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THE SPREAD OF DEPOSIT INSURANCE AND THE GLOBAL RISE IN BANK ASSET RISK SINCE THE 1970S

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ABSTRACT

We construct a new measure of the changing generosity of deposit insurance for many countries, empirically model the international influences on the adoption and generosity of deposit insurance, and show that the expansion of deposit insurance generosity increased asset risk in banking systems. We consider three asset risk measures: higher loans-to-assets, a higher proportion of lending to households, and a higher proportion of mortgage lending. None of the observed increases in these indicators is offset by declines in banking system leverage. We show that increased asset risk explains at least part of the positive association between deposit insurance and the likelihood and severity of systemic banking crises.

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1. Introduction

Over the past three decades, a vast literature has developed on the adoption and expansion of deposit insurance, and its role in increasing the systemic insolvency risk of banking systems. That literature has shown that the installation of deposit insurance or an expansion of its generosity, tend to be associated with higher asset risk, higher leverage, and a greater probability of a banking crisis, suggesting that the rise of deposit insurance may be one of the contributors to the pandemic of unprecedentedly frequent and severe banking crises around the world.[2]

There are also several studies that examine the origins of deposit insurance, the extent of its coverage, and other design features of deposit insurance systems. Interestingly, however, contributions to the two literatures—on the causes and consequences of deposit insurance, respectively—have occurred largely independently from one another. For example, Demirgüc-Kunt and Detragiache (2002) show how cross-country differences in deposit insurance coverage predict differences in banking system crisis risk, while Demirgüc-Kunt, Kane and Laeven (2008a, 2008b) identify key political characteristics of countries that tend to predict the timing and generosity of deposit insurance implementation.

In this study, we show that it is useful to address the questions of causes and consequences jointly within a common empirical model, which uses the identification of the causal influences on asset risk of deposit insurance adoption and expansion to improve the measurement of its consequences, especially consequences for systemic bank insolvency crises.

[2] For a review of the evidence on the bank risk increases that are associated with the expansion of coverage in historical and recent insurance systems, see Calomiris and Jaremski (2016), which surveys evidence for two centuries and many countries. With respect specifically to the increased probability of a banking crisis associated with the greater generosity of deposit insurance, see Demirguc-Kunt and Detragiache (2002), and Anginer, Demirguc-Kunt and Zhu (2014). For a crisis database and an analysis of its severity in historical perspective, see Laeven and Valencia (2013) and Calomiris and Haber (2014).

In doing so, we also seek to avoid endogeneity bias that can confound identification of the impact of deposit insurance on risk. Studies of the consequences of deposit insurance for increased crisis risk have relied on risk comparisons that fail to rule out endogeneity bias related to omitted variables and reverse causality. It is conceivable that some of the observed relationship between deposit insurance and risk taking could be driven by influences that exogenously raise risk and which also raise (or initiate) deposit insurance coverage as a response to increased risk.

To address that problem, we note that many of the drivers of deposit insurance adoption and generosity identified by Laeven (2004), Demirgüç-Kunt, Kane and Laeven (2008a, 2008b) and others are *international* influences that can plausibly serve as instruments with respect to measuring the risk-increasing consequences of deposit insurance. That is, these international influences should not reflect local economic changes that could cause local risks to rise.

Theory suggests that deposit insurance can either increase or decrease banking system risk. On the one hand, credible deposit insurance can make the banking system more stable by reducing liquidity risk by removing the incentive of depositors to withdraw funds from banks when bank risk increases. On the other hand, deposit insurance may be a source of "moral hazard"—it may increase the risk appetite of banks because their ability to attract deposits no longer reflects the risk of their portfolios. Deposit insurance can also cause "adverse selection", including as the result of unwitting increases in risk when the absence of market discipline permits poor risk managers to operate banks. If the capital position and asset risk of banks are not regulated and supervised carefully, the insurance-induced risk taking may increase insolvency risk and undermine financial stability in the long run, despite the liquidity risk reductions that deposit insurance creates.

To estimate risk-taking induced by deposit insurance and its consequences for systemic insolvency risk, we construct a three-step model of the origins of deposit insurance, its changing generosity over time, and the risk-taking consequences of deposit insurance, which treats all three aspects as endogenous variables. In the first two steps of the model, international influences predict the origins and generosity of deposit insurance coverage. We develop a new measure of the generosity of deposit insurance coverage, which we use as the dependent variable in the second step of the model. In the third step of the model, instrumented values of the predicted generosity of deposit insurance are used to explain different measures of risk-taking that affect the solvency of banking systems.

