Online Appendix for

The Dynamics of Non-Performing Loans during Banking Crises: A New Database

A. Definition of Non-Performing Loans

The regulatory definition of non-performing loans (NPLs) varies across jurisdictions. For countries reporting Financial Soundness Indicators (FSI) to the IMF, the FSI guideline recommends that loans (and other assets) should be classified as NPL when (1) payments of principal and interest are past due by 90 days or more, or (2) interest payments equal to 90 days interest or more have been capitalized (reinvested into the principal amount), refinanced, or rolled over (payment delayed by agreement). or (3) evidence exists to reclassify them as nonperforming even in the absence of a 90-day past due payment, such as when the debtor files for bankruptcy (IMF 2019, pg. 59).[1]

The 90-day past due criterion is most widely used by countries (Cortavarria and others, 2000) and in line with the Basel criteria for problem asset (Basel Committee on Banking Supervision, Core Principle 18) or establishing default (Basel II), and the European Banking Authority's (EBA) criteria for non-performing exposures (ECB 2017). The Basel and EBA criteria also include loans that are less than 90 day overdue but are deemed unlikely to be repaid similar to the FSI guideline (criteria 2 and 3).

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[1] Previous FSI guideline on NPLs are similar (IMF 2006) with one exception. The 2007 revision of FSI guideline redefined NPLs base on a narrow criterion of "principal or interest payments 90 days overdue". In cases where countries follow different FSI guidelines, the FSI NPL series may not be consistent.

Table A1. Source and definition of NPLs

Source	Crisis	Variable Name	Unit	Notes
IMF Financial Soundness Indicators	All	Bank Non-Performing Loans to Gross Loans (%)	Percent, EOP, Not Seasonally Adjusted	Calculated by taking the value of NPLs as the numerator and the total value of the loan portfolio (including NPLs, and before the deduction of specific loan loss provisions) as the denominator. Loans are classified as NPL when (1) payments of principal and interest are past due by 90 days or more, or (2) interest payments equal to 90 days interest or more have been capitalized (reinvested into the principal amount), refinanced, or rolled over (payment delayed by agreement). or (3) evidence exists to reclassify them as nonperforming even in the absence of a 90-day past due payment, such as when the debtor files for bankruptcy After a loan is classified as nonperforming, it (and/or any replacement loan(s)) should remain classified as such until written off or payments of interest and/or principal are received on this or subsequent loans that replace the original. Loans include those financial assets created through the direct lending of funds by a creditor to a debtor through an arrangement in which the lender either receives no security evidencing the transactions or receives a nonnegotiable document or instrument. Collateral, in the form of either a financial asset (such as a security) or nonfinancial asset (such as land or a building), may be provided under a loan transaction, though it is not an essential feature. Loans include commercial loans, installment loans, hire-purchase credit, loans to finance trade credit and advances, financial leases, repurchase agreements not classified as a deposit, and overdrafts. Trade credit and similar accounts receivable/payable are not loans.
World Bank World Global Financial Development Database	All	Bank Non-Performing Loans to Gross Loans (%)	Percent, EOP, Not Seasonally Adjusted	Data are submitted by national authorities to the IMF following the Financial Soundness Indicators (FSI) Compilation Guide.
Bankscope	All	Total impaired loans to gross loans (%, Bankscope)	Percent, EOP, Not Seasonally Adjusted	Total impaired loans to gross loans from Bankscope. Bank-level data are aggregated to country level using gross loans as weights. Bankscope does not report NPLs; instead it reports impaired loans. The source of these figures is mostly banks' annual reports and accounts, and these are all loans that have a specific impairment against them. There is no conformity to defining impaired loans, both across country and intracountry because all accounting standards are vague in their definition of when a loan is impaired and because management discretion can change from one year to the next within a particular bank.
IMF Staff Report	All	Bank Non-Performing	Percent, EOP, Not Seasonally Adjusted	Loans are classified as nonperforming if payments are overdue for three months or more. Reported on a gross basis over all banks, unless otherwise indicated below.

		Loans to Gross Loans (%)		
National source	Albania, 1994	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	International Monetary Fund (IMF), 1996. "Table 24. Nonperforming Bank Loans." Source in: World Economic Outlook, May 1996: Focus on Fiscal Policy." World Economic Outlook, IMF, Washington, DC.
National source	Argentina, 1995	NPL as % of total loans, Total financial system	Percent, EOP, Not Seasonally Adjusted	Central Bank of Argentina and Fund staff estimates. International Monetary Fund (IMF), 1994. "Table 13. Argentina: Indicators on Provisioning and Quality of Loan Portfolio." Source In: "Argentina - Background Papers." IMF Country Report No. 94/177, IMF, Washington, DC.
National source	Bolivia, 1994	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Sources: Central Bank of Bolivia; Ministry of Finance; and Fund staff estimates and projections. International Monetary Fund (IMF), 1999. "Table 5. Selected Economic Indicators, 1986–2004." Source in: "Bolivia—Ex Post Assessment of Longer-Term Program Engagement." IMF Country Report No. 05/99, IMF, Washington, DC.
National source	Brazil, 1994	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Bank of International Settlements (BIS), 1996. "Table VI.5: Non-performing loans as a percentage of total loans." Source in: BIS 67th Annual Report, 1996/97, BIS, Basle, Switzerland.
National source	Bulgaria, 1996	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	China, 1998	NPL as % of total loans, state-owned commercial banks	Percent, EOP, Not Seasonally Adjusted	Sources: Zhao Yi, 2001; Liu Mingkang's talk on May 29, 2003, China Banking Regulatory Commission; China Statistical Year Book.. "Table 1. NPLs of State-owned Commercial Banks Between 1985 and 2005." Source in: "Non-Performing Loan of China's Banking System." Tokyo Meiji Gakuin University Annual Report. Retrieved from: http://www.meijigakuin.ac.jp/econ/academics/publications/annual/PDF/23_asia%20east_4.pdf.
National source	Colombia, 1998	NPL as % of outstanding credit	Percent, EOP, Not Seasonally Adjusted	Source: Banco de la Republica. Outstanding credit data does not include leasing transactions. French-Davis R., Villar L., 2006. "Table 4. Chile and Colombia: financial sector, 1990-2003." Source in: "Real Macroeconomic Stability and the Capital Account in Chile and Colombia." Working paper No. 294, Banco de la Republica, Colombia. Retrieved from: http://www.banrep.gov.co/es/node/545
National source	Croatia, 1998	Nonperforming assets as % of total assets	Percent, EOP, Not Seasonally Adjusted	Nonperforming assets include loans classified in percent of total assets, which here refers to total assets of deposit money banks. At end-2001, nonperforming loans amounted to 7.8 percent of classified assets. International Monetary Fund (IMF), 2002. "Table 3. Croatia: Selected Macro Prudential Indicators, 1995-2002." Source in: "Republic of Croatia - Financial System Stability Assessment." IMF Staff Report No. 02/244, IMF, Washington, DC.

