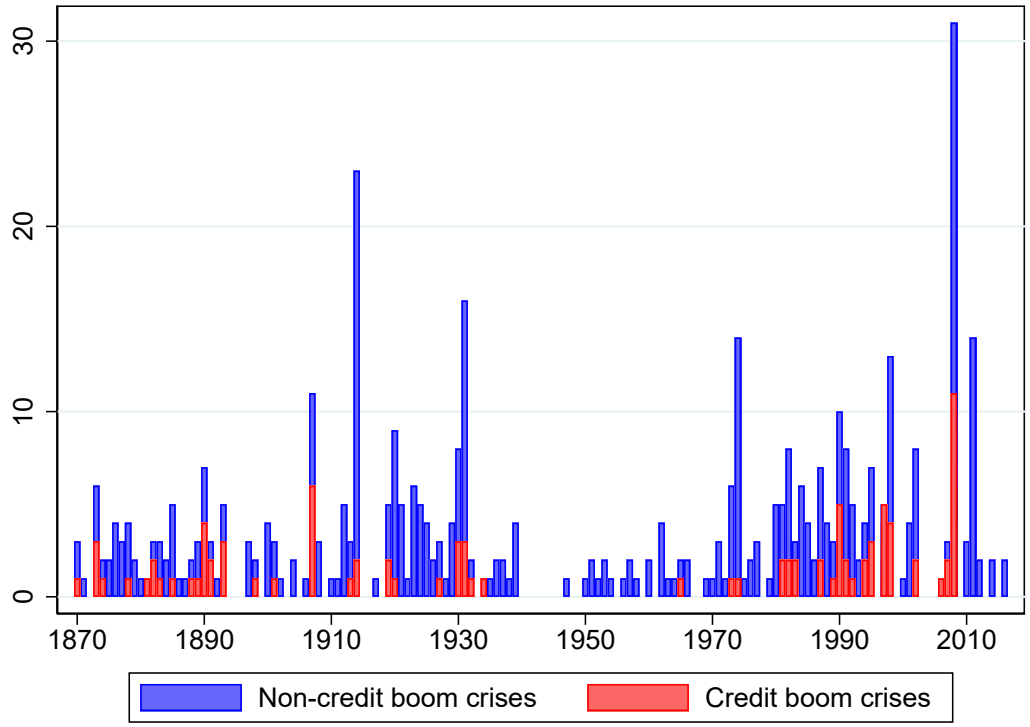
Table 4.2: Causes of banking crises, all types

Cause	1870–1913	1914–1945	1945–2016	1870–2016	Pooled
Credit boom	39.13	17.33	45.10	35.61	34.90
Asset boom	36.23	14.67	32.35	31.22	27.84
Bonds	4.35	0.00	0.98	1.95	1.57
Real estate and land	15.94	6.67	30.39	20.98	18.82
Stocks	26.09	9.33	6.86	14.15	13.33
Commodity shock	31.88	22.67	11.76	21.46	20.78
Trade shock	11.59	49.33	13.73	25.85	23.92
Monetary gold shock	15.94	4.00	0.00	6.34	5.88
Financial flow shock	59.42	32.00	65.69	54.63	52.55
Public finances	14.49	9.33	27.45	17.07	17.65
Exchange rate	7.25	5.33	11.76	6.83	8.63
Private flows	31.88	18.67	36.27	29.76	29.02
Interbank flows	21.74	5.33	22.55	17.07	16.86
Natural disaster	7.25	5.33	1.96	4.88	4.31
War	15.94	32.00	3.92	16.59	16.47
Political shock	13.04	12.00	45.10	24.88	25.10
Miscellaneous	39.13	38.67	54.90	42.93	44.71
Banking system structure	8.70	5.33	21.57	10.73	12.94
Bank governance	20.29	14.67	28.43	17.56	21.96
Domestic recession	13.04	6.67	7.84	8.78	8.63
Consumer price instability	5.80	18.67	19.61	16.59	14.90
Type					
Financial	36.23	8.00	53.92	33.17	34.51
Real	13.04	37.33	2.94	17.56	17.25
Both	49.28	53.33	39.22	47.32	45.88
Cannot be determined	1.45	1.33	3.92	1.95	2.35
Origin					
Domestic	23.19	17.33	31.37	23.41	24.71
Foreign	13.04	25.33	7.84	16.59	15.29
Both	53.62	37.33	56.86	49.76	49.02
Cannot be determined	10.14	20.00	3.92	10.24	10.98
Time horizon					
Structural	13.04	6.67	30.39	16.59	18.43
Sudden	28.99	48.00	7.84	28.29	27.06
Both	55.07	44.00	57.84	52.68	51.76
Cannot be determined	2.90	1.33	3.92	2.44	2.75
Number of countries	28	33	43	31	45
Number of observations	69	75	102	205	255

Notes: This table displays the causes of all types of banking crises, characterized by widespread bank failures, a panic, or both. For specific time horizons, only countries with full coverage over the entire time span are considered. The pooled column contains all crises observations pooled together, regardless of length of coverage. Read this table like this: Of all crises, XX.XX % had at least this cause. Causes and sub-categories not mutually exclusive in the upper part of the table. In the lower part of the table they are.

in the United States whose subsequent collapse subsequently spread banking distress around the globe. It is a recurring observation of our study that many domestic banking crises are the result of contagion from abroad in times of major global or regional financial distress, often originating from a single country or industry. Further below, we will investigate the issue of financial flow shocks and contagion in more detail.

Figure 4.1: Credit booms gone bust and other banking crises



Notes: The plot shows the total number of banking crises in a certain year for all countries for which we have complete coverage from 1870-2016. Marked in red is the number of countries that experienced a domestic credit boom gone bust as a cause of banking crisis.

Confirming what Jordà, Schularick and Taylor (2016) call "the great mortgaging", we find that the principal asset involved in credit-fueled asset booms shifts from stocks during the first era of globalization before World War I (26% of all crises) to real estate and land after World War II (30% of all crises). Even though real estate and especially (agricultural) land were a common target of speculation before WWI (16% of all crises), the share of real estate booms as a crisis causes doubled over the last century.

Commodity price shocks have lost their horror to a large extend over the past century-and-a-half. While around one third of banking crises before WWI where at least partly caused by commodity price shocks, this number gradually declined to around 12 percent in modern times and is largely prevalent today in emerging economies only. Since global commodity price volatility has remained at comparable levels historically (Williamson, 2012), we conclude that with increasing economic development, financial systems became more resilient against shocks to the manufacturing real economy. A similar pattern emerges from looking at the impact of domestic recessions. While recessions indeed have become less frequent post-WWII (Schularick & Taylor, 2012), we see a marked decline in the share of banking crises that are caused by a contraction

of the real economy from 13% to 8%. It remains to be seen whether our conclusion holds in light of the ongoing COVID-19 pandemic which—representing a purely real shock—poses a significant risk to modern financial systems worldwide. Lastly, a similar pattern emerges when we look at the share of banking crises caused (potentially among other factors) by natural disasters—the number reduced gradually from over 7% to not even 2% today—and by wars—here, the share climbed from 16% to 32% during the time of both world wars but then declined to 4% in modern times. Arguably, the development of good institutions and policies, such as lending of last resort and countercyclical fiscal measures have had an enormous and positive impact on the increased global financial stability in response to real shocks.

Considering shocks originating from the financial system itself, however, we observe a completely different pattern. We have already addressed credit-fueled asset booms which—according to our definition—represent a crisis cause originating from the domestic financial system. Next, we investigate shocks from financial flows and observe that the share of banking crises caused by at least one type of financial flow shock has remained at very high levels. From a share of 60% before WWI, the number dropped somewhat in the interwar years, where real factors were more prevalent for most countries, and then resurged to 65% in modern times. This pattern holds for all four subcategories, as well. Interestingly, the importance of interbank flows has risen substantially in modern times when we restrict the sample of crisis observations to panics only. All banking panics in the post-WWII sample that were related to financial flow shocks (64% of all panics) were simultaneously related to the collapse of the international interbank market.

When we aggregate categories along the three binary classifiers, we observe that the share of banking crises with purely financial origin increases from 36% in the beginning of our sample to 54% in modern times. Simultaneously, the share of banking crises with exclusively real causes follows an inverse v-shaped form, climbing from 13% to 37% in the interwar years, and dropping to 3% after WWII. Over time and with economic and financial development, banking crises have increasingly originated in the financial sector and less so in the real sector of the economy. In the following, we investigate further the role of the financial sector in causing banking crises. We are interested in finding out which parts of the financial sector are responsible for banking instability and whether the origins of major shocks tend to be domestic or foreign.

Table 4.3 displays the tabulation of credit booms gone bust (domestic origin) against the various types of financial flow shocks (the public finances

Table 4.3: Cross-tabulation of credit booms and financial flow shocks

Financial flow shock	Credit boom		Total
	0	1	
0	88	33	121
	72.73	27.27	100.00
	53.01	37.08	47.45
Public finances	18	4	22
	81.82	18.18	100.00
	10.84	4.49	8.63
Exchange rate	8	5	13
	61.54	38.46	100.00
	4.82	5.62	5.10
Private flows	31	24	55
	56.36	43.64	100.00
	18.67	26.97	21.57
Interbank flows	20	23	43
	46.51	53.49	100.00
	12.05	25.84	16.86
Other	1	0	1
	100.00	0.00	100.00
	0.60	0.00	0.39
Total	166	89	255
	65.10	34.90	100.00
	100.00	100.00	100.00

Notes: For each sub-category, the first row contains the number of observations, the second row is the share of observations with regard to credit booms, and the third row contains the share of observations with regard to financial flow shocks. The values in the second row sum to 100 horizontally, while the third-row values sum to 100 vertically. Except for the respective first rows, all values are percentages.

category is of domestic origin, the rest of foreign origin). We observe that two-thirds of all banking crises are financial in origin, being either a credit boom gone bust or the result of a financial flow shock or both. As excepted, most banking crises resulting from imbalances in public finances are not simultaneously *private* credit booms, while around half of the domestic credit booms that end in crises are accompanied by shocks to the inflow of private capital or interbank flows, leading to an interpretation that around 50% of the credit boom-crises in our sample are accompanied by the inflow of foreign capital or by the dependence on bank borrowing from abroad. Around 35% of the non-credit boom crises—23% of all crises in the full sample—are caused by shocks to the exchange rate, to private capital flows, or to cross-border interbank flows. Thus, almost a quarter of all banking crises in our sample are caused by contagion.

4.5 Quantifying the changing nature of banking crises over time

How has the nature of banking crises changed over time? In the previous section, we discussed the aggregated insights from our comprehensive inspection of the narrative historiography. Now, we turn to quantitative historical data to support our findings and uncover new ways in which the causes of banking crises have changed over the past century-and-a-half. The first observation comes from BVX who find that in banking crises in post-1945 advanced economies, bank equity tends to crash first ahead of nonfinancial equity, consistent with the view that banking crises originate from shocks to a narrow sector of the economy (such as subprime mortgages in the U.S. in 2008) before being transmitted to the broader nonfinancial economy. In contrast, they show that in the pre-1939 period and in emerging economies, nonfinancial equities are more likely to crash first, consistent with the view that prewar banking crises may have been the result of broader nonfinancial shocks that only later translated into losses for banks. Their discovery lends support to our finding that real shocks have become less important as causes of banking crises over time, as banking crises in modern times tend to originate more frequently from the financial or banking sector itself.

To quantitatively assess the relationship between bank distress and our categories of banking crisis causes, we exploit the main finding of BVX—namely that bank equity declines are predictive of banking crises—and compute rolling correlations of several variables, representing a large subset of our banking crisis causes categories, with real bank equity returns from BVX over time. Bank equity returns, thus, function as a proxy for future banking stability. We call the selection of variables representing our banking crisis causes categories "factors". We collect historical data for a total of nine factors and relate them to a subset of our banking crisis causes categories from Table 4.1. The private debt-to-GDP ratio from the BVX dataset measures bank credit in relation to economic activity and describes *credit booms*. The growth rate of real house prices is calculated from data from Knoll et al. (2017) and the Bank for International Settlements and relates to *asset booms in real estate and land*. Real returns of a broad stock index are taken from BVX and proxy for *asset booms in stock prices*. The real growth rates of an average of up to 40 commodity price indices are from Jacks (2019) and capture *commodity price shocks*. Real growth rates of exports cover *trade shocks* and are computed with data from Schularick & Taylor (2012). The public-debt-to-GDP ratio

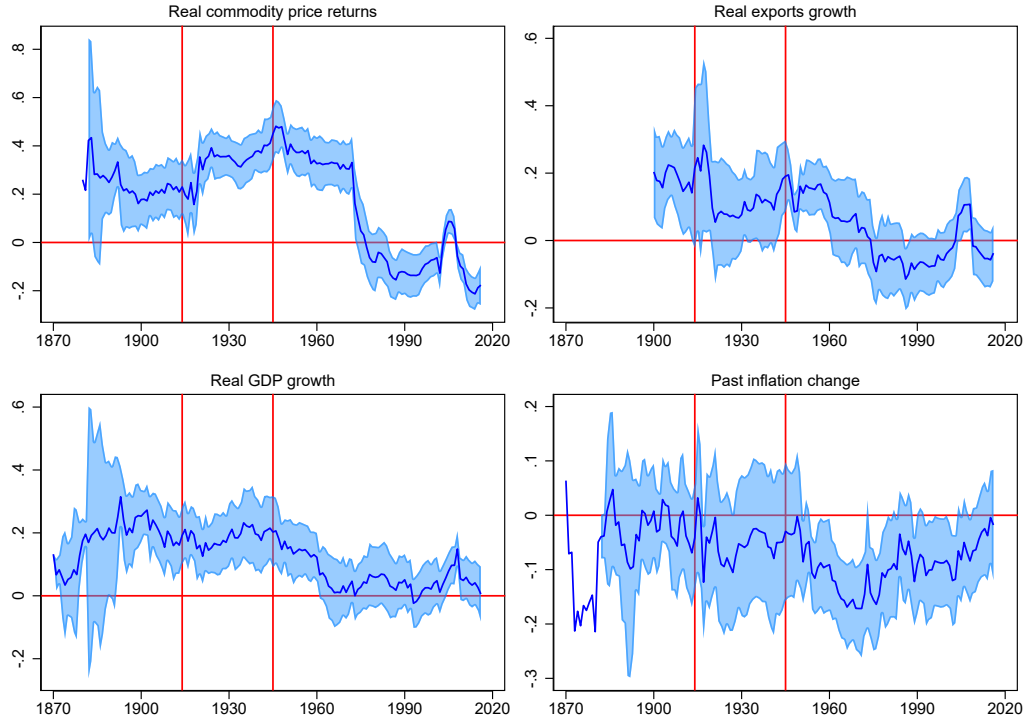
proxies for *shocks to public finances* and is taken from the Historical Public Debt Database maintained by the International Monetary Fund. We aggregate *shocks to private financial flows* and capture net capital flows in the form of changes in the current account balance-to-GDP ratio taken from Schularick & Taylor (2012). The impact of *domestic recessions* is quantified by growth rates in domestic real GDP from BVX. Last, changes to the domestic consumer price index from BVX capture *consumer price instability* as a banking crisis cause.

We collect four real and five financial factors according to our binary classification schemes of Table 4.1. Real factor correlations are depicted in Figure 4.2 and financial factor correlations in Figure 4.3, respectively. Since the banking crisis causes play out over different time horizons, we use contemporaneous values for our factor variable correlations when the time horizon is classified as "sudden" and a horizon of the past three years when it is "structural". Three of our factors are classified as having domestic origins while the remaining six represent shocks from abroad. All variables are annual and de-meaned within countries before calculating the correlation coefficient. Correlations are computed on a rolling basis over a 30-year window. The sample consists of all 46 countries if data are available, and of advanced economies otherwise. Data availability starts as early as 1800 for bank equity returns and some factors, which is why 30-year rolling correlations are partly available prior to 1900.

In the upper-left panel of Figure 4.2, we observe that real commodity prices are highly and positively correlated with real bank equity returns until the mid-1970s, indicating that drops in commodity prices tend to be followed by bank distress during this period. This observations fits very well with our narrative findings according to which a third of banking crises pre-1914 and around 23% in the interwar years were partly caused by commodity price crashes: For example, the collapse of copper prices in 1907 was linked directly to the crises in Chile, Japan, Germany, Italy, and the U.S. in the same year (Noyes, 1909).[6] Moving to the panel on the right hand side, we detect a general downward trend in the sensitivity of real bank equity returns to real exports growth while the correlation remains largely positive at statistical significance until the 1960s. During the Global Financial Crisis, the relevance of trade shocks for bank stability briefly flares up again. The overall picture is broadly in line with our narrative finding that real shocks—here, in the form of trade collapses due to global recessions or bad harvests—become less associated with bank distress over time and with increasing economic development.

[6] Other banking crises prominently linked in narrative accounts to commodity boom-bust cycles include France in 1889 (copper), Peru in 1876 (guano), and Sweden in 1878 (iron and timber). We provide an exhaustive list in Table 4.7 in the appendix.

Figure 4.2: Sensitivity of bank equity to real factors over time

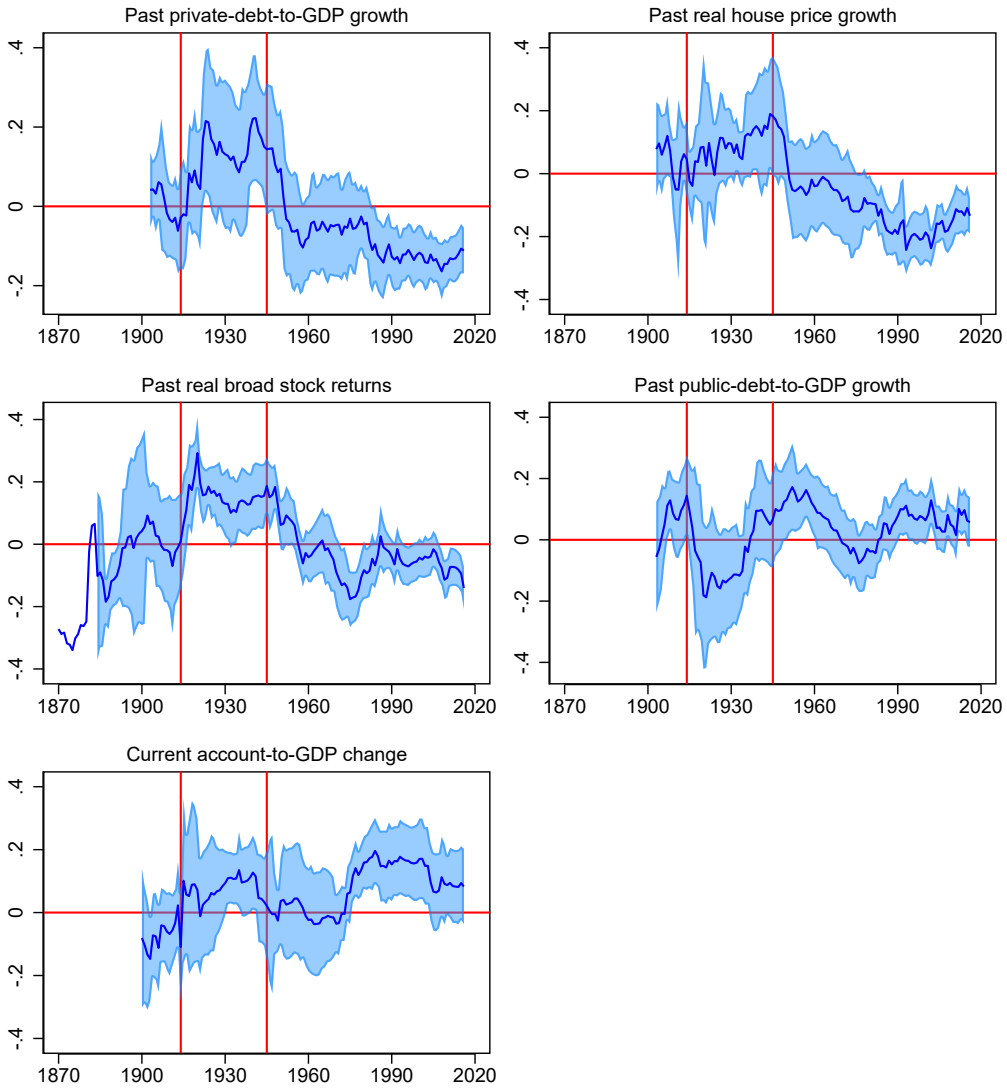


Notes: The blue line is the mean of 30-year rolling within-country correlations between the respective factor variable and real bank equity returns. The shaded areas in light blue represent 95% confidence intervals. The two vertical red lines are located at 1914 and 1945, respectively, and split the sample in line with our narrative analysis. All data are de-meaned on the country level. "Past" refers to a three-year past time horizon.

A similar pattern emerges in the panel in the lower-left corner where the sensitivity of bank equity to real GDP growth continuously declines beginning in 1900 until the relationship becomes statistically insignificant in the mid-1960s. We interpret this pattern such that declines in real GDP—i.e. recessions—are associated with future banking distress until the 1960s but not afterwards. This fits nicely with our narrative observation that real factors have become less relevant as crisis causes over time. Being a "structural" factor, we capture the correlation of real bank equity returns with percentage point changes in inflation over the past three years. From the panel in the lower-right corner, it is somewhat difficult to make out a clear relationship between the two variables. While the mean coefficient hovers around zero until WWI, a slow downward trend sets in afterwards which results in a statistically significant negative correlation from the 1950s to the early 1980s, until U.S. monetary policy tightens significantly. This temporary downward trend is in line with our narrative finding in Table 4.2 that the share of banking crises caused by disturbances to consumer price stability has increased over time. The tendency towards a negative coefficient value over the entire time span al-

lows for an interpretation where increases in past inflation are associated with increasing risks to banking stability. We suspect that there is significant non-linearity in this relationship which the rolling correlation coefficient of course does not capture. We believe that positive inflation up until a certain threshold is conducive to banking stability and that a negative relationship quickly sets in when that threshold is breached. In summary, the quantitative evidence supports our narrative finding that real shocks have become less relevant for future bank instability over time. Especially in modern times, we find little evidence that real shocks alone can cause banking crises.

Figure 4.3: Sensitivity of bank equity to financial factors over time



Notes: The blue line is the mean of 30-year rolling within-country correlations between the respective factor variable and real bank equity returns. The shaded areas in light blue represent 95% confidence intervals. The two vertical red lines are located at 1914 and 1945, respectively, and split the sample in line with our narrative analysis. All data are de-meaned on the country level. "Past" refers to a three-year past time horizon.

Next, we move to investigate shocks of financial origin and inspect the sensitivity of real bank equity returns to financial factors over time in Figure 4.3. We start out in the upper-left corner with the past three-year growth rate of private credit-to-GDP: We observe a positive relationship between past credit growth and real bank equity returns in the interwar period which collapses after WWII and turns significantly negative with the global wave of deregulation in the 1980s. We interpret the plot such that while past credit booms have had a positive economic impact in the past, they have become increasingly linked to banking instability. The positive correlation before the Great Depression may be surprising at first as the boom gone bust in the United States was fueled by an extension of private credit. However, as our narrative coding of causes in Table 4.7 in the appendix shows, most of the crises in other countries during the Great Depression were actually caused by financial contagion and the global economic collapse rather than by domestic credit booms. In the panel to the right, we observe a similar pattern for the sensitivity of bank equity to house prices over time. Beginning in the post-WWII era and turning significant in the 1980s, house price growth has increasingly become linked to impending banking crises in modern times. This is mirrored by our narrative analysis, by findings of Schularick et al. (2016), and by historical reports according to which banks were initially prohibited in many countries from lending in real estate and only gradually and especially after WWII developed into this role.

With regard to stock prices, we see a clear relationship with banking instability in the interwar years which is compatible with the reported stock market booms that ended in banking crises immediately after the end of WWI (Denmark and Sweden in 1919, Spain in 1920) and in the 1920s (in Austria, in the U.S., and in Italy). The positive coefficient indicates that bank equity declines were preceded by general equity price declines over the previous three years, pointing towards a collapse of the real economy preceding the emergence of distress in the banking sector. In the pre-WW1 era—the heyday of boom-bust stock market crises (particularly in 1873, 1893, and 1907)—we observe a reversed pattern where a negative coefficient indicates that stock market booms preceded banking instability, pointing towards an interpretation in which the collapse of the general equity prices induces the banking distress at that time. In modern times, the mean correlation coefficient has approached zero with a temporary exception in the 1970s, indicating that the relationship between stock market returns and impending banking instability has weakened significantly.

For past public debt growth, the general picture is inconclusive. While the mean coefficient exhibits medium-term trend trajectories over time, the relationship is almost never statistically significant. On closer inspection, however, this observation is not all that surprising as the countries for which these data are available are advanced economies only. The rise in banking crises related to the state of public finances in modern times is explained by a number of banking crises in emerging economies which are not captured in this graph. For advanced economies, public debt does not seem to have relevance for future banking instability. We, however, again suspect significant non-linearity in this relationship. In line with historical narrative evidence, after a certain threshold public debt should indeed matter for banking instability in advanced economies like it did in Greece and in other peripheral European countries during the European Debt Crisis in the early 2010s.

Last, we inspect the sensitivity of bank equity to three-year changes in the current account-to-GDP ratio as a proxy for the relationship between net financial flows and impending banking instability. Over the past 150 years, we can observe a slight upward trend where decreases in the current account—i.e. increasing net capital inflows—are followed by positive changes in bank equity returns (negative correlation) during the first era of globalization before WWI, while the reverse holds for the second era of globalization (positive correlation) starting in the late-1970s. Thus, in modern times, capital inflows are linked to impending banking instability. The graph confirms our major narrative finding that banking crises are increasingly linked to contagion from cross-border financial flows.

Summarizing the results of our brief quantitative analysis, we can confirm several major findings of our narrative analysis. First, real causes have indeed become less relevant for banking stability over time. Bank equity declines, which are predictive of future bank distress, are highly sensitive to sudden drops in global commodity prices until the mid-1970s. Similarly, collapsing exports and declining domestic economic activity are linked to impending banking fragility until the 1960s. In modern times, no significant sensitivity of bank equity losses to real factors can be observed. High inflation is linked to banking instability over the entire time horizon, but especially so between 1960 and 1990. We assume that significant non-linearity exists in the latter relationship. Second, we find supportive evidence for our narrative finding that banking crises increasingly originate in the financial sector and that the importance of credit-fueled housing bubbles and international contagion has increased significantly. Past credit and house price growth is negatively corre-

lated at statistical significance with bank equity returns since the early 1980s. Past stock price booms, however, are not associated with bank equity declines since the end of WWI, although an ongoing and downward-sloping trend can be observed. With the global deregulation wave in the 1980s, increases in net capital inflows have become tightly linked to future bank distress, pointing towards the increased importance of contagion through cross-border financial flows.

4.6 Conclusion

Our systematic reassessment of the global economic historiography of banking crises over the past 150 years documents how their main causes have developed over time. We find that, notwithstanding the recent scholarly interest in the matter, only 35% of all banking crises—and 40% of those with widespread bank failures—are domestic credit booms gone bust. While banking crises caused by disturbances to the real economy— such as domestic recessions, commodity price shocks, and natural disasters—have become much rarer, indicating that better institutions and policies have made financial systems more resilient to real shocks over time, the share of crises originating in the financial sector have risen. This trend is partly due to a rise the share of boom-bust-crises but also caused increasingly by contagion through the interconnected global financial system. The increased resilience against real shocks currently undergoes its litmus test: The ongoing global COVID-19 pandemic represents an unparalleled adverse shock to the global real economy post-WWII. In the light of our findings, we remain optimistic that banking crises will not occur on a large scale, as a testament to the built-up resilience of banking systems worldwide.

We corroborate our findings from narrative sources by quantitatively analyzing the sensitivity of real bank equity returns over time to several variables representing different causes of banking crises. Since bank equity declines are predictive of banking crises we interpret them as proxies for future bank distress. We find that real factors—such as global commodity prices, domestic GDP, and exports—are tightly linked to bank equity declines and, thus, to future bank distress prior to the 1970s, but not afterwards. Reversely, we show that financial factors—such as past credit and housing price growth—have become increasingly negatively correlated with bank equity returns, making them a primary precursor to banking crises today. We further discover an increasing association between net financial flows and bank equity declines which supports our finding that international contagion as a source of domes-

tic bank distress has become more important in recent decades. Overall, our quantitative analysis distinctly reaffirms our narrative findings.

We also confirm Reinhart & Rogoff's (2013) observation that banking crises tend to cluster. We recognize several globally or regionally clustered crisis periods which often originate from a financial center.[7] We find that around one quarter of all banking crises in our sample are due to contagion and financial interconnectedness and can occur irrespective of macroeconomic or financial conditions in the domestic economy.[8] This leads us to issue an acute warning to policy makers. The recent focus on domestic financial imbalances and credit aggregates in assessing financial instability and crisis risk only covers around 40% of the explained incidence of widespread bank failures. The historical record shows that it is paramount to capture the built-up of financial imbalances in countries to which the domestic economy maintains large exposures. Additionally, and with special relevance for emerging economies, our results highlight once again the importance of consumer price stability, solid public finances, careful deregulation, prudent supervision, and the right amount of competition among banks for achieving long-term financial stability.

Our birds-eye perspective on 150 years of banking crisis history reveals that while financial systems have become more resilient towards shocks from the real economy, banking crises have not become less common. With perplexing regularity has history repeated itself and have financial sectors produced disruptions that have spread across regions and the entire globe. Policy makers would do well to incorporate the built-up of foreign imbalances abroad into their models. Regarding the ongoing crises, however, history tells us that we may allow ourselves to be carefully optimistic that the world's financial systems will weather the pandemic without major bank failures.

[7] Examples of financial distress in global or regional financial centers, which serve as the origin of banking crises in other countries, are the U.S. in 1929, Japan in the mid-1990s, the U.S. in 2008, or the U.K. in 1890. One can extend this argument to include monetary policy decisions in financial centers to explain, for example, the banking crises in the mid-1980s (tightening in the U.S.) or in the early 1990s in Europe (tightening in Germany after reunification). Additionally, one can track crisis clusters to severe recessions originating in global or regional economic centers.

[8] Illustrative examples of banking crises that cannot be explained by financial imbalances but only by contagion are those in Switzerland and Germany in 2008. Both countries were neither financially leveraged nor exhibited real estate booms. Their banks, however, were heavily exposed to bad foreign assets. Refer to Dieckelmann (2020) or the second chapter of this dissertation, respectively, for a systematic assessment of this channel of crisis transmission.

4.7 Appendix

Table 4.4: Country coverage

Country	Coverage from	Entirely capitalist	Full coverage	Country	Coverage from	Entirely capitalist	Full coverage
Argentina	1870	1	1	Japan	1870	1	1
Australia	1870	1	1	Korea	1945	1	0
Austria	1870	1	1	Luxembourg	1870	1	1
Belgium	1870	1	1	Malaysia	1945	1	0
Brazil	1870	1	1	Mexico	1870	1	1
Canada	1870	1	1	Netherlands	1870	1	1
Chile	1870	1	1	New Zealand	1870	1	1
Colombia	1870	1	1	Norway	1870	1	1
Czech Republic	1870	0	0	Peru	1870	1	1
Denmark	1870	1	1	Philippines	1945	0	0
Egypt	1907	1	0	Portugal	1870	1	1
Finland	1870	1	1	Russia	1870	0	0
France	1870	1	1	Singapore	1965	1	0
Germany	1870	1	1	South Africa	1870	1	1
Greece	1912	1	0	Spain	1870	1	1
Hong Kong	1870	1	1	Sweden	1870	1	1
Hungary	1870	0	0	Switzerland	1870	1	1
Iceland	1870	1	1	Taiwan	1923	0	0
India	1907	0	0	Thailand	1945	1	0
Indonesia	1945	0	0	Turkey	1870	1	1
Ireland	1870	1	1	UK	1870	1	1
Israel	1948	1	0	US	1870	1	1
Italy	1870	1	1	Venezuela	1945	0	0

Notes: Coverage refers to the beginning of economic history literature of the respective country known and available to us.

Table 4.5: Causes of banking crises, all with widespread bank failures

Cause	1870–1913	1914–1945	1945–2016	1870–2016	Pooled
Credit boom	43.55	20.41	46.15	39.64	39.23
Asset boom	40.32	18.37	32.97	34.91	31.58
Bonds	4.84	0.00	1.10	2.37	1.91
Real estate and land	17.74	6.12	30.77	22.49	20.57
Stocks	29.03	14.29	7.69	17.16	16.27
Commodity shock	33.87	22.45	13.19	21.89	22.01
Trade shock	12.90	61.22	15.38	27.22	25.84
Monetary gold shock	16.13	4.08	0.00	6.51	6.22
Financial flow shock	62.90	36.73	65.93	58.58	56.94
Public finances	16.13	14.29	29.67	20.71	21.05
Exchange rate	8.06	6.12	13.19	7.69	10.05
Private flows	33.87	18.37	37.36	31.36	31.10
Interbank flows	24.19	6.12	17.58	17.16	16.75
Natural disaster	6.45	4.08	2.20	4.73	3.83
War	11.29	14.29	4.40	9.47	9.09
Political shock	11.29	12.24	49.45	26.63	27.75
Miscellaneous	40.32	53.06	59.34	48.52	51.20
Banking system structure	8.06	8.16	23.08	11.83	14.83
Bank governance	19.35	18.37	30.77	18.93	24.40
Domestic recession	14.52	8.16	8.79	10.06	10.05
Consumer price instability	6.45	28.57	20.88	19.53	17.70
Type					
Financial	37.10	8.16	50.55	34.32	35.89
Real	9.68	26.53	2.20	12.43	11.00
Both	51.61	63.27	43.96	50.89	50.72
Cannot be determined	1.61	2.04	3.30	2.37	2.39
Origin					
Domestic	25.81	18.37	31.87	25.44	26.79
Foreign	14.52	26.53	4.40	14.79	13.88
Both	56.45	51.02	60.44	56.21	55.98
Cannot be determined	3.23	4.08	3.30	3.55	3.35
Time horizon					
Structural	14.52	6.12	30.77	17.75	20.10
Sudden	25.81	32.65	4.40	20.71	18.66
Both	58.06	59.18	61.54	59.17	58.85
Cannot be determined	1.61	2.04	3.30	2.37	2.39
Number of countries	28	29	42	31	45
Number of observations	62	49	91	169	209

Notes: This table displays the causes of all banking crises that feature widespread bank failures. For specific time horizons, only countries with full coverage over the entire time span are considered. The pooled column contains all crises observations pooled together, regardless of length of coverage. Read this table like this: Of all crises, XX.XX % had at least this cause. Causes and sub-categories not mutually exclusive in the upper part of the table. In the lower part of the table they are.

Table 4.6: Causes of banking crises, only pure panics

Cause	1870–1913	1914–1945	1945–2016	1870–2016	Pooled
Credit boom	0.00	11.54	36.36	16.67	15.22
Asset boom	0.00	7.69	27.27	13.89	10.87
Bonds	0.00	0.00	0.00	0.00	0.00
Real estate and land	0.00	7.69	27.27	13.89	10.87
Stocks	0.00	0.00	0.00	0.00	0.00
Commodity shock	14.29	23.08	0.00	19.44	15.22
Trade shock	0.00	26.92	0.00	19.44	15.22
Monetary gold shock	14.29	3.85	0.00	5.56	4.35
Financial flow shock	28.57	23.08	63.64	36.11	32.61
Public finances	0.00	0.00	9.09	0.00	2.17
Exchange rate	0.00	3.85	0.00	2.78	2.17
Private flows	14.29	19.23	27.27	22.22	19.57
Interbank flows	0.00	3.85	63.64	16.67	17.39
Natural disaster	14.29	7.69	0.00	5.56	6.52
War	57.14	65.38	0.00	50.00	50.00
Political shock	28.57	11.54	9.09	16.67	13.04
Miscellaneous	28.57	11.54	18.18	16.67	15.22
Banking system structure	14.29	0.00	9.09	5.56	4.35
Bank governance	28.57	7.69	9.09	11.11	10.87
Domestic recession	0.00	3.85	0.00	2.78	2.17
Consumer price instability	0.00	0.00	9.09	2.78	2.17
Type					
Financial	42.86	57.69	9.09	41.67	28.26
Real	0.00	0.00	0.00	0.00	45.65
Both	28.57	7.69	81.82	27.78	23.91
Cannot be determined	28.57	34.62	9.09	30.56	2.17
Origin					
Domestic	0.00	15.38	27.27	13.89	15.22
Foreign	0.00	23.08	36.36	25.00	21.74
Both	28.57	11.54	27.27	19.44	17.39
Cannot be determined	71.43	50.00	9.09	41.67	45.65
Time horizon					
Structural	57.14	76.92	27.27	11.11	10.87
Sudden	0.00	0.00	36.36	63.89	65.22
Both	28.57	7.69	27.27	22.22	19.57
Cannot be determined	14.29	15.38	9.09	2.78	4.35
Number of countries	6	21	11	21	28
Number of observations	7	26	11	36	46

Notes: This table displays the causes of all banking crises that are pure panics, thus exhibiting no widespread bank failures. For specific time horizons, only countries with full coverage over the entire time span are considered. The pooled column contains all crises observations pooled together, regardless of length of coverage. Read this table like this: Of all crises, XX.XX % had at least this cause. Causes and sub-categories not mutually exclusive in the upper part of the table. In the lower part of the table they are.