From the perspective of a theory of insolvency risk (such as the Black-Scholes-Merton model), the likelihood of failure is increasing in leverage and asset risk, and asset risk is increasing in the proportion of risky assets relative to cash assets, and in the riskiness of risky assets (i.e., the riskiness of loans). We consider three complementary measures of bank insolvency risk: the loans-to-assets ratio of a country's banks in a given year, the extent of household lending (or mortgage lending) of a country's banks in a given year (measured by the proportion of bank loans to households, or the proportion of bank loans that are mortgage loans), and the debt-to-assets ratio of a country's banks in a given year. The first is an assets-side measure that captures risk increases resulting from a smaller proportion of low-risk, cash assets.

The second measure (mortgage lending or household lending) captures systemic loan portfolio risk increases due to mortgage lending exposure. Data on household loans primarily reflect mortgage lending and are available for a broader sample than narrowly defined mortgage lending. Although mortgages may not be high-risk loans for individual banks during normal times, there is substantial evidence that they are high-risk assets from the standpoint of systemic insolvency risk. When real estate prices decline, such declines can have widespread and severe implications for mortgage portfolios. For that reason, mortgage lending may entail greater systemic risk to the banking system. Several recent studies point to the importance of mortgage lending in promoting systemic risk, and our findings of a positive connection between mortgage lending and crisis risk also corroborate that view.

Jorda, Schularick and Taylor (2015a, 2015b) show that mortgage lending has been a major contributor to systemic risk in the banking sector for a wide range of countries. Mortgage lending exposes the banking system to increased systemic risk because the value of real estate is highly correlated with the business cycle, and because real estate is hard for lenders to liquidate in a downturn. The recognition of these facts led government regulation historically to discourage heavy commercial bank involvement in real estate finance, but those limits became increasingly relaxed in many countries during the last several decades. In recent decades, governments have promoted bank involvement in mortgage lending through various means, including favorable (low) risk-based asset weights for mortgages adopted by the Basel Committee, and various government credit subsidies promoting mortgage lending (e.g., Federal Home Loan Bank loans in the U.S.). Cournede and Denk (2015) show that the rising proportion of household borrowing (which is largely mortgages) has tended to crowd out the financing of other more productive types of investment, and therefore, is associated with adverse growth consequences.[3] Jorda, Schularick and Taylor (2015a, 2015b) and Mian, Sufi and Verner (2016) show that real estate lending has grown dramatically as a proportion of total lending in their sample of developed countries since 1970, and real estate risk has been central to banking crises around the world during that period, as well.

[3] Chen, Hanson and Stein (2017) also note the decline in bank lending to small businesses in the U.S., and its consequences for labor markets, which may also be related to this crowding out from greater mortgage lending.

Including the extent of household and mortgage lending in our analysis is useful for two reasons. First, if a banking system's debt-to-assets and loans-to-assets both rose, but the riskiness of loans fell sufficiently, bank failure risk could remain unchanged. Thus, it is important to consider loan risk alongside leverage and the loans-to-assets ratio when gauging changes in banking system risk. Second, mortgage loans are not only systemically risky, they also are a politically important category of lending. By tracking how mortgage loans respond to changes in deposit insurance, we are able to consider the possibility that the politics of deposit insurance and the politics of subsidizing mortgage credit interact. It is commonly recognized as standard economic theory to consider deposit insurance, in the absence of sufficiently strong prudential regulation, as providing a put option subsidy to banks, as originally modeled by Merton (1977). The rents from that subsidy can be used to fund other subsidies that banks may be encouraged to provide to borrowers. We hypothesize that the rise of deposit insurance (which, in the absence of prudential safeguards, provides a subsidy for risk that accrues to banks) makes it easier for governments to use banking systems as a means of subsidizing politically influential household mortgage borrowers (because the government can pressure banks to share the deposit insurance protection subsidy with a politically favored class of borrowers). By including the proportion of household and mortgage lending in our model, we are able to test the hypothesis that rising deposit insurance promotes increases in asset risk through multiple channels: (1) the rise in loans-to-assets, and (2) the increased lending risk associated with the lack of loan diversification and reduced loan liquidity associated with a greater focus on real estate lending. Our paper, we believe, is the first to study the real estate lending channel of deposit insurance.