National source	Czech Rep., 1996 (1994 onwards)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	Czech Rep., 1996 (Pre-1994)	NPL as % of total credit	Percent, EOP, Not Seasonally Adjusted	From 1994 loans previously classified as temporarily in arrears are now included under dubious and questionable claims. Includes claims both temporarily in arrears and those classified as dubious and questionable. International Monetary Fund (IMF), 1994. "Table 28. Czech Republic: Nonperforming Loans of the Banking System, 1992-94." Source in: "Czech Republic - Recent Economic Developments." IMF Country Report No. 94/194, IMF, Washington, DC.
National source	Ecuador, 1998	NPL as % of total credit	Percent, EOP, Not Seasonally Adjusted	Foreign currency components are valuated at end-period exchange rate. Excludes acceptances, equity holdings, and investment trusts. Nonperforming loans are defined broadly (including loans that no longer accrue interest). International Monetary Fund (IMF), 2000. "Table 36. Ecuador: Commercial Banks' Outstanding Credit to the Private Sector and Nonperforming Loans." Source in: "Ecuador-Selected Issues and Statistical Annex." IMF Country Report No. 00/194, IMF, Washington, DC.
National source	Estonia, 1992	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: EBRD Transition Report, 1998; International Monetary Fund; Central Banks. Tang, H., Zoli, E., Klytchnikova, I., 2000. "Table 3. Soundness of the Banking Sector: Non-performing Loans." Source in: "Banking crises in transition economies: fiscal costs and related issues (English)." World Bank Policy Research Working Paper No. 2484, World Bank, Washington, DC.
National source	Finland, 1991	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Bank of International Settlements (BIS), 1996. "Table VI.5: Non-performing loans as a percentage of total loans." Source in: BIS 67th Annual Report, 1996/97, BIS, Basle, Switzerland.
National source	Georgia, 1991	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: EBRD Transition Report, 1998; International Monetary Fund; Central Banks. Tang, H., Zoli, E., Klytchnikova, I., 2000. "Table 3. Soundness of the Banking Sector: Non-performing Loans." Source in: "Banking crises in transition economies: fiscal costs and related issues (English)." World Bank Policy Research Working Paper No. 2484, World Bank, Washington, DC.
IMF Staff Report	Greece, 2008	Nonperforming loans to total gross loans	Percent, EOP, Not Seasonally Adjusted	Until June 2017 loans were classified as nonperforming when (1) payments of principal and interest are past due by 90 days or more, or (2) interest payments equal to 90 days or more have been capitalized (reinvested in to the principal amount, refinanced, or rolled over), or (3) payments less than 90 days past due that are recognized as nonperforming under the national supervisory guidance. (IMF 2018 Article IV Staff Report).
National source	Hungary, 1991	Problem loans as % of	Percent, EOP, Not Seasonally Adjusted	Source: Berglöf, E., Mizsei, K., 1996. "Banking Sector Development in Central and Eastern Europe." Economic Policy Initiative CEPR and Institute for East West Studies. As sourced in: International Monetary Fund (IMF), 1997. "Table 32. Selected Countries in Transition:

		domestic credit		Problem Loans." Source in: "World Economic Outlook, October 1997: EMU and the World Economy." World Economic Outlook, IMF, Washington, DC.
National source	India, 1993	NPL as % of total loans (public sector banks only)	Percent, EOP, Not Seasonally Adjusted	Bank of International Settlements (BIS), 1996. "Table VI.5: Non-performing loans as a percentage of total loans." Source in: BIS 67th Annual Report, 1996/97, BIS, Basle, Switzerland.
National source	Indonesia, 1997	NPL/total property loans (%)	Percent, EOP, Not Seasonally Adjusted	Pangestu, M., 2003. Table 2. Non-Performing Property Loans, 1992-April 1997. "Source in: "The Indonesian bank crisis and restructuring: lessons and implications for other developing countries." G-24 Discussion Paper No. 23, Intergovernmental Group of Twenty-Four on International Monetary Affairs, United Nations, Geneva. Retrieved from: https://g24.org/wp-content/uploads/2014/03/23.pdf
National source	Kenya, 1992	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Waweru, N., Kalani, V. M., 2009. "Table 1: Non-Performing Loans 1995-2003." Source in: "Commercial Banking Crises in Kenya: Causes and Remedies." African Journal of Accounting, Economics, Finance and Banking Research 4(4).
National source	Kyrgyz Rep., 1995	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: EBRD Transition Report, 1998; International Monetary Fund; Central Banks. Tang, H., Zoli, E., Klytchnikova, I., 2000. "Table 3. Soundness of the Banking Sector: Non-performing Loans." Source in: "Banking crises in transition economies: fiscal costs and related issues (English)." Policy Research Working Paper No. 2484, World Bank, Washington, DC.
National source	Latvia, 1995	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	Lithuania, 1995	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	Malaysia, 1997	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Loans are classified as nonperforming if payments are overdue for three months or more. Total loans include housing loans. International Monetary Fund (IMF), 2005. "Table 6. Malaysia: Indicators of Financial Institution Soundness, 2000–04." Source in: "Malaysia—Staff Report for the 2004 Article IV Consultation." IMF Country Report No. 05/15, IMF, Washington, DC.

