Online Appendix

"Two Centuries of Systemic Bank Runs"

July 2025

A Online Appendix

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A.1 Full Bank Run Chronology

Table A.1: The JKMS Bank Run List

Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic	Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic
Afghanistan	2010	Bank	No	> 0					1931	No	No	> 0		Yes	Yes
Albania	2008	Bank	Yes	-0.7	Demand	No			1934	Bank	No	> 0		Yes	No
Antigua and Barbuda	2009	Bank	Yes	-25.1	Demand			Belize	2016	Macro	Yes	-7.2	Time	No	
Argentina	1876	No				No	No	Bolivia	1985	Macro	No	> 0		Yes	
	1890	Macro				Yes	Yes		1994	Bank	No	> 0		Yes	
	1914	Macro	Yes	-15.7	Total	Yes	Yes	Bosnia-Herzegovina	2008	Bank	No	> 0		No	
	1934	No	Yes	-5.1	Total	Yes	Yes	Brazil	1864	Bank	No	> 0		No	
	1980	Bank	Yes	-19.1	Demand	Yes	Yes		1900	Macro	Yes	-19.4	Total	Yes	Yes
	1985	Macro	No	> 0		Yes	Yes		1914	Bank	Yes	-18.1	Demand	Yes	Yes
	1989	Macro	No	> 0		Yes	Yes		1990	Macro	No	> 0		Yes	Yes
	1995	Macro	Yes	-4.7	Time	Yes	Yes	Bulgaria	1996	Macro	No	> 0		Yes	
	2001	Macro	Yes	-19.2	Time	Yes	Yes		2014	No	Yes	-5.8	Time	No	
Australia	1828	Macro				Yes		Canada	1837	Bank				Yes	
	1842	Bank	Yes	-13.8	Total	Yes			1867	Bank	Yes	-6.7	Total	Yes	
	1891	Macro	Yes	-8.6	Total	Yes	Yes		1879	No	No	> 0		No	No
	1893	Bank	Yes	-12.4	Total	Yes	Yes		1893	Bank	Yes	-8.7	Demand	No	No
	1931	Macro	Yes	-20.6	Total	Yes	Yes		1914	Macro	Yes	-8.1	Demand	Yes	
	1974	Bank	Yes	-7.5	Demand	No	No		1921	Bank	Yes	-17.7	Demand	Yes	Yes
	1977	Bank	No	> 0		No	No		1924	No	Yes	-0.4	Time	Yes	No
	1979	No	No	> 0		No	No		1982	Bank	No	> 0		Yes	Yes
	1989	Bank	No	> 0		Yes	Yes		1996	Bank	No	> 0		No	No
Austria	1873	Bank				Yes	Yes	Chile	1865	Macro	Yes	-50.9	Total	No	
	1924	Bank	No	> 0		Yes	No		1878	No	Yes	-12.3	Total	Yes	Yes
	1931	Bank	Yes	-31.0	Total	Yes	Yes		1895	Macro	Yes	-15.5	Total	No	No
Bahrain	1990	Macro	Yes	-20.1	Time				1898	Bank	Yes	-2.4	Total	Yes	Yes
Belgium	1838	Macro	Yes	-39.2	Demand	Yes			1907	No	Yes	-8.0	Total	Yes	Yes
	1870	Macro				Yes	Yes		1914	Macro	Yes	-2.3	Total	Yes	Yes
	1914	Macro	Yes	-24.5	Total	Yes	Yes		1976	Macro	No	> 0		Yes	Yes
	1925	Macro	No	> 0		Yes	No		1983	Macro	No	> 0		Yes	Yes

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Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic	Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic
China	1903	Bank				No		Finland	1900	Macro	No	> 0		Yes	Yes
	1916	Macro				No			1939	Macro	Yes	-0.4	Total	Yes	No
	1921	Macro				Yes		France	1805	Macro				Yes	
	1928	No	No	> 0		No			1838	Bank				Yes	
	1930	No	Yes	-12.7	Total	Yes			1847	Macro				Yes	
	1997	Bank	No	> 0		Yes			1871	Macro				Yes	Yes
	2019	No	No	> 0					1881	Bank				Yes	Yes
	2022	Bank	No	> 0					1889	Bank				Yes	Yes
	2023	Bank							1914	Macro				Yes	Yes
Colombia	1923	No				No	No		1930	Bank	Yes	-5.9	Total	Yes	Yes
	1982	Bank	No	> 0		Yes	No		1931	Bank	Yes	-5.9	Total	Yes	Yes
	1998	Bank	Yes	-9.3	Demand	Yes	Yes		1938	Macro	No	> 0		Yes	Yes
Costa Rica	1987	Bank	Yes	-4.9	Demand	Yes		Germany	1873	Bank	Yes	-9.5	Total	Yes	Yes
	2004	No	Yes	-39.5	Time	No			1891	Bank	Yes	-1.1	Total	Yes	Yes
Cote d'Ivoire	2011	Macro	No	> 0		No			1901	Bank	Yes	-0.3	Total	Yes	Yes
Croatia	1998	Bank	Yes	-7.3	Demand	Yes			1911	Bank	No	> 0		No	No
Cyprus	1939	No							1914	Macro	No	> 0		Yes	Yes
Czech Republic	1923	Bank	Yes	-11.8	Total	Yes	Yes		1929	Bank	Yes	-8.5	Total	Yes	Yes
	1931	Bank	Yes	-13.6	Total	No	No	Ghana	2015	Bank	No	> 0		No	
	1939	No						Greece	1931	Macro	Yes	-11.2	Total	Yes	Yes
	1994	Bank	Yes	-0.4	Time	Yes	Yes		2015	Macro	Yes	-47.6	Time	No	No
	2000	Bank	Yes	-1.5	Time	No	No	Hong Kong	1892	No	Yes	-12.5	Total	Yes	Yes
Denmark	1876	Macro	Yes	-5.8	Total	Yes	Yes		1961	No	No	> 0		No	No
	1908	Bank	Yes	-6.8	Demand	Yes	Yes		1965	Bank	No	> 0		Yes	Yes
	1922	Bank	Yes	-14.7	Demand	Yes	No		1982	No	Yes	-2.9	Demand	Yes	Yes
	1992	Bank	Yes	-1.4	Demand	Yes	No		1985	Bank	No	> 0		No	No
Dominican Republic	2003	Bank	No	> 0		Yes			1991	Bank	No	> 0		Yes	Yes
Ecuador	1998	Bank	Yes	-66.5	Time	Yes			1998	Bank	Yes	-9.5	Demand	Yes	Yes
Egypt	1907	Bank				Yes	Yes		2008	Bank	No	> 0		No	No
	1914	Macro				Yes	Yes	Hungary	1873	Bank				Yes	Yes
	1931	No				Yes	Yes		1930	No	Yes	-18.8	Total	Yes	Yes
Estonia	1998	Bank	Yes	-8.3	Demand	No			1931	Bank	Yes	-18.8	Total	Yes	Yes
	2008	Bank	Yes	-11.7	Demand	No			1997	Bank	No	> 0		Yes	Yes
Ethiopia	2016	Bank				No		Iceland	2008	Bank	Yes	-13.5	Time	Yes	Yes