The third measure of systemic risk we examine is a liabilities-side measure that captures bank risk increases that result from rising leverage in the banking system. In theory, of course, a rise in any one of these measures may not increase bank insolvency risk if that rise is offset by a sufficient decline in other measures. As we will show, however, the observed increases in systemic insolvency risk measured by one or more indicators is not offset by declines in any other risk measures.

We also considered controlling for cross-country differences in prudential regulation or banking supervision that might affect the systemic risk-increasing consequences of deposit insurance. Doing so may not be advisable, given that prudential regulation and banking supervision are themselves endogenous variables that may respond to changes in deposit insurance. Furthermore, existing data on prudential regulation or banking supervision are limited in both time and country dimensions for our purpose. We found that it was not possible to construct a usable cross-country measure of the strictness of minimum capital ratio requirements across countries and over time. In general, expansions of deposit insurance protection likely have been accompanied by stricter prudential regulation, intended to limit the moral-hazard and adverse-selection costs of deposit insurance. If that is the case, then our estimates should be regarded as conservative ceteris paribus measures of the impact of deposit insurance, because the risk-increasing impact of insurance should be partly offset by stricter prudential regulation. Our results show that endogenous strengthening of prudential regulation has not fully eliminated the moral-hazard and adverse-selection consequences of deposit insurance.

Our analysis employs the International Monetary Fund's (IMF) International Financial Statistics (IFS) database on aggregate banking system balance sheets, which covers many countries and stretches back into the 1970s.[4] We also use data for household loans and mortgage

[4] Consistent with the IFS definition, the term "country" does not in all cases refer to a territorial entity that is a state as understood by international law and practice. The term also covers some territorial entities that are not states.

loans from Cerutti, Dagher, and Dell'Ariccia (2017), which cover a smaller set of countries. We analyze countries as a panel of country years, combining data from advanced and emerging countries. In our robustness analysis we also divide countries into two categories (advanced and emerging) to explore possible differences in their responses.

Our findings can be summarized as follows. First, we find that (consistent with Demirguc-Kunt et al. 2008a, 2008b) international influences on the expansion of deposit insurance protection (captured by interactions among the proportion of countries that has adopted deposit insurance, and measures that account for endorsement or mandate from the IMF, World Bank, and the European Union) robustly predict the creation and expansion of deposit insurance coverage. That is true both for advanced and emerging economies. We also find that it is important to take into account other variables (which serve as controls in the three-step regression model) that influence the propensity to enact or expand deposit insurance. In particular, deposit insurance is more likely to be enacted or to expand during recessions and in the wake of a major banking crisis.

Second, we find that instrumented increases in deposit insurance coverage predict increases in the loans-to-assets ratio. When advanced and emerging economies are pooled, that effect is positive and statistically significant.

Third, with respect to the effects of exogenous increases of deposit insurance on mortgage lending, we find that exogenous increases in deposit insurance result in a higher proportion of household loans or mortgage loans, and this is true both for advanced and emerging or developing economies. This suggests that deposit insurance not only expands the asset risk of banking systems, but that it does so in a way that favors risky household and mortgage lending. Once deposit insurance frees banks from the constraints of market discipline, governments may be more able to use the regulation of the banking system as a means of targeting credit subsidies to household borrowers.

Fourth, we find that the asset risk-increases caused by deposit insurance expansion are not offset by reductions in leverage. On the contrary, instrumented increases in deposit insurance coverage tend to raise leverage ratios.

Having identified endogenous asset risk increases in response to increased deposit insurance coverage, we then consider the macroeconomic significance of those increases, and link them to the likelihood of crises. First, we find that exogenous increases in the generosity of deposit insurance not only predict higher riskiness of bank assets, but also greater bank asset risk as a proportion of GDP (measured either as loans-to-GDP, or household-loans-to-GDP, or mortgage-loans-to-GDP). Second, consistent with prior literature, we find that (after controlling for other factors), exogenously more generous deposit insurance tends to result in a significantly greater likelihood and severity of crises. Third, we find that exogenous increases in asset risk (measured as loans-to-GDP, household-loans-to-GDP, or mortgage-loans-to-GDP) produced by greater international influences promoting deposit insurance also are associated with the greater likelihood and severity of crises.