National source	Mexico, 1994	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Comisión Nacional Bancaria. Banca Múltiple.1982-93, and Mexico. Comisión Nacional Bancaria y de Valores, Boletín Estadístico de Banca Múltiple, 1993-2004. Haber, S., Musacchio, A., 2013. "Table 3. Reported and Estimated Risk Profile of the Bank Loan Portfolios, 1991-2003." Source in: "These Are the Good Old Days: Foreign Entry and the Mexican Banking System." NBER Working Paper No. 18713.
National source	Nicaragua, 2000 (Pre-2001)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	NPLs including restructured and reprogrammed loans. International Monetary Fund (IMF), 2001. "Table 10. Nicaragua: Indicators of Financial Sector Vulnerability." Source in: "Nicaragua: 2001 Article IV Consultation—Staff Report; Statement by Staff Representative; Public Information Notice on the Executive Board Discussion; and Statement of the Nicaraguan Authorities." IMF Country Report No. 01/148, IMF, Washington, DC.
National source	Nicaragua, 2000 (2002-2004)	NPL as % of total loans, all banks	Percent, EOP, Not Seasonally Adjusted	NPLs including restructured and reprogrammed loans. International Monetary Fund (IMF), 2006. "Table 9. Nicaragua: Financial Soundness Indicators: Core and Encouraged Sets, and Structure and Performance (in percent)." Source in: "Nicaragua: 2005 Article IV Consultation, Seventh, Eighth, and Ninth Reviews Under the Three Year Arrangement Under the Poverty Reduction and Growth Facility, Requests for Rephasing and Waiver of Performance Criteria, Financing Assurances Review, and Request for Extension of the Arrangement: Staff Report; Staff Statement; Public Information Notice and Press Release on the Executive Board Discussion; and Statement by the Executive Director for Nicaragua." IMF Country Report No. 06/174, IMF, Washington, DC.
National source	Nicaragua, 2000 (2005 onwards)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Superintendency of Banks; and Central Bank of Nicaragua. In 2006, a regulatory change narrowed the definition of Tier 1 capital. NPLs including restructured and reprogrammed loans. International Monetary Fund (IMF), 2012. "Nicaragua: Financial Soundness Indicators, 2005–11." Source in: "Nicaragua: Ex Post Assessment of Longer-Term Program Engagement." IMF Country Report No. 12/258, IMF, Washington, DC.
National source	Norway, 1991	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Norges Bank. International Monetary Fund (IMF), 2005. "Table 3. Norway: Bank Financial Soundness Indicators (FSIs)." Source in: "Norway: Financial System Stability Assessment, including Reports on the Observance of Standards and Codes on the following topics: Banking Supervision, Insurance Regulation, and Payment Systems." IMF Country Report No. 05/200, IMF, Washington, DC.
National source	Paraguay, 1995	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Central Bank of Paraguay and Fund staff estimates. International Monetary Fund (IMF), 2001. "Table 1.1: Selected Macroeconomic Indicators 1992-98." Source in: "Paraguay Country Assistance Evaluation." World Bank Report No. 22874, World Bank Operations Evaluation Department, Washington, DC.
National source	Poland, 1992	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: EBRD Transition Report, 1998; International Monetary Fund; Central Banks. Tang, H., Zoli, E., Klytchnikova, I., 2000. "Table 3. Soundness of the Banking Sector: Non-performing Loans." Source in: "Banking crises in transition economies: fiscal costs and related issues (English)." Policy Research Working Paper No. 2484, World Bank, Washington, DC.

National source	Romania, 1998	Ratio of NPL provisions made to gross portfolio	Percent, EOP, Not Seasonally Adjusted	Source: National Bank of Romania. Beginning with October 1, 2000, Regulation no. 2/2000 requires a monthly classification of loans and investments. The figures for December 2005 are calculated based on the prudential reports submitted by banks before the conclusion of banks' balance sheet. International Monetary Fund (IMF), 2006. "'Table 21. Romania: Commercial Banks' Specific Provisions, 1995-2005." Source in: "Romania: Selected Issues and Statistical Appendix," IMF Country Report No. 06/169, IMF, Washington, DC.
National source	Russia, 1998	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Barisitz, S., 2004. "Table 2. Russia: Banking Sector-Related Indicators." Source in: "Distorted Incentives Fading? 'The Evolution of the Russian Banking Sector since Perestroika, in Focus on European Economic Integration." Österreichische Nationalbank Eurosystem (ed.) *Focus on European Economic Integration* 1: 122-152.
National source	Slovak Republic, 1998	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	Slovenia, 1992	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Total non-performing balance and off-balance sheet assets in total assets. World Bank, 2001. "Table 1.2: Non-Performing Loans in Central and Eastern European Countries (Percent of total loans)." Source in: "Czech Republic - Enhancing the prospects for growth with fiscal stability - a public expenditure review (English)." World Bank Report No. 22114-CZ, World Bank, Washington, DC.
National source	South Korea, 1997	Non-performing credit of commercial banks as % of total loans	Percent, EOP, Not Seasonally Adjusted	Non-performing credit includes bad credit and substandard credit. Substandard credit is the credit due to customers classified under doubtful credit but covers the collateralized portion. Bad credit includes credit classified as "Doubtful" or "Estimated Loss". Doubtful Credit is that in excess of the portion collateralized to customers in arrears for more than six months, or to issuers of dishonored bills and checks, or to companies under court receivership. The Estimated Loss category is equivalent to customers in Doubtful Credit, but the loss has been realized. Source: BOK, Financial Supervisory Service. As sourced in: Kataoka, H., 2001. "Table 1b. Non-performing loans of Korean Commercial Banks (trillion KRW)." Source in: "Korean Banking Reform: Following the Asian Financial Crisis." J. Jay Choi (ed.) *Asian Financial Crisis Financial, Structural, and International Dimensions (International Finance Review, Volume 1)*, Emerald Group Publishing Limited: 263-292. ISBN: 978-0-76230-686-2.
National source	Sweden, 1991	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Bank of International Settlements (BIS), 1996. "Table VI.5: Non-performing loans as a percentage of total loans." Source in: BIS 67th Annual Report, 1996/97, BIS, Basle, Switzerland.
National source	Thailand, 1997	NPL as % of total loans	Percent, October values for 1998,	Jansen, K., 2001, "Table 4: Non-performing loans as a percentage of total loans of financial system." Source in: "Thailand, Financial Crisis and Monetary Policy." Journal of the Asia Pacific Economy 6(1): 124-152. https://doi.org/10.1080/13547860020024567