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Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic	Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic
India	1913	Bank	Yes	-3.3	Total	Yes	Yes	Mexico	1883	Bank				Yes	Yes
	2001	Bank	No	> 0		No	No		1913	Macro				Yes	Yes
	2008	Bank	No	> 0		No	No		1920	No				Yes	Yes
Indonesia	1991	No	Yes	-11.4	Demand	Yes	Yes		1931	Bank	Yes	-27.3	Total	Yes	No
	1992	Bank	Yes	-11.4	Demand	Yes	Yes	Montenegro	2008	Bank	Yes	-27.1	Demand		
	1997	Bank	No	> 0		Yes	Yes	Myanmar	2003	Bank	Yes	-74.4	Demand	Yes	
Iran	2022	Macro							2021	Macro					
Ireland	2008	Bank	Yes	-15.9	Demand	Yes	Yes	Nepal	2006	Bank	No	> 0		No	
Italy	1893	No	Yes	-2.3	Total	Yes	Yes		2011	No	Yes	-5.3	Demand	No	
	1907	Bank	No	> 0		Yes	Yes	Netherlands	1914	Macro	No	> 0		Yes	Yes
	1914	Macro	Yes	-5.2	Total	Yes	Yes		1921	No	Yes	-13.4	Total	Yes	No
	1921	Bank	No	> 0		Yes	Yes		2009	No	Yes	-5.4	Time	Yes	Yes
	1930	Bank	Yes	-5.5	Total	Yes	Yes	New Zealand	1893	No	Yes	-3.5	Total	Yes	No
Jamaica	1996	Bank	Yes	-3.2	Demand	Yes			1988	Bank	No	> 0		Yes	Yes
Japan	1871	No				Yes	Yes	Nicaragua	2000	Bank	Yes	-28.3	Demand	Yes	
	1900	No	Yes	-1.4	Demand	Yes	Yes	Nigeria	1996	Bank	No	> 0		Yes	
	1907	No	Yes	-14.8	Demand	Yes	Yes		2023	Macro					
	1920	Bank	Yes	-8.1	Time	Yes	Yes	Norway	1857	Bank	Yes	-19.3	Demand	No	
	1922	Bank	Yes	-2.6	Demand	Yes	Yes		1899	Bank	No	> 0		Yes	Yes
	1927	Bank	Yes	-3.2	Time	Yes	Yes		1914	Macro	No	> 0		Yes	Yes
	1997	Bank	No	> 0		Yes	Yes		1923	No	Yes	-16.2	Demand	Yes	No
Jordan	1989	Bank	Yes	-2.7	Demand	Yes			1931	Bank	Yes	-9.3	Demand	Yes	Yes
Kazakhstan	2014	No	No	> 0		No		Pakistan	2008	No	Yes	-8.4	Demand	No	
Kenya	2016	Bank	Yes	-9.7	Time	No		Panama	1987	Macro	Yes	-30.5	Demand	Yes	
	2022	No	No	> 0				Paraguay	1995	Bank	No	> 0		Yes	
Kuwait	2008	Bank	No	> 0		No			1997	Bank	Yes	-2.7	Demand	Yes	
Latvia	1931	Bank							2002	Bank	Yes	-4.6	Time	Yes	
	2011	No	Yes	-19.7	Time	No		Peru	1914	Macro	Yes	-33.7	Total	Yes	Yes
Lebanon	1966	No	Yes	-12.5	Demand			Philippines	1968	No	No	> 0		No	No
Libya	2011	Macro	Yes	-22.5	Time	No			1974	Bank	No	> 0		No	No
Lithuania	1995	Bank	Yes	-14.0	Time	Yes			1977	No	No	> 0		No	No
Macao	2005	Bank	Yes	-8.0	Demand				1981	Bank	Yes	-9.1	Demand	Yes	Yes
Malaysia	1985	Bank	Yes	-1.7	Demand	Yes	Yes		1983	Macro	Yes	-10.6	Demand	Yes	Yes
	1997	No	Yes	-14.3	Demand	Yes	Yes		2000	Bank	Yes	-0.5	Demand	No	No

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Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic	Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic
Poland	1926	Macro	No	> 0		No		Sweden	1808	Macro	No	> 0		No	
	2018	Bank	Yes	-5.3	Time				1817	Bank	Yes	-3.8	Total	No	
Portugal	1876	Bank	Yes	-60.1	Demand	Yes	Yes		1857	Bank	No	> 0		No	
	1891	Bank	Yes	-28.0	Total	Yes	Yes		1878	Bank	Yes	-4.1	Total	Yes	Yes
	1920	Macro	No	> 0		Yes	Yes		1907	Bank	No	> 0		Yes	Yes
	1923	Macro	Yes	-21.1	Total	Yes	Yes		1912	Bank	No	> 0		No	No
	1930	Bank	No	> 0		Yes	Yes		1932	Bank	Yes	-2.1	Demand	Yes	No
	1935	No	No	> 0		No	No		1939	Macro	Yes	-1.8	Demand	No	
Qatar	2017	Macro	Yes	-7.7	Time				1992	Bank	No	> 0		Yes	Yes
Romania	1931	Bank	Yes	-43.3	Total	Yes		Switzerland	1859	No	No	> 0			
Russia	1859	Bank				No			1865	Bank	Yes	-7.3	Total		
	1875	Bank	Yes	-18.3	Total	Yes	Yes		1870	Bank	Yes	-5.5	Total	Yes	Yes
	1899	No	Yes	-2.2	Total	Yes	Yes		1914	Macro	No	> 0		Yes	Yes
	1905	Macro	Yes	-13.5	Total	No	No		1931	Bank	Yes	-5.7	Time	Yes	Yes
	1914	Macro	No	> 0		No			1991	Bank	Yes	-8.1	Demand	Yes	Yes
	1998	Macro	Yes	-7.8	Demand	Yes	Yes		2023	Bank					
	2004	No	No	> 0		No	No	Taiwan	1985	Bank	No	> 0		Yes	Yes
	2008	Bank	Yes	-2.7	Demand	Yes	Yes		1995	Bank	Yes	-17.2	Total	Yes	Yes
	2022	Macro							1998	Bank	No	> 0		Yes	No
Serbia	1993	Bank				No			2000	Bank	No	> 0		Yes	No
	2008	Bank	Yes	-6.0	Demand	No			2007	Bank				No	No
Singapore	1974	No	No	> 0		No	No	Thailand	1984	Bank	Yes	-13.8	Demand	Yes	Yes
South Africa	1890	Bank				Yes	Yes		1996	Bank	Yes	-16.3	Demand	Yes	Yes
	1997	Bank	No	> 0		No	No		2014	Bank	No	> 0		No	No
	2002	Bank	No	> 0		No	No	Trinidad-Tobago	1939	Macro					
South Korea	1950	Macro				No			1988	Bank	Yes	-20.2	Demand	No	
	1961	Macro	Yes	-52.9	Time	No	No	Turkey	1895	Bank				No	No
Spain	1864	Macro	Yes	-15.8	Total	No			1914	Macro				Yes	Yes
	1913	Macro	Yes	-13.8	Time	Yes	Yes		1931	Bank	Yes	-3.4	Demand	Yes	Yes
	1920	Bank	No	> 0		Yes	Yes		1981	Bank	No	> 0		Yes	Yes
	1924	Bank	Yes	-12.5	Demand	Yes	Yes		1991	Macro	No	> 0		Yes	Yes
	1931	Macro	Yes	-20.3	Demand	Yes	Yes		2001	Bank	No	> 0		Yes	Yes
	1994	Bank	No	> 0		No	No	Uganda	1999	Bank	No	> 0		No	
St Vincent & Grenadines	2013	Bank	No	> 0				Ukraine	1998	Bank	No	> 0		Yes	

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Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic	Country	Year	Fund. run	Systemic run	Deposit growth	Affected deposits	Banking crisis	BVX panic
	2008	Bank	Yes	-17.0	Time	Yes			1929	Bank	Yes	-6.7	Demand	Yes	Yes
	2014	Macro	Yes	-8.1	Time	Yes			1930	Bank	Yes	-19.3	Time	Yes	Yes
United Arab Emirates	1990	Macro	Yes	-14.4	Demand				1931	Bank	Yes	-19.3	Time	Yes	Yes
United Kingdom	1815	Bank				Yes			1932	No	Yes	-19.3	Time	Yes	Yes
	1820	Bank				No			1974	Bank	No	> 0		No	No
	1825	Bank				Yes			1982	Bank	Yes	-11.4	Demand	Yes	Yes
	1840	Macro	Yes	-11.2	Total	No			1983	Bank	No	> 0		Yes	Yes
	1847	Bank	Yes	-38.9	Total	Yes			1984	Bank	No	> 0		Yes	Yes
	1857	Bank	Yes	-2.7	Total	Yes			1985	No	No	> 0		Yes	Yes
	1866	Bank	Yes	-12.6	Total	Yes			1990	Bank	Yes	-3.0	Demand	Yes	No
	1878	Bank	Yes	-3.3	Total	Yes	Yes		1991	Bank	Yes	-4.7	Time	Yes	No
	1914	Macro	No	> 0		Yes	Yes		1992	No	Yes	-4.7	Time	Yes	No
	1973	Bank	Yes	-21.2	Demand	Yes	Yes		2007	Bank	Yes	-6.0	Demand	Yes	Yes
	2007	Bank	Yes	-2.2	Demand	Yes	Yes		2008	Bank	Yes	-5.1	Demand	Yes	Yes
United States	1814	Macro	Yes	-10.0	Total	Yes			2023	Bank					
	1819	Macro	No	> 0		Yes		Uruguay	1866	Bank				No	
	1833	No	No	> 0		No			1890	Bank				No	
	1837	Bank	Yes	-23.2	Total	Yes			1898	Macro				Yes	
	1841	Bank	Yes	-18.5	Total	Yes			1964	Bank	Yes	-28.3	Time	No	
	1854	Bank	Yes	-1.3	Total	No			1982	Macro	Yes	-7.4	Demand	Yes	
	1857	Bank	Yes	-17.7	Total	Yes			2002	Macro	Yes	-27.0	Time	Yes	
	1861	Macro	Yes	-5.5	Total	Yes		Venezuela	1993	Bank	No	> 0		Yes	Yes
	1873	Bank	No	> 0		Yes	Yes		2009	Macro	Yes	-42.7	Time	Yes	Yes
	1884	Bank	Yes	-1.2	Total	Yes	Yes	Vietnam	2012	No	No	> 0		No	
	1893	Macro	Yes	-4.4	Total	Yes	Yes		2022	No	Yes	-5.0	Total		
	1896	Bank	Yes	-1.0	Total	No	No	Zimbabwe	2003	No	No	> 0		No	
	1907	Bank	Yes	-4.2	Total	Yes	Yes		2016	Macro	Yes	-9.9	Time	No	