Given that our instruments rely in part on common global factors that vary over time (which are reflected in the influence of the IMF, the EU, the World Bank, and the emulation of other countries' deposit insurance practices) we also consider whether our results are robust to adding alternative time-varying factors to our model. We consider two alternative measures of stock market volatility, or variables that capture the globalization of interbank borrowing or global capital flows, or measures of financial liberalization. We find that these variables have little effect on the estimated consequences of deposit insurance generosity for increases in bank asset risk, or the likelihood or severity of banking crises.

Our results on asset risk should be interpreted as identifying a risk-taking effect on bank assets that raises insolvency risk and crisis risk in response to increases in the generosity of explicit deposit insurance.[5] To the extent that our instrumentation strategy is valid, our estimations capture the causal effect of increased deposit insurance generosity. Nevertheless, our results are silent on whether the generosity of deposit insurance affects the liquidity risk of banking systems.

Our results are generally robust to dividing the sample of countries into advanced and emerging sub-groups, but statistical significance is reduced in some regressions, especially for the effect of deposit insurance generosity on loans-to-assets. Nevertheless, the connections for both sub-groups between exogenous variation in deposit insurance generosity and the increase in systemic risk—which is reflected in various measures of asset risk, as well as the likelihood and severity of systemic banking crises—lead us to conclude that the responses of the two sub-groups of countries are broadly similar. To increase sample size, which affects the precision of estimates, therefore, we emphasize our pooled regression results.

Our study is related to a large literature on deposit insurance (reviewed in Calomiris and Jaresmki 2016). As we discussed earlier, deposit insurance has an ambiguous effect on banking system risk from a theoretical perspective. The overall effect depends on the size of the moral-hazard and adverse-selection risk-enhance effect compared to the liquidity risk-reducing effect.

[5] Importantly, they should not be interpreted as comparing banking system risks between countries with and without deposit insurance (the latter including possible cases of greater implicit government guarantees).

Calomiris and Jaremski (2016) conclude that the empirical literature on the overall consequences of deposit insurance for bank risk consistently finds substantial net risk increases associated with deposit insurance, implying that the moral-hazard and adverse-selection disadvantages of deposit insurance tend to outweigh its liquidity risk-reducing advantages.

Our study makes several new contributions to the empirical literature. We believe we are the first to link exogenous variation in the expansion of deposit insurance coverage with changes in bank asset risk, and we are also the first to consider how deposit insurance coverage affects banking systems' propensity to provide mortgages. With respect to data contributions, we construct a new measure to capture the changing generosity of deposit insurance over time.

Section 2 describes our data base. Section 3 presents our empirical methodology and our regression models. Section 4 reports our empirical findings for the influence of exogenous increases in deposit insurance coverage on bank risk. Section 5 explores the links among deposit insurance generosity, asset risk and the probability and severity of crises. Section 6 concludes.

2. Data

2.1 Deposit insurance data

Our primary sources for deposit insurance coverage are Demirgüç-Kunt, Kane and Laeven (2005) and Demirgüç-Kunt, Kane and Laeven (2014). This is a comprehensive, global database of deposit insurance as of 2013. The original data have information on coverage and coinsurance for all years since adoption until 2003, as well as data for 2010 and 2013. We checked the existing data using national data sources, made some corrections, and extended the data to cover all years through 2013. Figure 1 shows the timing of different countries' adoption of deposit insurance.

We measure the consequences of the changing generosity of deposit insurance. There are two design features that affect the generosity of coverage—the breadth of deposit coverage and the extent of coinsurance of the risk of loss—and this complicates the measurement of the generosity of a deposit insurance scheme. Explicit deposit insurance schemes typically insure deposits up to a statutory coverage limit. In some cases, government guarantees are offered on top of statutory limits. With a full government guarantee in place, depositors essentially receive "unlimited" coverage on their deposits. Some deposit insurance schemes also include coinsurance, which insures depositors for a pre-specified portion of their deposits. Coverage and coinsurance together determine how much depositors would receive from the deposit insurer. For example, in a country with a statutory coverage limit of $10,000 and 20 percent coinsurance, depositors with up to $10,000 deposits could receive 80 percent of their deposit amount.[6] We define *deposit insurance score* (*DI score*) as an index for the generosity of a deposit insurance scheme. To calculate the *DI score*, we first convert all coverage amounts to US dollars using market exchange rates and compute the ratio of coverage to GDP per capita. We then define coverage score as an index between 0 and 1 based on the ratio of coverage to GDP per capita.[7] This approach to scaling the measurement of coverage avoids distributions with extreme outliers. We acknowledge that the coverage limit should also take into account other country specific factors, such as the distribution of deposit size. But such granular data are not available for a large set of countries. Finally, we define *DI score* as the coverage score if coinsurance is 0, as 0.5