Table 4.7: Causes of banking crises

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Argentina	1891	3	1					sovereign default				
Argentina	1914	1	1	agricultural land	cereal				bad harvests	ww1		
Argentina	1930	1	1		1	1						
Argentina	1934	3+	1		wheat							
Argentina	1980	3+									deregulation	
Argentina	1985	3						sovereign default				hyperinflation
Argentina	1989	3						sovereign default				hyperinflation
Argentina	1995	3	1								deregulation	
Argentina	2000	3						sovereign default				
Australia	1893	3	1	land, real estate, mining shares	1							
Australia	1931	1			1			capital retrenchment				
Australia	1989	1	1	commercial real estate							deregulation	
Austria	1873	3+	1	stocks, real estate				french war reparations				
Austria	1912	1								balkan war		
Austria	1914	1								ww1		
Austria	1924	2+		stocks								hyperinflation

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Austria	1931	3+	1					capital retrenchment				
Austria	2008	3+						exposure to bad foreign assets, international financial stringency				
Austria	2011	2+						exposure to bad foreign assets			european debt crisis	
Belgium	1870	1					evacuation of gold reserves			franco-prussian war		
Belgium	1876	3+										recession
Belgium	1885	3+	?									
Belgium	1914	3+								ww1		unexpected bank failure
Belgium	1929	3			1	1						
Belgium	1939	3+				global recession				ww2		
Belgium	2008	3+		real estate				exposure to bad foreign assets, international financial stringency				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Belgium	2011	2+									european debt crisis, lack of government	
Brazil	1890	3	1	stocks				capital retrenchment			abolition of slavery, inflow of immigrants, deregulation	
Brazil	1900	3+			coffee			sovereign default			deregulation	deflation
Brazil	1914	1			coffee	1	gold outflow	capital retrenchment		ww1		
Brazil	1929	1			coffee	global recession		capital retrenchment			military coup	
Brazil	1985	3+						high public debts				high inflation
Brazil	1990	1										hyperinflation
Brazil	1994	3				1					economic reforms	
Canada	1873	3									immigration	recession
Canada	1887	2		land								recession
Canada	1893	2						international financial stringency				
Canada	1907	2	1		crop failure			international financial stringency, capital retrenchment				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Canada	1914	1		real estate						ww1		
Canada	1920	3							spanish flu			return of soliders, recession
Canada	1982	3		real estate	oil, gas						deregulation	high inflation
Canada	1991	2		real estate		global recession						
Chile	1878	3			bad harvests, copper, silver	global recession	export of gold and silver	sudden stop				
Chile	1898	3+		real estate				capital retrenchment			tensions with argentina	
Chile	1907	3	1	stocks	copper, (nitrate)			exchange rate depreciation	val-paraiso earth-quake			
Chile	1914	1				global trade shock		sudden stop, exchange rate depreciation				
Chile	1925	3+									military coup	
Chile	1931	3			copper	global recession					military coup	
Chile	1976	3+			copper			high public debts			financial liberalization	recession
Chile	1982	3	1			global recession		capital retrenchment				high global interest rates
Colombia	1876	1								civil war		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Colombia	1885	3			quinine, coffee, tobacco		gold outflows			civil war		
Colombia	1904	3+						foreign exchange appreciation		war of a thousand days		hyperinflation
Colombia	1923	3			coffee			fiscal crisis				recession
Colombia	1931	1	1		coffee	global recession		capital retrenchment				recession
Colombia	1982	2+						sudden stop			financial liberalization	recession, low competition among banks, high inflation
Colombia	1998	3	1					sudden stop, fiscal crisis			financial liberalization	
Czech Republic	1873	3				global recession						
Czech Republic	1884	2+			sugar							
Czech Republic	1912	1								first balkan war		
Czech Republic	1923	3				global recession						weak supervision
Czech Republic	1991	3									financial liberalization, collapse of soviet union	

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Czech Republic	1995	3+	1					capital inflows, speculative attack			privatizations	weak supervision
Denmark	1877	3				global recession		international financial stringency				
Denmark	1885	3+										recession
Denmark	1907	3	1	real estate				international financial stringency, capital retrenchment				
Denmark	1919	3+	1	stocks						ww1		deflation
Denmark	1992	2						high public debts, large current account deficit, speculative attack			erm crisis	
Denmark	2008	3	1	real estate				international financial stringency				
Denmark	2011	2						exposure to bad foreign assets				
Egypt	1907	3+	1	real estate, land, stocks	good cotton crops							
Egypt	1914	1								ww1		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Egypt	1931	3			cotton	global recession	gold outflows					
Finland	1900	3			iron, steel							mismanagement, fraud
Finland	1921	2		stocks		global recession		exchange rate depreciation				deflation
Finland	1931	3	1	real estate	poor harvest	global recession						
Finland	1990	3+	1	stocks, real estate		collapse of soviet union					deregulation	recession
France	1870	1								franco-prussian war	paris commune	
France	1882	3+	1	railroad stocks, government bonds				war reparations				financial innovation
France	1889	3+			copper	trade war with italy						attempted market manipulation
France	1914	1								ww1		
France	1930	3				global recession	gold inflows					deflation, high competition
France	1937	1								ww2	war preparations	
France	1994	2+	1	real estate		global recession					deregulation, erm crisis	mismanagement

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
France	2008	1	1	real estate				international financial stringency				
Germany	1874	3	1	real estate, stocks				war reparations				
Germany	1891	3	1	stocks	iron, coal			international financial stringency				fraud
Germany	1901	3	1	real estate, stocks				exposure to bad foreign assets				recession
Germany	1914	1								ww1		
Germany	1930	3+				global recession		high fiscal deficits, capital retrenchment				mismanagement
Germany	2008	3						exposure to bad foreign assets, international financial stringency				weak regulation
Greece	1914	1								ww1		
Greece	1929	3				global recession		high fiscal deficits, exchange rate depreciation				high inflation, mass immigration

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Greece	2008	1						sudden stop, international financial stringency				
Greece	2010	3+						high fiscal deficits, high public debt levels			european debt crisis	fraud
Hong Kong	1892	3+			silver	global recession			hurricane mauritius			
Hong Kong	1914	1								ww1		
Hong Kong	1965	3+	1	real estate								weak regulation, mismanagement
Hong Kong	1982	3+	1	stocks, real estate		global recession					announcement of take-over by china	high inflation, high competition
Hong Kong	1991	1										fraud, mismanagement, weak supervision
Hong Kong	1998	3+	1	real estate				speculative attack			china handover	high inflation
Hungary	1873	3	1	railroad stocks								

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Hungary	1912	1								balkan war		
Hungary	1931	3						capital retrenchment, high public debts, high foreign debts				insufficient capital
Hungary	1991	2									financial liberalization, collapse of soviet union	weak regulation, insufficient capital
Hungary	1995	3										mismanagement
Hungary	2008	1	1					high public debts, high foreign debts, international financial stringency				
Hungary	2011	2+									nationalisation	insufficient capital
Iceland	1920	3+			fish	global recession		sudden stop				high inflation
Iceland	1930	3+				global recession		sudden stop				
Iceland	1993	2+				collapse in export demand		exchange rate depreciation				low competition

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Iceland	2008	3+	1	real estate				sudden stop			dergeulation, privatization	
India	1913	3+	1									weak regulation, insufficient capital
India	1914	1								ww1		
India	1920	3				global recession						mismanagement, insufficient capital
India	1938	1										mismanagement
India	1993	2						high fiscal deficit, exchange rate depreciation				mismanagement, insufficient capital, fraud
Indonesia	1990	3	1								financial liberalization	mismanagement, fraud
Indonesia	1998	3+	1					speculative attack, exchange rate depreciation				high foreign indebtedness
Ireland	1878	1			bad harvest, grain				severe weather			mismanagement, weak regulation, fraud

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Ireland	1885	3+										mismanagement, fraud
Ireland	2007	3+	1	real estate				international financial stringency				high foreign indebtedness, mismanagement
Ireland	2010	3+						high public debt, deposit retrenchment			european debt crisis	
Israel	1983	2+	1	bank stocks								high inflation, bank stock buy-backs, fraud, high concentration
Italy	1873	2	1	railroad stocks				international financial stringency				
Italy	1889	2	1	real estate		trade war with france	gold inflow	capital inflows, exchange rate appreciation				mismanagement, fraud, recession
Italy	1891	3+						sudden stop, exchange rate depreciation, international financial stringency				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Italy	1907	3+		stocks	copper			international financial stringency				
Italy	1914	3	1							ww1		recession
Italy	1921	3+				global recession				ww1		
Italy	1930	3+	1	stocks				international financial stringency				deflation, insufficient capital, weak regulation
Italy	1992	2	1			global recession		high public debts, speculative attack, exchange rate depreciation			erm crisis	
Italy	2008	1						international financial stringency				
Italy	2011	2+						high public debts			european debt crisis	high exposure to sovereign bonds
Italy	2016	2						high public debts			political instability	insufficient capital
Japan	1871	3+										mismanagement, weak regulation

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Japan	1882	2					depreciation of silver					recession
Japan	1890	3	1	stocks	bad harvest							
Japan	1901	3					gold outflows	currency depreciation		boxer uprising		
Japan	1907	3			cotton, copper, silver	decline of chinas purchasing power in silver						
Japan	1920	3				global recession		capital retrenchment				
Japan	1922	3										mismanagement
Japan	1923	3							great kanto earthquake			
Japan	1927	3	1								miscommunication	
Japan	1990	2	1	stocks, real estate							deregulation	
Japan	1997	3+	1			asian financial crisis		exposure to bad foreign assets			tax increase	recession, insufficient capital

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Japan	2001	2+						high public debt				recession, insufficient capital
Korea	1997	3+	1					capital retrenchment, high short-term foreign debts			deregulation	weak supervision, financial problems of large industrial groups
Luxembourg	2008	3	1					exposure to bad foreign assets				
Malaysia	1985	3			tin, palm oil			high public debts, high foreign debt				recession
Malaysia	1997	3	1	real estate				capital retrenchment, speculative attack				
Mexico	1883	3	1			global recession		capital retrenchment				
Mexico	1893	2			silver, bad harvests			high ficsal deficit, international financial stringency				
Mexico	1908	2						capital retrenchment				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Mexico	1913	3+					outflow of gold and silver	capital retrenchment, high fiscal deficit		civil war		hyperinflation
Mexico	1921	3			cotton crop failure							insufficient capital
Mexico	1928	3				global recession		sovereign default				
Mexico	1981	3+			oil			high public debts, high foreign debts, capital retrenchment				high inflation
Mexico	1994	3	1	government bonds				sudden stop, exchange rate depreciation		assasina-tions, chiapas conflict, civil war, terrorism	financial liberalization, privatization	weak regulation
Netherlands	1907	3	1	stocks				international financial stringency				fraud
Netherlands	1914	1								ww1		
Netherlands	1921	2+				global recession						inflation, weak supervision
Netherlands	1931	2				global recession		exposure to bad foreign assets				fraud

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Netherlands	1981	2	1	real estate								high inflation
Netherlands	2008	3+	1	real estate				exposure to bad foreign assets, international financial stringency				
New Zealand	1888	3+	1	agricultural land				exposure to bad foreign assets, capital retrenchment				weak regulation
New Zealand	1987	3+	1	commercial real estate, stocks				capital inflows			deregulation	
Norway	1886	2				decline in shipping industry						fraud
Norway	1898	3	1	real estate, land, stocks							railroad construction	high competition
Norway	1914	1								ww1		
Norway	1919	3+				global recession					deflationary monetary policy	hyperinflation
Norway	1931	3+		real estate		global recession						

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Norway	1987	3+	1	real estate	oil			high foreign debts, capital retrenchment			deregulation	high competition, weak supervision
Norway	2008	1	1	real estate				international financial stringency				
Peru	1876	3			guano			sovereign default				
Peru	1914	1				insufficient ships				ww1		
Peru	1931	3				global recession						
Peru	1981	2				global recession		sovereign default, high foreign debts, capital retrenchment				high inflation
Peru	1998	2	1					sudden stop	el niño			mismanagement
Philippines	1971	1										
Philippines	1981	3	1			global recession		sovereign default, high foreign debts, capital retrenchment		assasination of politician		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Philippines	1997	2	1					high foreign short-term debts, capital retrenchment			deregulation	
Portugal	1876	3										weak regulation, mismanagement, insufficient reserves
Portugal	1890	3						sovereign default, capital retrenchment, baring brothers collapse			abolition of slavery in brazil, british ultimatum	
Portugal	1921	3				global recession						
Portugal	1923	3			bad harvests	global recession						
Portugal	1925	1										fraud
Portugal	1931	3			wine, sugar	global recession		international financial stringency				
Portugal	2008	3	1					international financial stringency				
Portugal	2011	2						high public debts			european debt crisis	

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Portugal	2014	2+										mismanagement, insufficient capital
Russia	1875	3				global recession		international financial stringency				mismanagement
Russia	1900	3					second boer war induced gold shortage in europe	sudden stop, exchange rate depreciation		greco-turkish war, spanish-american war induced capital shortage in europe		
Russia	1995	3									monetary policy tightening	mismanagement, insufficient liquidity, high inflation

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Russia	1998	3			metals, oil			sovereign default, exchange rate depreciation, high foreign debts				weak supervision, mismanagement
Russia	2008	3	1	real estate	oil, natural gas, metals			capital retrenchment, international financial stringency			russo-georgian war	
South Africa	1881	3	1	diamond stocks						first boer war		insufficient reserves, mismanagement
South Africa	1890	3	1	gold mining stocks	gold discovery			capital inflows				
Spain	1882	3	1	stocks				sovereign default, sudden stop				
Spain	1890	3	1					international financial stringency, capital retrenchment				
Spain	1913	3+								mexican revolution		
Spain	1914	1								ww1		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Spain	1920	3+	1	stocks		global recession						high inflation
Spain	1924	3+				global recession						bad assets
Spain	1931	1				global recession		international financial stringency			proclamation of the second spanish republic	
Spain	1975	2			oil					yom kippur war	death of franco, trade union pressures	high inflation
Spain	1982	2				global recession						mismanagement, weak regulation, high inflation
Spain	1991	2+									erm crisis	mismanagement
Spain	2008	3	1	real estate				exposure to bad foreign assets				
Spain	2010	2+						exposure to bad foreign assets, high public debts			european debt crisis	insufficient capital
Sweden	1878	3+	1	railroad corporate bonds	iron timber			international financial stringency				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Sweden	1907	3	1		iron			international financial stringency, capital retrenchment, high foreign short-term debt				
Sweden	1919	2	1	stocks		global recession		capital inflows		ww1	revolution in russia	deflation
Sweden	1932	2+				global recession		capital retrenchment				mismanagement
Sweden	1991	3+	1	real estate				international financial stringency			deregulation	high inflation
Sweden	2008	1						international financial stringency, high foreign short-term debts, exposure to bad foreign assets				
Switzerland	1870	3	1	railroad stocks			sudden stop in gold flows from france			franco-prussian war		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Switzerland	1910	2										
Switzerland	1914	1								ww1		
Switzerland	1919	2				global recession						deflation
Switzerland	1931	3+				global recession		international financial stringency				
Switzerland	1990	3	1	real estate		global recession		international financial stringency				
Switzerland	2008	1						international financial stringency, exposure to bad foreign assets				
Taiwan	1923	1							great kanto earth-quake			
Taiwan	1927	3										mismanage-ment, failure of large corporation
Taiwan	1983	3									financial repression	fraud, misman-agement, weak supervision

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Taiwan	1995	3	1	real estate, stocks							financial liberalization, deregulation	
Taiwan	1998	2						international financial stringency				high share of npl, insufficient capital
Thailand	1979	2										weak regulation, mismanagement, fraud
Thailand	1983	3	1			global recession						weak regulation, mismanagement, fraud
Thailand	1997	3	1	real estate, stocks				sudden stop, speculative attack, high foreign short-term debts				
Turkey	1914	3						high public debts		ww1, balkan wars		

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
Turkey	1930	3						exchange rate depreciation, high foreign debts				deflation
Turkey	1980	3						sovereign default			financial liberalization	weak supervision, weak regulation, fraud, high competition
Turkey	1994	3						high fiscal deficit, sudden stop				high inflation
Turkey	2001	3						sudden stop, international financial stringency, high fiscal deficit, high public debts	earth-quake			high inflation
U.K.	1878	3+						exposure to bad foreign assets				mismanage-ment, weak regulation, fraud
U.K.	1890	1						exposure to bad foreign assets				mismanage-ment

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
U.K.	1911	1						decline in yield on domestic fixed-income securities			expansion of eligible trustee securities	
U.K.	1914	1								ww1		
U.K.	1973	3	1	commercial real estate				exchange rate depreciation				weak supervision
U.K.	1991	3	1	commercial real estate							erm crisis	
U.K.	2008	3+	1	real estate				international financial stringency, exposure to bad foreign assets				
U.S.	1873	3		railroad corporate bonds	silver			capital retrenchment	chicago and boston fires			high inflation
U.S.	1884	3					gold outflow	international financial stringency				recession
U.S.	1890	3					gold outflow	international financial stringency, capital retrenchment				

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

Table 4.4: Causes of banking crises (continued)

Country	Year	Type	Credit boom	Asset boom	Commodity shock	Trade shock	Monetary gold shock	Financial flow shock	Natural disaster	War	Political shock	Misc.
U.S.	1893	3	1	real estate, railroad stocks	agricultural prices		gold outflow	capital retrenchment			sherman silver purchase act	
U.S.	1907	3			copper				san francisco earth-quake			recession, fraud
U.S.	1930	3+	1	stocks, real estate	agricultural prices						restrictive monetary policy	deflation
U.S.	1984	3			oil						deregulation	high inflation, competition, mismanage-ment
U.S.	1990	2	1	real estate								mismanage-ment
U.S.	2007	3+	1	real estate								weak regulation
Venezuela	1981	3			oil			sovereign default, capital retrenchment				
Venezuela	1992	3			oil			sovereign default, sudden stop		coup attempts	financial liberalisation	high inflation, weak supervision
Venezuela	2008	3			oil			sudden stop				fraud, insuff. capital, mis-management.

Note: The numbers in the type column are to be read as follows: 1–banking crisis with panic only and no widespread bank failures, 2–banking crisis with widespread bank failures and no panic ("quiet crisis"), 2+–like number 2 but at least with one of the top-5 banks failing, 3–banking crisis with both widespread bank failures and a panic, 3+– like number 3 but with at least one of the top-5 bank failing. For the definition and identification of widespread bank failures and panics refer to section II.

4.8 Narrative summaries and sources

Argentina

1885

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here just for the purpose of demonstrating this conclusion.

Background and causes: In the late 19th century, Argentina had adopted various regimes attempting to establish a national monetary system, which included a bimetal standard with gold and silver coins as well as a paper Peso, which was issued by five banks: Banco Nacional, Banco de la Provincia de Buenos Aires, Banco Provincial de Santa Fe, Banco Provincial de Cordoba, and Otero & Co. (Della Paolera & Taylor, 2001). However, there was no regulation on how much gold the banks had to keep as reserve to guarantee the conversion.

The crisis: In 1884, the banks suspended convertibility of notes to specie at their par value. As mentioned by Della Paolera and Taylor (2001) and by Cachanosky (2012), this event may have been less of a banking crisis and more of a result of laws by the national government which debased the paper currency. Also, Bordo and Eichengreen (1999) only consider this a currency crisis but not a banking crisis. Reinhart & Rogoff (2014) no longer consider this a banking crisis in their 2014 update. *Banks failed:* There is no evidence of bank runs or bank failures.

Policy responses: There is no evidence of any significant policy measures regarding the banking system.

Sources:

Della Paolera, G., & Taylor, A. M. (2001). *Straining at the anchor: The Argentine Currency Board and the search for macroeconomic stability, 1880-1935*. Chicago: University of Chicago Press.

Cachanosky, N. (2012). The Law of National Guaranteed Banks in Argentina, 1887 – 1890. *The Independent Review,* 16(4), 569-590.

Bordo, M., & Eichengreen, B. (1999). *Is Our Current International Economic Environment Unusually Crisis Prone?* In Gruen, D., & Gower, L. (eds.). Conference: Capital Flows and the International Financial System. Reserve Bank of Australia. pp. 18-74.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

1890

Background and causes: The banking crisis was partly the result of a large sovereign debt crisis caused by the fact that, between 1885 and 1890, Argentina borrowed more than 200,000,000 pesos in gold (Hodge, 1970, p. 506). In 1890, Argentina was unable to roll over existing debt. Part of the problem was that most of Argentina's foreign loans could be repaid only in gold, while Argentina's revenues were mostly collected in the rapidly depreciating paper Pesos. Argentina issued bonds denominated in gold, which were purchased by domestic banks, which in turn borrowed the gold from abroad. Private borrowing and speculative investment also surged from 1884-1890. "The borrowing was maintained throughout the eighties, culminating in loans of such extent as have probably never been equaled by a country of so small a population as was that of Argentina" (Della Paolera & Taylor, 2001).

Mitchener & Weidenmier (2008): "Between 1880 and 1886, the national authorities and the government of the province of Buenos Ayres carried out a series of unprecedented state-run development projects in Latin America. As a result of the open capital markets that prevailed in the nineteenth century, Argentina was able to borrow extensively abroad. It was the fifth largest sovereign borrower in the world. It absorbed roughly 11 percent of all new issues in the new London market between 1884 and 1890 and 40 to 50 percent of all lending that occurred outside the United Kingdom in 1889 [...] The current account deficit, as a percent of GDP, averaged 20 percent from 1884 to 1889 [...] The financing of railroads and land improvement projects were aimed at promoting internal development, exports, and economic growth [...]" (pp. 464-465).

"From 1886 to 1890, Argentina passed a series of "banking reforms" that fueled the expansion of credit and paper money issues [...]. The banks that participated in the note issuance scheme floated loans in Europe to finance the purchase of the domestic gold bonds that backed note issuance. This scheme worked as long as foreign investors agreed to purchase the Argentine bonds and as long as additional note issuances were backed 100 percent by specie. Foreign investors, however, essentially were backing a credit boom in Argentina, financed by the issuance of new paper currency. By 1890, Argentine provincial banks had issued more than 30 million pounds of debt on foreign capital markets" (pp. 465-466).

Hodge (1970): "Another factor increasing the instability of the financial structure was the speculative trade in a peculiar type of Argentine land mortgage known as a cedula. The banks did not make the loans in cash; instead, they gave the borrower a negotiable bond or cedula, which the borrower then sold for cash on the market [...]" (p. 500).

The crisis: In 1889, Bank of the Province of Buenos Aires and the National Bank had run through their gold reserves. Triner & Wandschneider (2005, p. 207) and Cachanosky (2012) report that widespread bank runs occurred already in March 1890 at Banco de la Provincia and the Banco Nacional, which is when we date start of the panic. The failure of Barings' investment in the Buenos Ayres Water Supply Co. in November 1890 led to the failure of the British-based Baring Brothers' banking house, which led the crisis to have international dimensions. A second wave of a severe banking crisis started in January 1891 and led to runs on all the banks. The Bank of London and River Plate was the only bank that did not close its doors during the crisis.

Mitchener & Weidenmier (2008): "The Argentine economy worsened towards the end of the [1880s], with as much as 40 percent of foreign borrowing going towards debt service and 60 percent of imports going towards the purchase of (non-investment) consumption goods. Railway net profits were declining and gold pesos were trading at a large premium (94 percent) relative to paper pesos [...]" (p. 466).

"By the end of the decade, it was becoming clear to the financial community that paper pesos were inadequate to cover the normal service on the internal and external debt. In 1889, the government broke its promise and paid off some of its gold-denominated liabilities with paper currency. In response, primary issues on the London market were met with a tepid response, and investors dumped paper pesos in anticipation of a further decline in its value. The government used the gold (that backed the note issues) to defend the exchange rate, but by December 1889, the stock of gold at the Banco Nacional had dwindled such that it could no longer carry out this intervention in the currency market. Strikes, demonstrations, and a failed coup by military leaders erupted in 1889-1890 as the real wage of Argentine workers declined with the rising price level. Domestic political strife further reduced the willingness of foreign investors to hold Argentine securities. The questionable fiscal and monetary policies drained the banking system of specie, provoked multiple banks to experience runs beginning in 1890, and thus ushered in a financial crisis [...]. Argentina defaulted on nearly £48 million of debt in 1890, which ended up constituting nearly 60 percent of the world's defaulted debt in the

1890s" (p. 466-467).

"Argentina subsequently experienced a severe banking crisis in January 1891, in part, because of Banco Nacional's weakened financial position brought on by its transfer of assets to British creditors and its support of the Bank of the Province of Buenos Aires. The financial crisis worsened. The Bank of London and River Plate was the only bank that did not close its doors during the crisis" (p. 467)

Triner & Wandschneider (2005): "In November 1890, London brokerage house Baring Brothers notified Argentina it would not be able to remit the third installment of a loan they had promised. Argentina was subsequently unable to service its existing debt. The subsequent external default brought down Baring Brothers and sent a shock wave through financial markets and banking systems worldwide... In 1891, the Italian Bank of the River Plate suffered severe runs and later failed. London and the River Plate Bank also suffered from a run but received liquidity from Baron Rothschild" (p.).

Banks Failed: Banco Nacional, Italian Bank of the River Plate, Banco de la Provincia de BA, Banco Hipotecario Nacional.

Policy responses: In the early part of the crisis, after assuming the Argentine presidency in August 1890, Carlos Pellegrini issued 60 million new pesos to shore up the banking system, providing 50 million Pesos in loans to be divided between the Banco Nacional and the National Mortgage Bank (which had been suffering depositor runs) and 10 million to go to the municipality of Buenos Aires. The government then allowed banks to issue notes against the gold bonds they held.

In May 1891, after the severe second phase of the banking crisis starting in November 1890, Pellegrini detailed plans for a new bank, Banco de la Nacion Argentina, which would issue new equity and take over the remaining assets of the Banco Nacional (Hodge, 1970).

Consequences: According to our data, real GDP dropped by 16 per cent during the ensuing recession.

Mitchener & Weidenmier (2008): Argentina's real GDP fell by 11 percent between 1890 and 1891. Argentina suffered a deep recession for several years and did not fully recover from the crisis until the turn of the century, following a debt workout and more than a decade of monetary and fiscal reforms (p. 467).

Sources:

Bordo, M., & Eichengreen, B. (1999). *Is Our Current International Economic Environment Unusually Crisis Prone?* In Gruen, D., & Gower, L. (eds.). Conference: Capital Flows and the International Financial System. Reserve Bank of Australia. pp. 18-74

Cachanosky, N. (2012). The Law of National Guaranteed Banks in Argentina, 1887–1890: Free-Banking Failure or Regulatory Failure? *The Independent Review*, 16(4), 569-590.

Hodge, J. (1970). Carlos Pellegrini and the Financial Crisis of 1890. *The Hispanic American Historical Review*, 50(3), 499-523.

Mitchener, K. J., & Weidenmier, M. D. (2008). The Baring Crisis and the Great Latin American Meltdown of the 1890s. *Journal of Economic History,* 68 (2), 462-500.

Triner, G., & Wandschneider, K. (2005). The Baring Crisis and the Brazilian Encilhamento, 1889–1891: An Early Example of Contagion Among Emerging Capital Markets. *Financial History Review, 12*(2), 199-225.

1914

Background and causes: The crisis was precipitated by an agricultural land price boom with credits extended by European banks (Lough, 1915, pp. 7-15). The crops did poorly in 1913-14 and in the following three years. The national GDP in Argentina slipped by 19 per cent from 1912 to 1917 (Nakamura & Zarazaga, 2001, p. 26).

Nakamura & Zarazaga (2001): "In London, the bank rate was raised in late 1912, and monetary pressure was not relaxed until early 1914 [. . .] In the first quarter of 1913, gold continued to be imported into Argentina at a phenomenal rate (35 million gold pesos), and in the second quarter (10 million), gold was still being imported at the rate of the previous year. But in the second half of the year, 42 million gold pesos were exported [. . .] The 1913-14 crop did very poorly. Cereal exports for October 1913 to September 1914 fall to 182 million gold pesos from 322 in 1912-13. By June 1914, a generalized depression had resulted" (p. 24).

The crisis: Starting as early as 1912, the disturbances of the domestic economy began to lead to widespread withdrawals of cash from the private banks. When World War I broke out in and general depression occurred in July 1914, people scrambled for cash for security. Deposits at Argentine banks fell by as far as twenty percent and private banks experienced severe runs (Nakamura

& Zarazaga, 2001). Lough (1915, pp. 7-15) notes the failure of Banco Frances in August 1914 due to excessive land speculation. Banco Español also faced difficulties. There was a flight-to-quality effect on the Banco de la Nacion: depositors withdrew cash from the private banking system, as the reserve-deposit ratios at the Banco de la Nacion climbed, presumably because of its government guaranteed status. Banco de la Nacion used its emergency powers to rediscount commercial obligations of weaker private banks (Della Paolera & Taylor, 2001). *Banks Failed:* Banco Frances.

Nakamura & Zarazaga (2001): "Beginning in 1912, the disturbances of the domestic economy began to lead to widespread withdrawals of cash from the private banks, some of it in favor of the Bank of the Nation, which was clearly perceived as a safe haven. [In 1914,] total deposits at Argentine banks fell by nearly 20 percent. The brunt of the hardship fell on private banks, which lost over 45 percent of their deposits" (p. 25).

Federal Reserve Board (1920): "When the war broke out in the middle of 1914, Argentina was emerging from an industrial and economic crisis, and the sudden discontinuance of European markets and European supplies, the demoralization of foreign exchange, together with a great scarcity of available shipping facilities, produced an alarming situation" (p. 592).

Roberts (2013): "The prospect of war and news of stock exchange closures in Europe triggered, as elsewhere, a scramble for cash in countries of Latin America. The dumping of securities and withdrawals of deposits led to the closure of the sub-continent's eight bolsas on 30 July and the declaration of extended bank holidays. Then, in eleven countries, came a moratorium—Argentina, Bolivia, Brazil, Chile, Costa Rica, Ecuador, Haiti, Nicaragua, Paraguay, Salvador, and Uruguay. This was accompanied by suspension of the convertibility of notes into gold in countries that were on the gold standard and bans on the export of gold" (p. 215).

Policy responses: Regulatory actions included a one-week bank holiday, a one-month moratorium that excluded deposits, and a 30M peso fund to purchase short-term debt from banks to provide them with liquidity. The Office of Conversion suspended convertibility of paper currency into gold. Exports of gold to Europe were prohibited for the duration of WWI. Actions were taken by Banco de la Nacion and other strong banking institutions in Buenos Aires to provide liquidity support to weaker banks (Lough, 1915, pp. 7-15).

Lough (1915): "On August 9 a law was passed which extended the time for payment of internal obligations, except bank deposits, falling due in the month

of August, for 30 days" (p. 11).

Federal Reserve Board (1920): "The Government adopted a number of temporary measures to meet the emergency. A one-month moratorium was declared; the exchange of notes for gold at the conversion office was suspended; supervision of foreign-exchange transactions was entrusted to the Banco de la Nacion; the bank was also authorized to mobilize for commercial purpose 30 millions of gold which it held in the conversion fund; the conversion office was empowered to rediscount commercial paper for the Banco de la Nacion and to issue notes in exchange, provided the ratio of gold to notes at no time fell below 40 per cent" (p. 592).

Consequences: Della Paolera & Taylor (2001) write that "the dimension of the crisis cannot be overstated: this was by far the biggest recession in Argentine history, and the cumulative loss of output during the trough exceeded such losses in the Baring crisis and the Great Depression" (p. 171).

Nakamura & Zarazaga (2001): "Agricultural production had only one good year in the next three—1914-15, and does not fully recover until 1917-18. The nonagricultural sector's production fell 15 percent from 1913 to 1914, and another 10 percent from 1914 to 1915. In all, from 1912 to 1917, Argentina's real gross domestic product slid 19 percent while population rose nearly 14 percent. Output per capita thus fell nearly 29 percent, with consequences that have reverberated throughout the century" (p. 24).

Sources:

Lough, W. H. (1915). *Financial Development in South American Countries*. United States: Department of Commerce. Bureau of Foreign and Domestic Commerce. Government Printing Office.

Nakamura, L. & Zarazaga, C. (2001), Banking and Finance in Argentina in the Period 1900-35: *Research Papers*, Federal Reserve Bank of Dallas.

Della Paolera, G., & Taylor, A. M. (2001). *Straining at the anchor: The Argentine Currency Board and the search for macroeconomic stability, 1880-1935*. Chicago: University of Chicago Press

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Roberts, R. (2013). *Saving the City: the great financial crisis of 1914*. Oxford University Press.

1930

Background and causes: "The Great Depression began in Argentina in the late 1920s. Like many countries of the periphery, Argentina was exposed to the commodity lottery and the terms of trade worsened in the 1920s" (Della Paolera & Taylor, 2001, p. 188). "The collapse of commodity prices forced a generalized default of many farmers and the collapse of trade resulted in falling revenue for the government, resulting in a failure to pay for its debt and putting pressure on the banks" (Rocha & Solomou, 2015, appendix I).

The crisis: "By December 1929, the balance-of-payments crisis was severe and the exchange rate was left to float after a mere two-year resumption of the gold standard" (Della Paolera & Taylor, 2001, p. 188). "Argentina left the gold standard in 1929 but the debt overhang from the 1920s resulted in a build-up of insolvent bank loans" (da Rocha & Solomou, 2015 appendix I).

Conde (2010): "The fall of primary products' prices in the international markets not only affected the agricultural sector but the banks as well. Because of the huge drop in earnings, the rural sector—which was strongly indebted to the banks—became unable to pay its liabilities. The generalized default of the farmers not only affected the liquidity of the banks but also the value of their assets, pushing them to the edge of insolvency. This situation was aggravated by failure of the government to afford the payments of its debt with the banks, due to the effect that the fall in international trade had on its revenues" (p. 7).

Banks failed: None that we could identify.

Policy responses: Fiscal policy played no role, however – if anything it tightened during the period because of inflationary fears, as in many other countries at the time. The Conversion Office decided to begin rediscounting in April 1931, marking a fundamental change in economic thought towards independent monetary policy. To counter the liquidity crunch in the banking sector, "the Banco de la Nación [...] made abundant use of its rediscount provision in creating banking money to help other banks in distress" (p. 214) refinancing itself through the newly founded discount window at the Conversion Office. It is likely that this change in policy contributed to why the "Argentine Great Depression was so mild and short-lived by international standards" (p. 190).

Della Paolera & Taylor (2001): "However, in monetary policy actions from 1929 to 1935 we see evidence of a change of regime. Many commentators see the creation of the central bank (Banco Central) in 1935 as the main monetary policy event of the 1930s in Argentina. We instead emphasize the remarkable

decision of the Conversion Office to begin rediscounting in April 1931 and so forge an independent monetary policy. In many ways, we would argue, the Central Bank merely rubber-stamped this new macroeconomic policy regime and continued its operations after 1935. Yet, did [the actions of the Conversion Office] make a difference? We argue that the change of monetary regime was essential to Argentina's recovery in that it helped avert a devastating collapse of prices, and, potentially, of output in 1931-33. Instead of following the United States and other countries into this abyss, Argentina's regime shift destroyed deflationary expectations. Previously extremely high real interest rates were permanently lowered [. . .]" (p. 188-190).