Notes: This table reports all 316 bank run episodes for which we find narrative evidence. When a run episode spans two consecutive years, we report the first year. A run episode is defined as a series of bank runs indicating continuous liquidity pressure, for which all runs within one episode can be attributed to the same fundamental or non-fundamental cause. Runs in consecutive years that cannot be attributed to the same cause are reported as separate events. We use a narrative coding to determine whether a bank run was triggered by macroeconomic fundamentals, banking-related fundamentals, or non-fundamental causes. Macroeconomic-fundamental runs are runs for which historical accounts mention macroeconomic causes (e.g., a currency devaluation, a change in the monetary policy stance, or a non-financial recession). Banking-fundamental runs are triggered by systemic deterioration in aggregate banking sector fundamentals, a financial crisis, or bank-level causes. Non-fundamental runs are runs for which we neither find a macroeconomic cause nor a banking-related cause. For systemic bank runs, we report the type of retail deposits that experienced the largest deposit outflow observed anytime between one year before and one year after the run, along with the deposit contraction. For each run, we also report whether it coincides with a broader banking crisis, as defined in Section 2.5, and whether it is part of the Baron et al. (2021) list of banking panics.

A.2 Characteristics of Bank Runs and Banking Crises

Table A.2: How Frequent Are Bank Runs?

	Pre-1933		Post-1933	
	Run prob.	Share systemic	Run prob.	Share systemic
	(*all in percent*)			
Average	5.0	75.6	1.3	53.7
By region:				
East Asia and Pacific	3.6	92.3	2.9	42.5
Europe and Central Asia	5.2	67.1	1.6	65.0
Latin America and Caribbean	3.6	91.7	1.3	62.5
Middle East and North Africa	N/A	N/A	0.6	85.7
North America	11.6	82.6	6.7	50.0
South Asia	1.3	100.0	1.2	33.3
Sub-Saharan Africa	0.0	0.0	0.3	20.0
By income level:				
Advanced economies	6.7	82.0	1.7	54.2
Emerging economies	4.5	68.9	1.3	53.5
By financial development:				
Low	5.1	66.7	0.6	29.4
Medium	6.6	76.0	1.8	60.4
High	6.3	72.0	2.0	50.8
By deposit insurance:				
No	5.0	75.6	0.9	48.7
Yes	N/A	N/A	2.5	59.2

Notes: This table summarizes bank run probabilities for two subperiods: before 1933 (and, as such, before the introduction of deposit insurance) and after 1933. The share of systemic bank runs indicates what fraction of bank runs was accompanied by a contraction in outstanding deposits. We determine income levels based on real GDP per capita in PPP terms, where countries with median values in the top quartile in any given decade are treated as advanced economies and the remainder as emerging economies. Financial development is defined as the ratio of credit to GDP, where we split countries into the low, medium, and high categories based on the tercile they fall in for any given decade. All values are in percent.

Table A.3: Distribution of Fundamental Causes within Systemic vs. Non-Systemic Runs

	Macro-fundamental	Banking-fundamental	Non-fundamental	Total
Systemic runs	42	100	27	169
Non-systemic runs	22	57	18	97

Notes: This table reports the total number of bank runs for which we find (i) macroeconomic-fundamental causes, (ii) banking-fundamental causes, and (iii) no-fundamental causes. The sample is limited to all bank runs from our chronology for which we have narrative evidence and deposit data available. We consider systemic bank runs in the first row and non-systemic bank runs in the second row. We use a narrative coding to determine whether a bank run was triggered by macroeconomic fundamentals, banking-related fundamentals, or non-fundamental causes. Macroeconomic-fundamental runs are runs for which historical accounts mention macroeconomic causes (e.g., a currency devaluation, a change in the monetary policy stance, or a non-financial recession). Banking-fundamental runs are triggered by systemic deterioration in aggregate banking sector fundamentals, a financial crisis, or bank-level causes. Non-fundamental runs are runs for which we neither find a macroeconomic cause nor a banking-related cause.

A.3 Bank Runs and Deposit Contractions—Robustness

In this section, we study the dynamics of deposit contractions around bank runs in more detail. Section 3.2 of the paper shows that bank runs coincide with large contractions in total deposits (see Figure 2). Here, we zoom in on the dynamics of demand deposits and time deposits.

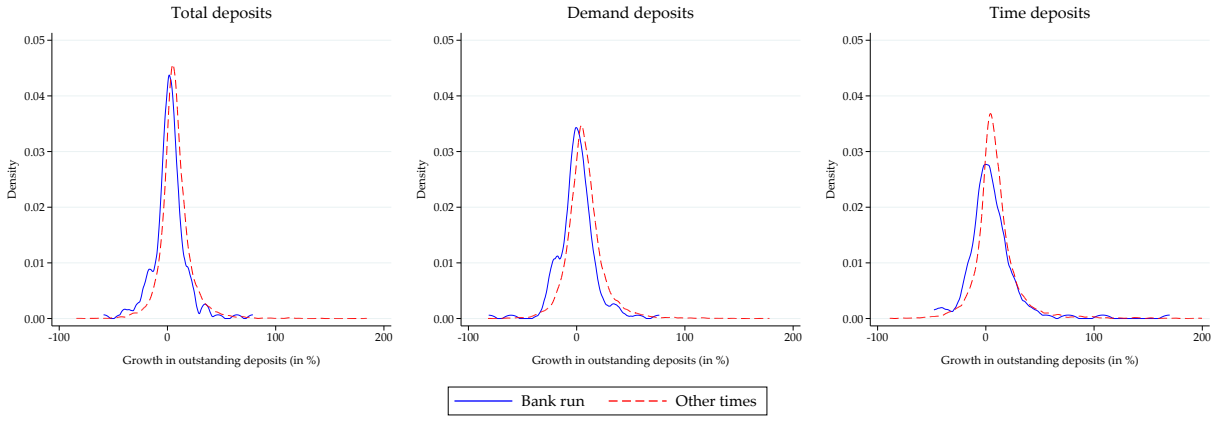
To test whether the deposit contractions around runs are driven by large deflationary episodes, Figure A.1 plots the density of real growth rates in total deposits, demand deposits, and time deposits. We again find a clear shift to the left for real deposit growth rates around bank run episodes. Bank runs coincide with contractions in both real and nominal deposits, which is further confirmed in Figure A.2, where we plot the impulse response functions of these different deposit growth rates. We show in Section B.3 of the Web Supplement that the macroeconomic aftermath of systemic runs is similar when classifying systemic runs using contractions in real, rather than nominal, deposits.

Furthermore, we visualize the density of nominal demand deposit growth rates and nominal time deposit growth rates. In Figure A.3, we plot the distribution of growth rates of both types of deposits around bank run episodes against the distribution of growth rates during normal, i.e., non-bank run, times. We observe a clear shift to the left in the distribution of demand and time deposit growth rates during run periods. Bank runs from our chronology thus coincide with runs on both types of deposits. During an average bank run, there is a 30.9% probability that nominal demand deposits contract, and a 21.1% probability that nominal time deposits contract.

To better understand the timing of these deposit contractions, we run an event study regression. In Figure A.4, we visualize the behavior of logged nominal demand deposits and logged nominal time deposits for a time window of ±5 years around a run episode. Bank runs are accompanied by sudden and severe contractions in demand deposits. The timing of the withdrawal coincides with the reported year of the run. Demand deposits recover quickly in the years following the run. In contrast, the outflow of time deposits is more prolonged, and time deposits also expand significantly before the run. When the run begins, there is a steady decline in time deposits that is persistent, continuing until up to three years after the narrative year of the run. Below, we show that both runs on demand and time deposits are followed by large contractions in real GDP.