[6] Many countries used coinsurance in the earlier part of our sample period but it has become less popular over time.
[7] Coverage score equals 0.2 if coverage to GDP per capita ratio ranges from 0 to 1, equals 0.4 if the ratio ranges from 1 to 2; equals 0.6 if the ratio ranges from 2 to 6; equals 0.8 if the ratio ranges from 6 to 20; and equals 1 if the ratio is greater than 20, or with full government guarantees (i.e. "unlimited" coverage).

times the coverage score if coinsurance is greater than 0 but smaller than 25 percent, and as 0 if coinsurance is greater or equal to 25 percent, or if there is no deposit insurance.[8]

2.2. Bank balance sheet and macroeconomic data

We assemble a comprehensive database of aggregate bank balance sheet and macroeconomic variables for the 1970-2013 period.[9] Our main data source is the IMF's IFS data. We focus on two aggregate balance sheet variables: *loans-to-assets ratio* and *debt-to-assets ratio*, both of which are expressed in logs (see Table 1 and Appendix A for details). The macroeconomic variables we consider are CPI inflation and real GDP growth.

Using the IFS data to construct bank balance sheet variables has two advantages. First, the data employ standardized formats and adjust for variations in accounting and auditing conventions so they are reasonably comparable across countries. Second, the IFS has a wide coverage of countries over our sample period, including advanced and emerging countries. The weakness of the IFS data is that it does not provide disaggregated (bank-level) information. Unfortunately, datasets with disaggregated information have more limited country and time coverage.

Our primary source for household loans and mortgage loans is Cerutti, Dagher, and Dell'Ariccia (2017), extended to 2013 when available. We define *household loans-to-total-loans ratio* as the proportion of private sector loans to the household sector. We define *mortgage-loans-to-total-loans* ratio as the proportion of private sector loans as mortgage loans. Both are

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[8] Some deposit insurance schemes apply different coinsurances to different deposit amounts. For example, during 2002-2008, Albania had no coinsurance for deposits up to 350,000 Albanian Lek and 15 percent coinsurance for deposits from 350,000 to 700,000 Albanian Lek. In these cases, we use the highest coinsurance percentage to calculation the DI score.

[9] We start our sample period in 1970 because this is the year when the IFS data become available for the majority of our sample countries. Our results are robust to including data starting from 1960. Using an earlier year would not affect our results because only one country (the United States) adopted deposit insurance prior to 1960.

expressed as log ratios. Our household loans and mortgage loans data have the same country coverage, although the former generally goes further back than the latter.[10] The two are highly correlated in our sample, with a correlation of 0.8. Although household loans are broader than mortgage loans (including non-mortgage consumer credit), mortgage loans accounts for a large proportion of household loans in our sample: 57 percent in all countries, 62 percent in advanced economies and 39 percent in emerging economies. The higher percentage in advance economies is not surprising because the mortgage markets in advanced economies are more developed. Overall, we view *household-loans-to-total-loans ratio* as a good proxy for mortgage lending.

We discard all observations in which the balance sheet identity is not satisfied (see Appendix A for details). To remove the effect of outliers, we winsorize all macroeconomic variables and balance sheet ratios at the 1 and 99 percent. We end up with a final sample of 1,426 observations in 69 countries for our balance sheet ratios analysis, of which 32 countries and 734 observations are in advanced economies, and 37 countries and 692 observations are in emerging economies. For the analysis with household and mortgage loans, we have a sample of 774 and 575 observations, respectively. They cover 47 countries, 31 of which are advanced economies and 16 of which are emerging economies (see Table 2 for details). Table 3 reports summary statistics.