Consequences: Della Paolera & Taylor (2001, pp. 188-190) further report that "recovery began in 1931 as output grew for the first time in several years. By 1934-35 output had regained its 1929 level." (p. 188)

Sources:

Da Rocha, B. T., & Solomou, S. (2015). The effects of systemic banking crises in the inter-war period. *Journal of International Money and Finance,*54, 35-49.

Della Paolera, G., & Taylor, A. M. (2001). *Straining at the anchor: The Argentine Currency Board and the search for macroeconomic stability, 1880-1935*. Chicago: University of Chicago Press.

Conde, R. C. (2010). The monetary and banking reforms during the 1930 Depression in Argentina. Working Paper, No. 98. Universidad de San Andres, Departamento de Economia.

1934

Background and causes: Bernanke & James (1991), Bordo et al. (2001), and Reinhart & Rogoff (2009) consider this as a separate crisis event from 1931, and we follow this line of thought.

The crisis: Della Paolera & Taylor (2001) report that the Banco de la Nación accumulated large quantities of bad assets through its rediscounting activities that did not strictly follow the Bagehot principle. It allowed the private banks to offload assets of inferior quality on to the balance sheet of the state bank as collateral for liquidity provisions at an interest rate below which was below the rate it offered on time deposits. Della Paolera & Taylor (2001) report that at Banco de la Nación, "by 1931, the capitalization fell to 10% of loans; soft rediscounting and non-performing loans amounted to 24% of loans and increased to an all-time high of 29% by 1934." Ultimately, Banco de la Nación

required a massive bailout in 1935 that it received from the government and the newly founded central bank.

Nakamura & Zarazaga (2001): "The melancholy demise of the BNA (Banco Nacional de Argentina) in 1935 detailed in Della Paolera and Taylor (1999) was due to bad loans arising predominantly in the private banking system. They calculate that one third of all private banking loans had gone bad by then [. . .]" (p. 30).

Banks Failed: Banco Espanol del Rio de la Plata, Banco el Hogar Argentina, Banco Argentina-Uruguayo, Ernesto Tornquist & Co., Banco Nacional de Argentina.

Policy responses: Della Paolera & Taylor (2001, p. 176) write: "Ultimately, in 1935, as part of a political economy solution worked out by the government and its new central bank, the banks got the final bailout they sought to head off an insolvency crisis arising from decades of bad loans-a solution with high social costs." Bernanke and James (1991) report that the banking problems resulted in a government-sponsored merger of four other banks (Banco Espanol del Rio de la Plata, Banco el Hogar Argentina, Banco Argentina-Uruguayo, Ernesto Tornquist & Co.). Della Paolera & Taylor (2001) estimate that the bailout by the Instituto Movilizador de Inversiones Bancarias (a specific-purpose institution created in 1935) included about 32 percent of the loans of the private banking system, suggesting that this was a major systemic crisis.

Consequences: Della Paolera & Taylor (2001, pp. 188-190) report that "by 1934-35 output had regained its 1929 level" (p. 188). Private credit in relation to GDP, however, was still in decline. Ultimately the ratio collapse by one-third.

Sources:

Bernanke, B., & James, H. (1991). The gold standard, deflation, and financial crisis in the Great Depression: An international comparison. In Hubbard, R. G. (ed.), *Financial markets and financial crises*, 33-68. Chicago: University of Chicago Press.

Della Paolera, G., & Taylor, A. M. (2001). *Straining at the anchor: The Argentine Currency Board and the search for macroeconomic stability, 1880-1935*. Chicago: University of Chicago Press.

Nakamura, L. I., & Zarazaga, C. E. (2001). Banking and Finance in Argentina in the Period 1900-35, FRB Philadelphia Working Paper, No. 01-7

Bordo, M., Eichengreen, B., Klingebiel, D., & Martinez-Peria, M. S. (2001).

Is the crisis problem growing more severe? *Economic policy*, *16*(32), 52-82.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

1980

Background and causes: The crisis followed a wave of deregulation in the late 1970s after a military government seized power in 1976. The economic problems, however, persisted within the new governance, including a hyperinflation rate at around 382 per cent and a high foreign debt rate due to immobile and depleted domestic credit. Banks leveraged up significantly and were engaged in arbitrage operations exploiting differences between the official and effective exchange rates (Montanaro, 1990). In an economic downturn profits of highly leveraged firms declined bringing banks in jeopardy.

Montanaro (1990): "The financial deregulation which the new regime implemented was part of a plan to free the economy by improving the allocative efficiency of the banking system... The Banking Act of 1977 decentralized deposits, whilst keeping 100 per cent guaranteed free public insurance... Between 1978 and 1980 there was an explosion of banking euphoria due to the following circumstances: the freedom to contract rates; the possibility of financing and/or investing in hard currency... and the enormous opportunities to make money out of arbitrage on exchange rates caused by the growing gap between the official and the effective rate of exchange." Also, the extent of leverage by firms in the real economy appeared to grow strongly.

The crisis: Montanaro (1990) citing Feldman (1983) says that distress in the banking sector reached panic proportions in Argentina in March 1980. The failure of Banco de Intercambio in 1980 initiated an overall banking crisis with three other bank failures (Kaminsky, 2003). Sixty-eight other banks failed, including the third, seventh, and ninth largest banks in the nation (Montanaro, 1990).

Montanaro (1990): "The expectation that when controls became more stringent the number of banks declared insolvent would increase, showed itself to be well founded. Panic spread amongst small and large depositors, triggering the corrida bancaria [bank runs] and massive flights of capital" (pp. 72ff)

Banks Failed: Banco de Intercambio Regional, Banco de los Andes, Banco Oddone, Banco International and other 68 banks by 1982 (Montanaro, 1990). LIquidiated or intervened banks accounted for 16% of assets of commercial banks and 35% of total assets of finance companies (Caprio & Klingebiel,

1996).

Policy responses: The Argentinian government spent a sum estimated at 3 per cent of GDP and 20 per cent of deposits to cover depositors' insurance in the first year alone of the crisis.

Montanaro (1990): "In just the first two months of the crisis, the additional liquidity pumped into the system reflecting the extraordinary rediscounts to the banks in trouble, was of the order of $2.6 billion, 27 per cent of the country's monetary base." But he later writes, "When the crisis exploded, the BCRA [the Argentinian central bank] did not intervene quickly enough in favor of the troubled banks in its role of lender-of-last-resort, but tried mainly to fulfil its duties as regards depositor's insurance" (pp. 72ff).

Consequences: According to our estimates real GDP decline by over 10% and private credit in relation to GDP by more than 40%. The Public debt-to-GDP ratio tripled over the course of the 1980s.

Sources:

Montanaro E. (1990). The Banking and Financial System in Argentina: The History of a Crisis. In: Gardener E.P.M. (ed.) *The Future of Financial Systems and Services*. Palgrave Macmillan, London

Honohan, P. & Klingebiel, D. (2000). Controlling the Fiscal Costs of Banking Crises. World Bank Policy Research Working Paper, No. 2441. Washington, DC: World Bank.

Caprio, G. & Klingebiel, D. (1996). Bank Insolvencies, Cross-Country Experience. World Bank Policy Research Working Paper, No. 1620. Washington, DC: World Bank.

Kaminsky, G. L. (2003). Varieties of Currency Crises. *NBER Working Papers, 10193*. National Bureau of Economic Research.

Feldman, E. V. (1983). La crisis financiera argentina: 1980-1982. Algunos comentarios. *Desarrollo económico*, *23*(91), 449-455.

1985

Background and causes: Hyperinflation persisted from the beginning of 1980s and rose from 434 percent to 580 percent in 1985. The Argentine government sought $4.2 billion foreign bank loans and $1.7 billion in IMF credit. Domestically, it agreed to decrease the budget deficit, devalue the peso more quickly, and increase interest rates to combat inflation (CIA, 1985, pp. 1-

3). However, the IMF found Argentina incompliant in 1984 which led other creditors to suspend their $3.2 billion loans in March

The crisis: "The first shock came in March 1985, when the IMF—finding Argentina out of compliance with several fourth-quarter 1984 targets—halted loan disbursements [...]. As a result, exasperated creditors suspended completion of the $3.2 billion bank loan [...]. New lending regulations precipitated several bank failures, including that of the third-largest private bank. This sparked a run on other banks [...]" (CIA, 1985, p. 3). In April 1985, the government raised reserve requirements for banks which triggered a second round of bank failures. In the following month, the country's 11th largest bank, Banco de Italia and Rio de la Plata failed. It was at the time the eighth bank to fold since the regulation change (Chavez, 1985).

Banks Failed: Banco de Italia y Rio de la Plata and at least seven others.

Policy responses: Dollar deposits were frozen for 120 days. The government launched a stabilization program in 1985 called the 'Plan Austral' [...]. In June 1985, President Alfonsin announced a wage and price freeze and replaced the peso with the Austral (CIA, 1985, p. 10).

Consequences: Real GDP declined by 7.6% and private credit nearly halved in relation to GDP.

Sources:

Central Intelligence Agency (1985). Argentina: Prospects for Economics Stabilization. An Intelligence Assessment, November.

Chavez, L. (1985). Argentina Shaken by Bank Failures. The New York Times, May 13. Available at: https://www.nytimes.com/1985/05/13/business/argentina-shaken-by-bank-failures.html.

1989

Background and causes: Caprio & Klingebiel (1996) report that the major cause of this crisis was "public sector debt distress coupled with loss of access to international credit markets" (p. 27). They surmise that the trigger of the crisis was the "government's decision to free [the] foreign exchange market and remove all price controls which provoked a sudden price increase and led to bank deposit withdrawals" (ibid.) which in turn led to severe illiquidity problems. In 1989, the government had released the 'Bunge y Borne plan' to stabilize exchange rates by tightening monetary policy and so forcing high domestic interest rates (Beckerman, 1995). However, from previous

hyperinflationary periods, the Argentine public sector and central bank were already so heavily burdened with external debt that the high interest rate further increased their distress level. After adopting numerous reforms to defend their fixed exchange rate in the face of a dwindling supply of foreign reserves, devaluing the official exchange rate became inevitable.

The crisis: "By May 1989 the economy was in full-blown hyperinflation, fueled by the Central Bank's provision of base money to banks so withdrawals would not force them to close" (Beckerman, 1995, p. 673).

Banks Failed: Banks failed accounted for 40% of financial system assets (Caprio & Klingebiel, 2003, p.7). Names unknown.

Policy responses: "Towards the end of 1990 [...] Treasury expenditure surged, and the Central Bank provided rediscount support to private banks that had lent heavily in the interbank market to distressed banks owned by provincial governments [...]. This produced a new burst of high inflation." (p. 680).

Consequences: We estimate the output loss due to this crisis at around 12%.

Sources:

Caprio, G. & Klingebiel, D. (1996). Bank Insolvencies, Cross-Country Experience. World Bank Policy Research Working Paper, No. 1620. Washington, DC: World Bank.

Caprio, G. & Klingebiel, D. (2003) Episodes of Systemic and Borderline Financial Crises. Report. Washington DC: The World Bank.

Laeven, M. L., & Valencia, M. F. (2018). Systemic banking crises revisited. IMF Working Paper, No. 18/206. Washington, DC: International Monetary Fund.

Beckerman, P. (1995). Central-Bank 'Distress' and Hyperinflation in Argentina, 1989-90. *Journal of Latin American Studies,* 27(3), 663-682.

1995

Background and causes: According to Jacome et al. (2011), "Latin America had liberalized financial markets during the late-1980s and early-1990s and this encouraged growing capital inflows, attracted also by increasing macroeconomic stability. As a result, real interest rates declined and the domestic currencies appreciated, all of which fostered a credit boom. Unfortunately, financial liberalization was not coupled with better financial surveillance and

enforcement capacity of bank regulators [. . .]" (p. 6).

The crisis: "The end-1994 Mexican devaluation triggered a wave of uncertainty on the sustainability of the currency board in Argentina, leading to widespread deposit runs and large capital outflows. As a result, from end-December to January 1995, peso deposits fell more than 15 percent" (Jacome, 2008, p. 27). Jacome et al. (2011) characterize this event as a small crisis, especially in relation to the much larger event following at the turn of the century.

Banks Failed: About 40 small and medium size banks failed or were acquired or merged (almost one third of total banks) representing about 12 percent of the system (Jacome et al., 2011, p. 27).

Policy responses: Jacome (2008) reports that the authorities took several policy measures that were successful. The "government passed a law in May 1995 that allowed the central bank to get involved in the resolution of distressed banks. The new legislation created the basis for conducting bank mergers, acquisitions, purchase and assumption operations, as well as other resolution procedures to replace the straight liquidation of an impaired bank [...]. A temporary Capitalization Trust Fund—funded by international and government resources—was created to inject capital into impaired institutions via a subordinated loan or by buying non-liquid assets. A third reform was the creation in April 1995 of a deposit insurance system to be fully funded from the private sector. Based on this new legal framework, from December 1994 to end-1995, out of 137 banks, 9 financial intermediaries failed and over 30 were either acquired or merged into a single institution." (p. 27). The central bank acted as a lender of last resort with certain lending limits and later focused on purchase and assumption operations.

Jacome (2008): "Argentina in 1995 [. . .] handled financial turbulence without allowing it to turn into full-fledged financial crises [. . .]" (p. 25).

Jacome et al (2011): "Countries with super-fixed and fixed exchange rate regimes—like Argentina (1995) [. . .] could preserve exchange rate stability at the cost of losing international reserves, provided the financial turbulence was not sufficiently strong to make the peg unsustainable" (p. 13).

Consequences: Real GDP declined by less than 3%.

Sources:

Jacome, H., Sedik, T. S., & Townsend, S. (2011). Can emerging market central banks bail out banks? A cautionary tale from Latin America. IMF Working

Paper, No. 11/258. Washington, DC: International Monetary Fund.

Jacome, H. (2008). Central Bank Involvement in Banking Crises in Latin America. International Monetary Fund Working Paper, No. 08/135. Washington, DC: International Monetary Fund.

2000

Background and causes: In December 2001, Argentina defaulted on its external public debt. Zettelmeyer (2018, p. 21) indicates that the crisis in Argentina was caused by external market shocks from Russia (default in 1998) and Brazil (currency devaluation in 1999) which drew capital out of Argentina and other emerging markets. Since 1998, Argentina had been in a recession with negative growth for three consecutive years prior to 2001 (Marshall, 2009).

Jacome et al. (2011): "In Argentina (2002) the value of the U.S. dollar quadrupled with respect to the peso as the country exited the currency board... Self-fulfilling expectations of a large currency depreciation turned into a speculative attack against the domestic currency and, hence, the central bank was forced to abandon the peg before international reserves were exhausted, thereby triggering [a balance of payments crisis]" (p. 13).

Marshall (2009): "Whereas the Mexican banking crisis took most investors by surprise, as classic crises are wont to do, the Argentine crisis was announced well in advance. When bank withdrawals were partially frozen in December 2001, the Argentine economy had experienced more than three years of negative growth. The market for Argentine bond default swaps had dried up months in advance, and local branches and subsidiaries of foreign banks had been repatriating record amounts of U.S. dollars throughout the year in preparation for the impending crisis. Yet although banks were eventually greatly affected by the economic crisis, they had little part in its decade-long gestation.

The defining characteristic of the Argentine economy during the 1990s was the one-to-one convertibility of the U.S. dollar to the Argentine peso, guaranteed by a currency board. With virtually no control over monetary policy, the Central Bank of Argentina could no longer provide a lender of last resort function to the domestic banking sector. Recognizing this structural weakness, authorities maintained strict supervision over local banks, while foreign banks, controlling around half of the market's share by the end of 2001, maintained their own internal controls. As a result, at the end of 1998, as measured by the World Bank's criteria of financial strength, the Argentine banking system was the twenty-first most robust in the world, tied with Hong Kong's (Yeyati

et al., 2002). During the years prior to the banking crisis, banks operating in the country did not foster any monetary expansion (due to convertibility), and the levels of speculation and fraud that accompany periods of euphoria were not present.

However, the banks were obviously not immune to crisis. After the structural imbalances created under convertibility plunged the economy ever deeper into depression, the historically punished Argentine deposit holders moved increasingly large amounts of savings out of domestic banks" (p. 676).

The crisis: Although the Argentine banking system had been deemed robust according to the World Bank, the announcement of a change to the exchange rate parity "initiated bank runs [especially at domestic banks] by mid-2001, which intensified towards the second half of the year, leading to a deposit freeze, a bank holiday, riots, and major political instability" by the end of the year (Laeven & Valencia, 2018). "As of December 2001, almost 24 percent of total deposits had been removed [...]. When the partial freeze on withdrawals was decreed, the banking sector entered full-blown crisis. Shortly thereafter, the system of convertibility was annulled, and a currency crisis arose" (Marshall, 2009, pp. 676-677). Jacome (2008, p. 42) report that three foreign banks failed and that other bank accounting for 12% of deposits were intervened or taken over by public banks.

Banks Failed: Three foreign banks exited the market. Credit Agricole, Bisel, and Entre Rios were intervened and their administration transferred to the Banco de la Nación to be privatized later.

Policy responses: According to Jacome et al. (2011), "12 private and public banks (40 percent of deposits) received liquidity assistance, and bank resolution was applied to three foreign banks that exited the market" (p. 27) [...] The monetary assistance extended to financial institutions exceeded 8 percent of GDP, and was mostly provided to public banks; although private banks, including few foreign institutions, also received central bank support [...]" (p. 10)

Consequences: The economic consequences of the default were severe. Real GDP decline by over 18%, according to our estimates, private credit-to-GDP collapsed by over 60%, and public debt ratio almost tripled in relation to GDP. There is also evidence that depositors suffered losses from bank failures.

Sources:

Zettelmeyer, J. (2018). Lessons from the 2000–2002 crisis in Argentina for the sustainability of the Euro. *ifo DICE Report*, 16(3), 21-24

Jacome, H., Sedik, T. S., & Townsend, S. (2011). Can emerging market central banks bail out banks? A cautionary tale from Latin America. IMF Working Paper, No. 11/258. Washington, DC: International Monetary Fund.

Jacome, H. (2008). Central Bank Involvement in Banking Crises in Latin America. International Monetary Fund Working Paper, No. 08/135. Washington, DC: International Monetary Fund.

Marshall, W. (2009). Origins of Banking Crises in Latin America: A Critical View. *Journal of Post Keynesian Economics,* 31(4), 669-690.

Laeven, M. L., & Valencia, M. F. (2018). Systemic banking crises revisited. IMF Working Paper, No. 18/206. Washington, DC: International Monetary Fund.

Australia

1893

Background and causes: A domestic lending boom fueled by capital inflows from the UK inflated speculative asset price bubbles in land, real estate and mining company shares. When commodity prices started to decrease, borrowers began to default, brining banks into distress. Globally, further pressure came from the Baring crisis, which erupted in the UK in 1891 and disrupted foreign capital inflows. In this situation, the credit bubble burst.

Bordo & Eichengreen (1999): "The run-up to the crisis saw a frenzied land boom involving both pastoral and urban real estate. The period was one of rapid entry into the financial system by new intermediaries into an essentially unregulated banking system" (p. 40).

Merrett (2013): "This was a focused affair: a banking crisis. There was no associated crisis in sovereign debt markets." Commodity prices decreased, leading to borrower defaults. This subsequently led to stress in the banking system" (p. 412).

The crisis: Merrett (2013) reports the failure of Commercial Bank of Australia in March 1892 and Federal Bank of Australia in January 1893 due to their close associations with building societies. Fifty-four deposit taking Australian banks, and thirteen trading banks followed in their footsteps, although twelve trading banks and at least 20 deposit-taking institutions were able to reopen in 1893 (Kent, 2011).

Bordo & Eichengreen (1999): "The immediate lead-up to the crisis saw falling export prices, which made it hard for the pastoral sector to repay its loans (in turn undermining real-estate speculation based upon pastoral expansion). The trigger was the closure of the Mercantile Bank of Australia and the Federal Bank of Australia, two of the new institutions, followed by the Commercial Bank of Australia. British deposits ran off, and residents moved theirs from smaller to larger banks. Cork (1894) puts deposits lost in the crisis at 7.5 per cent" (pp. 40-41).

Merrett (2013): "Widespread failures were evident among the land banks and building societies through 1891 and 1892 and intensified the fears of trading bank depositors." (Trading banks were the larger banks that were allowed to issue bank notes). "The suspension and liquidation on March 5, 1892 of the Mercantile Bank of Australia and on January 28, 1893 of the Federal Bank of Australia, both of which were closely linked to building societies, heightened

anxiety about the safety of the other twenty-two banks." "The Commercial Bank of Australia, the largest bank in the colony of Victoria, whose capital Melbourne was the epicenter of the speculative building boom, shut on April 5, 1893. Within six weeks, thirteen of Australia's twenty-two trading banks had suspended operations" (p. 412).

Banks failed: At least 30 deposit-taking institutions failed and permanently closed their doors. Other banks only temporarily suspended payments and were able to reopen later. Among the failed banks were Mercantile Bank of Australia, Federal Bank of Australia, and Queensland National Bank. According to Kent (2011), "Between 1891 and 1893, 54 deposit-taking financial intermediaries closed their doors, 60% of these permanently (Boehm, 1971; Pope, 1991). Despite a widespread loss of confidence in the banks, some depositors transferred funds from the weaker banks to the older, more conservative banks. In total, 13 trading banks closed their doors in 1893—at which time they controlled around half of trading bank deposits. Of these, 12 underwent reconstruction—a process that involved agreements that were binding with the approval of three-quarters of creditors, typically allowing reopening as new companies under old names, with newly acquired capital (much from former creditors) and deferred payment of deposits" (p. 129).

Policy responses: In response to the crisis, in New South Wales, the government legislated to make bank notes legal tender for six months, but this did not seem to have helped much (Bordo & Eichengreen, 1999). Much of the government action at this time was centered around making public announcements meant to shore up public confidence in the banks and to prevent runs. In 1892, the government passed the Companies Act Amendment Act, which strengthened the rights of creditors in the event of bank insolvency and gave the court system more oversight and power in imposing plans for the resolution of insolvent banks that preserved assets for all classes of creditors. "The proclamation of a five-day bank holiday on April 30, 1893 [...] increased uncertainty, and the strong banks ignored it", writes Merrett (2013, p. 412). Queensland National Bank received government guarantees due to political connections.

Bordo & Eichengreen (1999): "In New South Wales, bank notes were given legal-tender status to ease access to means of payment, and the government declared a 5 day bank holiday. Some banks never reopened their doors. Tens of thousands of depositors had their claims extended -- for four years and more & before any withdrawals could be made, and in some cases claims were converted into stock and preference shares. Bank share prices fell heavily. The

banks retrenched, withdrawing from the business of long-term lending. The "depression" of the 1890s followed" (pp. 40-41).

Merrett (2013): "All of the banks had reopened within a few months of suspending... The bargain with creditors was that instead of liquidation they accepted a conversion of their deposits into longer-dated securities and, in some cases, preference shares. The shareholders had to meet fresh calls for capital... Governments in each of the three colonies where bank panics occurred took a variety of measures to prevent or alleviate the crash... [Colonial governments banned short-selling of bank stocks.] In an attempt to retain confidence in bank notes, which were not in the first charge on bank assets in New South Wales, the government legislated to make bank notes legal tender for six months" (p. 412).

Consequences: According to Merrett (2013), "recent research suggests that by some measures the 1890s depression in Australia was deeper and longer lasting than that of the 1930s" (p. 409). From our data, we estimate that this crisis was comparable in its severity to the Great Depression in Australia. Real GDP declined by 15% and private credit contracted by almost 40% in relation to GDP.

Kent (2011): "Depositors incurred direct losses associated with failures (about 4% of total trading bank deposits in 1891) and there were considerable indirect losses via frozen deposits (in some cases until as late as 1918 (RC, 1937)). Many customers sold deposit receipts in secondary markets for less than face value (the discount was about 25% in 1894)" (p. 129).

Sources:

Merrett, D. (2013). The Australian Bank Crashes of the 1890s Revisited. *The Business History Review*, 87(3), 407-429.

Bordo, M., & Eichengreen, B. (1999). Is Our Current International Economic Environment Unusually Crisis Prone? In Gruen, D., & Gower, L. (eds.). *Conference: Capital Flows and the International Financial System.* Reserve Bank of Australia, 18-74

Kent, C. J. (2011). Two depressions, one banking collapse: Lessons from Australia. *Journal of Financial Stability*, 7(3), 126-137.

1931

Background and causes: The Great Depression in Australia was triggered by a sharp fall in export prices and a drying up of overseas loans. Australia's

terms of trade fell dramatically, causing a balance of payments crisis in 1929 (Fitz-Gibbon & Gizycki, 2001, p. 37).

The crisis: Only three banks failed in total—the Primary Producers Bank, the Federal Deposit Bank, and the Government Savings Bank of New South Wales. The Government Savings Bank of New South Wales and The State Savings Bank of Western Australia had to suspend payments after facing bank runs. The Government Savings Bank of New South Wales additionally suffered from political quarrels related to the election in New South Wales (NSW) in 1930. The Nationalist candidate announced that would use the bank's funds to finance expansionary policies in case of election, which exacerbated the speed of withdrawals. When the NSW Treasury defaulted on its debt obligations in February 1931, the bank received a further blow, having been the largest holder of NSW government securities. Government Savings Bank of NSW sought assistance from the Commonwealth Bank but the £3 mil. it received proved insufficient. Ultimately, it was announced that the bank would be merged with the Commonwealth Bank, triggering such severe withdrawals that the bank suspended payments on April 22. The insecurity spread and on May 1, a bank run began at the Commonwealth Savings Bank, a division of the Commonwealth Bank. The State Savings Bank of Western Australia faced liquidity constraints, too, but since the Treasury of Western Australia honored its debts, it was not affected as badly as the Government Savings Bank. Ultimately, it merged with the Commonwealth Bank.

Fitz-Gibbon & Gizycki (2001): "[After the run on the Government Savings Bank of NSW], in April 1931, the [Primary Producers Bank of Australia] sought the assistance of the Commonwealth Bank in anticipation of a run following the suspension of the Government Savings Bank [...] In 1930, the Primary Producers Bank of Australia accounted for less than 0.5 per cent of Australian banks' deposits. Most of its customers were farmers, and as the prices of primary produce fell the bank suffered a steady drain on its resources. Over the 18 months prior to the bank's closure, it lost 40 per cent of its deposits [...]" (p. 39).

"The general uneasiness following the failure of the Primary Producers Bank and the suspension of the Government Savings Bank of NSW led to a steady loss of deposits from the Federal Deposit Bank. This bank was more a building society than a fully-fledged bank and accounted for less than 0.2 per cent of Australian banks' deposits. The directors of the bank sought assistance from the Commercial Banking Company of Sydney, which released fixed deposits the Federal Deposit Bank held with it and lent to the bank against its holdings

of government securities... The day after the Federal Deposit Bank suspended payment, the Queensland Deposit Bank was subject to a heavy run. The bank withstood this run with aid from the National Bank of Australasia, which lent it £50,000 in bank notes (Blainey 1958)" (p. 40).

Banks failed: Primary Producers Bank, Federal Deposit Bank, Government Savings Bank of New South Wales (Fisher & Kent, 1999), The State Savings Bank of Western Australia (Fitz-Gibbon & Gizycki, 2001). The failing banks represented less than 1% of the deposits in Australia's banking system (Kent, 2011).

Policy responses: Generally, the Commonwealth Bank (established by the government in 1911 and endowed with certain lender-of-last resort functions) did not take a highly active role in emergency lending during the crisis (Fitz-Gibbon & Gizycki, 2001). It offered two limited emergency loans to the Primary Producers Bank when it faced liquidity shortfalls. There was no government liquidity assistance to banks.

Fitz-Gibbon & Gizycki (2001): "While the Commonwealth Bank provided some limited support to two... banks, it was later criticised for not taking a more active role, particularly since two of the banks were solvent when they suspended payment... Even during the height of the balance of payments crisis in 1929, the Commonwealth Bank lacked the power to obtain data on individual banks' London funds... Two other reasons might be advanced for the Commonwealth Bank's reluctance to provide stronger support. The first was a concern to conserve its own resources. This was borne out by the bank's objective that any recipient of assistance be able to repay its obligations. The second was that, although the bank's powers had gradually expanded during the 1920s, it remained relatively inexperienced in acting as a central bank" (p. 39).

"The [Government Savings Bank of NSW] sought specific assistance from the Commonwealth Bank, asking for funds and some reassuring statement by the Commonwealth Bank suggesting it would stand behind the bank. The Commonwealth Bank indicated it was not willing to make so large a guarantee (deposits of the Government Savings Bank were around £60 million, compared with the Commonwealth Bank's total assets of £52 million). However, it did indicate it was willing to prepay the fixed deposit the Government Savings Bank held with it and discount fixed deposits the Government Savings Bank had placed with other banks. This assistance totaled nearly £3 million but was insufficient to meet continuing depositor withdrawals... Once the Government Savings Bank had suspended payment, the Commonwealth Bank

offered to make funds available to the Government Savings Bank to allow it to release the funds of the most needy depositors. Between 23 April and 27 July, the Commonwealth Bank advanced £1.8 million on this basis. The shock of having their funds in the Government Savings Bank frozen led depositors to question the safety of other banks. A run on the Commonwealth Savings Bank (a division of the Commonwealth Bank) began on 1 May. On 3 May, the Chairman of the Commonwealth Bank, Robert Gibson, made a radio broadcast to assure the public of the bank's safety... The statement was effective in stopping the run. During June and July 1931, negotiations to arrange an amalgamation were conducted between the Government Savings Bank, the Commonwealth Bank and the NSW Government... At the end of July, Lang abandoned the request for amalgamation and submitted an application for a rehabilitation loan of £10 million. The Commonwealth Bank responded that it could not fund such a large sum, and that, in any event, depositors would rapidly withdraw their funds from the re-opened bank. On 3 September, the Lang administration attempted to re-open the Government Savings Bank. By mid-October, it was evident that this attempt had failed. A compromise amalgamation was announced on 23 November and effected on 15 December 1931. At first, some rationing of withdrawals from former Government Savings Bank accounts was imposed by the Commonwealth Savings Bank; but from 14 January 1932 depositors were permitted to draw freely against their balances" (pp. 45-46).

"In April 1931, the [Primary Producers Bank of Australia] sought the assistance of the Commonwealth Bank in anticipation of a run following the suspension of the Government Savings Bank. The Commonwealth Bank provided an unsecured overdraft of £100,000 and a loan of £295,000 secured by government bonds, a fixed deposit at another bank and the bank's premises. The Primary Producers Bank actively sought amalgamation with the other trading banks and overseas financial groups. While the Commonwealth Bank considered arranging joint action with the trading banks to avoid closure of the Primary Producers Bank, the other banks decided against the proposal. In the wind-up of the bank depositors were not quite fully paid, losing just 1.25 per cent of the value of their deposits" (p. 40).

"As the Federal Deposit Bank continued to lose deposits, it applied for assistance from the Commonwealth Bank. The Commonwealth Bank took the view that the circumstances did not justify intervention. The Federal Deposit Bank suspended payment on 4 September 1931 and was taken over by the Brisbane Permanent Building and Banking Company. The Federal Deposit

Bank's depositors were repaid in full in instalments over a number of years" (p. 41).

"Loss of deposits from the State Savings Bank of Western Australia in September 1930 prompted the Western Australian Premier to approach the Commonwealth Bank to broach the possibility of amalgamation. But nothing came of this. In August 1931, the State Savings Bank of Western Australia's liquidity fell further. The Western Australian Premier took immediate action and negotiated an amalgamation with the Commonwealth Bank in only 11 days. The conditions in Western Australia made it much easier for the Commonwealth Bank to agree to offer support than had been the case in NSW. The State Savings Bank of Western Australia had not suffered runs anywhere near as severe as the Government Savings Bank, and the Premier readily agreed to accept the conditions the Commonwealth Bank placed on the merger. When signs of a run became evident in late August, after the bank was already under agreement to amalgamate with the Commonwealth Bank, the Commonwealth Bank's Chairman made a radio broadcast promising to depositors of the State Savings Bank that "the Commonwealth Bank will see that you are paid". In October 1931, the Savings Bank of South Australia's liquidity fell sharply, but there was no evidence of an uncontrollable run. The Commonwealth Bank was concerned to conserve its own resources and to lend only as a true last resort when the State Bank of South Australia had exhausted its own liquid reserves. The Commonwealth Bank, therefore, offered to assist on the condition that the Savings Bank of South Australia first deplete its cash reserves of over £3 million. The bank refused to accept this condition and was able to withstand its liquidity shortage without any further calls for assistance" (p. 47).

Consequences: In international comparison, the crisis was relatively mild (Fitz-Gibbon & Gizycki, 2001) and was less severe than the 1893 crisis.

Sources:

Fitz-Gibbon, B. & Gizycki, M. (2001*).* A History of Last-Resort Lending and Other Support for Troubled Financial Institutions in Australia. *RBA Research Discussion Papers*. System Stability Department. Reserve Bank of Australia.

Kent, C. J. (2011). Two depressions, one banking collapse: Lessons from Australia. *Journal of Financial Stability*, 7 (3), 126-137.

Fisher, C., & Kent, C. (1999). Two Depressions, One Banking Collapse. Research Discussion Paper, No. 1999-06. System Stability Department, Reserve Bank of Australia.

1974

Background and causes: There was a large boom in property lending by banks and, especially, by non-bank property lenders ("building societies").

The crisis: "After interest rates soared, and financial conditions deteriorated, property prices declined and many property lenders faced liquidity problems. The property lender Cambridge Credit went into liquidation, which precipitated fears concerning the health of financial intermediaries. Runs occurred at building societies in New South Wales, Victoria, Queensland, and South Australia... In 1976 the Australian Permanent Building Society suspended payments. Queensland Permanent Building Society also suffered a run and ultimately had to close after trading banks would not issue loans to the institution to deal with its liquidity shortfall. Queensland's failure triggered a run on the Metropolitan Building Society" (Fitz-Gibbon & Gizycki, 2001, pp. 52-60).

Banks failed: Cambridge Credit, Queensland Permanent Building Society (note these are technically non-bank property lenders). Other banks severely affected: Hindmarsh Building Society, Commercial Bank of Australia, Australian Permanent Building Society, Queensland Permanent Building Society.

Policy responses: "The Reserve Bank made it clear that it would provide support as needed to any bank that provided financing to building societies and other financial institutions that faced liquidity shortfalls. After Hindmarsh Building Society faced a severe run, in 1974, the Reserve Bank provided a Special Drawing Facility, and other liquidity assistance for trading banks that lent to the troubled building societies [...]. The Reserve Bank provided a line of credit to the Commonwealth Bank, which in turn lent to Metropolitan" (Fitz-Gibbon & Gizycki, 2001, pp. 52-60).

Sources:

Fitz-Gibbon, B. & Gizycki, M. (2001*).* A History of Last-Resort Lending and Other Support for Troubled Financial Institutions in Australia. *RBA Research Discussion Papers*. System Stability Department. Reserve Bank of Australia.

1989

Background and causes: Deregulations in the 1980s encouraged a credit boom. "Credit growth ran ahead of banks' risk assessment procedures, which, in many institutions, had not adjusted to the newly liberalised environment. In

1989, the combination of high interest rates and a softening in the commercial property market brought broadly based credit quality problems to light. The banking industry experienced its worst losses since the 1890s" (Fitz-Gibbon & Gizycki, 2001, p. 62).

Davis (2004): "The problems of the [Farrow] Group stem from the freedom afforded by the deregulation of the 1980s. The Group went into commercial lending soon after deregulation and grew rapidly from that point. Between 1981 and 1989 assets grew from $260 million to $2,900 million. Particular actions by the Group further contributed to its problems. These actions included: borrowing at higher rates than the major banks (between 2 to 4 per cent higher), charging large upfront fees (the fees provided the Group's cash flow), capitalising interest on loans when borrowers were unable to meet repayments and having in place complex lending structures that allowed the Group to lend outside of the State. The most significant action, however, was the misused provision of the 'free tranche' which was permitted by regulations. The Group created a 'free tranche trust' which allowed the top-up of commercial loans beyond the prudential lending limits. This had the effect of exposing the Group to risky commercial borrowers" (pp. 241-247).