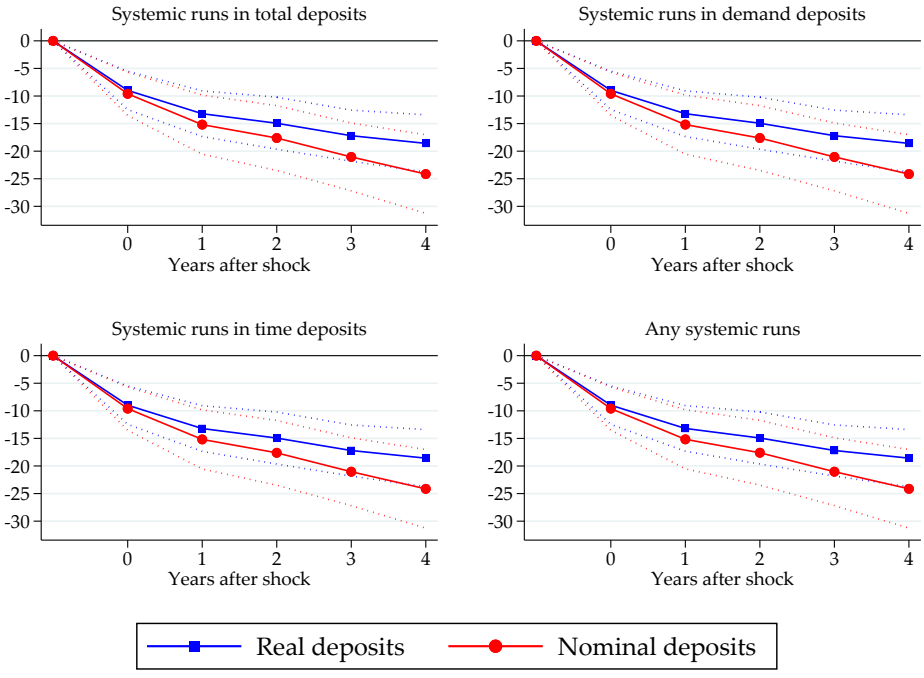
Taking stock, these results suggest that both demand and time deposits can exhibit runs. Our systemic run classification thus reflects periods of contractions in nominal deposits in either type.

Figure A.1: Distributions of Real Deposit Growth Rates



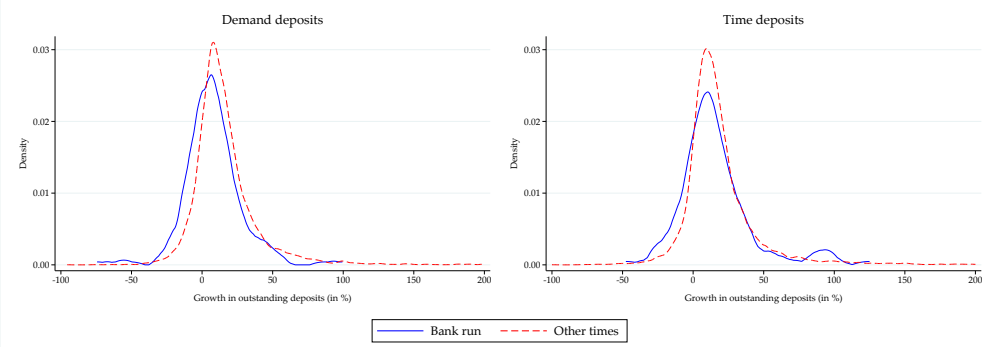
Notes: These figures plot the distributions of real growth rates of total deposits, demand deposits, and time deposits during periods of bank runs vs. other times.

Figure A.2: Real and Nominal Deposits Around Systemic Runs, By Category



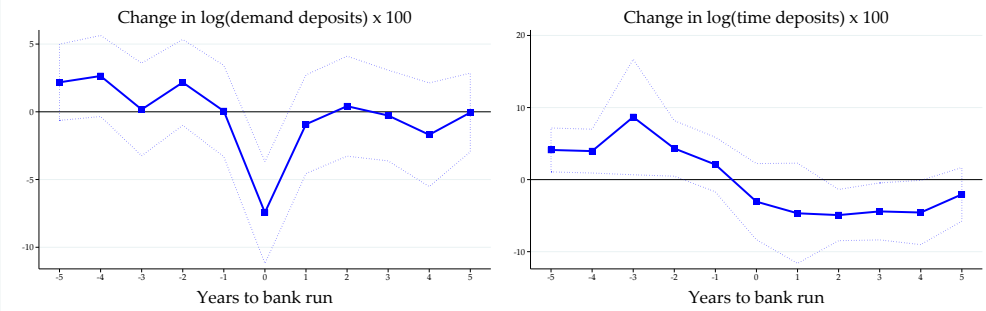
Notes: These figures plot the impulse response functions of real total deposits and nominal total deposits to a systemic bank run in either (i) total deposits, (ii) demand deposits, (iii) time deposits or (iv) any one of the three different deposit categories: total deposits, demand deposits, and time deposits. The dotted bands depict 95% confidence bands based on standard errors double-clustered by country and year.

Figure A.3: Distributions of Demand Deposit and Time Deposit Growth Rates



Notes: These figures plot the distributions of nominal growth rates for both demand deposits and time deposits during periods of bank runs vs. other times. We winsorize nominal growth rates at 200% to abstract from the influence of major inflation episodes.

Figure A.4: Contractions of Demand Deposits and Time Deposits Around Runs



Notes: These figures plot the estimates of an event study specification relating logged nominal demand deposits and logged nominal time deposits to the exact year a bank run starts. We specify the following event study regression: $\Delta Y_{i,t} = \alpha_i + \sum_{k=-5}^{5} \beta^k \mathbf{1}_{i,t+k}^{run} + \epsilon_{i,t}$, where $\mathbf{1}_{i,t+k}^{run}$ is one for country-year observations for which we have evidence of bank runs from our run chronology. Standard errors are double-clustered by country and year.

A.4 Bank-Level Appendix

A.4.1 Bank-Level Data Description and Cleaning Steps

For the bank-level analysis outlined in Section 3.3, we rely on two different bank-level datasets for the United States. The first dataset contains balance sheet data originally published by the Office of the Comptroller of the Currency (OCC) from Carlson et al. (2022), and the second dataset are the modern-day Call Reports published by the Federal Deposit Insurance Corporation (FDIC) and now maintained by the Federal Financial Institutions Examination Council (FFIEC). In Section A.4.3 of this Appendix, we extend our bank-level analysis to non-U.S. banks using data from Orbis. In the following, we describe these three datasets in more detail and elaborate on how we cleaned the data step by step.

Office of the Comptroller of the Currency (OCC) data. The OCC dataset covers the period of the national banking era at the annual frequency. The data cover the years from 1867 to 1904 and include over 100,000 individual balance sheets of national banks. The bank balance sheets were digitized using the methodology outlined in Correia and Luck (2023) and first used in Carlson et al. (2022). We made the following adjustments to the original dataset to control the potential influence of outliers:

1. We exclude observations with bank equity or total liabilities smaller than or equal to zero.

2. We exclude observations for which the difference between the asset and the liability side of banks is larger than 5%.

3. We winsorize the log differences for the following variables at the 0.5^{th} and 99.5^{th} percentiles:

    - Total liabilities
    - Non-core funding (proxied by non-deposit liabilities)
    - Deposits
    - Total assets
    - Loans.

4. We winsorize the following ratios at the 0.5^{th} and 99.5^{th} percentiles:

    - Debt-to-assets ratio

- Profits-to-assets ratio
- Non-core-funding-to-liabilities ratio.

Our final dataset contains 108,732 bank-year observations that cover 7,046 individual banks over 38 years.

Call Reports data. The second dataset are the Call Reports, covering the period between 1976 and 2020, which allow us to analyze the bank-level implications of three more recent bank run episodes. We clean the raw data by applying the following steps:

1. We exclude observations with bank equity, total assets, total liabilities, or tier 1 capital smaller than or equal to zero.
2. We exclude negative observations in total loans, total deposits, time deposits, demand deposits, cash, non-core funding, interest income on loans, or interest expenses on deposits.
3. We only keep commercial banks in the dataset.
4. We winsorize the log differences for the following variables at the 1^{st} and 99^{th} percentiles:
    - Total liabilities
    - Non-core funding
    - Deposits
    - Demand deposits
    - Time deposits
    - Total assets
    - Loans.
5. We winsorize the following ratios at the 2^{nd} and 98^{th} percentiles:
    - Debt-to-assets ratio
    - Net-interest-income-to-assets ratio
    - Non-core-funding-to-liabilities ratio.