2.3. Crisis data

Our definition of banking crises follows Laeven and Valencia (2013).[11] When we employ a crisis dummy as a control in our regressions, we define *Post crisis* as a dummy variable for the

[10] The few exceptions are Canada (2009-2011), Philippines (2000), and Switzerland (2005-2006), which has data for mortgage loans but not household loans.
[11] We could supplement the Laeven and Valencia (2013) data with other crisis datasets that go back to the beginning of our sample period such as Reinhart and Rogoff (2011). But this would make little difference in our analysis

three years following the start of a banking crisis. When we define the occurrence of a crisis as a dependent variable, we date the crisis using the first year of a systemic banking crisis. To avoid double counting crisis events, when the occurrence of a crisis is our dependent variable, we drop the next two years of data or until the end of a crisis, whichever is greater. We follow Laeven and Valencia (2013) and measure the severity of a crisis by output loss, defined as the three-year cumulative loss in GDP relative to a pre-crisis trend.

3. Empirical Methodology

3.1. Asset risk and deposit insurance

To examine bank risk responses to deposit insurance we employ an instrumental variable (IV) methodology adapted for sample selection that estimates the effect of deposit insurance generosity on risk. We consider two types of asset risk measures. First, we measure asset risk in the aggregate balance sheet of banks, captured by the loans-to-assets ratio and the share of household loans, or mortgage loans, in total loans. Because these measures capture loan risk relative to the assets of the banking system, we call them "micro" measures of asset risk.

Second, we measure asset risk to the macroeconomy, captured by the credit-to-GDP ratio, the household loans-to-GDP ratio, and the mortgages-to-GDP ratio. As we discussed in Section 1, these latter two measures are motivated by the literature on the role of real estate credit and real estate sector price fluctuations in propagating macroeconomic shocks in normal times and crises. Because measures of credit risk relative to GDP capture the banking system credit risk relative to the aggregate economy, we call them "macro" measures of asset risk. We additionally examine the effect of deposit insurance on banking system leverage. Although

because only one banking crisis is identified in Reinhart and Rogoff (2011) between 1960 and 1969—Brazil in 1963—and Brazil did not adopt deposit insurance until 1995.

liability-side risk is not the focus of this study, it is useful to include leverage in our analysis to examine whether asset-side risk increases are offset by reductions in liability-side risk.

The estimation consists of three steps. In the first step we estimate the probability of enacting deposit insurance using the model specified in equation (1):

$$DI_{ct} = I\left(\alpha + \beta \cdot Controls_{ct} + \gamma \cdot Instruments_{ct} + \varepsilon_{ct} > 0\right), \tag{1}$$

where DI is a binary variable that takes a value of 1 if country c has deposit insurance in year t and 0 otherwise. Controls are variables that we assume affect both the deposit insurance decision and balance sheet variables, such as inflation and real GDP growth. We find that the influence of inflation was different in emerging economies, and therefore, we include an interaction between inflation and emerging country type to capture that difference. We also find that it is important to control for the effects of the timing and severity of banking crises on deposit insurance design, and so we include two controls for that purpose, one measuring the timing of crises and the offer the loss severity of the crisis. Instruments are a set of variables that capture international influence on the adoption or design of deposit insurance, which we will discuss in more detail. $I(.)$ is the indicator function and ε_{ct} is a normally distributed error term. The fitted probabilities from the first step are then used to estimate the inverse Mills ratio, which we denote as λ_{ct} in the IV estimation.

The second and third steps proceed as a standard IV model with the inverse Mills ratio as an additional control: Different measures of banking system risks are regressed on the instrumented generosity of deposit insurance coverage. In other words, in the second step of the model, the dependent variable is deposit insurance generosity; the independent variables are the same set of exogenous instruments used to estimate equation (1). In the third step of the model, predicted values of deposit insurance generosity are used to explain banking system risk.

More specifically, we estimate:

$$y_{ct} = \delta + \eta \cdot DIscore_{ct} + \theta \cdot Controls_{ct} + \kappa \cdot \lambda_{ct} + \upsilon_{ct}, \qquad (2)$$

where y_{ct} is *loans-to-assets* ratio, the *household-loans-to-total-loans* ratio, or the *mortgage-loans-to-total-loans* ratio; *DI score* is the deposit insurance score that measures the generosity of deposit insurance; and υ_{ct} is an error term. An important element in (2) is the inverse Mills ratio estimated from step one of the model. Because we only observe the generosity of deposit protection after a country adopts deposit insurance, our approach ensures that countries' endogenous selection into deposit insurance is accounted for in steps two and three of the model. We also include country fixed effects in (2) to control for persistent heterogeneity in the aggregate banking system.[12]