The crisis: The two public banks State Bank of Victoria and State Bank of South Australia recorded the largest losses and failed in 1990 and 1991, respectively. Westpac and ANZ, the second- and third-largest banks in Australia, both suffered large losses, but had sufficient capital to cover their losses and did not fail. There were runs on numerous non-bank institutions such as property lenders (the so-called "building societies"). The Farrow Corporation, which owned three building societies, went into liquidation in June 1990. Metway Bank and the Bank of Melbourne, both of which had converted to banks from building societies, suffered runs.

Davis (2004): "The primary source of [State Bank of Victoria] SBV's problems was losses in its subsidiary, Tricontinental, which were more than 3.5 times greater than the value of SBV's capital. The SBV lost around $3 billion [...].

The [Farrow] Group began experiencing liquidity problems in late 1989 and early 1990 with a run on deposits throughout February/March 1990 with more than $200 million being withdrawn. A second run in May/June 1990 led to its ultimate close on 22 June 1990. Two weeks prior to its eventual failure, the Victorian Government assured the public that the Pyramid Group was financially sound" (pp. 241-247).

Banks failed: Moe and District Community Credit Union (1989), State Bank of

Victoria (1990), State Bank of South Australia (1991), Farrow Group consisting of three building societies (1990). Several smaller life insurance companies (e.g., Occidental Life and Regal Life) were also affected and had to be assisted.

Policy responses: State Bank of Victoria and State Bank of South Australia both required capital injections from their respective state governments. The Reserve Bank offered short-term liquidity support to the State Bank of Victoria. State Bank of Victoria was taken over by Commonwealth Bank, and State Bank of South Australia was bought, after being separated from its bad assets, by Advance Bank and continued its business under the name of BankSA (Davis, 2004, pp. 241-247). When various banks began to suffer large depositor withdrawals, the Reserve Bank of Australia made statements declaring its belief that the banks were generally safe and that it was willing to intervene to provide liquidity. This seemed on multiple occasions to quell depositor withdrawals and prevent large-scale bank runs that would force banks into liquidation.

Davis (2004): "The State Government [of Victoria] invested $2.7 billion in the [State Bank of Victoria] Group largely in connection with Tricontinental. The Reserve Bank of Australia (RBA) was prepared to offer short-term emergency liquidity support to the State Bank (provided the Victorian Government indemnified it against any losses) if the bank were to exhaust its stock of liquid assets. The RBA also offered to help the State Bank sell its portfolio of Commonwealth Government securities if the need arose, either by assisting the sale of those securities in the market or by buying them itself. In the event, no such arrangements were required... The State Government of South Australia was forced to bail out the [State Bank of South Australia] when it lost $3.3 billion. The cost to taxpayers was in the vicinity of $2.2 billion. [...]

Rural and Industries (R&I) Bank, then owned by the Western Australian Government, became the subject of a brief run in January 1992. The run ended when the RBA Governor issued a statement pointing out that deposits with the R&I Bank were guaranteed by the State Government of Western Australia and giving reassurance that the RBA would take whatever steps necessary to ensure the bank had adequate liquidity. [...]

Western Australian (WA) Teachers' Credit Society was one of the largest credit unions in Australia and grew rapidly in the first half of the 1980s partly based on commercial lending. In 1987 after several years of difficulty, State government assistance was sought and the Government-owned R&I bank acquired the credit union. That takeover ensured that member's deposits were protected, ultimately by the WA taxpayer. Several other credit unions in WA also expe-

rienced problems and experienced runs by depositors. Support by credit union associations from outside the State enabled the problems to be overcome, and subsequent legislation saw the development of a savings protection (stabilisation) fund... the Western Australian Government arranged a take-over of a failed credit union by the Government owned R&I bank at a cost to taxpayers estimated to be in the order of $220 million. [...]

In 1989 the Moe community credit union was placed under administration by the State regulator following discovery of large losses due to inappropriate lending practices. Other credit unions were required to inject additional funds into the State stabilisation fund to meet the losses, and the Moe community credit union was merged with the SEC Credit Union. Shortly thereafter, in the wake of this publicity and that surrounding the Pyramid collapse, several credit unions experienced liquidity problems due to member withdrawals (pp. 241-247).

Consequences: The impact on the real economy was negligible. Real GDP declined marginally, and private credit continued to grow in relation to the size of the economy.

Sources:

Fitz-Gibbon, B. & Gizycki, M. (2001). A History of Last-Resort Lending and Other Support for Troubled Financial Institutions in Australia. *RBA Research Discussion Papers*. System Stability Department. Reserve Bank of Australia.

Davis, K. (2004). *Study of Financial System Guarantees*. Canberra: Commonwealth of Australia.

Austria

1873

Background and causes: "The "Gründerkrach" dominates the economic historiography of Austria-Hungary as the most severe stock market crisis which hit the Habsburg Empire during the 50 years of dualism (1867-1918). Following a pronounced financial boom episode starting as early as 1867, investor sentiment began to revert in April 1873 until the Viennese Stock Exchange finally ground to complete halt on Black Friday, May 9th 1873" (Rieder, 2017). "Excessive speculative activities in stocks and real estate were one of the main underlying causes of the severe crisis at the end of the 19th century in continental Europe. Over-expansion during the so called 'Gründerjahre' in Germany and Austria was facilitated by an expansion of bank credit – for example, through new types of banks (e.g., Maklerbanken and Baubanken). In addition, French war reparations were used to expand the money supply. Optimistic expectations and euphoria in the context of the World Exhibition as well as reform of the stock corporation law further fueled speculation" (Brunnermeier & Schnabel, 2016, p. 523).

Rieder (2017): "In the decade from 1868 to 1878, mortgage loans on Austro-Hungarian bank balance sheets almost tripled. The most pronounced year-on-year increase in aggregate mortgage loans took place between December 1872 and December 1873. In addition, qualitative evidence from banks' board meeting minutes imply that real estate was de facto considered as the only remaining creditworthy collateral after the stock market had collapsed. Indeed, not only private banks saw their mortgage portfolios soar during the crisis. In a report on its activities during the apex of the crash, the Privilegirte Oesterreichische Nationalbank (OeNB, Austria-Hungary's single central bank) mentioned a "non-ordinary upswing" in its mortgage loan portfolio between May 1873 and October 1874" (p. 56).

The crisis: "Whereas signs of trouble had been evident before, the bubble burst in May [1873], when the World Exhibition in Vienna opened with disappointing sales. The sharp drop in stock prices and the closure of the Vienna stock exchange ('Black Friday') were followed by a banking crisis" (Brunnermeier & Schnabel, 2016, p. 523).

Rieder (2017): "The Grunderkrach stands out as a particularly long-lived stock market meltdown, especially if contrasted to other major negative shocks during this period, such as the panic in autumn 1869 or the outbreak of the Franco-Prussian War in July 1870" (p. 42).

"Bank closures during the "Grunderkrach" were tightly connected to the fate of the Viennese repo market. The run-up to the "Grunderkrach" was coined by a proliferation of repo loans which banks granted to brokerage firms in order to secure the easy placement of initial public offerings on the stock market ["Kostgeschaft" loans, which constituted an early version of repurchase (repo) agreements, which credit institutions had generously granted to stock brokers]... Together with the daily unwind of repos on the Bourse and the legal obstacles to raising margins for longer term repos, these features appear to have played an important role in causing the precipitous break-down of the market, rather than a gradual tightening of margins, following 9 May 1873" (p. 2 of 2016 draft).

Banks failed: The most prominent victim of this crisis was the largest mortgage bank in the country, Bodencreditanstalt, which failed in November 1873 (Riedel, 2017, p. 125). "The number of banks and banking firms dropped from 141 in 1873 to 45 in 1878" (Willis & Beckhart, 1929, p. 108). According to Rieder (2017), 30 per cent of the banking system failed terminally in this time span. Depending on the source, up to one-hundred banks failed or disappeared.

Rieder (2017): "the Creditanstalt and Bodencreditanstalt represented the two most prominent joint-stock banks in Vienna at the time. The Creditanstalt operated according to a universal banking model whereas the Bodencreditanstalt, at least on paper, constituted the largest private mortgage bank of the Empire" (p. 40).

Policy responses: Bodencreditanstalt was bailed out by the central bank and a bank consortium of private banks. "A [rescue] fund of 20 million gulden to be loaned on solid securities was assembled, with three million from the government, five from the Austrian National Bank, two from the Creditanstalt [...] and the remainder [including House of Rothschild] widely distributed. It proved inadequate" (Kindleberger, 1984, p. 279). The Bank Act of 1862 was suspended to allow for central bank assistance in case of a liquidity crunch and a syndicate of bankers was established to make advances on sound securities. Also, the Treasury granted loans to financial institutions in jeopardy. The central bank, however, did not fully embrace the position of lender of last resort (Jobst & Rieder, 2016).

Brunnermeier & Schnabel (2016): "In Austria, bailout of the Bodencredit-Anstalt by the central bank and a bank consortium; suspension of the Bank Act of 1862 to allow for central bank assistance in case of a liquidity crunch; syndicate of bankers was established to make advances on sound securities; the

Treasury granted loans" (p. 525).

Consequences: In summary, "despite bailouts and other emergency measures, the crisis could not be contained and it developed into a ruinous depression" (Brunnermeier & Schnabel, 2016, p. 523). Bordo and Landon-Lane (2010) report that according to Kindleberger (1978), the collapse of the property boom in Austria and later in Germany spread through the European continent and ultimately affected the United States, as European investors dumped US railroad stocks. Thus, the "Gründerkrach" triggered a massive global banking crisis.

Sources:

Brunnermeier, M., & Schnabel, I. (2016). Bubbles and Central Banks. In M. Bordo, Ø Eitrheim, M. Flandreau, & J. Qvigstad (Eds.), *Central Banks at a Crossroads: What Can We Learn from History?* Studies in Macroeconomic History, 493-562. Cambridge: Cambridge University Press.

Rieder, K. (2017). (Un)promising beginnings - Bagehot in the land of the waltz: financial crises and lending of last resort in the Austro-Hungarian Empire (1868-1914). PhD thesis. University of Oxford.

Jobst, C., & Rieder, K. (2016). Principles, circumstances and constraints: the Nationalbank as lender of last resort from 1816 to 1931. *Monetary Policy and the Economy,* Q3-Q4 (OeNB bicentennial issue), 140-162. Vienna: Oesterreichische Nationalbank.

Bordo, M. D., & Landon-Lane, J. S. (2010). The global financial crisis of 2007-08: Is it unprecedented? NBER Working Paper, No. 16589. National Bureau of Economic Research.

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Kindleberger, C. P. (1984). *A financial history of Western Europe.* Routledge.

Willis, H. P., & Beckhart, B. H. (1929). *Foreign Banking Systems.* NY: Henry Holt and Company.

1912

Note that this episode is not considered a banking crisis in Austria by Baron, Verner, and Xiong (2021) and us, as these events mainly occurred in other areas of the Austro-Hungarian empire, such as in modern-day Poland, Romania, and Czechia. Narrative evidence is given here to help support this conclusion.

Background and causes: The threat of war in the Balkans caused a brief banking panic in the Austro-Hungarian Empire.

Rieder & Jobst (2016): "The banking panic that gripped Austria in November 1912 has to be seen in the context of the political tensions following the defeat of the Ottoman Empire in the First Balkan War (October 1912 to May 1913). The probability of a military involvement of Austria-Hungary peaked in the last two months of 1912 when Serbia's ambitions to annex Albanian territory met with heavy opposition from the Habsburg empire and culminated in mutual threats of war. The tensions only eased when the Treaty of London was concluded in early 1913. The imminent danger of an armed conflict in fall 1912 served as an exogenous shock to Austro-Hungarian depositors with financial intermediaries in the border regions with Serbia (Carniola, Croatia- Slavonia, Dalmatia, the Austrian Littoral and Southern Hungary) and Serbia's major ally, Russia (Galicia, Bukovina). The preference for liquidity increased, fears were rife that the government might confiscate savings deposits in the case of war, and uncertainty arose about (local) asset values in the event of a hostile assault or an occupation. Bank creditors started to panic and withdrew a significant fraction of their sight liabilities from credit institutions and converted them into cash [...]" (pp. 146-147).

The crisis: Although the panics were concentrated in present-day Poland, Ukraine, and Romania, bank runs were reported starting in October 1912 in Upper Austria (Rieder, 2017, p. 231-234). At the same time, interbank credit in the Empire was drying up, as large correspondent banks in the core cities, which themselves faced tight conditions in money markets, turned increasingly cautious. (Jobst & Rieder, 2016).

Jobst & Rieder (2016): "From early October, when the first runs started, to the end of December 1912, banknotes in circulation increased from 2.4 billion crowns to 2.8 billion crowns, or by some 15%. At the same time, interbank credit was drying up, as large correspondent banks in the core cities, which themselves faced tight conditions in money markets, turned increasingly cautious. The business model of savings banks was particularly prone to maturity mismatches, as such banks financed long-term mortgages with sight deposits. Hence, the banks targeted by runs found it difficult to obtain funding and risked illiquidity-induced defaults" (p. 147).

Banks failed: -

Policy responses: As opposed to other periods of bank distress, in 1912 "the Austro-Hungarian Bank reacted by letting its standing facilities operate freely

and distributing liquidity generously" (p. 147). "The policy of the Austro-Hungarian Bank contained a second important aspect, namely its effort to revive the interbank market. During the autumn of 1912, the Nationalbank raised its policy rates twice, citing as reasons not only capital outflows in the face of interest hikes by the Bank of England, the Banque de France and the German Reichsbank but also the need to increase the opportunity costs of idle cash and to create incentives for intermediaries to relend in the markets [...]" (p. 148).

Jobst & Rieder (2016): "[...] the way the Austro- Hungarian Bank managed the panic of 1912 appears to be a clean example of Bagehotian lending of last resort. By lending freely, the Nationalbank prevented a regional banking crisis from escalating into a general market liquidity crisis. The adherence to the "free lending" principle finds itself unambiguously reflected in the fact that market rates never rose above the official rate. Last but not least, the Nationalbank's intimate knowledge of its counterparties allowed it to forestall any risk of moral hazard by forcing its borrowers to adjust their business models if they wanted to preserve their access to central bank refinancing in the future" (p. 149).

Consequences: There is no evidence of bank failures. Due to central bank intervention, the panics were quelled by mid-December 1912. According to our estimates, the Austria economy continued to grow through 1912 and real GDP only marginally declined in the following year.

Sources:

Rieder, K. (2017). (Un)promising beginnings - Bagehot in the land of the waltz: financial crises and lending of last resort in the Austro-Hungarian Empire (1868-1914). PhD thesis. University of Oxford.

Jobst, C., & Rieder, K. (2016). Principles, circumstances and constraints: the Nationalbank as lender of last resort from 1816 to 1931. *Monetary Policy and the Economy,* Q3-Q4 (OeNB bicentennial issue), 140-162. Vienna: Oesterreichische Nationalbank.

1914

Note that this episode is not considered a banking panic or banking crisis by Baron, Verner, and Xiong (2021), as any potential bank runs were quickly stopped by heavy-handed government interventions. Narrative evidence is given here just for the purpose of demonstrating this conclusion.

Background and causes: The outbreak of the war in the end of July 1914 was accompanied by a dramatic sell-off of stocks in the Vienna Bourse, which was closed, and by an immediate scramble for gold, silver, and coins.

The crisis: Kindleberger (1984) reports that the situation started on July 25.

Roberts (2013): "Eye-witnesses recorded that the news triggered an immediate scramble for gold, silver, and even token coins. It 'passed like an electric shock' through the Vienna and Budapest bourses and, on the afternoon of Sunday 26 July, their committees decided that they should stay shut; street trading in securities outside was strictly forbidden" (p. 201).

Banks failed: -

Policy responses: On 31 July 1914, a moratorium on the withdrawal of bank deposits was proclaimed and the general mobilization for the War began. The Austro-Hungarian Bank reacted by lowering interest rates (Roberts, 2013, p. 201).

Roberts (2013): "The Austro-Hungarian Bank, the central bank, responded to the emergency by raising its interest rate from 4 per cent to 5 per cent on 26 July, and to 8 per cent on Sunday 2 August in response to the news that the Bank of England had hiked up Bank Rate to the 'dizzy peak' of ten per cent. The Austro-Hungarian Bank was criticized for its latter hike because the advance to crisis level heightened public panic and harmed industry and commerce, complaints similar to those levelled at the Bank of England. 'The Austro-Hungarian Bank did not need to guard gold, for no bills are being granted.' stated Austria's Oesterreichsche Volkswirt. 'Gold cannot go out of the country, and no rise in the rate can bring it in.' But the internal drain depleted its gold stock, while its bills portfolio and banknote circulation soared. A moratorium covering bills and bank accounts was proclaimed on 31 July, the day of Austria's general mobilization. To halt runs on the banks, they were allowed to restrict withdrawals to 3 per cent of deposits or a maximum of 200 crowns a day. The lock-up of people's savings resulted in insecurity sometimes tinged with panic. The statutory requirement for 40 per cent of the note issue to be backed by gold was suspended on 4 August, followed by an expansion of the note issue. Thereafter, backing for bank notes increasingly took the form of loans to the state. The central bank's interest rate was lowered to 6 per cent on 20 August, and to 5 per cent in spring 1915" (p. 201).

Consequences: Roberts (2013, p. 2019) reports that "businesses found credit unavailable causing closures and unemployment. Military mobilization and transport chaos exacerbated the economic slump and hardship."

Roberts (2013): "Initially the government met the costs of the war with short-term borrowings from the banks, which themselves received advances from the central bank to do so. Large war loan bond issues were launched in both Austria and Hungary on 16 November, by coincidence a day ahead of Britain's first war loan, the funds being raised from the public by patriotic appeals and from banks by forced levies" (p. 201).

Sources:

Roberts, R. (2013). *Saving the City: the great financial crisis of 1914*. Oxford University Press.

Kindleberger, C. P. (1984). *A financial history of Western Europe*. Routledge.

1924

Background and causes: Following the end of the hyperinflation and stabilization of the currency, there was a stock market boom followed then by a stock market crash in 1924, which was then followed by severe banking difficulties (Schubert, 1992, p. 8). As Kindleberger writes (1984, p. 355), "The opening shot of a series of bank failures [in 1924] culminated in the breakdown of the Creditanstalt seven years later."

The crisis: A major bank, Allgemeine Depositenbank, ran into difficulty in May 1924 after failed speculation against the French franc, which caused it to go into liquidation after suffering heavy withdrawals. About 40,000 savers lost a part of their deposits. However, this seems to be the only run; all the other banks either received deposit guarantees or were absorbed. In 1926, two important banks, Centralbank der deutschen Sparkassen and Postsparkasse (Postal Savings Bank), suffered heavy losses, but the government guaranteed deposits to avoid a panic. Other banks that suffered losses were mostly absorbed by Creditanstalt (Schubert, 1992, p. 8).

Banks failed: Allgemeine Depositenbank was liquidated in July 1924. In 1924 the number of joint stock banks in Vienna dropped from 66 to 36. Austro-Polnische Bank, Austro-Orientbank, and Biedermannbank failed in 1926. Later, in 1927, large universal banks Unionbank and Verkehrsbank failed and were merged with major bank Bodencreditanstalt (Macher, 2018a). Many other banks failed or disappeared during the mid- to late-twenties.

Policy responses: Jobst & Rieder (2016) claim that Oesterreichische Nationalbank (OeNB) did not sufficiently act as a lending of last resort in response to the crisis. Kernbauer (1991), however, reports that OeNB provided liquidity

against collateral and special loans to several banks—among them Biedermannbank in 1924, and Centralbank until 1927. Both rescue attempts failed in the end. On June 30, 1926, the Austrian government announced that it would guarantee the deposits at Centralbank and announced a three-month moratorium that was subsequently extended by another month. Similarly, it provided guarantees for the Postsparkasse.

Consequences: The severe problems in the banking sector in the 1920s were temporarily delayed by massive mergers and bailouts but reemerged with catastrophic consequences in 1929 and 1931. Our estimates record only a slight decline of real GDP of about one per cent. There is evidence that depositors suffered losses from bank failures.

Sources:

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März, E. (1982). Economic Policy in the Crises of 1920 and 1929. Comment in Charles P. Kindleberger, C. P. & Laffargue, J.-P. (eds.) *Financial Crises: Theory, History and Policy.* Cambridge University Press.

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Macher, F. (2018a). The Austrian Crisis of 1931: One bad Apple Spoils the Whole Bunch. Economic History Working Paper, No. 274/2018. London School of Economics and Political Science.

Jobst, C., & Rieder, K. (2016). Principles, circumstances and constraints: the Nationalbank as lender of last resort from 1816 to 1931. *Monetary Policy and the Economy,* Q3-Q4 (OeNB bicentennial issue), 140-162. Vienna: Oesterreichische Nationalbank.

1931

Background and causes: The difficulties in the banking sector of the 1920s were exacerbated in 1929 when Bodencreditanstalt, the second largest bank in the country, failed after encountering serious liquidity shortfalls. The bank had just bailed out and merged with two other important universal banks two years earlier, inheriting significant amounts of bad assets, especially from Universalbank (Macher, 2018b). As to the cause of the crisis, Macher (2018b)

identifies two main explanations. While the first emphasizes the role of foreign capital outflows, the second underlines domestic problems especially with regard to universal banks' exposure to industrial enterprises, which performed poorly and rendered many banks insolvent. Macher (2018b) further claims that "Credit-Anstalt, [...] became an 'acquirer of last resort' [...] [and] was insolvent as early as 1925. The bank, however, could have avoided bankruptcy had it been spared the burden of Unionbank's non-performing assets" (p. 279). Foreign capital flight occurred at a massive scale only after the collapse of Creditanstalt in 1931.

Macher (2018b): "The Austro-Hungarian Monarchy was on the losing side of World War I. The country had to pay reparations and, since its assets were used as collateral, it could not borrow. In the early 1920s, in the immediate aftermath of the war, the country experienced hyperinflation. When the situation became untenable, the help of the League of Nations was sought, and the economy was stabilised through a large foreign loan. The implementation of a new currency, the Austrian Schilling (AS), the establishment of an independent central bank, the Austrian National Bank (ANB), and a balanced government budget requirement assured creditors of the macroeconomic and monetary stability of the country (Cottrell 2017, pp. 105–41; Marcus 2018, pp. 35–258).

"What followed stabilisation was, according to the literature, a 'borrowing binge'. The Austrian banking system was excessively exposed to short-term foreign creditors [...]. Banks borrowed short term and in foreign currency, extended these resources to Austrian industry as long-term loans denominated in Austrian Schillings, and thereby generated currency and maturity risks. Authors have argued that, due to Central Europe's high levels of indebtedness, foreign creditors had been doubtful about the stability of these currencies even before the announcement of the CA's weak financials on 11 May 1931 (Eichengreen, 1992, p. 261). When the largest Austrian bank's losses became public, foreign creditors began to flee the financial system. The currency and maturity mismatches produced gaping holes in the bank's balance sheet and brought about its demise: 'In Britain, Germany, Austria, and Hungary alike, the withdrawal of foreign deposits was the catalyst for the financial crisis that shattered the gold standard system' (Eichengreen, 1992, p. 262)" (pp. 297-298).

"Austria's largest financial institutions were universal, combining commercial and investment banking activities, and both owned and loaned to industrial enterprises. Their links to industry had originated in the pre-1914 period, and

they all had their own Konzerns: industrial networks into which the banks were invested either as shareholders or lenders, but in most cases, as both. [...] Most Austrian industrial joint-stock corporations were under the majority ownership of one of the Austrian universal banks (Rudolph 1976, p. 120). World War I and the subsequent years of hyperinflation further cemented such connections [...]. The strengthening ties between banks and industry had serious repercussions. Authors have argued that the reconstruction scheme of the League of Nations brought about 'no real recovery after 1924' (Kindleberger, 1986, p. 144). Hence, Austrian universal banks were exposed to the 'fitful performance' of industry [...]. This reduced the banks' profitability, and the loans provided to the Konzerns tied up their capital" (pp. 298-299).

The crisis: Political pressure was applied to Creditanstalt to rescue and merge with the failed Bodencreditanstalt, creating the by far biggest player in the Austrian banking system with almost 65% of total claims of all joint-stock banks in the country (Weber, 1995, p. 352). Then, on May 11, 1931 the crisis reached its climax when Creditanstalt collapsed.

Banks failed: Bodencreditanstalt, the second largest bank, failed in 1929 and was merged with Creditanstalt. The largest bank Creditanstalt failed on May 11, 1931. A smaller bank, Mercurbank, failed in July of the same year, as well. In 1932, Wiener Bankverein and Nieder-oesterreichische Escompte-Gesellschaft failed.

Macher (2018a): "The three universal banks that disappeared through the years from 1926 to 1929 [Verkehrsbank (VB), the Unionbank (UB), the Boden-Credit-Anstalt (BCA)] were not equally weak. There was one bad apple among them, the UB, whose Konzern had an unsustainably high debt level, was loss-making, and its performance was deteriorating from 1925" (p. 6).

Policy responses: Kindleberger (1986) reports "the government, the National Bank, and the House of Rothschild, the last with help of the Amsterdam branch, furnished 100 million, 30 million, and 22.5 million schillings, respectively" to bail out and nationalize Creditanstalt. The required amounts were so large that Austria had to appeal for help from the bank of England, the League of Nations, and the newly founded Bank for International Settlements (BIS). The BIS collected funds from central banks around the world and granted a loan of 100 million schillings to the nation. Mercurbank also failed in 1931, while Wiener Bankverein and Nieder-oesterreichische Escompte-Gesellschaft folded in 1932. Together with Creditanstalt the defaults accounted for 39% of total deposits in the country (Macher, 2018a).

Kindleberger (1986): "A historian of the episode concludes that the Creditanstalt was so riddled with bad foreign loans, many of them taken over from the bankrupt Bodenkreditanstalt when that failed in 1929, that it was a mistake to try to save it."

Consequences: We estimate that the Great Depression in Austria that followed caused real GDP to collapse by almost a quarter and private credit to halve in relation to GDP.

Sources:

Macher, F. (2018a). The Austrian Crisis of 1931: One bad Apple Spoils the Whole Bunch. Economic History Working Paper, No. 274/2018. London School of Economics and Political Science.

Macher, F. (2018b). The Austrian banking crisis of 1931: a reassessment. *Financial History Review,* 25(3), 297-321.

Weber, F. (1995). From Imperial to Regional Banking: The Austrian Banking System, 1918-1938. In Feinstein, C. H. (Ed.), *Banking, Currency, and Finance in Europe Between the Wars* (pp. 337-357). Oxford: Clarendon Press.

Kindleberger, C. P. (1986). *The world in depression, 1929-1939.* University of California Press.

Eichengreen, B. J. (1992). *Golden fetters: the gold standard and the Great Depression, 1919-1939.* Oxford University Press.

2008

Background and causes: "While the direct exposure towards the US subprime market was rather limited, the effects hit the Austrian banking sector mainly after the dry-up of the interbank markets following the Lehman Brothers default in September 2008 which brought the long-term structural weaknesses of the banking system to the fore" (Lo Duca et al., 2017, appendix). Much like Germany, Austria did not experience a housing price bubble or substantial above-trend deviations in private indebtedness.

The crisis: The Global Financial Crisis developed in Austria similar to other European countries. "With rising credit spreads [...] in early 2009, international investors feared an additional hit on the Austrian banking sector, but the situation stabilized over the course of that year. In response to the crisis, the authorities took several steps to support the banking system and to strengthen financial oversight" (Lo Duca et al., 2017, appendix).

Failed banks: Kommunalkredit Austria was nationalized in 2008. Constantia Privatbank failed in 2008 and was rescued by private banks. Hypo Alpe Adria was nationalized in 2009 and later liquidated. Volksbank received capital support from the government in 2009 and was later liquidated.

Policy responses: The state provided capital support and funding guarantees. The Austrian Financial Market Stability Package of 2008 included: €15 billion for bank recapitalization measures; up to €75 billion of bank funding guarantees; and unlimited deposit insurance until end-2009. A federal entity was created to manage public participations in the banking system. Major bank Erste Bank, Postal Savings Bank BAWAG P.S.K., Hypo Alpe Adria, Komunalkredit Austria, Österreichische Volksbanken, and Raiffeisen Bank International received capital support and guarantees in 2008 and 2009. Hypo Alpe Adria and Komunalkredit Austria were nationalized. (Lo Duca et al., 2017; Iwanicz-Drozdowska et al., 2016).

Lo Duca et al. (2017): "Capital support and funding guarantees [were granted] by the federal state of Austria. The Austrian Financial Market Stability Package of 2008 included: €15 billion for bank recapitalization measures; up to €75 billion of bank funding guarantees; and unlimited deposit insurance until end-2009. A federal entity was created to manage public participations in the banking system. The legal basis was laid out in the Interbank Market Support Act ('Interbankmarktstärkungsgesetz') and the Financial Market Stability Act ('Finanzmarktstabilitätsgesetz')" (appendix)."

Consequences: Due to fiscal stimulus the decline of real GDP was contained at less than 4 per cent. Private credit did not recede and the level of public debt in relation to the size of the economy grew by about a quarter.

Sources:

Iwanicz-Drozdowska, M., Kerlin, J., Malinowska-Misiąg, E., Smaga, P., Witkowski, B., Nowak, A. K., Kozłowska, A., & Wiśniewski, P. (2016). *European bank restructuring during the global financial crisis.* Springer.

Lo Duca, M., Koban, A., Basten, M., Bengtsson, E., Klaus, B., Kusmierczyk, P., ... Peltonen, T. (2017). A new database for financial crises in European countries: ECB / ESRB EU crises database. *ECB Occasional Paper,* No. 194. European Central Bank.

2011

Background and causes: Starting in late-2010, the European Sovereign Debt Crisis developed as bank bailouts and fiscal stimuli conducted by several

highly indebted governments across Europe threatened these states to default. Austria itself was only moderately affected by rising bonds rates, several Austrian banks, however, had maintained large exposures to central and eastern Europe (CEE) which was hit very hard by the financial crisis.

The crisis: Volksbank "lost 1.1bn EUR in 2009 due to losses on CEE loans and real estate. It was bailed out by the Austrian federal government, which provided it with 1bn EUR of subordinated debt." (Copolla, 2015). The bank again suffered large losses in 2011, when "it lost 1.3bn EUR due to writedowns on Greek debt and further losses on its CEE assets" (ibid.).

Failed banks: Volksbank again suffered large losses in 2011, was part-nationalized in 2011 by means of a debt-equity conversion of 250M EUR, and in October 2014, expecting failure of the ECB/EBA stress tests, was split up and restructured. A second bank, Hypo Alpe Adria, was split into a "good bank" and "bad bank" due to European sovereign debt losses in 2014. Pfandbriefbank Oesterreich had to be rescued in 2015 by its regional bank owners.

Policy responses: Volksbank was part-nationalized in 2011 by means of a debt-equity conversion of 250M EUR, and in October 2014, expecting failure of the ECB/EBA stress tests, was split up and restructured (Iwanicz-Drozdowska et al., 2016). Previously nationalized bank Hypo Alpe Adria was split into a "good bank" and "bad bank" due to European sovereign debt losses in 2014. Pfandbriefbank Oesterreich had to be rescued in 2015 by its regional bank owners. Hypo Tirol Bank received capital injections from the government in 2012. It had previously received guarantees in 2009.

Consequences: While economic growth did not decline, private credit relative to GDP contracted, according to our estimates, by about 12 per cent.

Sources:

Iwanicz-Drozdowska, M., Kerlin, J., Malinowska-Misiąg, E., Smaga, P., Witkowski, B., Nowak, A. K., Kozłowska, A., & Wiśniewski, P. (2016). *European bank restructuring during the global financial crisis*. Springer.

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Belgium

1870

Background and causes: Right before the declaration of war between Germany and France, Belgium faced the threat of invasion from either party due to geographical proximity. Germany and France both used the Belgian banking system for transferring as well as safeguarding funds. (Conant, 1910).

The crisis: In fear over Germany and France violating Belgium's neutrality, the Belgium Finance Minister and Governor of the National Bank of Belgium (NBB) instructed the NBB on July 13, 1870 to evacuate its metal reserves immediately to Antwerp. In response to the announcement, depositors panicked and demanded their notes to be exchanged for specie (Buyst & Maes, 2008a). Conant (1910) records that between 1 July and 20 September the number of notes presented for redemption totaled 85 mil. francs, or over 1 mil. francs per day.

Buyst & Maes (2008a): "Only in July 1870 things went wrong. Frightened by the threat of war between France and Prussia the Belgian Finance Minister and the governor of the NBB lost their nerves. They ordered to evacuate immediately the metal reserves out of the capital. The removal happened with so much commotion that it sparked panic among the population. People besieged the NBB's head office to demand the conversion of notes in coins. To the population's outrage, the NBB simply decided to close its counters, except for one."

Conant (1910): "As the result of the demand for discounts, Belgian commercial paper in the [National] Bank, which stood on July 10, 1870 at 177,500,000 francs, rose by July 20 to 203,923,100 francs; on July 31 to 223,231,744 francs; and maintained itself until August 20 in the neighborhood of 204,000,000 francs ($39,372,000). While other financial institutions and merchants thus sought discounts from the Bank much larger in volume than in normal times, the public was seized with panic and presented notes in large amounts for redemption... The discount rate was promptly advanced in order to check unnecessary demands for accommodation. The rate remained from July 1 to July 15 at 2% per cent for accepted bills and at 3 per cent for those which had not been accepted. These rates were promptly advanced on the 15th to 5 and 5.5 percent, where they remained until August 5, when they were again advanced to 6 and 6.5 per cent."

Failed banks: none, as far as we can tell.

Policy responses: "In order to resolve the confidence crisis, the government set up an emergency committee chaired by Jules Malou, director of the Socieéteé Geéneérale. It urged the NBB to resume the conversion of notes as usual. By doing so, Malou took a calculated risk. In the meantime, he had mobilized sterling assets, held by the Socieéteé Geéneérale, to fetch gold from London to Belgium. Malou's tactics proved successful: as soon as convertibility seemed assured again, the panic faded away" (Buyst & Maes, 2008a, pp. 163-164). "In 1872 the Banque de l'Union, the country's third largest provider of discount credit, ran into difficulties. During the crisis the Société Générale and the Banque de Belgique, together with eleven other financial institutions, participated in a temporary discount house. The NBB was not among them, but the issue institute pledged to pay 20 percent of the discount house's potential losses" (p. 168).

Conant (1910): "At the outbreak of the crisis the Bank possessed foreign paper to an amount of 64,144,561.25 francs ($12,370,000). Such prompt disposition was made of these securities to obtain coin that on July 31 the amount of such paper was reduced to 7,227,333.20 francs and on August 20 to 3,531,907.38 francs. The proceeds of this paper was employed in the purchase of gold and silver, principally silver bullion, which the mint converted into 5-franc pieces, with which the bank filled the void in its reserves caused by the redemption of notes. Thanks to these energetic measures, which imposed a loss of 705,340.42 francs ($136,100), the Bank weathered the storm and was able by August 27, 1870, to reduce discount rates to 5.5 per cent for accepted bills and 6 per cent for those not accepted, following this by reductions on September 20 to 4.5 and 5 per cent, and on October 8 to 3.5 and 4 per cent. Calm was reestablished by the middle of August and the Bank returned to normal conditions."

Consequences: Ultimately, no banks failed, and economic growth did not seem to be inhibited.

Sources:

Conant, C. A. (1910). The National Bank of Belgium. *Senate Documents 61st Congress, 2nd Session*, 10, document No. 400. Washington, DC: Government Printing Office.

Buyst, E. & Maes, I. (2008a). Central banking in nineteenth-century Belgium: was the NBB a lender of last resort? *Financial History Review,* 15, 153-173.

1876

Background and causes: Following the Franco-Prussian war, the Belgian economy experienced a short boom period resulting in the establishment of several new banks. During the economic downturn that followed, the Banque de l'Union, the country's third largest provider of discount credit, ran into difficulties in 1872. Then, in 1876, the failure of Simon Philippart's railway empire triggered a broader banking crisis in Belgium (Buyst & Maes, 2008a).