Finally, for the baseline analysis highlighted in Section 3.3, we annualize the Call Reports data to allow for a more straightforward comparison with the remainder of the analysis in the paper by keeping the fourth quarter values of all relevant stock variables. After applying these steps, our final dataset includes 424,066 bank-year observations with 20,621 unique banks.

Orbis data. The dataset we use is a subset of the original Moody's Orbis dataset. We start with a sample of financial firms between 1990 and 2022. After applying the selection criteria that we describe in the following, the final dataset ranges from 2005 to 2020. We entirely focus on banks and drop all other financial companies (non-banks). Further, we drop all U.S. banks from the sample since we already cover these banks in the more comprehensive Call Reports dataset. We then clean the raw dataset by following the steps outlined in Kalemli-Ozcan et al. (2015), namely:

1. We remove duplicates at the bank-year level.
2. We drop observations with missing currency units.
3. We drop observations for which the original BvD country code and the ISO code contradict each other.
4. We remove large jumps in total assets that do not originate from changes in the measurement units.
5. We harmonize the units in which the variables are reported across time and banks.
6. We drop observations for which the reported currency coincides with neither the domestic currency, currencies of neighboring countries in the same region, the US dollar, nor the euro.
7. We transform the currencies in which each bank's balance sheet items are measured to domestic currency.
8. We drop bank-year observations for which either assets, operational income, net income, or employment are missing.
9. We drop observations with negative values for employment, assets, total liabilities, equity, deposits, loans, leverage, or other securities.
10. We drop observations before 2005 due to poor data coverage for banks outside the US.

11. We eliminate bank-year observations with a leverage (debt-to-equity) larger than 10,000%, a debt-to-assets ratio smaller than 40%, or where the difference between the asset and the liability side is larger than 5%.

12. We winsorize the log differences for the following variables at the 2nd and 98th percentiles:

    - Total liabilities
    - Non-core funding
    - Deposits
    - Assets
    - Loans.

13. We winsorize the following ratios at the 2nd and 98th percentiles:

    - Debt-to-assets ratio
    - Profit-to-assets ratio
    - Non-core-funding-to-liabilities ratio.

After applying these cleaning steps, we are left with 66,104 bank-year observations that include 8,841 unique banks across 134 countries. Out of these countries, 21 experienced a bank run between 2005 and 2020.

A.4.2 U.S. Bank-Level Evidence

Table A.4: Bank-Level Summary Statistics for U.S. Banks

	Mean	Median	S.D.	P10	P90	Obs.
Panel A: OCC data (1867-1904)						
Total assets gr.	5.39	3.28	15.25	-10.28	22.67	100,241
Loans gr.	7.29	3.95	22.46	-14.29	30.55	100,235
Total liabilities gr.	7.47	4.45	22.09	-15.30	32.33	100,242
Total deposits gr.	10.30	6.10	30.33	-21.19	44.29	100,218
Non-deposit liabilities gr.	8.62	1.62	38.13	-22.21	42.14	100,241
Bank size	13.06	12.92	0.91	11.99	14.32	100,673
Debt to assets	0.67	0.68	0.11	0.52	0.82	107,645
Panel B: Call Reports (1976-2020)						
Total assets gr.	5.01	2.45	13.38	-6.48	17.83	387,201
Loans gr.	6.50	3.53	19.10	-11.01	24.38	335,484
Total liabilities gr.	5.32	2.40	14.97	-7.02	18.85	387,202
Total deposits gr.	5.18	2.22	15.02	-7.11	18.70	387,026
Demand deposits gr.	4.29	1.10	23.04	-18.46	28.47	386,077
Non-deposit liabilities gr.	13.36	4.19	49.41	-31.79	63.20	289,788
Bank size	10.70	10.60	1.08	9.37	12.14	380,183
Debt to assets	0.91	0.91	0.03	0.87	0.93	407,088

Notes: This table summarizes the bank-level variables for banks in the United States. Panel A reports the statistics for the OCC dataset covering the period 1867-1904. Panel B reports the statistics for the Call Reports data for the period 1976-2020. All growth rates are reported in real terms.

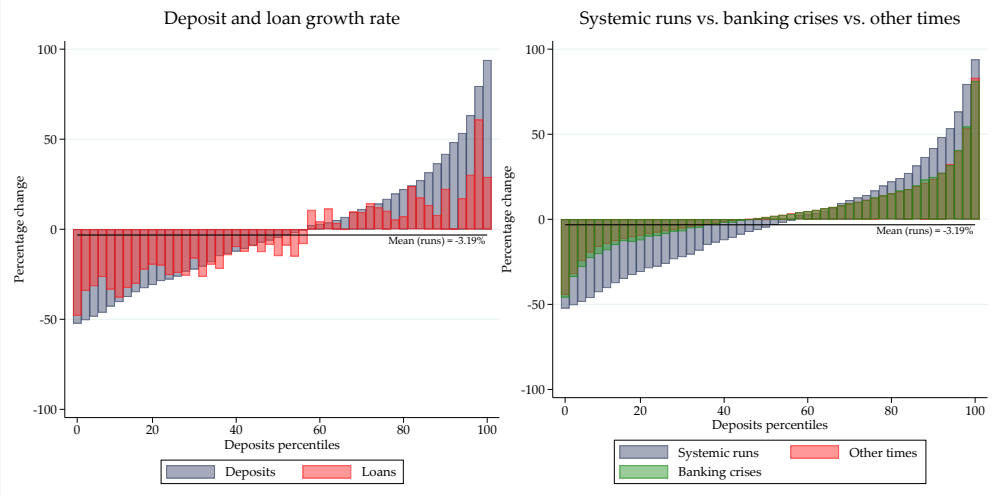
A.4.3 International Bank-Level Evidence

Table A.5: Bank-Level Summary Statistics for Non-U.S. Banks from Orbis

	Mean	Median	S.D.	P10	P90	Obs.
Total assets gr.	3.19	1.66	15.56	-13.46	21.51	54,009
Loans gr.	3.72	2.01	18.99	-15.07	23.62	52,628
Total liabilities gr.	3.43	1.66	17.53	-14.53	23.12	54,000
Total deposits gr.	4.19	1.92	20.45	-15.21	25.16	52,460
Non-deposit liabilities gr.	4.26	-1.47	35.97	-30.27	41.48	52,454
Bank size	19.43	18.80	3.10	16.16	24.15	54,009
Debt to assets	0.88	0.91	0.11	0.78	0.95	63,446

Notes: This table summarizes the bank-level variables for banks outside the United States. We report the statistics for the Orbis dataset covering the period 2005-2020. All growth rates are reported in real terms.

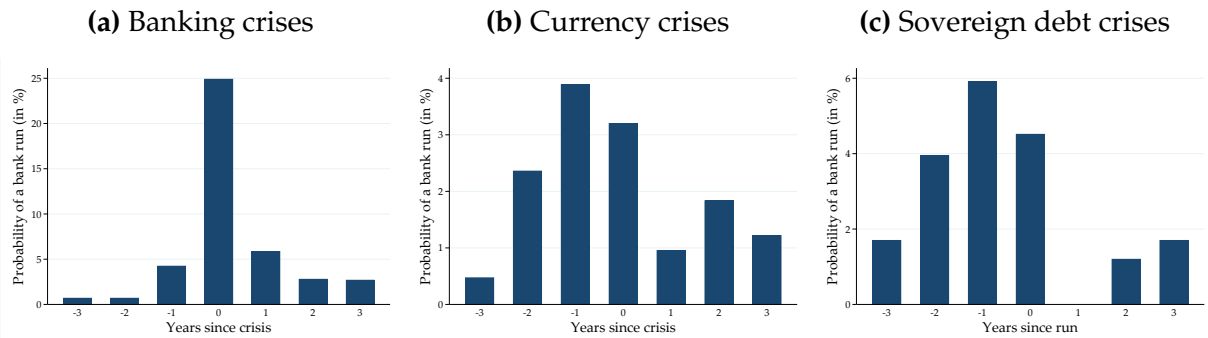
Figure A.5: Dispersion in Bank-Level Deposit and Loan Growth During Systemic Runs (Non-U.S. Banks)



Notes: The left-hand side figures plot bank-level growth rates of real deposits and real loans outside of the U.S. during periods of systemic bank runs across percentile bins of real deposit growth rates. The right-hand side figures plot bank-level growth rates of real deposits during periods of systemic bank runs, periods of banking crises, and periods outside of runs or crises across percentile bins of real deposit growth rates. The figures are based on the Orbis dataset for the period 2005-2020. The black solid line indicates the average deposit growth rate during systemic runs in the sample.