			Not Seasonally Adjusted	
National source	Uganda, 1994	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Various issues of Bank of Uganda Quarterly and Annual Reports. The figures for non-performing loans are average ratios per bank. Nannyonjo, J., 2002. "Table 4.4 Commercial Bank Activities, 1993-2000." Source in: "Financial Sector Reforms in Uganda (1990-2000): Interest rate spreads, market structure, bank performance and monetary policy." Economic Studies No. 110, Göteborg: Kompendiet. ISBN: 91-88514-70-6. Retrieved from: http://hdl.handle.net/2077/2947
National source	Ukraine, 1998	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: EBRD Transition Report, 1998; International Monetary Fund; Central Banks. Tang, H., Zoli, E., Klytchnikova, I., 2000. "Table 3. Soundness of the Banking Sector: Non-performing Loans." Source in: "Banking crises in transition economies: fiscal costs and related issues (English)." Policy Research Working Paper No. 2484, World Bank, Washington, DC.
National source	Venezuela (1991-1993)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Central Bank of Venezuela, Ministry of Finance, IMF staff estimates. International Monetary Fund (IMF), 1996. "Chart 2. Venezuela Commercial Banks, Non-Performing Loan Portfolio." Source in: "Venezuela—Recent Economic Developments." IMF Country Report No. 96/157, IMF, Washington, DC.
National source	Venezuela (1994-1996)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Sources: Superintendency of Banks and Financial Institutions; Central Bank of Venezuela; and Fund staff estimates. International Monetary Fund (IMF), 1999. "Table 7. Venezuela: Commercial Banks Indicators." Source in: "Venezuela-Staff Report for the 1999 Article IV Consultation." IMF Country Report No. 99/184, IMF, Washington, DC.
National source	Venezuela (1997-1999)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Bank of International Settlements (BIS), 1996. "Table VI.5: Non-performing loans as a percentage of total loans." Source in: BIS 67th Annual Report, 1996/97, BIS, Basle, Switzerland.
National source	Vietnam, 1997	NPL of 4 SOCBs as % of total loans	Percent, EOP, Not Seasonally Adjusted	Kubo, K., 2006. "Table 10.3. Overdue loans of deposit money banks, 1989-2002." Source in: "Repression of the Banking Sector in the Transition to a Market-based Economy: The Case of Vietnam." Watanabe M. (eds) *Recovering Financial Systems*. IDE-JETRO. Palgrave Macmillan, London.
National source	Yemen Arab Republic, 1996 (Pre-2000)	Problem loans as % of total loans	Percent, EOP, Not Seasonally Adjusted	Defined as nonperforming loan over 90 days in arrears. The large increase in 1996 reflects the introduction of the CBY's own rigorous classification system rather than reliance on commercial banks reporting. International Monetary Fund (IMF), 1999. "Box 5. Features of the Banking Sector." Source in: "Republic of Yemen-Staff Report for the 1998 Article IV Consultation, Review Under the Extended Arrangement, and Request for the Second Annual Arrangement Under the Enhanced Structural Adjustment Facility." IMF Country Report No. 99/25, IMF, Washington, DC.

National source	Yemen Arab Republic, 1996 (2000 onwards)	NPL as % of total loans	Percent, EOP, Not Seasonally Adjusted	Source: Central Bank of Yemen. Data refers to all banks except the Housing Bank and CAC bank. International Monetary Fund (IMF), 2009. "Table 6. Republic of Yemen: Indicators of Banking System Financial Soundness, 2001–09" Source in: "Republic of Yemen—Staff Report for the 2009 Article IV Consultation, IMF Country Report No. 09/296, IMF, Washington, DC.

Table A2: Summary NPL data sources

	Total No. of Crises	Crises with pre- & post-crisis data
One Source	7	2
Two Sources	15	8
Three Sources	51	49
Four Sources	12	14
Total	88	73
Source used		
IMF FSI / WB GFDD	74	66
IMF Staff Reports	27	27
National Sources	10	7
Bankscope	7	3

Notes: This table summarized data sources used in constructing the final NPL data series.

Table A3: Variable definitions (NPL dynamics)

| Dependent variable	Definition
Elevated NPLs	Dummy variable that equals 1 if the peak NPL ratio is above 7 percent and zero otherwise.
Peak NPLs	The absolute magnitude of the NPL ratio at its global maximum over the sample period.
Time to peak	Defined as $t^{peak} - T$, where T is the starting year of banking crisis in Laeven and Valencia (2013, forthcoming) and t^{peak} is the year at which the NPL ratio reaches its global maximum.
Time to resolve	Defined as $t^{resolve} - T$ where $t^{resolve} \geq t^{peak}$ is the first year after t^{peak} where the NPL ratio is reduced below 7 percent. If there is no such year, then $t^{resolve} - T = 8$
NPL resolution	Dummy variable that equals 1 if the NPL ratio is reduced below 7 percent within 7 years after the banking crisis date and to zero otherwise.