Buyst & Maes (2008a): "The early 1870s were also an important turning point in Belgium's general economic climate. A long period of malaise ushered in, which lasted until the early 1890s (see figure 2). This unfavorable context together with the speculative investment policies of some Belgian banks were a breeding ground for financial storms. In 1875-1876 for instance, the collapse of Simon Philippart's railway empire plunged the Belgian banking system in its third major crisis since independence [...]" (p. 167).

The crisis: Banque de Belgique, the second largest financial institution in the country, threatened to collapse in March 1876. The country's Minister of Finance feared that its failure would trigger a run to the entire banking system and "formed a consortium of Belgian and French financiers to keep the Banque de Belgique afloat" (Buyst & Maes, 2008a, p. 169). Banque de Bruxelles experienced a serious deficit in 1876 and had to be dissolved and a new restructured Banque de Bruxelles immediately reconstituted (Bayot, 2017, p. 7).

Buyst & Maes (2008a): "When a crisis hit universal or investment banks, the Finance Minister did not ask the NBB for assistance. A clear case was the debacle of the Banque de Belgique, the country's second largest financial institution, in March 1876, due to the bankruptcy of the Philippart empire. To make matters worse, large-scale fraud by an employee of the bank came to the surface which immersed the affair in a tense atmosphere of scandal. Therefore, [Belgium's Minister of Finance Jules] Malou feared that the collapse would trigger off a run on the banks" (p. 168-169).

Failed banks: Banque de l'Union, the country's third largest provider of discount credit, ran into difficulties in 1872. The second-largest financial institution Banque de Belgique failed in 1876, was reorganized, and was finally liquidated later in 1885. Union du Crédit de Bruxelles and Banque Central Anversoise had to be re-organized. Banque de Bruxelles failed, as well.

Policy responses: "The NBB was not officially involved in the massive [rescue] operation [of Banque de Belgique], nor [in 1876] did it provide large

amounts of additional liquidity to the market in a discreet way. [...] Similarly, the NBB did not join the efforts to rescue the Banque Centrale Anversoise in April 1876" (Buyst & Maes, 2008a, p. 169). Instead of the NBB, major private bank Société Générale de Belgique was heavily involved in the rescue operations of Banque de Belgique, Banque Centrale Anversoise, and Union du Crédit de Bruxelles. Only for the latter, did the NBB provide financial aid even if the contribution was rather small. The former two were reorganized (Grossman, 2010, p. 299). According to Buyst & Maes (2008a), neither the NBB nor the Société Générale can be said to have assumed the full role of lender of last resort.

Buyst & Maes (2008a): "[In 1872, after the failure of Banque de l'Union,] the Société Générale and the Banque de Belgique, together with eleven other financial institutions, participated in a temporary discount house. The NBB was not among them, but the issue institute pledged to pay 20 percent of the discount house's potential losses. Moreover, figure 4 shows a substantial increase in the NBB's (re)discount operations in 1872 and 1873 which suggests that the issue institute also provided emergency liquidity assistance."

Buyst & Maes (2008a): "In all rescue operations set up by [Belgium's Minister of Finance Jules] Malou [in 1876], the Société Générale was clearly present (table 3). Nevertheless, it would be too rash to state that Belgium's largest financial institution acted systematically as a kind of lender of last resort. Much depended on the personality of the Finance Minister. Malou's successors took a far less active stance when banks got into trouble" (p. 169).

Consequences: Grossman (2010) reports that Durviaux (1947) calls this a serious crisis, while Chlepner (1943) suggests it may have been less serious. Buyst & Maes (2008a) follow Durviaux's (1947) judgement. Our GDP estimates suggest that real growth slowed by 3 percentage points but did not turn negative.

Sources:

Bayot, B (2017). Histoire bancaire en Belgique. Report, part 1. Réseau Financité. Available at: https://www.financite.be/fr/reference/histoire-bancaire-en-belgique-13.

Buyst, E. & Maes, I. (2008a). Central banking in nineteenth-century Belgium: was the NBB a lender of last resort? *Financial History Review,* 15, 153-173.

Cameron, R. & Bovykin, V. I. (1991). *International Banking, 1870-1914*. Oxford University Press.

Chlepner, B. S. (1943). *Belgian banking and banking theory.* Washington, DC: Brookings Inst.

Durviaux, R. (1947). *La banque mixte: origine et soutien de l'expansion économique de la Belgique.* Brussels: Établissements Émile Bruylant.

Grossman, R. S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800.* Princeton, NJ: Princeton University Press.

1885

Background and causes: Severe financial stress reemerged in the mid-1880s. The banking system was already weakened from the crises of the previous decade. "The first banks hit were those already weakened by the turmoil of the 1870s. [. . .] The 1885-1886 financial crises coincided with a deep industrial slump" (Buyst & Maes, 2008a, p. 170).

The crisis: Banque de Belgique closed down permanently, and the country's third-largest bank Banque des Travaux Publics failed in 1885. The successors of Jules Malou as directors of Socieéteé Geéneérale de Belgique took a far less active stance when banks got into trouble (Buyst & Maes, 2008a, p. 169).

Failed banks: The third-largest bank Banque des Travaux Publics failed in 1885. Other smaller banks seemed to have failed, as well.

Policy responses: In 1885-1886, no rescue operations were set up and several banks went bankrupt. "The absence of a lender of last resort of some kind was felt in a painful way" (Buyst & Maes, 2008a, p. 170). The NBB was seriously constrained as to the range of assets it could accept as collateral. Furthermore, it gave clear priority to safeguarding the convertibility of its banknotes over safeguarding financial stability. Lastly, "the NBB became a bureaucratic, inward looking institution with little attention for the new responsibilities in the public interest that an issue bank could take up" (Buyst & Maes, 2008a, p. 171).

Consequences: According to our estimates, private credit collapsed by over 40% in relation to GDP, while GDP continued to grow. Buyst & Maes (2008a), citing Durviaux (1947), report that more than 20% of total paid-up capital in the Belgian banking sector went up in smoke.

Sources:

Buyst, E. & Maes, I. (2008a). Central banking in nineteenth-century Belgium: was the NBB a lender of last resort? *Financial History Review,* 15, 153-173.

Durviaux, R. (1947). *La banque mixte: origine et soutien de l'expansion économique de la Belgique.* Brussels: Établissements Émile Bruylant.

1900

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. However, narrative evidence suggests extensive bank distress.

Background and causes: Buyst & Maes (2008a) and Grossman (2010) report a minor banking crisis. On close inspection, however, we were not able to find evidence of widespread bank failure nor of a panic.

The crisis: Caisse Commerciale de Bruxelles was absorbed by the Credit Liegeois and several other financial institutions were in difficulty. More information may be available in Chlepner (1930, p. 96, and 1943, p. 37) and Durviaux (1947, p. 82), which Grossman (2010) references.

Failed banks: Caisse Commerciale de Bruxelles was absorbed by the Credit Liegeois. We do not have further information whether this was due to a failure or not. Grossman (2010) reports that "many small new and stock-market-related institutions went out of business."

Policy responses: There is no evidence of any public or private rescue operations, either. Buyst & Maes (2008a) report that "no rescue operations were set up."

Consequences: While real GDP continued to grow, private credit collapsed quite strongly by about 40% in relation to GDP.

Sources:

Buyst, E. & Maes, I. (2008a). Central banking in nineteenth-century Belgium: was the NBB a lender of last resort? *Financial History Review,* 15, 153-173.

Chlepner, B. S. (1930). *Le Marche Financier Belge Depuis Cent Ans.* Brussels: Falk Fils.

Chlepner, B. S. (1943). *Belgian banking and banking theory.* Washington, DC: Brookings Inst.

Durviaux, R. (1947). *La banque mixte: origine et soutien de l'expansion économique de la Belgique.* Brussels: Établissements Émile Bruylant.

Grossman, R. S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800.* Princeton, NJ: Princeton University Press.

1914

Background and causes: The year of 1914 saw two separate events of financial distress.

The crisis: First, in spring, the country's third-largest bank Banque de Reports de Fonds Publiques et de Dépôts d'Anvers suspended payments and was rescued and acquired by Société Générale de Belgique. Second, in July, Austria's declaration of war against Serbia which would mark the beginning of the First World War led to a banking panic in Belgium. Lemoine (1929): "The declaration of war on Serbia by Austria caused, at the end of July 1914, a banking crisis in Belgium, manifested by the withdrawal of deposits from the private banks and demands for the redemption of notes by the National Bank of Belgium." The stock exchanges in Brussels and Antwerp closed and private banks suffered from widespread withdrawals.

Failed banks: The third-largest bank, Banque de Reports de Fonds Publiques et de Dépôts d'Anvers, failed and was rescued through acquisition by Société Générale.

Policy responses: There are reports that the NBB assisted the rescue operation of Banque de Reports de Fonds Publiques et de Dépôts d'Anvers. These reports, however, cannot be backed up by archival sources of the NBB. "In any case it seems rather unlikely that the NBB would have backed an operation, not integrated in a broader consortium..." (Buyst & Maes, 2008a, p. 171).

The NBB answered the second crisis following the outbreak of the war by heavily rediscounting the commercial portfolio of these banks (Lemoine, 1929). Notes were presented in large quantities for redemption at the NBB's head office and the panic continued to rage on. When several banks ran out of eligible collateral and threatened to exhaust their funds, the "banks formed a consortium with limited joint liability to furnish the second signatures on the promissory notes of credit establishments. These promissory notes, reinforced by security, could be discounted by the [NBB]." (p. 190). This measure and "a royal decree of August 3, established a moratorium of bank deposits, limiting withdrawals to a thousand francs in fifteen days" (ibid.) were successful at quelling the panic.

Lemoine (1929): "To meet the crisis, the Bank of Issue rediscounted the commercial portfolio of all of the banks, and between July 25 and August 6, the Bank's holdings of Belgian commercial paper rose from 425 million francs to 818 million. The discount rate was raised from 4 to 7%. Extensive and liberal redemptions of the Bank's notes at the head office in Brussels and in the

provincial agencies did not stop the panic, especially since the hoarding of specie caused a scarcity of the smaller media of payment, the bank note of the lowest denomination being that of twenty francs.

In spite of the enormous rediscounting of the commercial portfolios of the banks, several that had considerable credits abroad found their available funds exhausted. The statutes of the Bank forbidding it to make advances on other assets, the banks formed a consortium with limited joint liability to furnish the second signatures on the promissory notes of credit establishments. These promissory notes, reinforced by security, could be discounted by the institution of issue.

In fact, the consortium had an excellent moral effect that checked the panic. In addition, a royal decree of August 3, established a moratorium of bank deposits, limiting withdrawals to a thousand francs in fifteen days. Following the withdrawal of specie and the issue of notes, the Bank's reserve had fallen on August 7, 1914, from 44.4% of the amount of its sight liabilities (bank notes and current accounts) to 27.7%, the legal minimum being 30%. The government authorized this infringement of the statutes" (pp. 189-190).

Consequences: Both panics were dealt with effectively. While in the beginning of the year, it was Société Générale which was able to safe the banking system by taking over Banque de Reports de Fonds Publiques et de Dépôts d'Anvers, later in the year it was NBB's liberal lending policy that stop a liquidity crisis from developing into a full-blown banking crisis.

Sources:

Lemoine, R. J. (1929). The Banking System of Belgium. In Willis, H. P., & Beckhart, B. H. (Eds.). *Foreign Banking Systems.* NY: Henry Holt and Company, 175-288.

Buyst, E. & Maes, I. (2008a). Central banking in nineteenth-century Belgium: was the NBB a lender of last resort? *Financial History Review,* 15, 153-173.

1920

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here just for the purpose of demonstrating this conclusion.

Background and causes: The end of World War resulted in a global recession.

The crisis: Grossman (2010) reports that the "end of the post-war boom

led to bank failures" (p. 300) and cites Chlepner (1943) who argues that this episode, however, "did not rise to the level of crisis." Vanthemsche (1991, p. 105) also seem to point more towards a period of banking concentration through mergers and acquisitions than one of crisis.

Vanthemsche (1991): "Between 1895 and 1914, the Belgian banking system was already vigorously expanding, but after the First World War, two features dominated the Belgian banking system. The first was an increasing trend towards concentration. The 1920s were marked by a number of important mergers and take-overs leading to a banking structure where two groups, centred around the Société Générale de Belgique and the Banque de Bruxelles, cumulated in 1930 not less than 52 per cent of the total paid-up capital and reserves of all Belgian banks, and 55 per cent of the total value of the share portfolio. The second feature of the evolution of Belgian banks was the reinforcement of the already existing industrial involvement. Belgian industry had been badly damaged during the war and was to be reconstructed; the Belgian mixed banks fully responded to this need. They supplied large amounts of capital on the occasion of the creation of new societies or the enlargement of existing ones; they kept large amounts of industrial shares in portfolio. An evaluation of the assets of eighteen of the most important banking institutions showed that they held 550 million Belgian francs in private securities in 1919, as against 1.450 million in public securities; in 1929 these items respectively amounted to 3.085 and 340 million. Another important symptom of the banks' growing industrial involvement is the huge development of current account-credits (30 per cent of the balance sheet total of all Belgian banks in 1913, 46 per cent in 1929)" (p. 105).

Failed banks: Some banks failed. No further information available.

Policy responses: There is no evidence of any specific policy measures with regard to the banking sector taken during this period.

Consequences: While the economy did not shrink, its growth drastically slowed down and private credit in relation to the size of the economy collapsed by more than 20%.

Sources:

Grossman, R. S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800.* Princeton, NJ: Princeton University Press.

Chlepner, B. S. (1943). *Belgian banking and banking theory.* Washington, DC: Brookings Inst.

Vanthemsche, G. (1991). State, Banks and Industry in Belgium and the Netherlands (1919-1939), in James, H., Lindgren, H., & Teichova, A. (eds.). *The Role of Banks in the Interwar Economy*, 104-121. Cambridge: Cambridge University Press.

1925

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here just for the purpose of demonstrating this conclusion.

Background and causes: Bussière (1998) reports a monetary crisis in 1926 when Belgium left the Latin Monetary Union and separated their currency from the French Franc.

Bussière (1998): "Belgium's new priorities on the commercial front had their counterpart in the monetary sphere. The liquidation of the Ruhr occupation was accompanied at the start of 1924 by a monetary crisis which struck both the French and the Belgian francs. At the time rumours were rife of deliberate attacks by agents of Germany or the Anglo-Saxon powers to force a settlement. Whatever the role of political pressures, it highlighted the risks the Belgian government took in associating too closely with French plans, and encouraged the prime minister, Georges Theunis, in particular to dissociate the two currencies. The victory of the Cartel des Gnashes in the French legislative elections of May 1924 strengthened this tendency. In the circumstances, the Belgian authorities were obliged to turn to Anglo-Saxon finance in order to arrange the separate stabilisation of the Belgian franc. The bases of stabilisation were elaborated during the summer of 1925, with Montagu Norman, governor of the Bank of England, playing the preponderant role in the negotiations and encouraging the Belgian authorities definitively to divorce their currency from the French franc" (pp. 79-80).

The crisis: Reinhart & Rogoff (2009)—erroneously, in our opinion—consider this a systemic banking crisis. After a close reading of their sources, however, no evidence for widespread bank distress could be found. The authors cite Johnson (1997) who in turn refer to a "funding crisis" in Makinen & Woodward (1990). But "funding crisis" refers to, in the original article, the inability of governments and nonfinancial firms to rollover their debt, not a banking crisis.

Failed banks: -

Policy responses: After attempting to stabilize its new currency, the NBB finally allowed the devaluation of the newly founded Belgian Franc against

the French Franc in July 1926. This is in line with Grossman (2010, p. 300) who records deposit withdrawals over the fear of a currency devaluation. In summary, this event had the characteristics of a currency crisis rather than a banking panic.

Bussière (1998): "Belgium took the necessary domestic stabilisation measures and agreed to adhere to the gold exchange standard which the British supported by contributing to a large sterling/ dollar loan. With this backing, the Banque Nationale de Belgique intervened in the exchange markets in September 1925 in an attempt to stabilise the Belgian franc. Despite heavy sacrifices, however, this first attempt failed, partly because domestic inflationary pressures had not been fully quelled, but mainly because of the speculative pressure on the French franc between October 1925 and March 1926, which spilled over onto the Belgian franc. On 15 March the Banque Nationale de Belgique threw in the towel and allowed the exchange rate to slide" (p. 80).

Consequences: The economy continued to grow throughout the mid-1920s even if at a slower place following the events of the currency crisis. The private credit-to-GDP ratio declined by some 17%.

Sources:

Bussière, E. (1998). Economics and Franco-Belgian relations in the inter-war period. In Boyce, R. W. D. (Ed.). *French foreign and defence policy, 1918-1940: the decline and fall of a great power*, 71-87. London: Routledge.

Johnson, H. C. (1997). *Gold, France, and the Great Depression, 1919-1932.* Yale University Press.

Makinen, G. E., & Woodward, G. T. (1990). Funding crises in the aftermath of World War I. In Dornbusch, M., & Draghi, M. (eds.), *Public Debt Management: Theory and History.* Cambridge University Press, ch. 6.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

Grossman, R. S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800.* Princeton, NJ: Princeton University Press.

1929

Background and causes: Buyst & Maes (2008b) describe the general situation as follows: "Being a small open economy, Belgium was seriously hit by the Great Depression. The general slump in world demand and the spread of various forms of protectionism soon strangled exports. Things became even

worse as the Belgian government decided in September 1931 not to follow the British pound's abandonment of gold convertibility. The subsequent steep depreciation of sterling dealt a heavy blow to Belgium's competitive position on world markets, all the more so as two-thirds of Belgian foreign trade was paid for in sterling" (p. 12).

The crisis: In Belgium, distress in the banking sector during the Great Depression unfolded in two waves. The first wave started in 1929 with collapsing stock prices and in 1930 with several larger bankruptcies in the export industry. "The Banque de Bruxelles, which had pursued a policy of aggressive expansion in the late 1920s, was one of those to suffer heavy losses. When a number of medium-sized banks suspended their payments in 1931-1932, the public began to withdraw deposits, causing a further deterioration in the liquidity position of financial institutions" (Buyst & Maes, 2008b, p. 13). From 1932 onwards, banks started to become seriously distressed.

Buyst & Maes (2008b): "The government responded to the [currency] problems by launching a deflation policy. Reducing domestic prices and costs would once again bring them into line with the lower world market level. However, this proved to be much more difficult than anticipated. In the case of public finances, the government did not succeed in pushing through sufficient austerity measures so that substantial budget deficits kept on popping up. The government often resorted to tax increases that, in one way or the other, pushed up production costs. The reduction in nominal wages also encountered fierce resistance, so that the intended alignment of Belgian prices with the world market level made only painfully slow progress. So, in the sectors exposed to international competition, business closures and downscaling of operations continued unabated (Buyst, 2004).

For many Belgian banks, this was bad news. They often had substantial shareholdings in export-oriented producers of semi-finished goods – steel, non-ferrous metals, glass – precisely the categories hardest hit by the world depression. To survive, these companies needed additional loans. There was immense pressure on the universal banks to put more money on the table, because if a company which it controlled went bankrupt, the financial institution would lose both the stake in the firm and the loans granted (Van der Wee and Verbreyt, 1997). Moreover, no-one could foresee that the economic malaise would drag on for so long. The outcome was inevitable: soon the companies could no longer repay their additional borrowings either, which in turn undermined further the liquidity position of the universal banks. Nor could the financial institutions cash in their share portfolio without incurring heavy losses, because

of the persistently steep fall in share prices" (pp. 12-13).

The second wave occurred in 1934. "Algemeene Bankvereeniging, a credit cooperative, also went nearly bankrupt... In March 1934 the banking crisis reached a first peak with the failure of the Belgische Bank van de Arbeid/Banque Belge du Travail, a middle-sized mixed bank... During the winter of 1934-1935 other middle-sized banks failed, which started off a new and even more intense wave of deposit withdrawals. Soon the whole banking system in Belgium stood on the verge of total collapse" (Buyst, 2003).

Buyst & Maes (2008b): "Only from 1932 onward did some Belgian banks become financially distressed. In 1934 two mid-sized Flemish banks, the Bank van den Arbeid and the Algemeene Bankvereeniging, had to close down [...] At the end of 1934, rumours started circulating that the Algemeene Bankvereeniging and the Middenkredietkas – the savings bank of the Belgian Farmers League – were on the point of closing their doors. Again the government launched a large-scale rescue operation (Goossens 2002), but this could not prevent the outbreak of a general crisis of confidence. People not only rushed to financial institutions to withdraw their deposits en masse. In addition, the government's deflation policy lost all credibility as it seemed to cause nothing but financial crises and unemployment. The spectre of massive capital flight reared its head, rendering the position of the Belgian banking system still more precarious. On international currency markets, the franc soon came under heavy attack from speculators. If a financial catastrophe was to be avoided, an immediate turnaround was essential" (p. 15).

Failed banks: The mid-sized Banque Chaudoir failed in 1930. The smaller bank Banque Belge de Travail and 7th-largest bank Algemeene Bankvereeniging failed in 1934.

Policy responses: Starting in 1929, "the NBB repeatedly set up rescue operations to help banks suffering payment difficulties, but its capabilities were constrained by the strict provisions of its statutes. For example, it was not allowed to rediscount industrial loans, often the most important collateral of universal banks. Also, as a private company, the NBB was very concerned about the satisfactory conclusion of the operations financed. Once all acceptable securities owned by a financial institution with liquidity problems had been pledged, the NBB mercilessly turned off the supply of credit" (Buyst & Maes, 2008b, p. 13).

Buyst (2003) reports that a Glass-Steagall-type law was passed in 1934 in which "existing mixed banks had to be split before January 1936 into a holding

company and a pure deposit bank. Unfortunately, the reform clearly missed the mark, [as] during the winter of 1934-1935 other middle-sized banks failed, which started off a new and even more intense wave of deposit withdrawals."

When, in 1935, the difficulties in the banking sector threatened to escalate, "the Belgian government created a public institution [the Société Nationale de Crédit à l'Industrie (SNCI)] to rescue the banking sector." Since those bonds were backed by State guarantee, this vehicle allowed banks to swap their frozen claims against companies for bonds that were eligible for rediscounting at the NBB. It took several months for the procedures to be implemented and the liquidity support proved to be "too little and too late" (Buyst & Maes, 2008b).

Buyst & Maes (2008b): "The first Decree authorized the banks to exchange sound but frozen claims on industry for bonds issued by the Société Nationale de Crédit à l'Industrie (SNCI), up to a maximum of 2 billion francs. Since those bonds were backed by State guarantee, they could be presented to the NBB for discounting. However, it took several months for all practical problems to be solved and the system to become fully operational. The measure improved the liquidity of banks, but it was a case of "too little, too late". A rough estimate indicates that at least double the amount had to be injected to really get the banking system afloat again. But such an effort was of course not reconcilable with a deflation policy [...]" (p. 14).

"March 1935 brought a radical upheaval on the Belgian political scene. King Leopold III asked the NBB's vice-governor, Paul van Zeeland, to form a government of national unity. Once van Zeeland was appointed prime minister, he immediately devalued the franc by 28 per cent. In the short run, the devaluation of the franc was certainly beneficial to the Belgian economy. It restored the competitiveness of Belgian firms, so that they were able to take full advantage of the revival in international economic activity which got under way in the mid-1930s. Moreover, large amounts of capital flowed back into the country, immediately solving the banks' liquidity problems" (pp. 15-16).

Consequences: The recovery began when Belgium went off the Gold Standard in March 1935 and devalued its currency. Real GDP fell by 7% during the Great Depression and private credit in relation to GDP more than halved. The increases in public debt was relatively moderate in comparison with a growth of around one quarter.

Sources:

Buyst, E. (2003). Corporate governance and the Belgian banking sector, 1934-2000. In *Proceedings EBHA 200*, 1-14. University of Helsinki.

Buyst, E., & Maes, I. (2008b). The Regulation and Supervision of the Belgian Financial System. Bank of Greece, Economic Research Department – Special Studies Division.

Kurgan-van Hentenryk, G. (1991). Finance and financiers in Belgium, 1880–1940. In Y. Cassis (Ed.), *Finance and Financiers in European History 1880–1960*, 317-336. Cambridge: Cambridge University Press.

Bernanke, B., & James, H. (1991). The gold standard, deflation, and financial crisis in the Great Depression: An international comparison. In Hubbard, R. G. (ed.), *Financial markets and financial crises*, 33-68. University of Chicago Press.

1939

Background and causes: Immediate concerns over World War II lead to large capital outflows and mass withdrawal of deposits. Previously, between mid-1937 and September 1938, deposits had fallen by about a quarter because of a new international recession and the growing threat of war (Buyst & Maes, 2008b; Reinhart & Rogoff, 2009).

The crisis: Despite a severe decline in aggregate deposits of 9%, relatively few banks ran into trouble. The Credit Anversois, however, had already been weakened during the crisis of the 1930s, and it failed in December 1939.

BIS (1940): "The failure of the Mendelssohn Bank in Amsterdam precipitated the closing of the Caisse Générale de Reports et des Dépôts of Brussels in November and of the Crédit Anversois early in December. The former was reorganised without loss to the depositors by a banking consortium, but the latter had to liquidate: depositors received 75 per cent, of claims up to B.fcs 10,000 and 25 per cent, above that amount. The Institut de Réescompte et de Garantie, formed in 1935 to grant credits to the banks upon assets which by their nature could not be given as collateral to the National Bank, was called upon to open emergency credits which, at the end of 1939, amounted to B.fcs 568 million. The total deposits held with the banks in difficulties, however, amounted to only 3% per cent, of all bank deposits. In August 1939 the "open-market" powers of the National Bank were extended beyond the limits imposed in 1937: the maximum was raised from B.fcs 1,500 million to at the end of 1939 through the amortisation of securities held under previous laws. The costs of mobilisation and other extraordinary military outlay estimated at some B.fcs 6,000 million a year were met principally by the issue of short-term Treasury certificates, taken in a large measure by the National Bank, whose

holding of government securities rose as is shown in the table. At the end of December 1939, the National Bank held B.fcs 3,740 million out of the total short-term domestic debt of B.fcs 4,430 million." (p. 122).

Failed banks: The fourth largest bank (in 1930) Caisse Générale de Reports et des Dépôts of Brussels failed in November, and the eighth largest bank Credit Anversois failed in December 1939. The former was reorganized without loss to the depositors by a banking consortium, but the latter had to liquidate.

Policy responses: The Belgian government could not raise funds on international capital markets and had to turn to money markets. The newly created Rediscount and Guarantee Institute (RGI) provided advances to Crédit Anversois's depositors. It also tried to arrange a rescue operation, but in vain. Caisse Générale de Reports et des Dépôts was reorganized without loss to the depositors by a private banking consortium that included Belgium's major banks. The bank was reinstituted under the name Caisse de Reports et de Dépôts in 1940 (Scott, 1944, p. 38).

Consequences: There is little evidence over the exact fate of the banks after the start of the war as they were put under German control for the time of the occupation. Due to the war, economic statistics are unreliable in determining the severity of this crisis. It is our overall impression, however, that this was a relatively mild period of banking distress.

Sources:

Buyst, E., & Maes, I. (2008b). The Regulation and Supervision of the Belgian Financial System. Bank of Greece, Economic Research Department – Special Studies Division.

BIS (1940). *Tenth Annual Report.* Basle: Bank for International Settlements.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

Scott, R. D. (1944). Preliminary Study of Certain Financial Laws and Institutions. Treasury Department of Austria, Office of the General Counsel.

2008

Background and causes: In the 2000s, Belgium experienced a period of continued economic growth that was accompanied by a doubling of house prices and inflation rates well above Euro-area averages (IMF, 2009, p. 9). This development came to a grinding halt in the last quarter of 2008 when global trade collapsed. Mortgage lending practices, however, were conservative and

household indebtedness at relatively low levels (IMF, 2010, pp. 8-9) such that Belgium did not experience the bursting of a domestic credit-driven boom-bust cycle but rather imported the crisis through international exposure in trade and banking.

The crisis: "Belgium's financial sector weathered the early rounds of financial turmoil in 2007 but succumbed in September–October 2008. The system's strong capitalization and moderate exposure to subprime risk appeared to confer relative resilience when the 2007 liquidity shock broke. However, tighter world liquidity conditions in the wake of the Lehman collapse, together with specific concerns about Fortis and Dexia banks, triggered a crisis in September 2008. As world financial conditions turned increasingly desperate, the authorities were forced to intervene in all three major Belgian banks and in an insurance company" (IMF, 2009, attached public information notice, p. 2).

Lo Duca et al. (2017): "The Belgian financial sector was impacted strongly by the intensification of the global financial crisis after the default of Lehman Brothers, in particular to the powerful deleveraging forces and severe disruptions in wholesale financing markets in the days that followed the default of Lehman Brothers. This put severe pressure on the profitability and liquidity position of key credit institutions and insurance companies in the Belgian financial system, requiring government interventions to stabilize market confidence. While the immediate trigger was the reliance of these institutions on wholesale financing markets, other institution-specific elements added to the vulnerability of the individual institutions" (Lo Duca et al., 2017, appendix).

IMF (2009): "Worsening world liquidity conditions in the wake of the Lehman collapse, together with specific concerns about Fortis and Dexia banks, triggered the crisis in Belgium in September 2008. Already in early 2008, Dexia's CDS spread spiked due to a loss of confidence by investors in its U.S. monoline and the value of securitized mortgages in the United States, compounded later by concerns about the effects of the collapse of AIG (Table 2; Figure 2). In the case of Fortis—Belgium's largest bank—concerns focused on the costly and ill-timed acquisition of the Dutch operations of ABN-Amro in 2007. The purchase depleted Fortis's capital while the credit turmoil made it difficult to obtain needed liquidity. In addition, Fortis's contradictory statements about its involvement in the subprime market deeply affected market sentiment and investors and depositors' confidence dropped. As world financial conditions turned increasingly desperate, the authorities were forced to intervene in Fortis on September 28 and two days later in Dexia. The third large Belgian-owned bank, KBC, had stronger capital and liquidity positions but faced increas-

ing pressures in October as the crisis spread to Emerging European markets where it has a large presence, necessitating a government recapitalization" (pp. 11-12).

Failed banks: Fortis, then the largest financial-services firm, was nationalized. Third largest bank Dexia was rescued by the governments of Belgium, France, and Luxembourg, and was later liquidated. Second largest bank KBC received several rounds of capital injections.

Policy responses: The state support measures included recapitalizations, asset/liability guarantees, transfer of risky assets to special purpose vehicles, emergency liquidity assistance, and an increased amount of deposit guarantees. Belgium, France and Luxembourg injected liquidity into Dexia and guaranteed liabilities. Belgium, France and the Netherlands provided financial aid to Fortis. KBC received capital support from the Belgian government (Lo Duca et al., 2017)

IMF (2009): "Once the crisis broke, the Belgian authorities intervened decisively together with partner countries. During September-October 2008, the government was forced to step in to all three of the main Belgian-owned bancassurance groups, along with a medium-sized insurance company (Ethias) (Box 3). In the case of Fortis, initially there was a joint intervention with the Netherlands and Luxembourg, with a partial nationalization and capital injections and a management change. The Netherlands subsequently fully nationalized the Dutch assets of Fortis (including the ABN-Amro assets), and Belgium nationalized the remainder of Fortis, agreeing to sell Fortis's Belgian banking operations to BNP-Paribas while segregating toxic assets in an SIV and continuing to hold international insurance operations and some overseas operations. Dexia, a bank originally publicly owned and specialized in financing local and regional governments, had more stable deposit and investor bases, and the Belgian, French and Luxembourg governments jointly injected capital into the bank while providing funding guarantees to keep it afloat. The Belgian authorities also strengthened KBC's capital but without changing the current management. Intervention in the Ethias insurance group was necessitated by a severe weakening in the firm's assets due to the crisis and a poor investment strategy" (p. 13).

Consequences: Real GDP declined by 2.3% while private debt increased by almost 15%. The stock of private credit in relation to GDP fell only marginally.

Sources:

Lo Duca, M., Koban, A., Basten, M., Bengtsson, E., Klaus, B., Kusmierczyk,

P., ... Peltonen, T. (2017). A new database for financial crises in European countries: ECB / ESRB EU crises database. ECB Occasional Paper, No. 194. European Central Bank.

IMF (2009). Belgium: Staff Report for the 2008 Article IV Consultation. IMF Country Report, No. 09/87. Washington, DC: International Monetary Fund.

IMF (2010). Belgium: Staff Report for the 2009 Article IV Consultation. IMF Country Report, No. 10/63. Washington, DC: International Monetary Fund.

Iwanicz-Drozdowska, M., Kerlin, J., Malinowska-Misiąg, E., Smaga, P., Witkowski, B., Nowak, A. K., Kozłowska, A., & Wiśniewski, P. (2016). *European bank restructuring during the global financial crisis.* Springer.

2011

Background and causes: Starting in late-2010, the European Sovereign Debt Crisis developed as sovereign debt yields spiked in several European countries. Belgium, which at the time had the third highest public debt-to-GDP ratio in the Eurozone, was briefly considered to be another candidate for severe headwinds in bond markets like some other countries in the European periphery (Greece, Italy, Ireland, Portugal, Spain). Additionally, Belgium was effectively without a government for the majority of 2010 and 2011 after political parties were unable to form a functioning coalition after national elections in 2010 (Pignal, 2010).

The crisis: Belgian government bonds came under moderate pressure when bond spreads for countries with similarly high public debt levels shot up. Fears over the country's fiscal position in the absence of a functioning government and the prolonged issues with the resolution of Dexia led markets to price Belgium sovereign debt at around 100 basis points above German debt in 2010 (Pignal, 2010). Belgian banks also reported high exposure to Irish sovereign debt. When, "a fiscal consolidation plan was agreed in November 2011, which paved the way for the creation of a new government" (IMF, 2012, p. 4), tensions started to ease. In October 2011, Dexia faced large withdrawals from retail and wholesale depositors alike, prompting the authorities to issue another round of capital injections and guarantees.

IMF (2012): "Since late 2010, the intensifying euro area crisis made Dexia's accelerated deleveraging, as implied by its 2008 restructuring plan, impossible without taking substantial losses. Access to secured wholesale funding was squeezed by falling collateral values. In late-June and early- July 2011, banks' CDS spreads began rising significantly and bank equity prices fell (Figure 1).

Despite a significant reduction in short-term liabilities from €260 billion in 2008 to €96 billion by June 2011, Dexia remained heavily reliant on wholesale funding while its recourse to ECB funding had to be renewed. [Footnote: By the time of its 2008 bail-out, 43 percent of Dexia's balance sheet was financed by short-term instruments. Despite major restructuring, the reliance on short-term wholesale funding still stood at a significant one-fourth of Dexia's total funding needs in June 2011. While its reported capital adequacy appeared healthy compared to peers (with core Tier 1 ratio at 12.1 percent at end-2010 and 10.4 percent under the stressed scenario in the EBA July 2011 stress test), a large part of its assets enjoyed zero risk-weighting with risk-weighted assets only at 21 percent of total assets—at the extreme end in the peer group of global systemically important banks.] Margin calls on interest rate swaps, a lack of unencumbered collateral, and panic of both wholesale and retail depositors in early October 2011 eventually set in motion an intervention by the public authorities in Belgium, France, and Luxembourg. Dexia's business model of predominantly municipal government lending differed significantly from that of other Belgian banks. While the latter have not been directly affected by Dexia's resolution, it has been accompanied by the bankruptcy of some of Dexia's shareholders" (p. 5).

Failed banks: Major Franco-Belgian bank Dexia failed (again) and received bail-out funds (again) from Belgium and France in 2011.

Policy responses: In October 2011, after a large withdrawals from Dexia, the Belgian and French governments declared a guarantee for Dexia's liabilities and announced a plan to split the bank into a sound part and a bad bank. In December 2012, the bank was split up, and its healthy part was put up for sale (Iwanicz-Drozdowska et al., 2016). As no buyer could be found, the latter part operates now in public ownership under the name of Belfius.

Consequences: While Belgium returned to positive growth in 2010 relatively soon after the 2008 crisis economic activity started to slow down again until, in 2013, it flattened out. Growth resumed at very moderate levels of around one-and-half percent in the following years.

Sources:

IMF (2012). Belgium: Staff Report for the 2011 Article IV Consultation. IMF Country Report, No. 12/55. Washington, DC: International Monetary Fund.