A.5 The Overlap of Bank Runs and Financial Crises

Figure A.6: The Probability of a Bank Run Around Financial Crises



Notes: These figures plot the probability of a bank run around periods of (other) financial crises. We define the dates of financial crises by combining several chronologies as described in Section 2.5. Banking crisis dates are taken from Baron et al. (2021), Laeven and Valencia (2018), Jordà et al. (2017), and Reinhart and Rogoff (2009), in that order of priority. Dates for currency and sovereign debt crises are from Laeven and Valencia (2018) and Reinhart and Rogoff (2009). Banking panics are from Baron et al. (2021).

Table A.6: Bank Runs Conditional on Financial Crises—Different Crisis Measures

	Number of crises	Narrative bank run prob.	Deposit contraction prob.	Systemic bank run prob.	Non-systemic bank run prob.
Banking crises					
Combined chronology	355	0.51	0.81	0.38	0.18
Reinhart and Rogoff (2009)	303	0.53	0.75	0.40	0.18
Laeven and Valencia (2018)	151	0.32	0.74	0.24	0.15
Jordà et al. (2017)	88	0.64	0.89	0.46	0.21
Baron et al. (2021)	224	0.65	0.82	0.45	0.23
Baron et al. (2021) panics	192	0.72	0.83	0.50	0.25
Currency crises					
Combined chronology	543	0.16	0.65	0.13	0.08
Reinhart and Rogoff (2009)	628	0.17	0.64	0.13	0.08
Laeven and Valencia (2018)	239	0.16	0.56	0.09	0.10
Sovereign debt crises					
Combined chronology	271	0.17	0.71	0.18	0.08
Reinhart and Rogoff (2009)	247	0.19	0.66	0.19	0.10
Laeven and Valencia (2018)	140	0.23	0.64	0.15	0.11

Notes: This table summarizes the probabilities of narrative bank runs, deposit contractions, systemic runs (i.e., narrative runs accompanied by deposit contractions), or non-systemic runs (i.e., narrative runs without deposit contractions) within three years of a financial crisis. For each type of financial crisis we report the probabilities for our three measures of combined chronologies and the probabilities when using the original chronologies from the literature. We define the dates of our three chronology measures by combining several chronologies as described in Section 2.5. Banking crisis dates are taken from Baron et al. (2021), Laeven and Valencia (2018), Jordà et al. (2017), and Reinhart and Rogoff (2009), in that order of priority. Dates for currency and sovereign debt crises are from Laeven and Valencia (2018) and Reinhart and Rogoff (2009). Banking panics are from Baron et al. (2021).

Table A.7: Banking Crises Conditional on Bank Runs—Different Crisis Measures

	Number of runs	Banking crisis JKMS	Banking crisis R&R	Banking crisis L&V	Banking crisis JST	Banking crisis BVX	Banking panics BVX
Narrative runs	316	0.72	0.71	0.53	0.66	0.83	0.79
Deposit contractions	1,699	0.23	0.26	0.20	0.29	0.35	0.32
Systemic runs	169	0.79	0.81	0.61	0.73	0.91	0.86
Non-systemic runs	97	0.60	0.57	0.43	0.53	0.72	0.67

Notes: This table summarizes the probabilities of different types of banking crises within three years of either a narrative bank run, a deposit contraction, a systemic run (i.e., a narrative run accompanied by a deposit contraction), or a non-systemic run (i.e., a narrative run without a deposit contraction). We report the probabilities when using our measure of combined banking crisis chronologies followed by the probabilities using the original banking crisis chronologies from the literature. We define the dates of our banking crisis chronology by combining several chronologies as described in Section 2.5. Banking crisis dates are taken from Baron et al. (2021), Laeven and Valencia (2018), Jordà et al. (2017), and Reinhart and Rogoff (2009), in that order. Banking panics are from Baron et al. (2021).

Table A.8: Predicting Bank Runs With Financial Crises

	Narrative bank run	Systemic bank run	Deposit contraction	Non-systemic run
	(1)	(2)	(3)	(4)
Banking crisis	0.312***	0.224***	0.168***	0.087***
	(0.045)	(0.035)	(0.031)	(0.018)
Currency crisis	0.013	0.009	0.010	0.004
	(0.008)	(0.007)	(0.022)	(0.007)
Sovereign debt crisis	0.014	0.020	0.007	0.003
	(0.011)	(0.011)	(0.029)	(0.009)
Country FE	Y	Y	Y	Y
Observations	17,171	10,630	10,630	10,630
Countries	161	156	156	156
Run episodes	276	152	1,272	85
R^2	0.14	0.12	0.02	0.04
AUC	0.71	0.73	0.52	0.65

Notes: The table summarizes the estimated coefficients of the following panel regression: $\mathbf{1}_{i,t}^{run,j} = \alpha_i + \beta^{bcrisis}\mathbf{1}_{i,t}^{bcrisis} + \beta^{curr}\mathbf{1}_{i,t}^{curr} + \beta^{sovDebt}\mathbf{1}_{i,t}^{sovDebt} + \epsilon_{i,t}$, where α_i denotes country fixed effects and $\mathbf{1}_{i,t}^{run,j}$ is an indicator variable for a bank run of type j: narrative bank runs from our chronology, systemic runs (i.e., narrative runs accompanied by deposit contractions), deposit contractions, or non-systemic runs (i.e., narrative runs without deposit contractions). The indicator variables on the right-hand side are (i) any banking crisis, (ii) any currency crisis, and (iii) any sovereign debt crisis. Standard errors are double-clustered by country and year.

A.6 Comparing Precursors of Runs and Other Crises

A large literature studies the precursors of financial crises. Financial factors such as credit growth, capital inflows, or real exchange rate appreciations are widely considered to contribute to a build-up of vulnerabilities that can expose the financial system to shocks (see, e.g., Kaminsky and Reinhart, 1999; Gourinchas and Obstfeld, 2012; Schularick and Taylor, 2012). A related strand of literature links the outbreak of bank runs directly to the business cycle (see, e.g., Gorton, 1988; Calomiris and Gorton, 1991).

To understand how these patterns differ for the case of bank runs, we estimate a set of predictive panel regressions that take the following form:

$$\mathbf{1}_{i,t}^{event,j} = \alpha_i + \beta \Delta X_{i,t-4 \to t-1} + \epsilon_{i,t}, \tag{A.1}$$

where $\mathbf{1}_{i,t}^{event,j}$ is an indicator variable that equals one for the first year a country i experiences an event of type j in year t. Events denoted by j include: narrative bank runs from our chronology, systemic runs (i.e., narrative runs accompanied by deposit contractions), or banking crises. $\Delta X_{i,t-4 \to t-1}$ is the predictor variable, where we consider the growth rate of real GDP between four years to one year before the run/crisis occurs, and the changes between four years to one year before the run/crisis in the following variables: bank equity returns, the credit spread, credit-to-GDP, and deposits-to-GDP. α_i denotes country fixed effects. We evaluate the performance of the predictors using univariate regressions. We double-cluster standard errors by country and year.

We are particularly interested in the ability of these different predictors to distinguish between periods of crisis and calm. We base our evaluation on the value of the Area Under the Curve of the Receiver Operating Characteristic (ROC) curve that we report in Table A.9. For our analysis, we use the list of bank runs from our chronology, systemic bank runs, and the list of banking crises as the events that we try to predict by using a given predictor $\Delta X_{i,t-4 \to t-1}$.

The ROC is defined as the ratio of predicted true positives to predicted false positives for a specific probability threshold setting when using one of the business cycle indicators. The area under the resulting ROC curve (AUC) measures the overall performance of the classifier. A model with an AUC of 0.5 suggests no ability to discriminate between crisis times and other periods equivalent to flipping a coin. The higher the AUC value the better the classifier performs.

Contractions in variables related to the financial cycle—such as deposits-to-GDP, credit-to-GDP, or higher credit spreads—predict bank runs, and in particular systemic ones, better than business cycle indicators such as the growth rate of real GDP or bank

Table A.9: What Predicts Runs, What Predicts Crises?