B. Local projection

Figure B1: Output dynamics (robustness)
Panel A: Elevated NPLs (>5 percent of total loans)
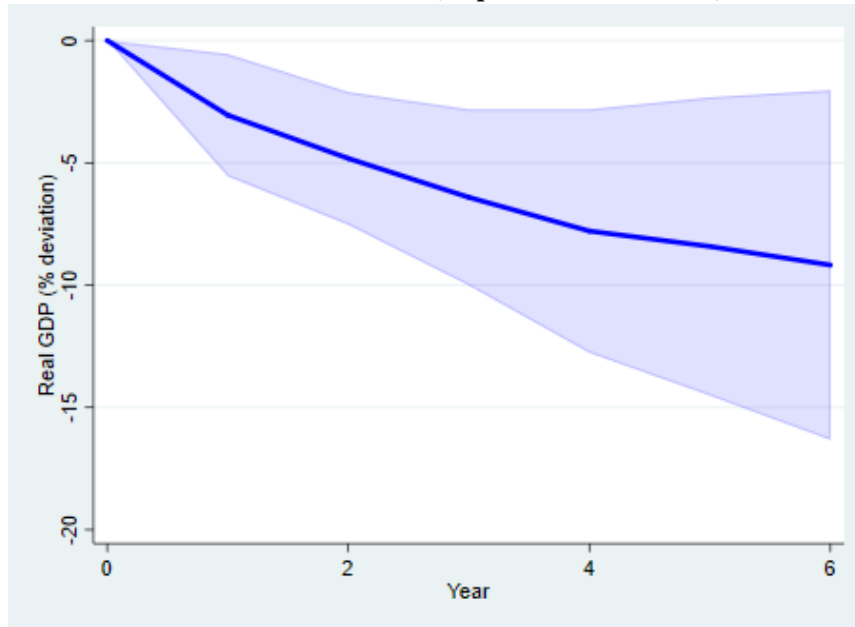
Panel B: Elevated NPLs (>10 percent of total loans)
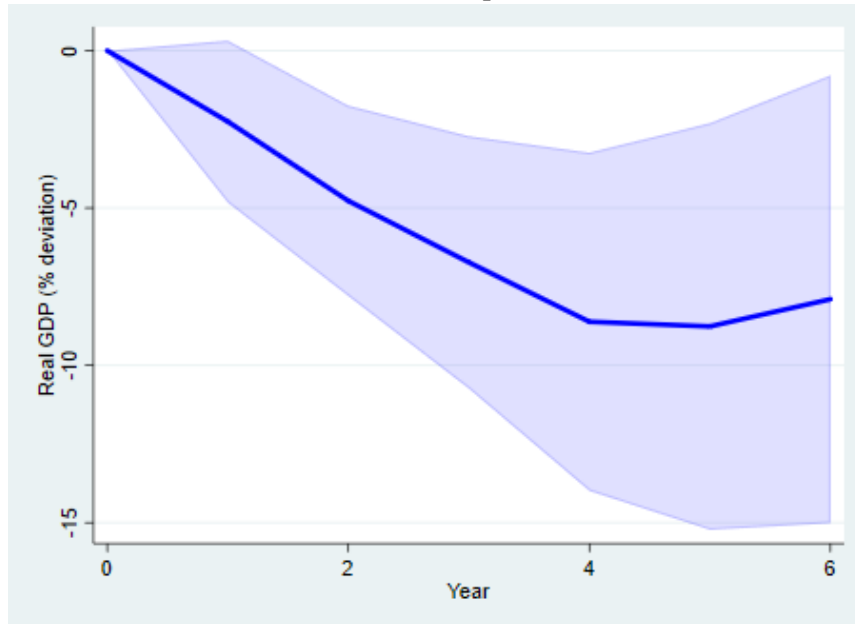
Notes: Panels A and B plot the coefficients of the average real GDP (in logarithm, relative to the crisis year, i.e. year zero, multiplied by 100) in crises with high NPLs relative to crises with elevated NPLs. Elevated NPLs is defined when NPLs are higher than 5 percent (Panel A) or 10 percent (Panel B) of total loans. Controls include crisis wave fixed effects, two lags of exchange rate, debt to GDP ratio, credit to the private sector (all measured in first difference), two lags of real GDP (in log first difference), and two lags of NPL to total loans ratio. The blue bar plots the 90 percent confidence interval. Source: Authors' estimations.

Figure B2: Output dynamics (robustness)