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Brazil

1890

Background and causes: "The Republican government that came to power in November 1889 gave further impetus to a banking reform introduced a year before, as the Empire drew to an end. Pressed by the continuing demand for monetary expansion in the wake of the abolition of slavery (1888) and the massive inflow of European immigrants, the new administration [including Finance Minister Rui Barbosa] was forced to act quickly, and new banking and corporate legislation was passed. In essence, it extended the rights to note issue to several private institutions and relaxed the requirements for the formation of limited-liability joint-stock companies. The result was a speculative bubble known as the Encilhamento, which saw the number of banks in Rio de Janeiro alone jump to 68. The volume of bank deposits in the country, in turn, increased 77% and 44% during 1890 and 1891, respectively... As of 1850 there were only three commercial banks operating in the Empire, rising to 17 in 1877 and 26 in 1888... with just over 25% [of deposits] held in the largest bank, the privately-owned Banco do Brasil" (Briones & Villela 2006, p. 13).

Luna & Klein (2014): "It was this banking reform, the cheap credit for agriculture, and the legal changes that made it easier to form corporations, which promoted the rapid growth of the money supply in this period. All these changes and reforms created a climate of euphoria in the first years of the republic, generating a process of intense speculation in the stock exchange, which resulted in the creation of dozens of new companies that used the market to issue new stocks to finance their operations. These new companies were often founded with modest resources, but then raised large amounts of capital in the market from other investors. As these stocks rapidly increased in value, there was created a market bubble, which has been called the "Encilhamento."

Pereira da Silva (2019): "The new banking law of 1888... provided for the incorporation of a new issuing bank (Banco Nacional do Brasil), whose issued papers could be backed by government bonds... In addition, the Treasury made loans to some banks at a rate of 4.5%, with the commitment of this credit being passed on to the agents of farmers, generally at a rate of 6% per year, which were a policy of farming aid loans... This situation of credit advancement, especially in the area of Rio de Janeiro - in which 14 banks in Rio de Janeiro were founded in 1889 - increased even more with the arrival of Rui Barbosa as the first Minister of Finance of the Republican period. On January 17, the minister instituted the banking law of 1890, creating three new issuing

banks (Norte, Centro and Nordeste), which were authorized to issue up to 450 thousand contos de réis - a value that represented more than twice the paper money in circulation at that time - that would be inconvertible and backed by public debt. Along with the banking law, and in order to channel credit expansion to new firms, Rui Barbosa instituted Decrees 164 and 165, also on 17 January 1890, which facilitated the formation of public limited companies. These new companies traded their shares only with the payment of 10% of the capital subscribed by the developers - previously it was necessary to subscribe 20% capital."

The crisis: When the excessive monetary and stock market expansion peaked in 1891, it left the Brazilian economy with inflationary chaos and devastated domestic financial markets that alone would have justified a banking crisis. Additionally, the default of Brazil's neighbor Argentina and the subsequent collapse of Baring Brothers in 1890 led investors in London to reconsider risk in Latin America and inhibited Brazil's access to international capital. This made it difficult for Brazil to abandon gold convertibility to help its banking sector, that by 1891 was characterized by widespread bank failures (Triner, 2000).

Briones & Villela (2016): "With a lag of about one year, inflationary chaos and exchange-rate collapse came to testify to the speculative excesses of the Encilhamento. Widespread bank failure followed, with the volume of demand deposits dropping by more than 50% in real terms between their peak in the third quarter of 1891 and the third quarter of 1893. The extent of the monetary crunch guaranteed that the Brazilian economy would remain stagnant for the rest of the 1890s. Successful stabilization would only be achieved at the turn of the century, following further (and severe) fiscal and monetary contraction implemented at the behest of foreign creditors who, years earlier, had agreed to reschedule Brazil's mounting foreign debt. Deflation ushered a second wave of bank failures, which left Rio with only 10 commercial banks remaining in 1905 – a sharp drop from the 68 existing banks in 1891 [. . .]" (pp. 14-15).

Triner (2001): "The combination of the abolition of slavery, developmentalist efforts to expand both agricultural production (coffee) and industry simultaneously, inconsistent and inflationary monetary policies, large scale rural/urban and international migration, and the military overthrow of the Brazilian monarchy to establish a republic was not a prescription for stability. Nevertheless, a number of factors suggest that it would be useful to examine the relationship between the Brazilian and Argentine crises." (p. 3)

"The proximate events to the Baring Brothers' failure occurred in Argentina,

next-door to Brazil, and... [did not] directly affect [Brazilian] productive prospects or policy determinants. Even without identifiable direct connections, the collapse of Argentine financial markets and the crisis that it generated in London resulted in an immediate deterioration in the cost of money and a slower change to the risk component of long-term capital costs for Brazil. After the crisis, London investors judged Brazilian debt to be riskier and their capacity to commit capital to Brazil to be diminished. In part, because of the investment decisions resulting from those judgements, it was a self-fulfilling assessment. Just as this early period of open financial markets eased access to international capital for the emerging economies of the period, such as Argentina and Brazil, so did it leave them vulnerable. The Baring crisis eliminated the possibility of containing the risks of abandoning the commitment to the gold standard in 1890. It re-initiated (or consolidated) a currency crisis that ultimately spread into the domestic banking and equity markets. While the Baring crisis did not cause the crack of the Encilhamento, the Argentine experience eliminated the possibility of international markets continuing their support of the fragile policy improvements that Brazilians were introducing" (pp. 36-37).

Smith (2014): "[President Floriano Peixoto] found it impossible to restrain money supply and balance the budget because he had to meet unexpected financial costs arising from serious internal disturbances such as the Naval Revolt and the civil war in Rio Grande do Sul. Consequently, the foreign exchange value of the milréis fell to 10 pence in 1892. The devaluation of the milréis not only damaged Brazil's international reputation and ability to raise foreign loans, but it also had the practical effect of making it more expensive to service the foreign debt because the payments were usually made in gold. The low point was reached in 1898 just after the election to the presidency of Campos Sales when it was estimated that servicing of the foreign debt would absorb more than half the federal budget. Even after stringent economies were taken into account, a deficit of 4 million was forecast. A vicious economic circle had been created in which the milréis steadily dropped to 5 pence and the country's gold reserves were seriously depleted."

Vidal Luna & Klein (2014): "As the basic federal income depended on import taxes, crises in the value of exports reduced government revenues... The government had to pay its debts in British pounds sterling, thus the decline of the exchange rate was a factor in generating instability in the public finances. This fiscal deterioration, the inflation of prices and the depreciation of the Brazilian currency internationally, made the foreign bankers unwilling to provide new

credit to Brazil. To add to Brazil's problem there was a major expansion of the coffee harvest, which in 1897 led to a reduction in world prices for coffee, and [...] lowered the value of Brazilian exports."

Failed banks: 58 out of 68 banks in Rio de Janeiro disappeared between 1891 and 1905, many of them through failures (Triner, 2014, p. 158).

Policy responses: The government allowed the Banco Nacional de Brasil and the Banco do Brasil to issue 100 million milreis to solve liquidity problems. This effectively allowed an increase in unbacked circulation. In December of 1890 the government consolidated the banking sector. In 1893, the Banco Nacional de Brasil and the major privately-owned bank Banco do Brasil were merged to form the Banco da República dos Estados Unidos do Brasil, which enjoyed a note-issuing monopoly. Generally, banks did not receive support from the Treasury after the burst of the bubble in 1891-1892, as it adhered to monetary orthodoxy (Bordo & Eichengreen, 1999).

Smith (2014): "Effectively bankrupt, Brazil was saved from financial disaster by the 1898 Funding Loan. This was an arrangement that the Brazilian government negotiated with the British bankers, the House of Rothschild, for a loan of 8.5 million to 'fund' Brazil's budgetary deficit and promote the country's economic recovery. The terms were favorable in that interest payments were deferred for three years and a further moratorium of ten years was placed on the repayment of the original capital sum. The loan, however, was conditional on President Campos Sales undertaking to balance the federal budget and setting targets to reduce the amount of paper money in circulation. Despite criticism that the administration was too subservient to foreign bankers, Campos Sales and his finance minister, Joaquim (Duane) Murtinho, firmly believed that a strict deflationary policy was absolutely necessary to achieve financial stability and economic growth.

Vidal Luna & Klein (2014): "In exchange [for the funding loan], the government promised to eliminate the budget deficit and retire from circulation an amount of money equivalent to the value of the funding loan. The revenues of its customs houses were used to serve as a guarantee of these loans. In order to obtain income to honor its external obligations, the government also instituted a gold charge on its custom duties, which meant that it did not need to compete in the exchange market to acquire the currency."

Consequences: According to our estimates, real GDP collapsed by almost 17% while deposits decline by about one third. Both factors indicate catastrophic implications for the real economy.

Sources:

Bordo, M., & Eichengreen, B. (1999). Is our current international economic environment unusually crisis prone? In Gruen, D., & Gower, L. (eds.), Conference: Capital flows and the international financial system, pp. 18-74.

Briones, I. & Villela, A. (2006). European Banks and Their Impact on The Banking Industry in Chile and Brazil: 1862-1913. Working Paper, No. 108. Vienna: Oesterreichische Nationalbank.

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Vidal Luna, F.., & Klein, H. S. (2014). *The economic and social history of Brazil since 1889.* Cambridge University Press.

1897

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this conclusion.

Background and causes: Reinhart & Rogoff (2009) report civil war, deflation, and currency depreciation. The Federalist Revolution began in 1893 and threatened Brazil's national integrity. The government was forced to increase military expenditure in response to riots across the country. Meanwhile, the decentralized taxation policy implemented by the new regime reduced its national tax income from imported goods. Such measures led Brazil into a sovereign debt crisis, during which Brazilian sovereign debt service totaled £9.8 million from 1893 to 1897 (Weller, 2015, p. 398).

The crisis: Pressured by government officials, the London banking house

Rothschild came to rescue the country in 1898 with the Funding Loan, which enforced austerity measures and effectively withdrew notes from circulation (Triner, 2000, p.47). With such a loan, Minister of Finance Murtinho was able to implement a deflationary policy, which was meant to keep the milreis (the Brazilian currency at the time) at an over-valued position and remove inefficient coffee producers from the country (Bordo and Eichengreen, 1999, p. 43). However, the milreis exchange rate continued to slide with declining international coffee prices. Although Reinhart & Rogoff (2009) list this event as a banking crisis, however, we could not find sufficient evidence of widespread bank failures or a banking panic. This episode clearly has the characteristics of a currency and sovereign debt crisis. In 1898, Brazil defaulted on its sovereign debt.

Bordo & Eichengreen (1999): "Conant notes that Brazil was in civil war [...] The milreis depreciated by 16 per cent against the dollar in 1897 and 7 per cent in 1898. From parity (at 27 pence) in 1889, it fell to under 10 pence in 1898. One adverse effect was to increase the milreis value of Brazil's sterling-denominated external debt... The crisis was ameliorated by a Funding Loan from Rothschild's in London, whose terms stipulated that the federal government could, Argentine-style, suspend its payments on its foreign debts, interior gold loans, and its gold railway guarantees until July 1901. Creditors were issued coupons or gold funding bonds at 5 per cent, secured by the customs revenues of Rio de Janeiro. The government was to deposit, with three Rio banks, securities which would back new note issues up to an equal amount. Eventually these securities would be retired, destroyed or used to buy drafts on Rothschild's; the money would thus constitute a fund for resuming payment on the interest of the outstanding debt. Finally, provision was made for constituting an emergency gold fund to be held in London. In the case of a future confidence crisis in Brazil, this fund would be used to meet demands of British creditors" (pp. 42-43).

Policy responses: There is no evidence of significant policy measures with regard to the banking sector. Regarding public finances, however, "the London merchant banking house of the Rothschilds underwrote a loan to re-finance the Brazilian government debt in 1898" (Triner, 2014, pp. 157-158).

Consequences: According to our estimates, real GDP declined by 7.5%. The real value of deposits collapsed by more than 40% between 1898 and 1900 (Triner, 2014, p. 158). The sovereign debt and currency crisis of the years 1897 to 1899 ultimately culminated in a banking crisis in 1900.

Sources:

Bordo, M., & Eichengreen, B. (1999). Is our current international economic environment unusually crisis prone? In Gruen, D., & Gower, L. (eds.), Conference: Capital flows and the international financial system, 18-74.

Triner, G. D. (2014). British Banking in Brazil during the First Republic. *Locus-Revista de História*, 20 (2).

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly*. Princeton: Princeton University Press.

Weller, L. (2015). Rothschilds' "Delicate and Difficult Task": Reputation, Political Instability, and the Brazilian Rescue Loans of the 1890s. *Enterprise & Society*, 16(2), 381-412.

1900

Background and causes: Severely weakened by the austerity measures connected to the conditions of the Refunding Loan, by widespread deflation and currency devaluation, and, last but not least, by lax banking regulation, the currency and sovereign debt crisis of the late-1890s culminated at the turn of the century in a full-blown banking crisis.

Bordo & Eichengreen (1999): "[Minister of Finance] Murtinho is alleged to have held the value of the currency in an over-valued position in the run-up to the crisis. Manuel Pelaez argues that the crisis was then aggravated by the failure of inelastically-supplied coffee exports to respond to the declining value of the milreis. Murtihno's deflationary policy was meant to expel inefficient coffee producers from the industry. The net effect was to concentrate the industry and limit competition. Manuel Pelaez and Wilson (1976) claim this stifled coffee exports that normally would have accompanied depreciation and hastened recovery" (p. 43).

The crisis: The panic started in 1900 with the failure of major Banco da República*, which was* the quasi-national bank of the Early Republic. This failure triggered a much wider series of bank failures (Triner, 2014, pp. 157-160). Hanley (2005, p. 172-182) reports that domestic banks took the largest hit during the crisis due to their liquidity issues. Unlike foreign banks, which had access to foreign capital, regional banks had little access to branch funds but large shares of the deposits market and found themselves fully exposed to the crisis.

Hanley (2015): "The vulnerability of domestic banks in the great bank panic of 1900 was caused by their low liquidity. This was most evident in Rio de

Janeiro, where commercial banks holding worthless paper dating back to the Encilhamento bubble collapsed under the austerity measures enacted as part of the 1898 Funding Loan... Finance Minister Joaquim Murtinho's economic policies provoked a strong economic recession that felled eight Rio de Janeiro banks in September and October of 1900... The recession worked away at the foundations of São Paulo banking. Between 1902 and 1906, failed banks littered the road, each succumbing at its own pace in a painfully drawn out death spiral. Two banks failed in 1902, one of them the Banco Mercantil de Santos, which, founded in 1873, was the oldest bank in São Paulo. Two more banks failed in 1904, and another in 1906, the same year that the universal Banco Uniaõ de São Paulo abandoned its banking business to become a full-time industrial corporation... The amount of equity invested in São Paulo's domestic banks in 1906 was just half the value of the 1901 sector. Deposits, too, fell spectacularly, by more than 28 percent by 1904 and another 4 percent by 1906. All told, the sources of domestic bank funding fell by more than one-third from 1901 to 1906."

"The most striking result of the bank panic is that it utterly reversed the position of domestic and foreign banks in the São Paulo economy. Where domestic banks had held the lion's share of deposits and extended the greatest proportion of credit before the crisis and its fallout, foreign banks, by virtue of sheer survival, became the predominant financial institutions after the crisis. Contemporary accusations suggested that the foreign banks provoked the bank crisis in order to profit from it. Panics do benefit the survivors, who find themselves in a strong position to absorb the clientele of the failed banks. Indeed, David Joslin's history of British banking in Brazil concludes that the domestic bank failures had positive consequences for the British banks. Yet foreign bankers denied manipulating the market, pointing instead to their more liquid, conservative banking practices as the reason for their survival.

"The liquidity of these banks was an important part of the reason why this reversal occurred, as domestic banks operated with a thinner liquidity buffer than did the foreign banks. It was not the only reason, however. For a bank to fail in a panic, it had to have failed to gain access to fresh funds to cover its obligations. Foreign banks were part of a larger, branch-banking network and therefore did have access to such funds. In a time of crisis, these foreign branches could and did appeal to the home office for an infusion of cash. This access to home funds both acted as a lifeline for the branch and, in effect, served to diversify the bank's assets, shielding it to some degree from local economic conditions... The British Bank, in business since 1892, had never listed home-

office funds among its liabilities, but in 1900 it received a onetime infusion of cash worth 5 million mil-réis... The Brasilianische Bank für Deutschland, likewise, received an infusion of funds when its liquidity ratio worsened from .83 in 1897 to 1.17 in 1898. The São Paulo branch, which had always listed home-office funding on its balance sheet, got an immediate 30 percent increase in its funds from the home office in 1898, an additional 71 percent increase in 1999, and another 5 percent increase in 1900." (pp. 174-175).

Failed banks: A second wave of bank failures (after the first one that started in 1891) occurred. Major bank Banco da República dos Estados Unidos do Brasil failed in 1900. 58 out of 68 banks in Rio de Janeiro disappeared between 1891 and 1905, many of them failed (Triner, 2014, p. 158). Eight banks failed in Rio de Janeiro in September and October of 1900. Foreign bank Banque Française de Brésil and São Paulo bank Banco Mercantil de Santos failed in 1902 in. Two more São Paulo banks failed in 1904, and another in 1906 (Hanley, 2005, pp. 172-178).

Policy responses: The Treasury refused to support Banco da República dos Estados Unidos do Brasil in 1900 during a liquidity crisis that occurred after a short-term decline in the exchange rate. The Treasury took administrative control of the bank and terminated its ongoing business with the private sector. This triggered a (second) wave of bank failures. In 1905-1906, Banco da República dos Estados Unidos do Brasil was fully nationalized by the State and renamed back to Banco do Brasil (Triner, 2000, p. 47; Calomiris & Haber, 2015, pp. 427-428).

Triner (2014): "A major component of the banking reform and organizational structure of the Banco do Brasil was the establishment of a Conversion Office (or currency board, in modern terminology) within the bank. The Conversion Office put Brazilian currency on the gold standard, in anticipation of the continuing decline of the mil-réis to which coffee valorization would contribute" (pp. 158-159).

Consequences: After several dismal years, real GDP declined only slightly in 1900 and then resumed on a positive trajectory. "Deposits in foreign banks fell 32 percent from 1899 to 1904, most of the decline taking place by 1901" (Hanley, 2015, p. 175).

Hanley (2015): "The long-term outcome... was consolidation in the Sao Paulo banking sector. The most spectacular aspect of this consolidation was the concentration of market share in the hands of foreign banks (see Table 6.13). Although foreign banks had been hit earlier and harder by the 1900 bank crisis,

their access to funds from their network allowed them to survive. As a result, the foreign banks captured a large share of the domestic banking business, a share they would not relinquish for twenty years. By 1910, foreign banks had captured half of the banking business in Sao Paulo, and by 1920, foreign banks took almost three-fourths of all deposits and made more than 60 percent of all loans.

This great increase in market share has been attributed directly to the bank panic of 1900. The story, told by British banking historian David Joslin, is that British banks mopped up deposit accounts and took over accommodation during bank crises. In relating the accomplishments of the London and Brazilian Bank's stellar manager, he writes: "[The bank manager, P. J. de Souza] saw the [Sao Paulo city] branch through the critical years after 1892, and when a major run began on all the banks in the city in February 1897 he helped other banks and merchant houses to weather the crisis. [...] During the crisis in October 1900 it again acted as sheet anchor for other banks. On both occasions the branch gained fresh accounts, and the demand for its drafts became even more widespread." The image suggests that the newly acquired market share by foreign banks was a direct result of the bank panic" (pp. 178-179).

Sources:

Bordo, M., & Eichengreen, B. (1999). Is our current international economic environment unusually crisis prone? In Gruen, D., & Gower, L. (eds.), Conference: Capital flows and the international financial system, 18-74.

Calomiris, C. W., & Haber, S. H. (2015). *Fragile by design: The political origins of banking crises and scarce credit.* Princeton University Press.

Hanley, A. G. (2005). *Native capital: financial institutions and economic development in Sao Paulo, Brazil, 1850-1920.* Stanford University Press. (pp. 172-182)

Triner, G. D. (2000). *Banking and economic development: Brazil, 1889-1930.* Macmillan.

Triner, G. D. (2014). British Banking in Brazil during the First Republic. *Locus-Revista de História*, 20 (2).

Weller, L. (2015). Rothschilds' "Delicate and Difficult Task": Reputation, Political Instability, and the Brazilian Rescue Loans of the 1890s. *Enterprise & Society*, 16(2), 381-412.

1914

Background and causes: The Brazilian economy started suffering as early as 1912, which was accompanied by a large increase in government deficits and by a sharp fall in foreign trade and capital flows (Triner, 2000). The reversal of Brazil's favorable balance of payments position, in both trade and capital accounts, caused problems in the local operation of the gold standard and, ultimately, the eventual abandonment of convertibility a year later (Briones & Villela, 2006, pp. 51-53). One major problem was that the global demand for coffee, Brazil's main export good, plummeted with the beginning of the war.

The crisis: Roberts (2013) and Reinhart & Rogoff (2009) argue this is a banking crisis. Roberts (2013, p. 215) dates the panic to July 1914 when deposit runs triggered by the outbreak of World War I led to the closure of stock exchanges across countries in Latin America. Due to the recession that started in 1912, most of the banks had already been cutting their lending for more than a year.

Lough (1915): "[. . .] [By August 1914] most of the banks had been for more than a year slowly cutting down their credits and liquidating their resources; most of them were at this time in an exceptionally strong position. The banking situation was, however, complicated by the unfavorable exchange position of the Banco do Brazil. For some months it had been necessary to sustain the fixed rate of exchange (16d.) both by shipping gold and also by large purchases of short bills on the part of the. Banco do Brazil, which in turn sold its own long bills of exchange. A large proportion of these bills of the Banco do Brazil were falling due in August and the months following. When the war broke out the Banco do Brazil suddenly found its lines of credit in London banks canceled; a shipment of gold for its account which had gone forward in a German vessel was held up; and all the coffee and other bills bearing German indorsements or drawn against goods shipped in enemy bottoms, which it had forwarded to cancel its own commitments in London, were refused acceptance. In consequence it suddenly became imperative for the Banco do Brazil to begin ship ping considerable sums of gold, a process which has been going on more or less steadily ever since. It is stated that the Banco do Brazil at this writing has greatly reduced, possibly almost fulfilled, its London commitments."

"At the same time the Federal Government found itself face to face with large obligations in London which it had no immediate facilities for meeting. It had relied upon the new loan announced in July, as above noted, for funds with which to pay both the interest on its foreign debt and an issue of one-year Treasury bills, amounting to about $7,000,000, due in August 1914. Not only

was the Government itself in no position to pay out gold in London, but, as just explained, it could secure no assistance whatever from the Banco do Brazil. Furthermore, shipping facilities were for the moment almost wholly cut off, and there was therefore no means of building up London exchange with which to meet governmental, banking, and mercantile obligations abroad."

Failed banks: There is no evidence of bank failures.

Policy responses: In 1914, the Treasury lent 100,000 contos to banks after the suspension of the gold standard. After the outbreak of the war, a moratorium on bank deposits, which was extended twice well into 1915, was put in effect. In 1915, the Treasury established a fund of 50,000 contos at the Banco do Brasil to rediscount commercial notes that other banks held (Triner, 2000; Roberts, 2013).

Lough (1915): "In common with every other commercial country, Brazil was forced to adopt extraordinary methods to meet the emergency. At the session of the cabinet on August 4 it was agreed to declare a bank holiday for 10 days—later extended to 12 days, expiring August 17; to ask Congress for a 30-day moratorium following the holiday, which was granted; to take steps to prevent the exportation of gold; and to close the Office of Conversion. On August 11 Congress authorized the issue of 250,000 contos (say $80,000,000) of new paper money, 150,000 of which was to be paid out by the Federal Treasury to settle its more pressing obligations, while the remaining 100,000 was reserved for distribution to banks which were in need of cash. The currency, which was already at a high level considering the stagnation of business, was thus suddenly increased by well over 25 per cent."

"The 100,000 contos reserved for the banks were secured by deposits of Federal stock or commercial bills to a par value of approximately 140 per cent of the amount loaned by the Government. The banks agreed to repay the money advanced to them by December 31, 1915. As the law provided that only those banks which have at least two-thirds of their capital in Brazil could obtain any of this money, the privilege was for all practical purposes restricted to domestic institutions. It is understood that about one-fourth of the total amount went to the Commercial and Industrial Bank of Sao Paulo, and perhaps one-third to the Banco do Brazil, while the rest was scattered among the various domestic banks, chiefly in the coffee-growing district. At this writing all of these loans are still outstanding. [...]"

"Before the expiration of the bank holiday on August 17 Congress voted a 30-day moratorium. Later a second moratorium of 90 days, from September

17 to December 15, was put into force. A final and third moratorium was established, running from December 15 to March 15. This third moratorium, however, provided that 25 per cent of each obligation affected should become payable on January 15, 35 per cent on February 15, and the final 40 per cent on March 15" (pp. 24-25).

Consequences: The panic led to a marginal decline in deposits of around 3%. We do not have real GDP estimates for the time of World War I, but narrative evidence suggests that the negative economic consequences partly due to the panic but largely due to the collapse of Brazil's trade were significant. Brazil's banking system remained stable and functioning (Lough, 1915, pp. 23-28).

Sources:

Briones, I. & Villela, A. (2006). European Banks and Their Impact on The Banking Industry in Chile and Brazil: 1862-1913. Working Paper, No. 108. Vienna: Oesterreichische Nationalbank.

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Lough, W. H. (1915). *Financial Development in South American Countries.* Department of Commerce, Bureau of Foreign and Domestic Commerce, Government Printing Office.

1923

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this conclusion.

Background and causes: From the beginning of World War I until the early 1920, Brazil's access to international markets was severely limited, which led domestic financial markets to develop in its place. The Treasury and Banco do Brasil facilitated monetary expansion through increased note issuance (Triner, 2014, pp. 164-165). When global commodity prices collapsed after the end of the war and new liquidity contractions arose in global financial markets, Brazil was unable to uphold their expansive policy. "Increasing international and domestic debt burden, price inflation and the strong global post-war slump

in commodities diminished the financial options for the Brazilian government by 1923. Through the mid- and late-1920s, the Brazilian economy was under pressure" (p. 165).

The crisis: Bordo et al. (2001) and Reinhart & Rogoff (2009, 2014) classify this as a banking crisis, but this classification may not be accurate. Reinhart & Rogoff (2009, pp. 353-356) report a severe monetary contraction due to Brazil's return to the Gold Standard, which is confirmed by Triner (2014, pp. 164-166). Between 1925 and 1925, banks were challenged to deal with a severe shortage of funds due to monetary policy. Nevertheless, banks seemed to fare relatively well, and overall, there is little evidence of bank runs or failures. Reinhart & Rogoff (2009) claim that the banking system contracted by 20%, citing Triner (2000). Triner (2000, p. 57), however, only seems to refer to the money supply.

Failed banks: -

Policy responses: In 1923, A newly elected government pursuing monetary orthodoxy reorganized the Banco do Brasil, making it a central bank with the monopoly on note issue and the Treasury as the major shareholder. The Treasury closed the Rediscount Office. "Reflecting economic and political realities, orthodox monetary policies regained political strength. At the end of 1922, a new government based its strength largely on an orthodox platform of tightened monetary policy and financial restructuring" Triner (2014, p. 165).

Consequences: Economic growth fell flat in real terms in 1924 and 1925 but otherwise was clearly positive until the end of the decade. Private credit, however, contracted by slightly more than 30%. Total deposits declined by roughly 18% (Triner, 2000).

Sources:

Triner, G. (2000). *Banking and economic development: Brazil, 1889-1930.* Macmillan.

Triner, G. D. (2014). British Banking in Brazil during the First Republic. *Locus-Revista de História*, 20 (2).

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

1926

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this

conclusion.

Background and causes: "The pressure on public finance and the consolidation of the banking system continued through the remainder of the 1920s; and the financial situation remained precarious. The severe deflationary monetary policies (partially associated with the Montagu Commission recommendations) were in effect until 1926. They were followed by a sharp domestic recession, largely due to contraction in the textile industry" (Triner, 2014, p. 167).

The crisis: Reinhart & Rogoff (2014) refer to this period as a non-systemic banking crisis but do not do so in their 2009 book. Banco de Brasil was affected by deflationary policies (Triner, 2000, p. 59). There is no evidence indicating bank failures or a banking panic.

Failed banks: -

Policy responses: There is no evidence of any significant policy measures in relation to the banking sector.

Consequences: The economy continued to grow in real terms and private credit contracted by about 8% in relation to GDP.

Sources:

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

Reinhart, C. M., & Rogoff, K. S. (2014). This Time is Different: A Panoramic View of Eight Centuries of Financial Crises. *Annals of Economics and Finance*, 15(2), 1065-1188.

Triner, G. D. (2014). British Banking in Brazil during the First Republic. *Locus-Revista de História*, 20 (2).

1929

Background and causes: The Great Depression in Brazil was heralded by a domestic recession starting in 1928. The price for coffee, Brazil's main export good, peaked in March 1929 and plummeted afterwards. Its "supply—which had been restored after the WWI disruptions—[had] started to outstrip demand" (Martinez, 2009). State subsidies had long supported the politically influential coffee sector but also created overproduction (Scranton, 2012). When the stock market at Wall Street crashed in October 1929, foreign capital started to dry up. There was also a military coup in 1930 by Getúlio Vargas, who stayed in power as dictator until 1945, along with a civil war in 1932 by

Constitutionalists who opposed the Vargas regime.

Scranton (2012): "After 1929, prices, demand and credit for international sales cratered. Wholesale coffee prices in Brazil dropped from 1929 to 1931, and demand did not rebound. Instead, mountains of unwanted coffee piled up. By mid-1932, the new government's Coffee Stabilization Council had spent $63 million to purchase more than 14 million bags of coffee -- 1.9 billion total pounds -- and then set about destroying it all, the New York Times reported."

Calomiris and Haber (2015): "The Great Depression seriously challenged the deals that sustained this coalition of Paulista and Mineiro elites. The price of coffee completely collapsed. Manufacturing output fell. Unemployment was widespread. The governor of the southern state of Rio Grande do Sul, Getúlio Vargas, put together a coalition called the Liberal Alliance that promised to restore Brazilian economic growth and provide a higher degree of inclusion for the workers who populated Brazil's rapidly growing industrial cities of São Paulo, Belo Horizonte, and Rio de Janeiro. When the election was subsequently stolen, elements of the army carried out a bloodless coup to install Vargas in power... He used his peculiar blend of populism, anticommunism, anti-Semitism, and fascism to create a dictatorship that lasted from 1930 until 1945."

The crisis: Reinhart & Rogoff (2014) refer to this period as a non-systemic banking crisis but do not do so in their 2009 book. Triner (2000, p. 59) state that the depression was comparatively mild in Brazil. In June 1930, "the Brazilian Treasury removed exchange restrictions. The anticipated depreciation of the value of the mil-réis caused all banks to withdraw available funds immediately" (Triner, 2014, p. 167). The result was that local currency was converted into gold and shipped out of the country as much as possible. By 1932, stress in the banking sector had reached levels that had not been observed since 1891 (Triner, 2000).

Scranton (2012): "The Great Depression deepened an ongoing Brazilian political crisis that had intensified during the 1920s and resulted in a military coup and the rise to power of Getulio Vargas in 1930. Civil war broke out in 1932 as Constitutionalists from Sao Paulo rejected Vargas's provisional government... Paulista leaders soon challenged Vargas, demanding a return to constitutional rule and the restoration of Sao Paulo state's full autonomy. Brazil's federal government rejected such options, and the Paulista War broke out in July 1932... Early reports that Sao Paulo's forces had crumbled proved premature. Battles erupted along a 225-mile front, as federal troops sought to subdue Constitutionalist forces that were anchored by the state militia. Ominously for the

rebels, no other Brazilian state joined their revolt... Although a stalemate was widely predicted, Vargas's Navy began a shipping blockade by mining Santos's harbors, preventing coffee exports and food imports. Within weeks, the uprising collapsed, as did coffee prices, which had increased 50 percent during the crisis."

Failed banks: -

Policy responses: Starting in 1929, Banco do Brasil pursued a countercyclical policy after the recession that had set in in 1928. In 1930, the government was overthrown by Getúlio Vargas. In 1932, the new government declared a moratorium on international interest payment obligations and in June created an emergency "Banking Mobilisation Fund" to meet withdrawals of deposits (Calomiris & Haber, 2015, pp. 429-431; Triner, 2000) "This fund, administered by the Banco do Brasil, was formed by contributions from all banks established in Brazil, all cash holdings in excess of 20 per cent of their deposits having to be put at the disposal of the fund. If these resources should prove inadequate, the Treasury was authorised to borrow on behalf of the fund. The purpose of the fund is to assist individual banks by enabling them to meet withdrawals of deposits" (League of Nations, 1935, p. 163). "[...] The Vargas Government announced a moratorium on its foreign debt in 1932" (Triner, 2014, p. 169).

Consequences: Ultimately, the Great Depression turned out to be relatively mild in Brazil in international comparison (Triner, 2000). Still, according to our estimates, real GDP declined by slightly more than 8%, private credit nearly halved in relation to GDP, and the public debt level more than doubled. A military coup in 1930 was followed by civil war in 1932, resulting in a dictatorship under Getúlio Vargas that lasted until 1945. Structurally, the Great Depression resulted in a political and economic shift from agriculture and an export-driven economy driven by influential political elites in the coffee sector, towards industrialization and a focus on domestic demand (Martinez, 2009).

Sources:

Calomiris, C. W., & Haber, S. H. (2015). *Fragile by design: The political origins of banking crises and scarce credit.* Princeton University Press.

Triner, G. D. (2000). *Banking and economic development: Brazil, 1889-1930.* Macmillan.

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econlib.org/library/Columns/y2009/Martinezgreatdepression.html

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Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

1962

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this conclusion.

Background and causes: While Reinhart & Rogoff (2009, 2014) follow Bordo et al. (2001) and report 1963 as a systemic banking crisis, we were unable to find credible evidence that there was any sort of banking crisis. The narrative evidence as well as available macroeconomic data points towards a macroeconomic and political crisis and, to a lesser extent, a balance of payments crisis.

The macroeconomic situation was as follows. From 1951 to 1964, inflation accelerated dramatically in Brazil. From an already high 15% it climbed up to 73%. The main reason for this was a seigniorage policy of government spending that was financed by an inflation tax. Capped interest rates drove out deposits of the nation's banking system and caused the provision of private credit for funding investments continuously to decline. (Calomiris & Haber, 2015, pp. 431-436). During the 1956-1961 national development plan of President Juscelino Kubitschek, Brazil experienced high growth rates in real GDP per capita but entered a recession in 1962 and 1963, accompanied by rising fiscal deficits and inflation. That crisis was followed by a military coup in 1964 and by the implementation of an economic stabilization program in 1964-1967, PAEG, which aimed to stop the inflationary process and resume growth through fiscal and financial reforms.

The crisis: By 1964, inflation was out of control, there was a military coup, and potentially a balance of payments crisis, which led to the implementation of the PAEG economic stabilization program. However, there is no evidence of a banking crisis.

Failed banks: -

Policy responses: The military government that came into power through a coup in 1964 launched a reform plan called PAEG. The reforms were aimed at bringing inflation back under control, consolidating fiscal deficits, and creating a central bank for the country.

Ayres et al. (2019): "PAEG was launched in November 1964. At that time, there was a clear relationship between inflation and the expansion of the monetary base (Figure 5a), and the government understood that it should find alternative ways to finance its expenditures and investment projects other than through seigniorage revenues. The government tackled that problem on two fronts: a fiscal reform to decrease government deficits and a financial reform to create other financing options. On the fiscal side, the government increased its tax revenues to around 23 percent of GDP (Figure 4) and managed to reduce its fiscal deficits, as documented in table 1, subperiod 1965-1972. That was achieved through the creation of new taxes, increases in existing tax rates, and modernization of the tax system with the introduction of a value-added tax. On the financial side, the main changes were the introduction of monetary correction (indexation) to circumvent the legal limits on nominal interest rates, the creation of the Central Bank of Brazil (CBB), and the adoption of a banking system with a clear-cut separation between commercial banks and nonbank institutions. These changes would have important implications for the inflationary process" (p. 6).

Consequences: Our estimates indicate that economic growth did not turn negative but slowed down. A dictatorship ruled the country until 1985.