	Narrative bank runs AUC	Systemic bank runs AUC	Banking crises AUC
	(1)	(2)	(3)
Real GDP growth, $t-4$ to $t-1$	0.520	0.510	0.560
Bank equity returns change, $t-4$ to $t-1$	0.590	0.580	0.610
Credit spread change, $t-4$ to $t-1$	0.570	0.570	0.490
Credit-to-GDP change, $t-4$ to $t-1$	0.620	0.640	0.580
Total Deposits-to-GDP change, $t-4$ to $t-1$	0.560	0.590	0.560

Notes: This table reports the estimated Area Under the Curve (AUC) for a variety of early warning models described by regression specification (A.1). We use different predictors $\Delta X_{i,t-4\to t-1}$ for the classification of narrative bank runs, systemic bank runs (i.e., narrative runs accompanied by deposit contractions), or banking crises. These results are based on univariate specifications as in (A.1), such that each cell refers to the result of one empirical model.

equity returns. The latter are relatively more informative about banking crises. These results indicate that bank runs and banking crises may have different drivers. We find evidence that bank runs tend to follow a withdrawal of funds from the banking system, in line with Diamond and Dybvig (1983) and Gorton (2012). For banking crises, in turn, our results can be interpreted as evidence that an erosion of bank equity results in distress in the banking system, which would be in line with He and Krishnamurthy (2013) and Brunnermeier and Sannikov (2014). The results on the role of deposit contractions also strongly support our strategy to use them for identifying periods of systemic bank runs since these run periods are indeed more likely to be accompanied by changes in deposits than one would observe during banking crises identified in the literature.

A.7 Average Output Losses from Bank Runs—Robustness

In this section, we consider robustness checks for the macroeconomic aftermath of runs documented in Section 4.2. We focus on the robustness of the local projections from the baseline regression equation (1). Figure A.7 plots the results.

The blue lines depict the baseline results from the main body of the paper. The red lines are based on the same set of control variables but we only allow for one lag. The green lines refer to a specification with the same set of control variables but using six lags. For the specification visualized by the purple lines, we again use three lags of lagged macroeconomic control variables, as in our baseline specification, but extend the set of variables to include lagged values of real demand deposit growth rates, real time deposit growth rates, and real growth rates of credit.

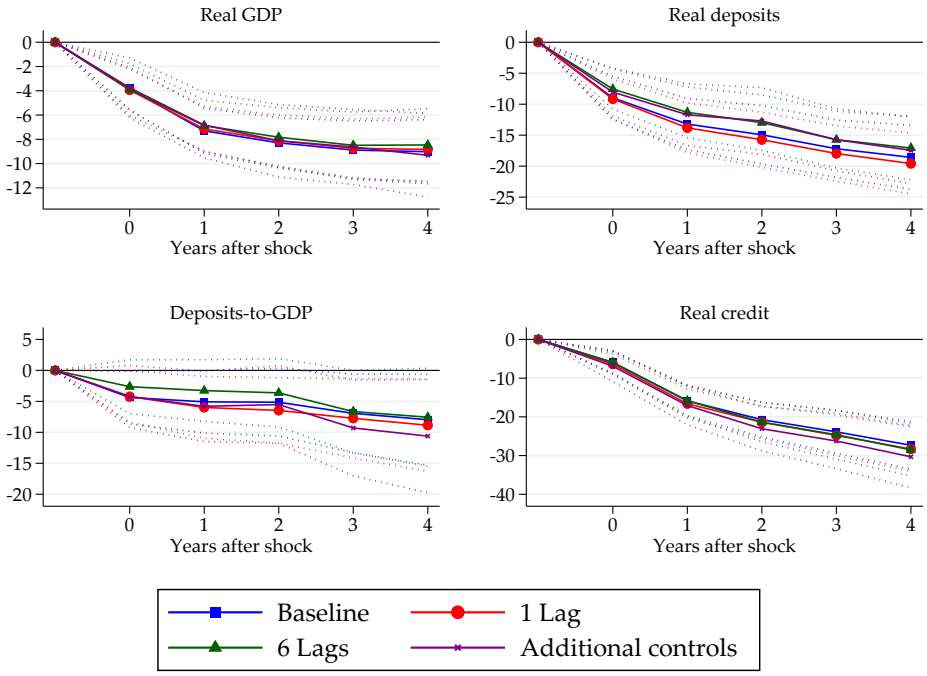
We find that the estimated macroeconomic aftermath of bank runs is robust to changes in the number of lags and the inclusion of the above-mentioned additional control variables. The persistent output losses shown in the local projections imply a trend shift in GDP after a systemic bank run. These findings are furthermore robust to the inclusion of year fixed effects (Figure A.8) and without controlling for lagged changes in log real credit (Figure A.9). The macroeconomic aftermath depicted in Figure A.9 by excluding real credit growth probes at the same time for robustness to the inclusion of additional systemic bank run episodes before 2016. The real credit variable covers 179 countries for the period 1870 to 2016. Excluding the lagged changes in logged real credit from regression (1) allows us to include 13 additional systemic bank runs.[1]

In Figure A.10, we further consider in detail the path of real GDP around systemic bank runs depending on the type of deposits experiencing a contraction. We find that systemic bank runs are associated with similar output losses regardless of which deposit category experiences a run.

Finally, we split the sample into high-income vs. low-income countries in Figure A.11, and find a somewhat stronger response for high-income countries, in line with the literature (e.g., Laeven and Valencia, 2018).

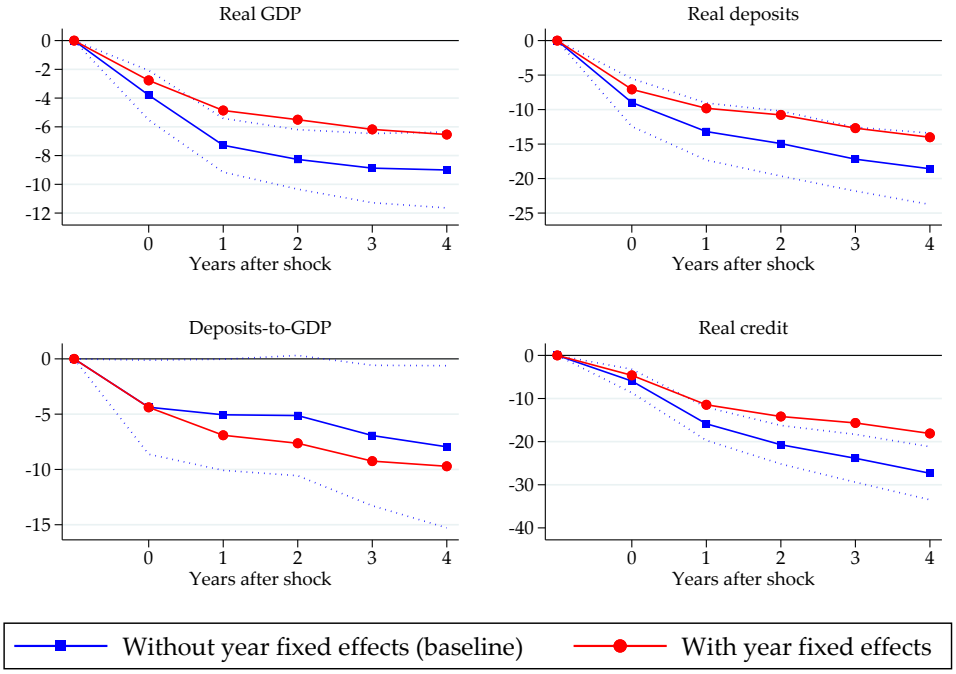
[1] Excluding also the lagged change in logged real deposits and the lagged change in the deposits-to-GDP ratio as controls from regression equation (1) would allow us to include two additional systemic runs on top.