Panel A: NPL resolution (<5 percent of total loans)
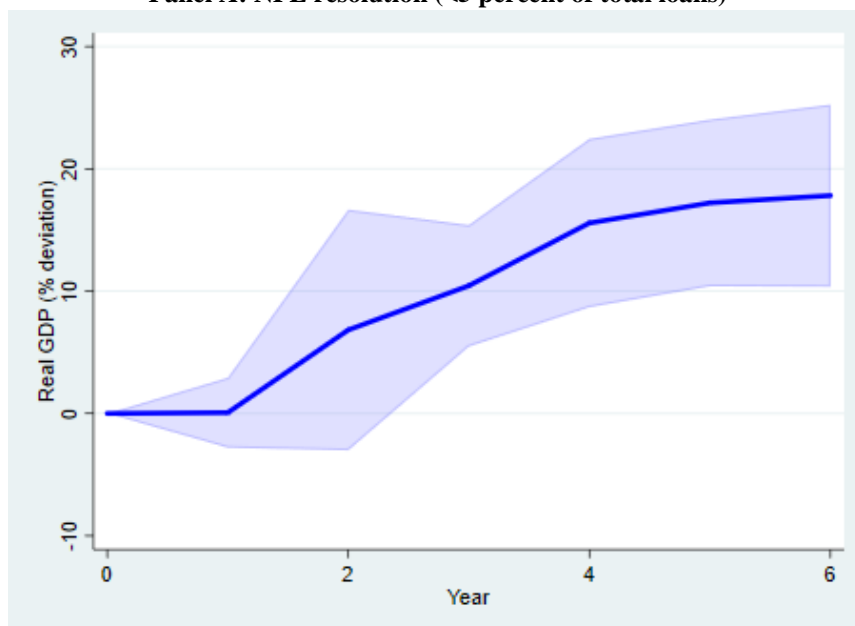
Panel B: NPL resolution (<10 percent of total loans)
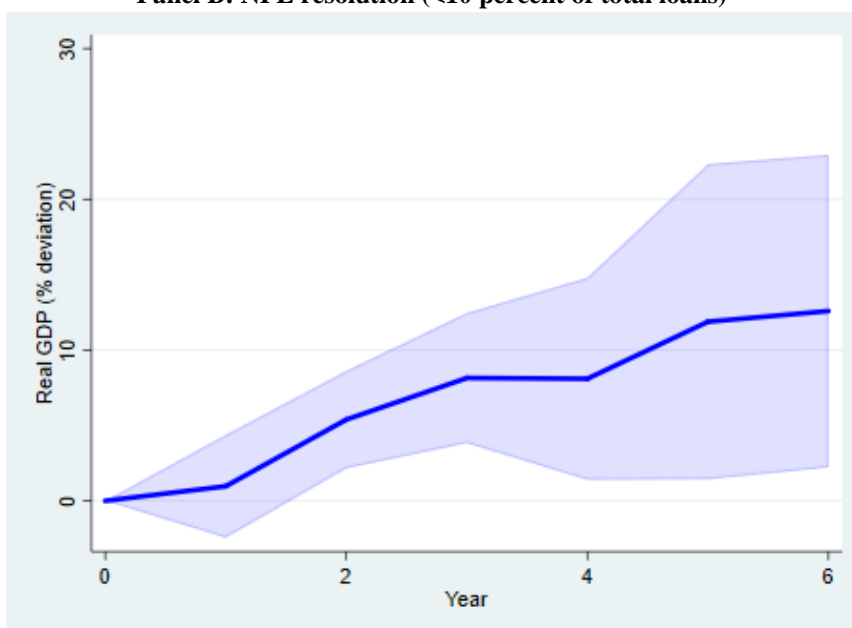
Notes: Panels A and B plot the coefficients of the average real GDP (in logarithm, relative to the crisis year, i.e. year zero, multiplied by 100) in crises with resolved NPLs relative to crises with unresolved NPLs. NPL resolution is defined when NPLs are below 5 percent (Panel A) or 10 percent (Panel B) of total loans, inclusive. Controls include crisis wave fixed effects, two lags of exchange rate, debt to GDP ratio, credit to the private sector (all measured in first difference), two lags of real GDP (in log first difference), and two lags of NPL to total loans ratio. The blue bar plots the 90 percent confidence interval. Source: Authors' estimations.

C. Model selection

Table C1: Crisis waves

Group	Crises
Asian financial crisis (Asia)	China, 1998; Indonesia, 1997; Japan, 1997; Korea, 1997; Malaysia, 1997; Philippines, 1997; Thailand, 1997; Vietnam, 1997
Asian financial crisis (non- Asia)	Croatia, 1998; Romania, 1998; Russia, 1998; Slovak Republic, 1998; Ukraine, 1998
Global financial crisis (GFC)	Austria, 2008; Belgium, 2008; Cyprus, 2012; Denmark, 2008; France, 2008; Germany, 2008; Greece, 2008; Hungary, 2008; Iceland, 2008; Ireland, 2008; Italy, 2008; Kazakhstan, 2008; Latvia, 2008; Luxembourg, 2008; Mongolia, 2008; Netherlands, 2008; Nigeria, 2009; Portugal, 2008; Russia, 2008; Slovenia, 2008; Spain, 2008; Sweden, 2008; Switzerland, 2008; Ukraine, 2008; Ukraine 2014; United Kingdom, 2007; United States, 2007
Low-income countries	Bolivia, 1994; Cape Verde, 1993; Haiti, 1994; Kenya, 1992; Moldova, 2014; Nicaragua, 1990; Nicaragua, 2000; Nigeria, 1991; Togo, 1993; Uganda, 1994; Yemen, 1996; Zambia, 1995; Zimbabwe, 1995
Transition countries, EU accession	Bulgaria, 1996; Czech Republic, 1996; Estonia, 1992; Hungary, 1991; Latvia, 1995; Lithuania, 1995; Poland, 1992; Slovenia, 1992
Transition countries, non-accession	Albania, 1994; Armenia, 1994; Azerbaijan, 1995; Belarus, 1995; Bosnia and Herzegovina, 1992; Georgia, 1991; Kyrgyz Republic, 1995; Macedonia, 1993
Nordic	Finland, 1991; Norway, 1991; Sweden, 1991
Other	Argentina, 1995; Argentina, 2001; Brazil, 1990; Colombia, 1998; Costa Rica, 1994; Dominican Republic, 2003; Ecuador, 1998; Eswatini, 1995; India, 1993; Jamaica, 1996; Lebanon, 1990; Mexico, 1994; Paraguay, 1995; Turkey, 2000; Uruguay, 2002; Venezuela, 1994

Notes: "Low-income countries" is defined according to the IMF's list of Poverty Reduction and Growth Trust (PRGT) eligible countries (IMF, 2016).