Sources:

Ayres, J., Garcia, M., Guillén, D. A., & Kehoe, P. J. (2019). The monetary and fiscal history of Brazil, 1960-2016. NBER Working Paper, No. 25421. National Bureau of Economic Research.

Bordo, M., Eichengreen, B., Klingebiel, D., & Martinez-Peria, M. S. (2001). Is the crisis problem growing more severe? *Economic policy*, 16 (32), 52-82.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

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1985

Background and causes: At first, the reforms that were initiated after the change in government in 1964 worked in reducing the country's fiscal deficit. But then in the 1970s unsustainable government spending, financed by external borrowing, was used to boost the domestic economy. When rising interest rates around the globe made external finance increasingly costly in the late 1970s and early 1980s, the government found it difficult to sustain the deficit and started to rely on seigniorage again to pay both principal and interest of the external debt as well as the primary deficit**s**. Inflation stood already at around 100% at the beginning of the decade and doubled until 1985 (Ayres et al., 2019).

The crisis: In the early 1980s, the government prioritized resolving the severe balance of payment crisis over reducing inflation. The main objective was to reduce the need for foreign capital. (Ayres et al., 2019, pp. 9-14). In 1982, the country began accumulating arrears on its external debt repayments while the country's banking problem became serious. The underlying problem was that Brazil's government used the banking system and particularly its many state-owned banks to finance growing fiscal deficits (Chwieroth & Walter, 2019, pp. 457-460). Reinhart & Rogoff (2009, 2014) considers this a systemic banking crisis and Chwieroth & Walter (2019) report that first bank failures occurred as early as February 1985. The government also decided to discontinue agricultural subsidiaries, which rendered several lenders in this sector insolvent. As a result, non-performing loans at Banco do Brasil, the main lender in the agricultural sector, soared. The amount of loans under water reached their height at US$636 million by 1991.

Failed banks: The investment bank, Brazilinvest, was closed by the government. Three large banks, Comind, Maison Nave, and Auxiliar, were nationalized. In February 1985, the government intervened in the 13th-largest bank, Banco Sul Brasileiro, and in a related mortgage lender, Habitasul. The National Housing Bank went bankrupt in 1986 (Reinhart & Rogoff, 2009, p. 354; Chwieroth & Walter, 2019, pp. 457-460).

Policy responses: In February 1985, the government intervened in the 13th-largest bank, Banco Sul Brasileiro, and a related mortgage lender, Habitasul. The central bank injected liquidity into the banking system. In March, a major investment bank, Brazilinvest, was closed by the government. Three large banks, Comind, Maisonnave, and Auxiliar, were nationalized in November 1985 but the government guaranteed their liabilities to depositors. In 1987, Banco Central do Brasil was allowed to deal with failing banks via liquidation, recapitalization, merger and acquisition, and restructuring and resale. The

central bank took temporary control of several state banks and fully protected their depositors. After they stabilized, they were returned to state government control. There also was an IMF program in place (Reinhart & Rogoff, 2009, p. 354; Chwieroth & Walter, 2019, pp. 457-460).

Ayres et al. (2019): "In February 1986, the government implemented the Cruzado Plan. As what became standard in most Brazilian stabilization plans, the first rule was to change the currency, in that case from cruzeiro to cruzado, which meant cutting three zeros. Prices were frozen, and any indexation clauses for periods shorter than one year were forbidden. Wages were converted into cruzados based on the average purchasing power of the last six months but could be readjusted every time inflation hit 20 percent or during the annual readjustment cycle. Moreover, unemployment benefits were introduced, and the minimum wage was raised by 8 percent in real terms. The exchange rate regime also changed, with the domestic currency now pegged to the US dollar. Fiscal and monetary policies were put under the discretion of the policymakers. [...]

"One story that is consistent with such evidence is that even though prices were not allowed to change, equilibrium prices were increasing, which produced overheating since posted prices were too low. Therefore, production increased to meet the higher demand in the beginning, but then production decreased and stores started to run out of stock. Meanwhile, the Central Bank of Brazil tried to keep interest rates low to induce low expectations. One huge imbalance was the inconsistency of the plan for inflation and the monetary base: the monetary base was increasing much faster than inflation itself. In July 1986, the government implemented a timid fiscal package, Cruzadinho, focusing on increasing government revenues. But in reality, Cruzadinho had the opposite result of what policymakers expected. Expecting prices to be allowed to change again, demand increased and the overheating problem became even more dramatic. Inflation remained low, but it was not truly representative because products were scarce. Because of the high demand, imports kept increasing while exports declined (figure 19), thereby exacerbating the trade deficit. A rumor of a large devaluation in the near future reinforced that pattern. This expectation lead to a postponement of exports and an acceleration of imports, which increased the problems with the balance of payments. Facing all these challenges, in November 1986, the government opted for a fiscal plan, Cruzado II, trying to increase revenues through the readjustment of some public prices and some indirect taxes, which led to a high inflationary shock. Once again, the environment was one of high inflation (17 percent per month

in January 1987). Meanwhile, the external crisis was just getting worse. In February 1987, the government suspended interest payments on external debt for an indeterminate amount of time (figure 16). The idea was to stop the losses of international reserves and to start a new phase of the renegotiation of the debt with the support of the population" (pp. 11-12)

Consequences: Growth in real GDP slowed down substantially but did not turn negative. Public debt, however, rose by more than 170% in relation to GDP. A period of hyperinflation with peaks of annual inflation rates of more than two thousand per cent in 1990 and 1994 followed.

Sources:

Ayres, J., Garcia, M., Guillén, D. A., & Kehoe, P. J. (2019). The monetary and fiscal history of Brazil, 1960-2016. NBER Working Paper, No. 25421. National Bureau of Economic Research.

Chwieroth, J., & Walter, A. (2019). *The Wealth Effect: How the Great Expectations of the Middle Class Have Changed the Politics of Banking Crises.* Cambridge: Cambridge University Press.

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: the causes of banking and balance-of-payments problems. *American Economic Review*, 89(3), 473-500.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

Reinhart, C. M., & Rogoff, K. S. (2014). This Time is Different: A Panoramic View of Eight Centuries of Financial Crises. *Annals of Economics and Finance*, 15(2), 1065-1188.

1990

Background and causes: Inflation was very high throughout the 1980s. While in the beginning of the 1980s it stood at around 100%, it soared to 2000% in 1990. From 1985 to 1990 several plans for economic reform were suggested, with some carried out and others failing to secure political support. (Ayres et al., 2019, pp. 14-15).

Laeven & Valencia (2018): "The stance of monetary policy was expansionary throughout 1988-90 and the first half of 1991. As a result, the monetary aggregates expanded rapidly: in 1988-90, the net domestic assets of the Central Bank rose by almost 1,400 percent a year while those of the banking system grew at an average rate of 1,200 percent a year. During the same period,

the public increasingly reduced its holdings of financial assets in real terms: overall liquidity, including government securities held by the public, fell from the equivalent of 23.5 percent of GDP in December 1987 to 19 percent of GDP in June 1991."

The crisis: The consistently high inflation allowed weak banks to continue operating, according to Chwieroth & Walter (2019, p. 457-460), who report that about forty percent of banking sector income came from collecting revenues from the floating temporal difference between check payments and clearing, as the real value of demand deposits were falling so rapidly due to hyperinflation. Thus, any attempt on bringing inflation under control threatened the stability of the country's banks. With the efforts to control inflation, many banks ran into liquidity problems. Reinhart & Rogoff (2009, 2014) report a systemic banking crisis in 1990. Laeven & Valencia (2018) refer to this as a borderline case. The latter date the start of the crisis to February 1990.

Failed banks: There is no evidence of widespread bank failures.

Policy responses: In 1989, an IMF program was put into place. Most of the banks that ran into liquidity problems from 1990 onward were under public ownership. Virtually all liquidity assistance by the central bank went to these banks. A deposit freeze was announced in mid-March 1990 and was planned for 18 months as part of a reform plan, known as "Collor Plan." The un-freezing of deposits began in August 1991 (a month earlier than planned).

Ayres et al. (2019): "In an attempt to reduce the money supply, the government confiscated deposits in both transaction and savings accounts for a period of eighteen months. Those resources amounted to 80 percent of bank deposits and financial investments, which would be held at the Central Bank of Brazil and invested in federal government bonds. These resources were remunerated while they were kept at the central bank, but their rates of return were decided by the government itself and therefore were subject to partial defaults. Following the plan's implementation, monetary aggregates fell sharply, especially the higher ones (figure 20), and real GDP per capita contracted by 5.7 percent in 1990. This reduction in liquidity, however, was not sufficient to control inflation" (pp. 15-16).

Consequences: According to our estimates, real GDP decline by around 2%. Ayres et al. (2019, p. 15), however, report a much more drastic decline of real GDP per capita of 5.7%.

Sources:

Ayres, J., Garcia, M., Guillén, D. A., & Kehoe, P. J. (2019). The monetary

and fiscal history of Brazil, 1960-2016. NBER Working Paper, No. 25421. National Bureau of Economic Research.

Chwieroth, J., & Walter, A. (2019). *The Wealth Effect: How the Great Expectations of the Middle Class Have Changed the Politics of Banking Crises.* Cambridge University Press.

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1994

Background and causes: "The Brazilian economy entered a new phase with the implementation of the "Plan Real" in July 1994. The plan triggered a major process of structural changes, which aimed primarily at lowering inflation" (Laeven & Valencia, 2018).

The crisis: Jacome (2008, p. 13) report this as a systemic banking crisis, and so do Reinhart & Rogoff (2014) and Laeven & Valencia (2018). Non-performing loans were at 16% of total assets at its peak, indicating the severity of this event. Reinhart & Rogoff (2009) date the beginning of the panic to July 1994, while Laeven & Valencia (2018) and Kaminsky & Reinhart (1999) indicate December.

Laeven & Valencia (2018): "With this process [of structural change], a remonetization of the economy took place and with it, liabilities and assets of banks expanded rapidly—loans to private sector grew by 60% during the first year of the plan—despite higher reserve requirements. At the same time a sharp deterioration in the trade account took place, to which the central bank responded by raising interest rates and imposed credit restrictions. The financial situation of banks weakened as bad loans increased noticeably and also because they lost their inflation revenues. The problems were particularly more acute at public banks. For federal banks, the ratio of loans in arrears and in liquidation to total loans increased from 15.4 percent in June 1994 to 22.4 percent at end-1995, and to slightly more than 30 percent in October 1996.

For state-owned banks the ratio increased from 8 percent to almost 12 percent and more than 14 percent for the same dates. For private banks, the ratio increased from 5 percent in June 1994 to 9 percent in December 1995."

Failed banks: 17 small banks were liquidated, representing nearly 35% of market share, and the government put 43 financial institutions under administration or intervention (Reinhart & Rogoff, 2009, p. 354; Jacome, Sedik & Townsend, 2012, p. 27).

Policy responses: Institutions with an aggregate market share of about 35% were either intervened in, liquidated or entered a special administration regime. The problems were particularly more acute at public banks. Most of the closures were medium to small-sized banks, while large banks were resolved under a "good bank/bad bank" approach. Explicit deposit insurance was introduced in 1995 (Laeven & Valencia, 2018).

Consequences: While real GDP continued to grow, even if at a slightly slower rate, the level of private credit contracted by around 10% in relation to GDP.

Ayres et al. (2019): "The years following the implementation of the Real Plan represented a consolidation of the reforms that had begun in the previous subperiod. The government kept the privatization process and promoted both fiscal and banking reforms. Part of these reforms were possible only because of the success of the Real Plan in conquering the hyperinflation, which gave the government the political support to push its agenda of reforms. The value the public bestowed on the new low-inflation scenario became clear in the following presidential elections. Fernando Henrique Cardoso, the finance minister during the elaboration of the Real Plan, was elected president of Brazil in the first round, not only in the presidential elections of 1994 but again in the 1998 elections" (p. 20).

Sources:

Jacome, H., Sedik, T. S., & Townsend, S. (2012). Can emerging market central banks bail out banks? A cautionary tale from Latin America. *Emerging Markets Review*, 13(4), 424-448.

Jacome, H. (2008). Central Bank Involvement in Banking Crises in Latin America. International Monetary Fund Working Paper, No. 08/135. Washington, DC: International Monetary Fund.

Laeven, M. L., & Valencia, M. F. (2018). Systemic banking crises revisited. IMF Working Paper, No. 18/206. Washington, DC: International Monetary Fund.

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Canada

1873

Background and causes: From 1868 to 1874, increasing immigration and the continued expansion of new territories greatly encouraged agricultural activities and commerce, which led to the establishment of twenty-eight new bank charters (Jamieson, 1953, p.22).

The crisis: The traditional view is that, "In the strict sense of the word, Canada suffered no panic" (Breckenridge 1910, p. 114, as quoted by Grossman (2010)). However, Ross (1922) provides evidence of widespread depositor runs starting in July 1873 (pp. 90-91), which is why we consider this episode a panic. The slowdown of economic activity led to heavy losses in the banking sector and caused the money supply and deposits to contract. According to Grossman (2010), "Towards the end of the severe cyclical downturn ushered in by the commercial crisis of 1873, several banks failed or were liquidated [...] These accounted for about 7.5 per-cent of total bank capital at the time. [...] Although the banks were criticized for reducing outstanding credit during this period, most banks survived by relying on their capital and reserves and by mergers" (p. 300)

Ross (1922): "On the evening of July 25 the directors of the Consolidated Bank had a meeting in Montreal with representatives of three Montreal banks, among which were the Bank of Montreal and the Merchants, but apparently nothing could be done to save the tottering institution. On the afternoon of Thursday, July 31, 1879, [Consolidated Bank] suspended payment. The failure was not a bad one, as it was able to pay its creditors, both noteholders and depositors, in full. [...] On August 6, an uneasy feeling was observable in Hamilton and Sarnia with regard to the position of the Exchange Bank of Canada, the head office of which was in Montreal, and the following morning it suspended. Next day came the suspension of the Banque Ville Marie, and rumours regarding the solvency of the Banque de St. Hyacinthe, the Banque de St. Jean and the Banque d'Hochelaga. To quote Mr. Anderson again: 'On the 9th [August] the run upon the City and District Savings Bank [Montreal] was serious, and the aggregate withdrawals of deposits were estimated at $500,000. There was also a run upon the Molson's Bank in Montreal, the Bank of Hamilton in Hamilton, and the Merchants Bank in Hamilton.' [...] On Saturday afternoon the run on the City and District Savings Bank stopped. The Exchange Bank of Canada and the Banque Ville Marie were able to resume payment after the panic had subsided" (pp. 90-91).

Beckenridge (1910): "Through 1874, the effort to restrict accommodation was hampered by the necessity of supporting many debtors whose assets were likely to prove deficient, if realization were forced forthwith. It was not until 1875 that the stringency was generally felt in the fullest force. Early in that year a heavy contraction occurred in both the circulation and deposits of the banks, but although the drain reached $12,500,000 in three months, total discounts were reduced by scarcely 2 per cent. Failures for $28,843,000 occurred in Canada in 1875, or in twice the number and for nearly four times the liabilities of the year before. [. . .]

"At the same time, it was expensive for the banks. In December, 1874, their current loans were reported at $139,379,000; four years later at $97,603,688; the circulation on like dates fell from $29,000,000 to $22,000,000. Notwithstanding all that was written off in these trying years, unsecured overdue debts rose from$ 1,494,000 to $2,921,000, while overdue debts secured by real estate were doubled, and the holdings of real estate, other than bank premises, increased from $575,499 to $2,383,474. By way of reductions of capital stock, amalgamations in which proprietaries of one or both banks took new stock of less value than the par of their old, or by voluntary liquidation, seven banks effected, independently of anything written off their surplus funds or rests, a diminution of the paid-up banking capital of Canada amounting to $6,500,000 between 1875 and 1880." (pp. 114-115).

Failed banks: Bank of Acadia, Mechanics Bank, Bank of Liverpool, and Banque Sainte Hyacinthe failed in 1873. Niagara District Bank, Banque Metropolitain, St. Lawrence Bank Toronto, Stadacona Bank, City Bank Montreal, Royal Canadian Bank, and Consolidated Bank failed in the following years until 1879. With 11 banks, this is a fairly large number of failures since there were no more than 36 banks reporting to the government during this period (Kryzanowski & Roberts, 1993, p. 364; Willis & Beckhart, 1929, pp. 327 & 334-337). According to our estimates, failed bank accounted for 5.7% of total assets in Canadian banks.

Policy responses: There is no evidence of government intervention. Failures and illiquidity crises of individual banks were met by writing down banks' capital, raising new capital often by enforcing double shareholder liability, or by mergers and acquisitions (Jamieson, 1953; Breckenridge, 1910).

Consequences: The economy contracted by slightly more than 9% in real terms and the public debt level rose by more than 40%. The private credit contraction in relation to declining GDP was relatively small at about 3%. The economy did not start to fully recover until 1879.

Beckenridge (1910): "The period of readjustment was long; the recovery exceedingly slow. Just when normal conditions were restored would be hard to determine; little marked improvement in business appeared before the fall of 1879" (pp. 115).

Sources:

Breckenridge, R. M. (1910). The history of banking in Canada. Senate Documents 61st Congress, 2nd Session, document No. 332. Washington: Government Printing Office.

Grossman, R. S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800.* Princeton, NJ: Princeton University Press.

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Ross, V. (1922). *A history of the Canadian Bank of Commerce with an account of the other banks which now form part of its organization.* Volume II. Oxford University Press.

Willis, H. P., & Beckhart, B. H. (1929). *Foreign Banking Systems.* NY: Henry Holt and Company.

1887

Note that while Baron, Verner, and Xiong (2021) do not consider this episode a banking crisis, because the bank equity decline was modest and because of the absence of a banking panic, narrative evidence suggests that bank distress was substantial among a number of small banks.

Background and causes: Although we date the start of the crisis to 1887 when most of the bank failures occurred, the banking crisis may have started as early as 1883. The first half of the 1880s was a period of economic prosperity that was accompanied by a land price boom in Manitoba and in the Northwest Territories that collapsed in 1882 (Jamieson, 1953, pp. 24-25). Canada's neighbor, the United States, had experienced a banking crisis in 1884 that was accompanied by economic stagnation since 1882. After six years of strong growth, the Canadian economy experienced a short-lived but sharp recession in 1885. Real GDP declined by about 6% in 1885 two years before most of the bank failures started to occur, indicating that many of the bank failures may have been the result of the contraction of the real economy.

The crisis: There is no narrative evidence to support a banking panic. However, there were a significant number of bank failures which were triggered by a combination of over-speculation, fraud, and the bankruptcy of some of the banks' borrowers (Breckenridge, 1895). Banks that maintained branches in the regions suffering from the collapse of the land price bubble were especially affected, as many businesses including railway companies in these regions went bankrupt (Jamieson, 1953, pp. 24-25).

Breckenridge (1895): "The collapse of the Northwest boom [in 1883] was still troubling men's thoughts, and many felt that the country was about to experience a serious crisis. The crisis might be precipitated by the sudden stoppage of a single bank and end in the failure of several. The advances [in April 1883 from the government to the Exchange Bank], the friends of the Government afterwards said, were made to prevent a run on the Exchange Bank, and so to ward off the crisis... In the four months following the advances [to the Exchange Bank] the condition of the bank grew worse and worse... the bank failed on the l0th September, 1883... It is true that while the failure caused great scandal and indignation in Canada, it started no panic. The prices of bank stocks generally were unaffected...

"The next failure was that of the 'Maritime Bank of the Dominion of Canada' situated in St. John, N. B... Its president was described as a merchant, manufacturer, politician and banker, a man of large ambition and small capital, always ready to play high, especially when staked with the money of others. The bank was reorganized in 1883-4, put in more careful hands, and the paid-up capital reduced by 64 per cent, to $247,000. In spite of the fact that large provincial and Dominion deposits were made with the bank, its subsequent course was not prosperous. In 1887 it had accounts overdrawn for $650,000, of which $350,000 were against the assets of bankrupts. Advances far in excess of its capital were locked up in a series of lumber accounts, which, though under different names, were really against a single concern. The bank became a party to kiting sterling bills of exchange in order to sustain itself. When it stopped payment on the 8th March, 1887, its liabilities were about $1,826,000.

"Through the failure of some of its largest debtors, the Pictou Bank, of Pictou, N. S., suffered dangerous lock-ups between 1884 and 1886. amounting to over $220,000. No dividends were paid after January, 1884, and in 1886, 20 per cent, of its paid-up capital was written off by authority of Parliament. The next year it became necessary to suspend banking operations. The shareholders secured a permissive act, and in September, 1887, the bank being still solvent, they voluntarily put it into liquidation, paid their debts in full.

"The Bank of London, ... after a brief life of four years, suspended payment on 19th August, 1887. The fortunes of the bank were blighted by the sinister influence of a speculative president.

"The liquidation of the Central Bank of Canada was not quite so creditable. This bank was another young concern chartered in 1883. It suspended payment on the 16th November, 1887, and ceased a business which, for a year at least, had been distinctly discreditable. It placed stock in towns outside of Toronto by promising to establish branches if certain amounts were subscribed for. It had pushed business tending to increase the note circulation. It had even paid brokers for help in keeping out its issues, and in order to get money it sold them certificates of deposit at a discount. Its comparatively large deposits were acquired by paying one or two per cent, more than the current rate. A few large customers, a clique of directors, and certain brokers got advances utterly out of proportion to their credit. Through their schemes, and in methods still more scandalous and dishonest, the capital of $500,000 and the proceeds of the double liability to nearly an equal sum, were wholly sunk.

"The Federal Bank of Canada (originally called the Superior Bank) ... [engaged in] a highly disreputable evasion of the prohibition in the Bank Act against loaning on bank stocks. A run was started on the bank in the last days of June and the first week in July, but was successfully met by help of the other banks, who offered temporary advances for $2,000,000, and made arrangements for transfers of discount accounts. Under the new manager appointed [and capital write-downs]... the Federal Bank did not recover its prosperity, or the full confidence ordinarily placed by the public in its banking institutions. Bank stocks fell generally in the autumn of 1887, and the Federal dropped below par. The bank was thus discredited, and between the 31st October and the 25th January its situation again became critical... [The other banks] offered to advance enough money to pay off the entire liabilities of the bank, and to wait for repayment from the liquidation of its assets, on condition that the bank should be wound up with open doors... [to] avoid the panic which the Federal's suspension, after the uneasiness due to the Central and London failures, was likely to cause.

Failed banks: Exchange Bank failed in 1883. Maritime Bank, Pictou Bank, Bank of London, Central Bank, and Federal Bank, all small banks, failed in 1887 and 1888 (Kryzanowski & Roberts, 1993, p. 364). Fingard (1993) also mentions the failure of the Merchants Bank of Saint John in 1887. According to our estimates, failed banks accounted for at least 4.5% of total assets in Canadian banks.

Policy responses: There is no evidence of significant policy measures in direct response to the bank failures. Several reforms of the banking system were adopted by Parliament under the *Bank Act of 1890*. Afterwards, the charters of the Canadian banks were renewed for another ten years (Breckenridge, 1895, pp. 315-351). One of the important additions was the creation of the Notes Redemption Fund which was to be used for redemption of notes of suspended banks. The Fund would furthermore pay an interest rate to note holders of failed banks to compensate for the time span between the suspension of payments and the actual repayment of the funds after the liquidation (Fung, Hendry & Weber, 2017, pp. 7-8).

Consequences: A first clearing house was set up in Halifax in 1887 and other regions soon followed (Jamieson, 1953, p. 25). The economy continued on a growth path from 1886 through 1891.

Sources:

Breckenridge, R. M. (1895). *The Canadian banking system, 1817-1890.* Publications of the American Economic Association, Volume 10, Nrs. 1-3.

Fung, B. S. C., Hendry, S., & Weber, W. E. (2017). Canadian bank notes and Dominion notes: Lessons for digital currencies. Staff Working Paper, No. 2017-5. Bank of Canada.

Jamieson, A. B. (1953). *Chartered banking in Canada.* Toronto: The Ryerson Press.

Kryzanowski, L., & Roberts, G. S. (1993). Canadian Banking Solvency, 1922-1940. *Journal of Money, Credit and Banking*, 25(3), 361–376.

1893

Note that while Baron, Verner, and Xiong (2021) do not consider this episode a banking crisis, because the bank equity decline was modest and because of the absence of a banking panic, narrative evidence suggests that bank distress was substantial among a number of small banks.

Background and causes: The traditional view is that Canada was relatively unaffected by the global banking panic of the early 1890s (Reinhart & Rogoff, 2009; Bordo, Redish & Rockoff, 2015; Bordo, 2018). We find, however, that both its real economy and banking sector were adversely affected, with several bank failures clustered in this time period.

The crisis: International financial stringency caused by the global panics of 1890 and 1893 seem to have affected Canadian banks. Even though the

banking crisis was not systemic, there were significant bank failures. Heavy withdrawals from the Commercial Bank of Manitoba in July 1893 led to its failure and marked the beginning of a period of bank distress. Several other failures occurred in 1885. In parallel, Newfoundland, which at the time was not yet part of the Confederation, experienced a severe banking crisis at the end of 1894 that caused the island's economy to collapse (Higgins, 2008a).

Breckenridge (1910): "Six of the banks acting under Dominion charter have failed since 1889; two others, now in process of winding up, have been obliged by heavy losses to withdraw from business, although, through the help of other banks, it has been possible to conduct their liquidation with open doors. The first of the failures, attributable to ill-advised or incapable administration of the bank's lending resources, and first also in point of time, was that of the Commercial Bank of Manitoba, with its head office in Winnipeg, July 3, 1893. On the date of failure, the liabilities amounted to $1,344,269 and the nominal assets to $1,954,167. Its note circulation, partly as the result of heavy withdrawals by depositors, preceding the failure, had run up to $419,485, the paid-up capital being then but $552,650. Ultimately the depositors and other creditors, as well as the note holders, were paid in full. Better to realize upon certain assets through giving the debtors more time than was originally agreed, the liquidator of the bank arranged with other banks, sometime competitors of the Commercial, for a slight extension of the period—sixty days after suspension—within which redemption of all outstanding notes should have been offered" (pp. 166-167).

Higgins (2008): "On 10 December 1894, two of Newfoundland and Labrador's three banks closed their doors and never opened them again. The impacts were immediate and widespread – businesses collapsed, workers became suddenly unemployed, families lost their savings, and the country, which used the bank notes as its main source of currency, was left with no reliable circulating medium. Although the crash caught most people off guard, it was the result of many years of reckless banking amid a troubled fishery and declining economy. The banks depleted their own holdings to loan large sums of money to fish merchants already in debt and in turn had to borrow from other financial institutions. The process left the banks dependent on outside loans – if a crisis disturbed the process or if the banks' credit deteriorated, then they would be forced to close. This was the case on Black Monday, when the Union and Commercial Banks ceased operations permanently."

Failed banks: Commercial Bank of Manitoba failed in 1893, while Banque Ville

Marie, Banque du Peuple, and Banque Saint Jean failed in 1895.[9] According to our estimates, failed banks' assets accounted for 6.9% of total assets in Canadian banks. On Newfoundland, two of the three banks of the island—the Commercial Bank and the Union Bank—failed on 8 December 1894 and never re-opened. The remaining institution, Newfoundland Savings Bank, was owned by the public and managed to stay solvent (Higgins, 2008a).

Policy responses: Breckenridge (1910) reports that the existence of the previously established Notes Redemption Fund enabled the bank notes of the failed Commercial Bank of Manitoba to circulate at face value with other banks. Depositors were paid back in full after some time and the fund did not even have to be used. While capital for the Fund was collected by the Treasury from private banks, there was explicitly no government guarantee for its solvency (Fung, Hendry & Weber, p. 8). Other than that, there is no evidence of significant policy measures in direct response to the bank failures.

Fung, Hendry & Weber (2017): "The Act did not provide for any government liability with respect to the Bank Circulation Redemption Fund. That is, there was no provision in the Act for the Canadian government to step in should the Fund not have enough resources to redeem the notes of all insolvent banks should several banks with substantial amounts of notes in circulation fail at the same time. Although this possibility was recognized, according to Breckenridge (1894, 260), it was thought by the legislature that, 'The experience of twenty-three years showed the improbability of one of the overwhelming banking catastrophes, without which a long impairment of the fund would be impossible.' The Bank Circulation Redemption Fund was never used" (p. 8).

Consequences: Canada's economy contracted by 3.7% in real terms in during 1895 and 1896 according to our estimates. After the severe crisis on Newfoundland, which saw the island's banking system collapse, Canadian banks quickly arrived to provide financial intermediation which led the island to adopt Canadian currency long before it joined the Confederation (Higgins, 2008a).

Sources:

Bordo, M. D., Redish, A., & Rockoff, H. (2015), Why Didn't Canada Have a Banking Crisis? *The Economic History Review*, 68, 218-243

Bordo, M. D. (2018). Reflections on the Evolution of Financial Crises: Theory, History and Empirics. In: Rockoff, H., & Suto, I. (Eds.), *Coping with Financial Crises*, 1-15. Singapore: Springer.

[9] Kryzanowski & Roberts (1993, p. 364) state that Bank of Prince Edward Island failed in 1891, though this is likely incorrect, as Breckenridge (1910) and Fingard (1993, p. 92) state that it failed in 1881.

Breckenridge, R. M. (1910). The history of banking in Canada. Senate Documents 61st Congress, 2nd Session, document No. 332. Washington: Government Printing Office.

Fingard, J. (1993). The 1880s: Paradoxes of Progress. In Forbes, E. R., & Muise, D. A. (eds.). *The Atlantic Provinces in Confederation*, chapter 3, 82-116. University of Toronto Press.

Fung, B. S. C., Hendry, S., & Weber, W. E. (2017). Canadian bank notes and Dominion notes: Lessons for digital currencies. Staff Working Paper, No. 2017-5. Bank of Canada.

Higgins, J. (2008). The 1894 Bank Crash. Newfoundland and Labrador Heritage Website. Available at: https://www.heritage.nf.ca/articles/economy/1894-bank-crash.php.

Kryzanowski, L., & Roberts, G. S. (1993). Canadian Banking Solvency, 1922-1940. *Journal of Money, Credit and Banking*, 25(3), 361–376.

Reinhart, C. M., & Rogoff, K. S. (2009). *This time is different: eight centuries of financial folly.* Princeton: Princeton University Press.

1901

Note that Baron, Verner, and Xiong (2021) do not consider this episode a banking crisis. Narrative evidence is given here to help support this conclusion.

Background and causes: The turn of the century was a period of fierce competition in the banking sector during which several smaller regional banks succumbed to the competition of the big banks in the metropolitan areas that were able to offer countrywide services through branching (Howell, 1993; Breckenridge, 1910).

The crisis: Banks were generally in good condition (Darroch, 1994, pp. 175-176) and the reported failures in other sources were in fact mergers due to a competitive trend towards centralization and concentration in the Canadian banking sector.

Failed banks: Only one bank failed, the small Exchange Bank of Yarmouth, which failed on March 6, 1905 (p. 169). The assets of Exchange Bank of Yarmouth accounted for less than 0.2% of the total assets of all Canadian Banks. Except for this case, all the following amalgamations involved banks in good financial condition. The mid-sized Bank of British Columbia (1900), Halifax Banking Company (1903), and the small bank Merchants Bank of Prince Edward Island (1906) were in good financial condition and were ab-

sorbed by Canadian Bank of Commerce to expand its branching network and access to trade finance both at the Atlantic and Pacific (Darroch, 1994, pp. 175-176). The Bank of Montreal bought the Exchange Bank of Yarmouth in 1903, the People's Bank of Halifax in 1905, and the People's Bank of New Brunswick in 1906 (Breckenridge, 1910, p. 165). "The Summerside Bank was sold to the Bank of New Brunswick [and] the Commercial Bank of Windsor (Nova Scotia) to the Union Bank of Halifax (1902)" (Breckenridge, 1910, p. 166).

Breckenridge (1910): "As a consequence of loans to one firm out of all proportion to its own means, the [Exchange] Bank of Yarmouth, one of the more or less local banks domiciled in Nova Scotia, was obliged to close its doors March 6, 1905. A considerable recovery after their failure from the assets of the bank's principal debtors made it possible to pay off depositors as well as note holders in full. The sums involved were not large at the worst [...]" (p. 169).

Policy responses: There is no evidence of significant policy measures in direct response to the bank mergers.

Consequences: Real GDP growth slowed down to 1.4% in 1904 but the economy did not contract. The provision of private credit, however, collapsed by about a quarter in relation to the size of the economy.

Sources:

Breckenridge, R. M. (1910). The history of banking in Canada. Senate Documents 61st Congress, 2nd Session, document No. 332. Washington: Government Printing Office.

Darroch, J. L. (1994). *Canadian banks and global competitiveness.* McGill-Queen's Press.

Howell, C. (1993). The 1900s: Industry, Urbanization, and Reform. In Forbes, E. R., & Muise, D. A. (eds.). The Atlantic Provinces in Confederation, chapter 5, 155-191. University of Toronto Press.

Willis, H. P., & Beckhart, B. H. (1929). *Foreign Banking Systems.* NY: Henry Holt and Company.

1906

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021). Narrative evidence is given here to help support this conclusion.

Background and causes: The early 1900s were a period of economic prosperity that was characterized by urbanization, consolidation of the banking sector, and high real economic growth rates. There is no indication that the bank distress in 1906 was preceded by a contraction of the real economy.

The crisis: The event consists of a single bank failure. In October 1906, the Bank of Ontario failed, which came as a surprise to bankers in the financial centers of the country. The banking community feared that the bank was big enough to potentially jeopardize the stability of the entire banking system, and swiftly decided to intervene. According to Carr, Mathewson, & Quigley (1995, p. 1139), "The assets and liabilities of the Ontario Bank were assumed by the Bank of Montreal in October 1906, with the other members of the CBA [Canadian Banking Authority] giving it a guarantee against ultimate loss. On 31 August 1908, the bank was formally placed in liquidation to facilitate the collection of the double liability, which proved more than sufficient to cover the deficiency in the assets."

Johnson (1910): "On the evening of October 12 [1906] the bankers in Toronto and Montreal heard with surprise that the Bank of Ontario had got beyond its depth and would not open its doors the next morning. Its capital was $1,500,000 and its deposits $1,200,000. The leading bankers in the dominion dreaded the effect which the failure of such a bank might have. The Bank of Montreal agreed to take over the assets and pay all the liabilities, provided a number of other banks would agree to share with it any losses. Its offer was accepted, and a representative of the Bank of Montreal took the night train for Toronto. [...] The bank opened for business the next day with the following notice over its door: 'This is the Bank of Montreal.' " (pp. 81-82).

Failed banks: Mid-sized Ontario Bank failed in 1906. According to our estimates, Ontario Bank's assets accounted for 2.1% of total assets in Canadian banks.

Policy responses: "When a bank that was large enough to threaten the entire system failed [...] the Bank of Montreal stepped in to coordinate a response by the other banks. This happened in 1906, when the Bank of Ontario failed [...]" (Calomiris & Haber, 2015). This event was resolved entirely by the banking sector itself and the government took no action.

Consequences: There is no evidence that this event had any significant impact on the real economy or on regulative legislation. Depositors and noteholders were paid in full (Kryzanowski & Roberts, 1993).

Sources:

Calomiris, C. W., & Haber, S. H. (2015). *Fragile by design: The political origins of banking crises and scarce credit.* Princeton University Press.

Carr, J., Mathewson, F., & Quigley, N. (1995). Stability in the absence of deposit insurance: the Canadian banking system, 1890-1966. *Journal of Money, Credit & Banking*, *27*(4), 1137-1158.

Johnson, J. F. (1910). The Canadian Banking System and Its Operation under Stress. *The Annals of the American Academy of Political and Social Science*, 36(3), 60-84.

Kryzanowski, L., & Roberts, G. S. (1993). Canadian Banking Solvency, 1922-1940. *Journal of Money, Credit and Banking*, 25(3), 361–376.

1907

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021), due to the modest bank equity decline, though there is narrative evidence of bank failures and a sharp lending contraction.