Figure A.7: Macroeconomic Aftermath of Systemic Bank Runs—Robustness



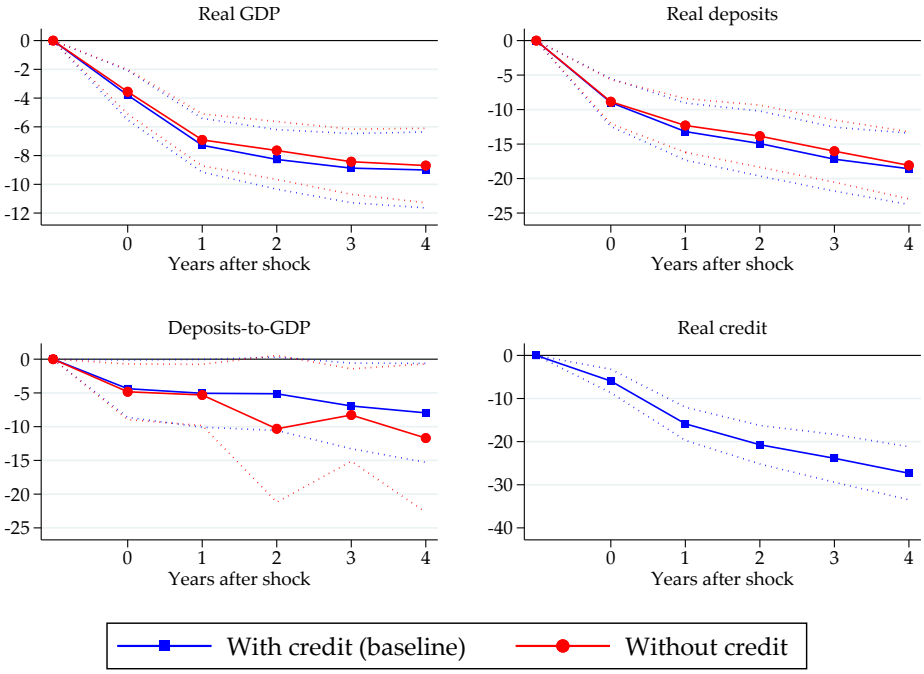
Notes: These figures plot the impulse response functions of real GDP, real deposits, real credit, and deposits-to-GDP to a systemic bank run in any one of the three different deposit categories: total deposits, demand deposits, and time deposits. The estimates are based on the local projection specified in (1), and are probed for robustness to (i) the reduction of lags to one lag of real GDP growth rates, real deposit growth rates, real credit growth rates, and changes in deposits-to-GDP (red lines), and (ii) an increase in the number of lags to six lags (green lines) of the same control variables. In addition, we show the impulse responses when (iii) including additional macroeconomic controls (purple lines). The set of additional controls includes three lags of real demand deposit growth rates, real time deposit growth rates, and real growth rates of credit. The blue lines depict the baseline results from the main body of the paper, with three lags of the following variables: real GDP growth rates, real deposit growth rates, real credit growth rates, and changes in deposits-to-GDP. The dotted bands depict 95% confidence bands based on standard errors double-clustered by country and year.

Figure A.8: Macroeconomic Aftermath of Systemic Bank Runs—Year Fixed Effects



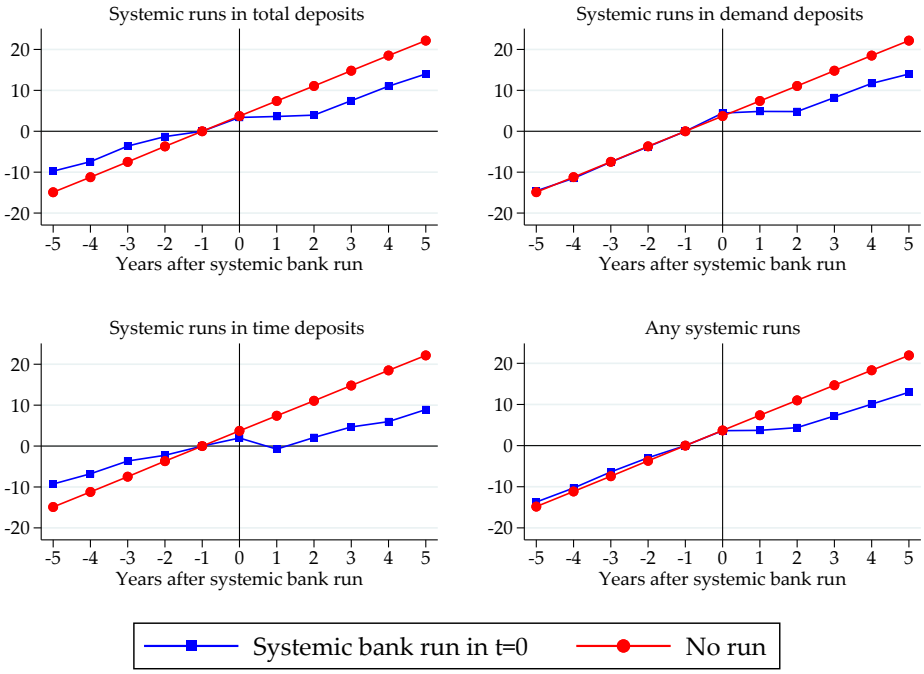
Notes: These figures plot the impulse response functions of real GDP, real deposits, real credit, and deposits-to-GDP to a systemic bank run in any one of the three different deposit categories: total deposits, demand deposits, and time deposits. The estimates are based on the local projection specified in (1), and are probed for robustness to the inclusion of both country fixed effects and year fixed effects (red lines). The blue lines depict the baseline results from the main body of the paper, without year fixed effects. The dotted bands depict 95% confidence bands based on standard errors double-clustered by country and year.

Figure A.9: Macroeconomic Aftermath of Systemic Bank Runs—Without Credit



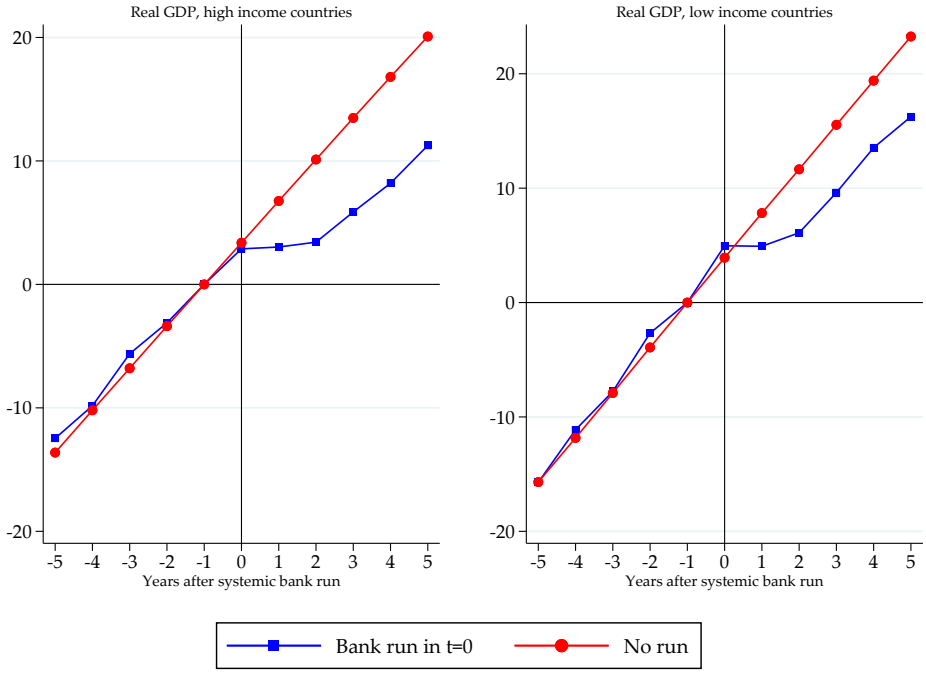
Notes: These figures plot the impulse response functions of real GDP, real deposits, real credit, and deposits-to-GDP to a systemic bank run in any one of the three different deposit categories: total deposits, demand deposits, and time deposits. The estimates are based on the local projection specified in (1), and are probed for robustness to the exclusion of three lags of credit growth rates as a control variable (red lines). The blue lines depict the baseline results from the main body of the paper. The dotted bands depict 95% confidence bands based on standard errors double-clustered by country and year.

Figure A.10: Path of Output Around Systemic Bank Runs on Different Deposit Categories



Notes: These figures plot the path of real GDP around systemic bank runs. Blue lines visualize real GDP around bank runs. In the first three panels, we differentiate between systemic runs on the following three deposit categories: (i) total deposits, (ii) demand deposits, and (iii) time deposits. In the fourth panel in the bottom right, we plot the real GDP path around systemic runs in any one of the three different deposit categories: total deposits, demand deposits, and time deposits. The red lines depict the counterfactual path based on periods when no runs occurred.

Figure A.11: Path of Output Around Systemic Bank Runs By Income Groups



Notes: These figures plot the path of real GDP around systemic bank runs separately for high-income countries (left panel) and for low-income countries (right panel). Blue lines visualize real GDP around systemic bank runs, and red lines the counterfactual path based on periods when no runs occurred.

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