Table C2: Predictors used in model selection

Variable name	Definition	Source
Corporate current asset to liability ratio	Ratio of current assets to current liabilities.	IMF CVU
Corporate debt to asset ratio	Total debt to total asset ratio, where total debt is the sum of short-term debt, current portion of long-term debt, and long-term debt.	IMF CVU
Corporate interest coverage ratio	Ratio of earnings before interest and taxes (EBIT) to interest expenses on debt.	IMF CVU
Corporate foreign assets as percent of total assets	Foreign assets as a share of total assets, where foreign assets represent the consolidated firm's total or identifiable assets of foreign operations.	IMF CVU
Corporate short-term debt as percent of total debt	Short term debt as a share of total debt, where total debt is the sum of short-term debt, current portion of long-term debt, and long-term debt.	IMF CVU
Bank net interest margin	Accounting value of bank's net interest revenue as a share of its average interest-bearing (total earning) assets.	World Bank GFDD
Bank noninterest income to total income	Bank's income that has been generated by noninterest related activities as a percentage of total income (net-interest income plus noninterest income).	World Bank GFDD
Bank return on assets	Commercial banks' after-tax net income to yearly averaged total assets.	World Bank GFDD
Bank return on equity	Commercial banks' after-tax net income to yearly averaged equity.	World Bank GFDD
Bank operating expenses as a share of net-interest	Operating expenses of a bank as a share of sum of net-interest revenue and other operating income.	World Bank GFDD
Bank concentration	Assets of three largest commercial banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax assets, discontinued operations and other assets.	World Bank GFDD
Domestic credit to private sector	As a percentage of GDP. Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises. The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies.	World Bank GFDD
Gross government debt-to-GDP ratio	Debt is the entire stock of direct government fixed-term contractual obligations to others outstanding on a particular date. It includes domestic and foreign liabilities such as currency and money deposits, securities	IMF Historical Public Debt

	other than shares, and loans. It is the gross amount of government liabilities reduced by the amount of equity and financial derivatives held by the government.	
Unemployment rate	Unemployment, total (percent of total labor force). Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	World Bank WDI
GDP per capita	Constant 2010 USD, included only in pre-crisis and crisis duration.	World Bank WDI
GDP growth	Real GDP growth rate (annual percent) at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars.	World Bank WDI, IMF IFS
Inflation rates	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. If World Bank data is missing, we use consumer inflation data from the World Economic Outlook (April 2018)	World Bank WDI
Exchange rate depreciation against USD	Annual growth rate of the bilateral nominal exchange rate (percent) to USD. Positive values indicate a depreciation of the local currency.	BIS
Exchange rate peg	Dummy variable that equals 1 if the country's exchange rate regime was either fixed peg or crawling peg at time t, equals 0 otherwise. Exchange rate regimes are based on the Ilzetzki, Reinhart, and Rogoff classification.	Ilzetzki, Reinhart & Rogoff (2017)
Exchange rate regime change	Dummy variable that equals one if the exchange rate peg variable changed in the five years before the Laeven-Valencia crisis date.	Ilzetzki, Reinhart & Rogoff (2017)
Rule of law	Captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Bank WGI

Note: CVU is IMF's Corporate Vulnerability Utilities data. IFS is IMF's International Financial Statistics data. GFDD is World Bank's Global Financial Development Database. WGI is World Bank's World Governance Indicator

Table C3: Candidate predictors by specification

Specification	List of candidate predictors	Number of observations
Macroeconomic conditions	Exchange rate regime change, exchange rate peg, GDP per capita, GDP growth, inflation rate, exchange rate depreciation against USD, gross government debt-to-GDP ratio, change in gross government debt-to-GDP ratio, domestic credit to private sector, change in domestic credit to private sector, unemployment rate, change in unemployment rate.	43-59
Banking sector conditions	Everything in the baseline specification, bank concentration, change in bank concentration, bank return on assets, bank return on equity, bank operating expenses as a share of net-interest, bank noninterest income to total income, bank net interest margin, rule of law	29-43
Corporate conditions	Everything in the baseline specification, corporate current asset to liability ratio, corporate debt to asset ratio, corporate EBIT to total interest expense ratio, corporate foreign assets as percent of total assets, corporate short-term debt as percent of total debt	23-35

Note: Number of observations vary due to changes in the dependent variable (see Table A1) and missing values for independent variables. "Change" in a variable refers to cumulative change between $T-5$ and $T-1$ where T is the banking crisis date.

Table C4: Model selection with country wave dummies

Panel A: High NPL probability

Dependent variable: Elevated NPLs dummy (Peak NPL > 7%)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
GDP per capita	-0.221*** (0.067)	-0.316*** (0.016)	-0.498*** (0.177)
Corporate debt to asset ratio			0.311* (0.164)
No. of observations	59	43	35
Log likelihood	-26.62	-15.55	-6.98
Adj. Pseudo R²	0.602	0.836	0.862

Panel B: Peak NPLs

Dependent variable: Peak NPL ratio (% of total loans)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
GDP per capita	-6.697** (3.168)		-9.588* (4.917)
Exchange rate depreciation against USD	4.246** (1.621)		
Bank return on assets		-4.449** (2.001)	
Corporate short-term debt (as % of total debt)			3.704* (1.963)
No. of observations	47	32	24
R²	0.393	0.430	0.316
Adj. R²	0.245	0.293	0.127

Panel C: Time to peak

Dependent variable: Time to peak	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
GDP growth		-0.856*** (0.299)	
Government debt-to-GDP ratio (gross)			0.786*** (0.215)
No. of observations	47	32	24
Log likelihood	-87.85	-46.96	-34.67
Adj. Pseudo R²	0.036	0.165	0.190