Background and causes: While the early 1900s were a period of great prosperity and of rapid growth of credit and output for Canada, the country "in 1907 was running a current account deficit which it financed out of foreign capital inflows. It then experienced a crop failure and encountered international financial turbulence." (Bordo & Eichengreen, 1999, p. 44). International pressure came from the United States where, in October 1907, the failure of Knickerbocker Trust Company triggered a banking panic. Rich (1989) argues that although the Canadian economy started to contract as early as December 1906, and thus half a year earlier than the United States, the cause for the banking crisis in Canada was directly related to the banking panic in New York City. Martin (2014) underlines the effect of the domestic economic slowdown earlier in 1907. In summary, a combination of domestic and international factors seems to have caused the crisis.

Martin (2014): "The economic boom created an unusual demand for money, forcing interest rates upward. Canadian bankers began to urge their customers to use caution, claiming that the profits and growth of the preceding years should not be expected to continue unabated. A general feeling was shared among all bankers they should begin to retrench in preparation for an eventual crash. [...] The fact that Europe was still bearing the cost of a war in South Africa and the conflict between Russia and Japan — coupled with more recent fires and earthquakes in San Francisco — meant that global capital had vanished or been destroyed. [...]

"Because other banks were also tightening their credit, more and more businesses looked to the [Canadian Bank of] Commerce for credit, but they were also being turned away. As a result, the bank raised rates on loans to try to reduce demand and trim the portfolio of borrowers. By July [1907], Commerce managers were informed that any requests to extend credit beyond pre-set limits would have to be approved by head office, indicating further credit restriction and reflecting a heightened sense of unease in the financial markets." (pp. 7-8)

The crisis: "The combination [of crop failures and international financial stringency] rendered eastern banks unwilling to ship funds west to move crops to market. The banks raised loan rates, cut lending to all but the most creditworthy borrowers, and limited credit to farmers." (Bordo & Eichengreen, 1999, p. 44). The result was a severe credit crunch in the Western provinces which was exacerbated by a shortage of reserves due to the crisis in New York. One mid-sized and several larger banks were not able to survive the stringency.

Rich (1989): "As a result of soaring short-term interest rates in New York, Canadian capital imports shrank drastically, resulting in a massive balance-of-payments deficit, gold outflows, and reserve losses by the Canadian banks. The reserve drain triggered by the New York crash occurred at a time when a strong cyclical expansion in economic activity had already led to a substantial deterioration in the banks' liquidity position. In order to shore up their liquidity, the banks took steps to curtail their lending" (p. 159).

Failed banks: Mid-sized bank Sovereign Bank failed in 1907-1908 largely due to previous mismanagement and reckless lending with improper due diligence (Martin, 2014, pp. 13-14). Many small banks, including People's Bank of New Brunswick, Banque de St. Hyacinthe, Banque de St. Jean, Crown Bank Toronto, Northern Bank Winnipeg, and Western Bank, failed or were absorbed until 1909. According to our estimates, failed banks accounted for 3.3% of total assets in Canadian banks.

Policy responses: "In order to alleviate a severe credit squeeze, the government undertook to provide temporary liquidity assistance to the chartered banks through an emergency issue of Dominion notes. The crisis of 1907 [...] prompted the Canadian government to assume, for the first time, the role of lender of last resort to the banking system" (Rich, 1989, p. 136). This special issue of Dominion notes worked very well in supplying the needed liquidity and contributed greatly to resolving this banking crisis.

When Sovereign Bank of Canada failed in 1908, the Bank of Montreal or-

ganized a coordinated response among private market participants. When the bank prepared to close its doors in January 1908, "twelve members of the Canadian Bankers Association agreed to guarantee all its liabilities and shared out the branches and assets among themselves. There was no panic, and the guaranteeing banks lost nothing after the double liability of the shareholders was drawn on. Thus, in Canada, illiquidity of a solvent institution was met by joint action of the banking system rather than a banking panic" (Bordo, Redish & Rockoff, 2015, p. 227). Additionally, "banks were allowed to increase their note issue to 115 per cent of their paid-in capital plus reserves. The increase was legal only during the crop moving season" (Bordo & Eichengreen, 1999, p. 44).

Consequences: As Bordo & Eichengreen (1999) remark, "the subsequent recession was sharp but short." Real GDP contracted by 5% while the provision of private credit declined by around 11% according to our estimates. The Canadian economy grew again rapidly in 1909.

Sources:

Bordo, M., & Eichengreen, B. (1999). Is our current international economic environment unusually crisis prone? In Gruen, D., & Gower, L. (eds.), Conference: Capital flows and the international financial system, 18-74.

Bordo, M. D., Redish, A., & Rockoff, H. (2015), Why Didn't Canada Have a Banking Crisis? *The Economic History Review*, 68: 218-243

Martin, J. (2014). The Forgotten Credit Crisis of 1907. Case Study, Rotman School of Management, University of Toronto.

Rich, G. (1989). Canadian banks, gold, and the crisis of 1907. *Explorations in Economic History*, 26(2), 135-160.

1912

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021). Narrative evidence is given here to help support this conclusion.

Background and causes: A general trend of concentration and consolidation in the banking sector continued.

The crisis: The Farmers' Bank of Canada suspended payment in 1910. Other than that, there is little evidence of bank distress, at least not until 1914 (see the next crisis episode). Carr, Mathewson & Quigley (1995) report that, of the four banks who disappeared in 1912 and 1913, all were absorbed by larger banks. Based on the merger acquisition premium, they conclude "there is also

no evidence that the purchase involved sacrifice of the type that would be associated with a forced merger of an insolvent institution. In every case the post-announcement share price of the purchasing bank was very close to the pre-announcement price." (pp. 1144-1146).

Carr, Mathewson & Quigley (1995): "When the Farmers' Bank of Canada suspended payment in 1910, shareholders and depositors campaigned for compensation from the government. They argued that the Minister of Finance had been negligent in allowing the promoter to obtain
the Treasury Board certificate necessary to activate the charter in 1906. This became
an issue in the 1911 election..."

Failed banks: Small bank Farmers Bank had failed in 1911 and sought government support, which had been declined. This failure, however, was a singular event without little implication for the banking system or the real economy.

Policy responses: Carr, Mathewson & Quigley (1995) provide evidence that the government was in support of mergers, as long as they did not endanger depositors' claims at the absorbed banks.

Consequences: The economy continued to grow even if at a somewhat slower pace.

Sources:

Carr, J., Mathewson, F., & Quigley, N. (1995). Stability in the absence of deposit insurance: The Canadian banking system, 1890-1966. *Journal of Money, Credit and Banking*, 27(4), 1137-1158.

Conant, C. A. (1915). *A history of modern banks of issue.* GP Putnam's sons.

1914

Background and causes: The long period of economic prosperity known as the Laurier boom that had begun roughly in 1896 ended in 1912 when economic growth and trade slowed down significantly. In the same year, a substantial real estate boom in Vancouver and the western farm provinces came to an abrupt halt. The slowdown in economic activity and trade that had begun in 1912 was shortened by the beginning of the World War I and its ensuing command-led war economy. The outbreak of the war in July 1914 came as a surprise to the global business community. In Canada—as well as in many other countries around the globe—it resulted in deposit withdrawals and a surge in the demand for gold in return for bank notes.

The crisis: Roberts (2013) reports that, especially in Toronto and Montreal, depositors actively demanded safe deposit boxes to store all the gold they had received from the conversion of their bank notes. In fear over banks running low on specie, the government stepped in. Jamieson (1953, p. 46) writes: "Yet, although there was evidence of alarm here and there, including a few runs on the banks, on the whole reason prevailed, and nowhere in Canada was there anything approaching panic." After the failure of a trust company, a run on the Bank of Vancouver began in October 1914 (Carr, Mathewson, & Quigley, 1995, pp. 1141-1142). Roberts (2013) writes that, other than Bank of Vancouver, banks stood the situation well and that the emergency-issued "Dominion notes were only little availed" (p. 213).

Carr, Mathewson, & Quigley (1995): "The difficulties of the Bank of Vancouver were first discussed by the CBA Executive Committee at a meeting on January 15, 1914. Both the Bank of Montreal and the Royal Bank offered to conduct an open-door liquidation of the bank, secured by all of its assets including the double liability, provided that the directors give additional personal guarantees against loss. However, officials of the Bank of Vancouver were unwilling to suspend, and both provincial and federal politicians lobbied the CBA to make an advance to the bank to allow it to continue in operation. The CBA accepted evidence that the Bank of Vancouver was still solvent and provided it with a line of credit, secured against commercial paper and the personal wealth of the directors. In October and November 1914, the failure of a trust company prompted a run on the Bank of Vancouver. . . "

Failed banks: The Bank of Vancouver, suspended payments on December 14, 1914. Jamieson (1954, p. 54) writes: "Though relatively it was a bad failure and depositors got very little, the absolute amounts were unimportant and repercussions purely local." According to our estimates, the Bank of Vancouver's assets accounted for 0.1% of the total asset of Canadian banks.

Policy responses: The Canadian government intervened in 1914 by providing reserves in the form of Dominion notes against good collateral at an interest rate of 5%. For this, it created a government rediscount facility under the Finance Act of 1914. Effectively, the government assumed the role of lender of last resort. The Canadian Bankers' Association (CBA) acted in concert with the state. Canada suspended convertibility but there was no general moratorium (Roberts, 2013). "The records of the CBA provide no evidence that the Minister of Finance or the president of the CBA considered any course other than a liquidation in which depositors would bear the full brunt of their assigned losses." (Carr, Mathewson & Quigley, 1995, p. 1142).

Carr, Mathewson, & Quigley (1995): "The Bank of Vancouver... sought assistance from the Department of Finance. The Minister wrote to the President of the CBA explaining that the government was unable to provide assistance because the bank did 'not appear to have any liquid assets which it [could] hypothecate [for a Finance Act advance]' ... The executive of the CBA agreed to consider renewing the line of credit set up for the bank earlier in the year and commissioned an audit of the bank to determine the advisability of this course of action. While the audit was being conducted, the Minister of Finance approached the Bank of Montreal for support. He was told that it would 'be prepared to join with other banks in advancing money to pay off the depositors and noteholders provided the Bank of Vancouver has securities (including double liability) sufficient to justify such an advance. Unless we embark on a career of something akin to charity, I do not see how we can go further.' Subsequently, the president of the CBA emphasized that for the Bank of Montreal to provide any credit 'it is absolutely that it must be the opinion of [the auditors] that there are quite sufficient justify such an advance.' By 5 December the auditors had reported that the Bank must be liquidated. The records of the CBA provide no evidence that the Minister of Finance or the president of the CBA considered any course other than a liquidation in which depositors would bear the full brunt of their assigned losses."

Consequences: Private credit contracted by 8.6% in relation to GDP, though this may partly have been due to other causes, as Canada shifted towards a command-led war economy.

Sources:

Carr, J., Mathewson, F., & Quigley, N. (1995). Stability in the absence of deposit insurance: The Canadian banking system, 1890-1966. *Journal of Money, Credit and Banking*, 27(4), 1137-1158.

Jamieson, A. B. (1953). *Chartered banking in Canada.* Toronto: The Ryerson Press.

Roberts, R. (2013). *Saving the City: the great financial crisis of 1914.* Oxford University Press.

1920

Background and causes: Canada's post-war economy was characterized by "economic uncertainty (grounded in clear signs of a downturn), the challenges posed by the return of nearly half a million troops, unprecedented mortalities from influenza, labour unrest, and the example of a successful workers' rev-

olution abroad [...]. The economy staggered for nearly four years after the war. By 1922, however, there were signs of a recovery" (Belshaw, 2016, p. 291). "The post-war collapse of farm and war industry earnings played havoc with the banks' earnings from depreciating assets" (Naylor, 2006, p. 527), jeopardizing the stability of the banking system throughout the early 1920s.

The crisis: The post-war recession began to affect the banking industry in earnest in 1920. Bank stock prices declined by around 43%. In the first half of the 1920s, one outright bank failure (Home Bank of Canada) and six bank mergers occurred. Carr, Mathewson & Quigley (1995) and Kryzanowski & Roberts (1993) are in dispute over to what extent these merges were due to imminent failure. The case of the first merger involving small bank La Banque National, however, seems to be clear: In 1921, knowledge of large losses at the bank became public and resulted in a depositor run in December 1921. The bank was later merged with Banque d'Hochelaga and would have failed otherwise (Carr, Mathewson, & Quigley, 1995, pp. 1148-1149; Jamieson, 1953, p. 54). In 1923, "millions of deposits were withdrawn, and it was not until the end of the year that the situation quietened" (Jamieson, 1953, p. 65).

The case of the mid-sized Merchants Bank of Canada is more complicated. Kryzanowski & Roberts (1993, p. 365) provide evidence that the bank—with assets accounting for roughly 6.4% of total assets and deposits of 5.9% of total deposits in Canada—was in financial difficulties in 1921. The general expectation of the Minister of Finance Henry Drayton at the time was that if a prospective merger with Bank of Montreal could not be executed, the only alternative would be Merchants Bank's insolvency incurring heavy losses to depositors. Carr, Mathewson, & Quigley (1995, p. 1146-1148), on the other hand, argue that Bank of Montreal payed a premium on the share price of Merchants Bank, indicating that according to their valuation the bank indeed was solvent and its assets valuable. In 1923, Bank of Hamilton was absorbed by the Canadian Bank of Commerce. "Some solvent banks, such as the Dominion and Imperial, experienced runs in 1924, but dealt with them by obtaining liquidity from the larger banks and the Department of Finance" (Carr, Mathewson & Quigley, 1995, pp. 1147). Sterling Bank of Canada was bought by Standard Bank of Canada in 1924 without any evidence of financial difficulty. The mid-sized Union Bank ran into trouble in 1925 and was bought by the Royal Bank of Canada. The small Molson's Bank was bought by Bank of Montreal in 1925. We were unable to find evidence that Molson's Bank was in serious financial distress at the time of the merger.

Failed banks: With its 70 branches across the country, the failure of Home Bank

of Canada in August 1923 due to large-scale fraud was a major event according to Kryzanowski & Roberts (1993, p. 364), even though the bank's size in assets or deposits corresponded to slightly less than 1% of the Canadian banking system. Also, La Banque National, which fell victim to a bank run in 1921 and was absorbed in 1924 by Banque d'Hochelaga, must be counted as a failure brought about by financial difficulties. In line with our methodology, we count the merger of mid-sized Merchants Bank of Canada in 1922 as a bank failure, as it invoked policy responses and was due to previous financial difficulty. Carr, Mathewson & Quigley (1995) report that while Union Bank was solvent in 1925, it was in financial difficulty and that the authorities favored a merger to safeguard depositors' and shareholders' interests. We, thus, count it as a bank failure affecting 4.3% of total deposits and 4.1% of total assets (Willis & Beckhart, 1929, p. 332). Kryzanowski & Roberts (1993, p. 372) report that Hamilton bank was insolvent at the time of the merger in 1923, representing roughly 2.8% of total assets and of total deposits.

In total, we count five bank failures during the first half of the 1920s. Of these five, one was an outright failure with subsequent liquidation and the remaining four cases were banks in financial distress whose liabilities were assumed by purchasing institutions, which were often guaranteed by the government. According to our estimates, failed banks accounted for almost 15% of total assets in Canadian banks, making it—strictly speaking—the most severe banking crisis in Canadian financial history in terms of size of involved banks. Due to government forbearance and massive private sector involvement resulting in little losses to depositors and only marginal financial unrest, this crisis, however, does not have the corresponding weight in collective memory and historiography.

Policy responses: In 1922, the troubled mid-sized Merchants Bank was absorbed by the Bank of Montreal with the support of the Federal Government and implicit guarantees to all depositors. In 1923, the Government of Quebec used $15 million of innovative, off-balance-sheet debt financing to support the merger of La Banque Nationale with the Banque d'Hochelaga to avoid a bank failure. In 1924, the merger of the small Sterling Bank with the Standard Bank was supported by the federal government to avoid any bank failures (Kryzanowski & Roberts, 1993). The Department of Finance provided liquidity to Dominion Bank and Imperial Bank when they experienced bank runs in 1924. The Canadian parliament further passed legislation in June 1925 to pay a total of $3.46 million for 22.3% of average depositors' claims against the Home Bank of Canada which had failed in 1923 (Carr, Mathewson & Quigley,

1995, p. 1143).

Kryzanowski & Roberts (1993): "The Canadian government policy of forbearance through implicitly guaranteeing all deposits at par, primarily by standing ready to lend to banks and by facilitating the merger of troubled and healthier banks. [...] After a major bank failure in 1923 and several 'forced' mergers of 'failing' banks in 1921-1923 [...] this policy provided an implicit guarantee that no other bank would be allowed to fail and cause losses to depositors" (p. 373).

Consequences: According to our estimates, real GDP declined by a sharp 19.3% between 1919 and 1921 while public debt levels rose by about 30% until 1922. The provision of private credit, too, contracted sharply by around one third between 1922 and 1925. Canada returned to the gold standard for a brief period between July 1926 and 1929. The process of bank concentration that had begun at the turn of the century came to a close in 1929 with a total of eleven banks remaining in the country.

Carr, Mathewson & Quigley (1995): "The history of Canadian banking provides a number of examples of failures in which depositors suffered substantial losses. The banks collectively provided liquidity to solvent institutions but eschewed any responsibility for the depositors in institutions with assets worth less than the deposit liabilities, and successive Canadian governments rejected the concept of deposit insurance. The failure of the Home Bank of Canada established the precedent that the Minister of Finance was responsible for the exercise of due care in the administration of the Bank Act and provided a system of government audit to facilitate this. But depositors still cared about the safety of their deposits if they had not, there would have been market pressure for weak banks to merge after 1924" (p. 1156).

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1932

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this conclusion.

Background and causes: With the economy recovering after 1921, a Canadian variant of the "roaring twenties" had set in—prosperity and optimism reigned until 1929. This period was characterized economically by heavy capital investments in machinery and buildings, an over-extension of credit and stock market speculation. Signs of trouble already emerge in 1928 when commodity prices were staggering, and new housing construction began to slow down. A period of severe dust storms in the prairies, caused by excessive deep plowing throughout the 1930s, resulted in droughts that made vast quantities of farmland unusable, which resulted in plummeting land prices. Additionally, the crop harvests of 1929 and 1930 were poor (Belshaw, 2016, pp. 417-418).

Kobrak & Martin (2018): "The severity of the Depression in Canada owed much to not only the worldwide collapse in commodity prices, some of which preceded the economic crisis, but also to its proximity to and economic connections with the United States. The Smoot-Hawley Tariff, signed into law by President Herbert Hoover in 1930, increased the rate on dutiable-good imports from 39 to 53 per cent, the highest in history. Canada's exports to the United States plummeted by 70 per cent, sales of agricultural and vegetable products declined by 93.5 per cent, animals and animal products dropped by 81.5 per cent. Wood and paper, although still Canada's largest export to the United States, declined by over 60 per cent. The full force of the Great Depression fell upon Canada's staple exports—hardest hit were the markets for cattle, dried codfish, copper, and wheat—all of which was compounded by a dramatic decline in the value of the Canadian dollar as the country went off the gold standard [...]. Average incomes declined by 48 per cent, but in the Prairie province of Saskatchewan, they declined by 72 per cent" (p. 173).

The crisis: Kryzanowski & Roberts (1993) argue that no bank failures occurred due to implicit guarantees made during the mergers process of the 1920s that no bank would be allowed to fail. Also, national branching, lower

competition due to concentration, and regional diversification played a role in Canada's supposed financial stability during the Great Depression. The authors, however, show that nine out of ten banks in Canada were economically insolvent due to deep losses until 1935 and survived mainly because of forbearance by regulators. At the Bank of Montreal, for example, over half of the loans were nonperforming in between 1932 and 1936 (p. 371). Carr, Mathewson & Quigley (1995) oppose their view, claiming that the large Canadian banks were solvent during the 1930s and that Kryzanowski & Roberts' (1993) argument of implicit guarantees are wrong. We were unable to find evidence of any bank panic.

Failed banks: There is no evidence of widespread bank failures during the Great Depression in Canada. Only one relatively small bank—Weyburn Security Bank, an agricultural bank with 30 branches in rural Saskatchewan—was absorbed by Imperial Bank in 1931 after substantial withdrawals and in expectation of significant financial difficulties due to bad harvests affecting its debtors. Weyburn Security Bank's assets accounted for 0.2% of total assets in Canadian banks and for roughly 0.1% of total deposits (Willis & Beckhart, 1929, p. 332; Carr, Mathewson & Quigley, 1995, p. 1144). Some loan and trust companies, such as Colonial Investment & Loan Co., were liquidated as well (Wilton, 1996), although overall failure rates seemed to have been low, despite the high rate of mortgage defaults.

Policy responses: No bank failures occurred either due to implicit guarantees carried over from the last crisis in the first half of the 1920s (Kryzanowski & Roberts, 1993) or because the remaining larger banks actually remained solvent during the crisis (Carr, Mathewson & Quigley, 1995). The Canadian government provided liquidity assistance to banks during the early 1930s. The Bank of Canada Act to establish a central bank was passed in 1934. Other major reforms included the Dominion Housing Act and the creation of the Ontario Securities Commission. Unlike the U.S. authorities, the Canadian government did not create a deposit insurance fund.

Bordo, Redish, and Rockoff (2015): "The Commission was headed by a Scottish lawyer, Lord Macmillan, who travelled across the country listening to an outpouring of complaints about a monetary system that had caused deflation and reduced the availability of credit. The Commission responded, unsurprisingly in the face of both political outcry and the predisposition of its chair, by recommending the establishment of a central bank; the Bank of Canada Act was passed in 1934."

Consequences: According to our estimates, real GDP collapsed by a colossal

31% while public debt more than doubled in relation to the size of the economy between 1929 and 1933. Canada's central bank was chartered in 1934 under the Bank of Canada Act. The provision of private credit in relation to GDP contracted by more than 40% between 1934 and 1937.

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1966

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us, although there was considerable bank distress.

Background and causes: "By the early 1960's, an increasingly competitive deposit-taking industry raised concerns about its potential impact on overall monetary policy and financial stability. At that time, and until 1967, banks were limited to charging an interest rate of 6% on loans, which, in combination with the rising interest rates during that period and certain other factors, resulted in banks being largely excluded from the mortgage market. At that time there were also some concerns about the concentration of banking in a few banks and the need to have more/new banks. Other concerns pertained to the jurisdiction over deposit-taking, weak and varied provincial standards, and the control of the money supply if a significant portion of the deposit-taking business would be outside the control of the Bank of Canada" (CDIC, 2016, p. 4). Generally, the 1960s were a period of strong economic growth and rapid productivity gains in Canada.

The crisis: There were a series of bank failures connected with the collapse of the Atlantic Acceptance Corporation, a the sixth-large finance company in Canada, with $150 million in assets, specializing in commercial, real estate, and auto loans. The company attracted loans from major banks, pension funds, and other prominent institutional investors, using the funds to make a number of risky and poorly documented loans. The company faced liquidity problems in 1965 and collapsed on June 17, 1965, bring down several banks that had invested in it. There was also a bank run on the Montreal City and District Savings Bank in 1967. No further bank panic ensued, however, as the government introduced a general deposit insurance scheme (CDIC, 2016).

Failed banks: Finance company Atlantic Acceptance Company failed in 1965 due to mismanagement and fraud. In 1966, the Prudential Finance Company failed. British Mortgage and Trust also failed.

Policy responses: The Government of Ontario protected depositors of the Atlantic Acceptance Company, and this episode ultimately led to the creation of the Canadian Deposit Insurance Corporation (CDIC), which was established in 1967. British Mortgage and Trust was rescued by the Ontario government and merged with Victoria and Grey Trust Company.

Consequences: Real GDP growth slowed down by four percentage points and private credit decreased slightly by less than 4% in relation to GDP.

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1982

Background and causes: After the Canadian banking system had undergone a long period of concentration that started back in the beginning of the 20th century, policy preferences shifted towards a more liberal approach regarding the new entry of banks to increase competition. This led to the founding of several new banks, especially in the western provinces. "The Canadian Commercial Bank (CCB) and the Northland Bank of Canada (NBC), established in 1975, were such new players. Both banks concentrated their activities in

the western provinces, and both invested heavily in oil, gas, and real estate loans", whose prices collapsed in the early 1980s (Bank of Canada & Canadian Payments Association, 2003, p. 26). The beginning of the 1980s was also characterized by high inflation, high interest rates, and high unemployment in Canada. Inflation rate well above 10% incentivized many households to borrow larger quantities for the purchase of assets and real estate, leading to a rapid surge in house prices. Preceded by the global economic slowdown of the late 1970s and early 1980s, this trend came to a grinding halt and Canada entered a severe recession in 1982.

The crisis: Reinhart & Rogoff (2014) and Caprio & Klingebiel (2003) consider the years 1983-1985 a non-systemic banking crisis. Soon after the recession hit, "on July 8 [1982], depositors withdrew $148 million from the Canadian Imperial Bank of Canada, and in Newfoundland, a large run started at the branches of the Bank of Nova Scotia, which was quelled only when the bank's chairman issued statements assuring the public that the bank was sound" (Freeman, 1982, p. 12). The energy sector in western Canada was hit particularly hard by the recession and brought loan portfolios of its banks into jeopardy. Subsequent depositor runs at two western banks—Canadian Commercial Bank and Northland Bank —led to their failures in 1985. Mercantile Bank of Canada also suffered from a run and was taken over by National Bank. All these were wholesale funded banks (Gup, 1998, pp. 18-21). The bank failures in 1985 caused severe financial stress for other smaller institutions and created an environment of caution against wholesale-funded banking for years to come (Bank of Canada & Canadian Payments Association, 2003, ch. 5).

Failed banks: 10^{th}-largest bank Canadian Commercial Bank (CCB) and 11^{th}-largest bank Northland Bank failed in September 1985. Both banks were relatively small and had a regional focus and accounted for 0.69% and for 0.33%, respectively, of total assets in Canadian banks. Additionally, 21 deposit-taking trust companies and mortgage corporations failed between 1980 and 1988. In 1986, the Bank of British Columbia—then the 27^{th}-largest financial institution and 9^{th}-largest bank in the country accounting for 0.81% of total assets—had to be rescued and was bought by HSBC. Following the failures of CCB and Northland, Mercantile Bank of Montreal, Continental Bank of Toronto, and Morguard Bank of Vancouver were taken over by larger banks due to financial difficulties in 1985, which is why we count them as failures, as well. In terms of total assets in Canadian banks, they accounted for 1.12%, 1.57%, and 0.08%, respectively.

"The major six banks provided short term loans to Mercantile [Bank]" and de-

spite rumors to the contrary there were no government guarantees. Ultimately, the Mercantile was acquired by National Bank of Canada which had significant advances outstanding against the bank (Goodhart, 1995, p. 377). "Morguard Bank was taken over by Security Pacific Bank of Canada in November 1985" (p. 377). After having been dependent for a year on advances by the Bank of Canada, Continental Bank of Toronto was taken over by Lloyds Bank in November 1986 (p. 378). "Morguard Bank was taken over by Security Pacific Bank of Canada in November 1985" (p. 377). According to our estimates, the assets of the six failed banks amounted to 4.63% of total assets of the Canadian banking system (Dean, 1988).

Policy responses: The Bank of Canada provided substantial liquidity support against collateral to CCB, Nortland Bank, Continental Bank, and Bank of British Columbia. Mercantile Bank and Morguard Bank were resolved without the involvement of public sector funds. The government provided funds for rescue packages for CCB, Continental Bank, and Bank of British Columbia. The major banks were actively involved in the rescue packages. The CDIC guaranteed the deposits of the failed trust companies and mortgage corporations. In 1985, the federal government undertook a comprehensive policy review of the whole area of financial regulation.

Consequences: The recession led to a contraction of real GDP of 3.2% in 1982 and a decrease of private credit in relation to GDP of around 13%.

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1991

Note that this episode is not considered a banking crisis by Baron, Verner, and Xiong (2021) and us. Narrative evidence is given here to help support this conclusion.

Background and causes: The summer of 1990 saw the beginning of a three-year long recession, with global macroeconomic uncertainty spilling over on the Canadian economy (Belshaw, 2016, p. 470). Any early sign of trouble was the peak of a house price rally that had started in 1985 and peaked in the first quarter of 1989.

The crisis: The burst of the housing bubble in 1989 set off a second wave of failures (the first one having occurred between 1980 and 1988) of trust companies and mortgage corporations in the first half of the 1990s. Although the number of failed institutions was quite considerable, their actual size did not matter very much for the banking system per se (Savage, 2014). There was no panic, as all deposits were guaranteed by the CDIC. Strictly speaking, all the institutions involved were not chartered banks, but since they are all deposit-taking, under the umbrella of the CDIC, and perform important intermediation services, we consider them as close substitutes.

Failed banks: 18 deposit-taking trust companies and mortgage corporations failed between 1990 and 1996 (Gup, 1998, pp. 18-22; CDIC, 2019).

Policy responses: The CDIC guaranteed the deposits of the failed trust companies and mortgage corporations. There is also some evidence that the Bank of Canada provided liquidity against collateral (Savage, 2014).

Consequences: While the economy started to grow again in late 1992, the provision of private credit slowed down by 6.6% between 1993 and 1995 in relation to GDP.

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Chapter 5

Conclusion

Not all banking crises are credit booms gone bust. As a matter of fact and as I have shown in the previous chapter, only 35% of banking crises are caused by a collapse of credit-fueled asset booms over the past century-and-a-half. While historically real factors—such as recessions, natural disasters, and wars—have often caused banking distress, economies today have become much more resilient to real shocks. Reversely, the share of banking crises of financial origin has increased over time. Nowadays, around 25% of banking crises are caused by contagion from instability in foreign financial systems. Over the entire time span, banking crises exhibit a strong tendency to cluster regionally or globally. These crises often originate in financial centers where emerging bank distress or unexpected monetary policy changes in response to exogenous events propagate instability to other countries around the globe.

The fact that the Global Financial Crisis was caused by a perfect example of a Minskyan boom-bust dynamic in the U.S. real estate market lead to the development of many sophisticated monitoring tools that capture the built-up of domestic financial imbalances proxied by credit aggregates and asset price indicators. The findings of this dissertation suggest that, albeit important, policy makers are missing a significant portion of risk if they restrict their focus on domestic imbalances alone. Chapter 2 introduces a channel of international crisis transmission that works through domestic banks' asset-side exposure to fragile foreign banking systems. Policy makers monitoring the built-up of financial imbalances in foreign economies with which the domestic banking system maintains large exposures can significantly enhance the predictive abilities of their early-warning models in and out-of-sample. Importantly, this holds for developed economies only—the transmission channel is inactive for emerging economies.

Another improvement to current macro-prudential practice is presented in chapter 3. I show that sudden reversals in corporate securities issuance, which I interpret as unexpected swings in credit and equity sentiment, have more predictive power for future bank distress than credit aggregates in a sample of new quarterly U.S. data for the period of 1900–2020. Monitoring the issuance activity of corporate credit and equity can enhance the predictive ability of domestic early warning models. The last important contribution of this thesis is on the data side. It provides a new comprehensive database on the causes of banking crises for 46 countries from 1870–2016 which is accompanied by narrative summaries of all bank distress events in some major countries to showcase the attention to detail with which the database was produced. Additionally, I present new historically consistent quarterly U.S. data of corporate securities issuance and bank loans which were previously unavailable.

In this dissertation, I have shown that there is still a lot to learn from history to further our understanding of banking crises and especially to improve the ability of their prediction. Policy makers would do well in looking beyond credit aggregates and asset price indicators to forecast financial instability. Investigating very long time horizons shows that including measures of international contagion and market-based indicators of corporate finance will improve our ability to prevent financial disasters from happening in the future. From the historical record, we can also remain carefully optimistic that the severe real shock to the global economy that is the COVID-19 pandemic will not result in widespread bank failures, as economic development has led to better institutions and policies over the past century which allow banking systems today to withstand such shocks with higher probability.

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Abstract

This dissertation is located at the intersection of three research areas: financial stability, macro-finance, and quantitative economic history. Addressing a major limitation in the literature, I investigate in three separate essays—forming each a chapter of the thesis—the causes and the prediction of banking crises over a very long time horizon. In particular, I explore sources and causes of financial instability other than those of domestic credit built-ups and asset price bubbles and their changing behavior over time. I find that, historically, the majority of banking crises (65%) are *not* credit booms gone bust but instead are the result of a much wider range of causes. While banking systems have become more resilient against shocks from the real economy with advancing economic development, the share of banking crises of purely financial origin has risen continuously over the past 150 years. Contagion through various types of financial flows is responsible for a quarter of banking crises in modern times. Especially the asset-side exposure of domestic banks to fragile foreign banking systems is a potent channel of international crisis transmission that is active irrespective of domestic financial conditions. Beyond credit aggregates and asset prices, I find that sudden reversals in corporate securities issuance are another helpful predictor of bank distress and recessions previously neglected. This dissertation further contributes to the literature by making available new historical data. It provides a comprehensive database on the causes of banking crises in 46 countries (accompanied by narrative summaries of banking crises in selected major economies) from 1870–2016 and previously unavailable historically consistent quarterly U.S. data on corporate securities issuance and bank loans from 1900–2020.

Zusammenfassung

Die vorliegende Dissertation ist an der Schnittstelle dreier Forschungsbereiche angesiedelt: Finanzstabilität, Macro-Finance und quantitativer Wirtschaftsgeschichte. Um eine wesentliche Einschränkung der Literatur zu adressieren, untersuche ich in drei separaten Essays, welche jeweils ein Kapitel der Arbeit bilden, die Ursachen und die Vorhersage von Bankenkrisen über einen sehr langen Zeithorizont. Insbesondere erforsche ich die Ursachen von Finanzinstabilität, die nicht auf inländischen Kredit- und Vermögenspreisblasen beruhen, sowie deren verändertes Verhalten im Zeitablauf. Ich komme zu dem Ergebnis, dass historisch gesehen die meisten Bankenkrisen (65%) *nicht* auf geplatze Kreditblasen zurückzuführen sind, sondern auf einen oder mehrere Gründe aus einem viel breiteren Spektrum von Ursachen. Während Bankensysteme mit fortschreitender wirtschaftlicher Entwicklung widerstandsfähiger gegen realwirtschaftliche Schocks wurden, ist der Anteil der Bankenkrisen, welche durch rein finanzielle Faktoren ausgelöst werden, kontinuierlich gestiegen. Ein Viertel der Bankenkrisen der Neuzeit wird durch verschiedene Arten von Finanzströmen aus dem Ausland importiert. Insbesondere die Exposition inländischer Bankbilanzen zu fragilen ausländischen Bankensystemen ist ein besonders potenter Kanal der internationalen Krisenübertragung, welcher unabhängig von den Bedingungen im inländischen Finanzsystem aktiv ist. Neben Kreditaggregaten und Vermögenspreisen erweisen sich plötzliche Umschwünge im Emissionsvolumen von Unternehmenswertpapieren als ein weiterer hilfreicher Prädiktor für Bankenkrisen und Rezessionen, der in der Literatur bisher vernachlässigt wurde. Einen weiteren wichtigen Beitrag dieser Dissertation stellt die Bereitstellung neuer historischer Daten dar. Diese beinhalten eine umfassende Datenbank über die Ursachen von Bankenkrisen in 46 Ländern (begleitet von narrativen Zusammenfassungen von Bankenkrisen einer Auswahl von wichtigen Volkswirtschaften) von 1870 bis 2016 sowie bisher nicht zur Verfügung stehende historisch konsistente vierteljährliche US-Daten über die Emission von Unternehmenswertpapieren und das Volumen von ausstehenden Bankkrediten von 1900 bis 2020.

Erklärungen

Erklärung gem. § 4 Abs. 2

Hiermit erkläre ich, dass ich mich noch keinem Promotionsverfahren unterzogen oder um Zulassung zu einem solchen beworben habe, und die Dissertation in der gleichen oder einer anderen Fassung bzw. Überarbeitung einer anderen Fakultät, einem Prüfungsausschuss oder einem Fachvertreter an einer anderen Hochschule nicht bereits zur Überprüfung vorgelegen hat.

Berlin, im März 2021

Daniel Dieckelmann

Erklärung gem. § 10 Abs. 3:

Hiermit erkläre ich, dass ich für die Dissertation folgende Hilfsmittel und Hilfen verwendet habe: R, STATA, Microsoft Word and Excel, Mendeley, Texmaker.

Auf dieser Grundlage habe ich die Arbeit selbstständig verfasst.

Berlin, im März 2021

Daniel Dieckelmann