Panel D: Time to resolve

Dependent variable: Time to resolve	Specification		
	(1) Macro	(2) Bank	(3) Corporate
Inflation rate			0.319* (0.177)
Government debt-to-GDP ratio (gross)			1.115*** (0.367)
Change in domestic credit to private sector	0.975** (0.416)		1.507*** (0.443)
No. of observations	43	29	23
Log likelihood	-75.28	-42.08	-32.53
Adj. Pseudo R^2	0.034	0.002	0.102

Panel E: NPL resolution probability

Dependent variable: NPL resolution dummy	Specification		
	(1) Macro	(2) Bank	(3) Corporate
GDP growth	0.225*** (0.080)		
Change in unemployment rate	0.183** (0.074)	0.149*** (0.043)	
Exchange rate depreciation against USD		0.601*** (0.120)	
Government debt-to-GDP ratio (gross)			-0.273** (0.115)
Change in government debt-to-GDP ratio (gross)	-0.204*** (0.071)	-0.096** (-0.048)	
Change in domestic credit to private sector	-0.334*** (0.056)		-0.298* (0.169)
Bank noninterest income to total income ratio		0.285*** (0.087)	
Corporate current asset to liability ratio			-0.160** (0.068)
No. of observations	44	30	24
Log likelihood	-17.16	-8.52	-6.48
Adj. Pseudo R^2	0.106	0.217	0.086

Notes: Robust standard errors are in parentheses. ***, ** and * respectively indicate 1, 5 and 10 percent significance levels. Panel A is based on observations from the whole sample of banking crises for which sufficient data on NPL dynamics and candidate predictors are available. Panels B-E are based on the subset of crises with elevated NPLs (i.e. peak NPL ratio in excess of 7%). Predictors are selected using the post-r-lasso estimator (Belloni et al., 2012; Belloni & Chernozhukov, 2013). For the second step estimates, Panels A, E report results from logistic regressions and C, D report results from Tobit regressions. The coefficients reported in these panels correspond to marginal effects. Panel B reports OLS results. Change refers to cumulative change over the 5 years prior to the banking crisis. All other variables represent average values over the same period. Country group dummies are specified in Appendix Table C1. Coefficients for intercepts, country group dummies and statistically insignificant predictors are not reported. Adjusted Pseudo R^2 values are calculated according to McFadden (1974). See Appendix Table A3, C1, and C2 for variable definitions, data sources and further details on specifications.

Table C5: Model selection with alternative definitions

Panel A: High NPL probability

Dependent variable: Elevated NPLs dummy (Peak NPL > 5%)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
GDP per capita	-0.261*** (0.064)	-0.236*** (0.084)	-0.211* (0.108)
Change in domestic credit to private sector			0.138** (0.066)
Corporate debt to asset ratio			0.148*** (0.048)
No. of observations	59	43	35
Log likelihood	-31.78	-19.32	-12.32
Adj. Pseudo R^2	0.459	0.520	0.749

Panel B: Peak NPLs

Dependent variable: Peak NPL ratio (relative to NPL ratio at crisis date)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
Exchange rate depreciation against USD			-0.895* (0.502)
No. of observations	47	32	24
R^2	0.030	0.167	0.183
Adj. R^2	0.009	0.078	0.106

Panel C: Time to peak

Dependent variable: Time to peak (relative to first year with NPL > 7%)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
Exchange rate peg	1.475** (0.660)		1.970** (0.906)
No. of observations	47	32	24
Log likelihood	-99.77	-66.27	-51.70
Adj. Pseudo R^2	0.016	-0.003	0.019

Table C5: Model selection with alternative definitions (cont')

Panel D: Time to resolve

Dependent variable: Time to resolve (relative to first year with NPL > 7%)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
Change in government debt-to-GDP ratio (gross)			0.856** (0.358)
Bank operating expenses as a share of net-interest		-0.683** (0.314)	
No. of observations	46	32	16
Log likelihood	-104.30	-69.14	-29.54
Adj. Pseudo R^2	0.000	0.007	0.047

Panel E: NPL resolution probability

Dependent variable: NPL resolution dummy (=1 if NPL 7 years after crisis date below 25% of peak NPL)	Specification		
	(1)	(2)	(3)
	Macro	Bank	Corporate
Exchange rate peg	-0.237*** (0.063)		
Exchange rate depreciation against USD		0.239** (0.116)	
Government debt-to-GDP ratio (gross)			-0.161** (0.081)
Change in government debt-to-GDP ratio (gross)	-0.135*** (0.044)	-0.111*** (0.031)	
Change in domestic credit to private sector	-0.249*** (0.057)	-0.129*** (0.027)	-0.345*** (0.079)
Bank noninterest income to total income		0.210*** (0.073)	
Corporate debt to asset ratio			0.189** (0.091)
No. of observations	44	30	24
Log likelihood	-15.98	-3.19	-10.96
Adj. Pseudo R^2	0.252	0.696	0.555

Notes: Robust standard errors are in parentheses. ***, ** and * respectively indicate 1, 5 and 10 percent significance levels. Panel A is based on observations from the whole sample of banking crises for which sufficient data on NPL dynamics and candidate predictors are available. Panels B-E are based on the subset of crises with elevated NPLs (i.e. peak NPL ratio in excess of 7%). Predictors are selected using the post-r-lasso estimator (Belloni et al., 2012; Belloni & Chernozhukov, 2013). For the second step estimates, Panels A, E report results from logistic regressions and C, D report results from Tobit regressions. The coefficients reported in these panels correspond to marginal effects. Panel B reports OLS results. Change refers to cumulative change over the 5 years prior to the banking crisis. All other variables represent average values over the same period. Coefficients for intercepts and statistically insignificant predictors are not reported. Adjusted Pseudo R^2 values are calculated according to McFadden (1974). See Appendix Table A3 and C2 for variable definitions, data sources and further details on specifications.

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