Our estimation procedure follows Wooldridge (2002).[13] We use the same set of exogenous variables in (1) to predict *DI score* and the predicted values are used to estimate (2). As noted by Wooldridge (2002), it is appropriate to include all instruments in both (1) and (2). Note that a standard assumption (i.e., the rank condition) of sample selection models requires that some instruments only affect the selection equation (1) but not the outcome equation (2). This is true in our model, too, as we assume that the creation and expansion of deposit insurance are influenced by exogenous instruments that are not included as direct influences on risk measures; they only influence risk through their effect on deposit insurance. In our model, adoption and expansion of deposit insurance are treated separately in the estimation, but as Wooldridge (2002) points out, it is desirable to have the same set of instruments included in both

[12] We do not include country fixed effects in the probit model (1) because once countries adopted deposit insurance, they do not revoke it. Our results are robust to excluding country fixed effects from (2).
[13] Wooldridge (2002), procedure 17.2, pg. 568.

the adoption and expansion specifications; doing otherwise is "dangerous and unnecessary."[14] We do not expect, however, that each of the international influences will have identical effects on adoption and expansion of deposit insurance. For example, the IMF recommended in 1999 that countries adopt explicit deposit insurance but did not advocate a certain level of coverage.[15]

We use a set of instruments that capture international influences on deposit insurance, as found in Demirgüç-Kunt, Kane and Laeven (2008a, 2008b). Our instruments include *IMF best practice*, *Emulation*, an interaction term of *IMF best practice* and *Emulation*, *World Bank loan*, *EU candidacy*, and *EU directive*. *IMF best practice* is a dummy variable that takes a value of one for the years 1999 and onwards. The year 1999 is when the IMF published a best-practice paper on the design of deposit insurance and recommended explicit deposit insurance for developing countries (Garcia, 1999). *Emulation* is the proportion of countries with explicit deposit insurance in a given year. We interpret this value as a proxy for the extent to which deposit insurance is considered to be best practice around the world. *World Bank loan* is a dummy variable that takes a value of one during and following the year that the World Bank started an adjustment lending program with a country that entailed the adoption of deposit insurance. The European Union (EU) also mandated deposit insurance. The year 1994 was when the EU Directive on Deposit Insurance came into force. *EU directive* is a dummy variable that takes a value of one for the years 1994 and onwards for EU member (EU-15) countries. *EU candidacy* is a dummy variable that takes a value of one for years 1994 and onwards for EU candidate countries. Figure 2 plots the timing of these various measures of international influence and their importance over time.

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[14] This is because dropping some exogenous variables in either equation imposes exclusion restrictions on a reduced-form equation (Wooldridge, 2002, pg. 569).

[15] For example, the IMF suggested that "(m)ost effective schemes are ... limited to protecting small depositors and do not cover large depositors and other creditors, including other banks, so as to create incentives for market discipline to exert pressure on banks" (Folkerts-Landau and Lindgren, 1998, pg. 10). IMF staff suggested that countries consider factors such as per capital income and the distribution of deposits when setting the coverage limit (Garcia, 1999).

Our identification assumption is that these instruments only matter for the balance sheet variables through their effect on deposit insurance adoption or design. Because *IMF best practice* is defined based on a year (i.e., 1999), our assumption requires that it did not coincide with other changes (e.g., actions from the IMF, or shocks to banking systems) that had a significant effect on banking system risks of all countries independent of deposit insurance. That assumption seems reasonable in light of the smooth growth and calm financial markets that characterized the global economy in 1999 and 2000. A similar assumption must hold for EU member and candidate countries in the year 1994. That seems reasonable, given that European growth and financial markets were stable during this time.

The assumption that *World Bank loan* is unrelated to other economic changes in the local economy is harder to defend; World Bank lending programs that entailed the adoption of deposit insurance might have coincided with other significant economic shocks and may have reflected other policy objectives, including those directly targeting the risk of the banking system, independent of the effects of deposit insurance. To alleviate the concern that this may be the case, we treat *World Bank loan* as a control variable in our robustness check.

4. Results

4.1 "Micro" Bank Risk

Before turning to our regression analysis, Figure 3 and plots the growth of loans-to-assets and debt-to-assets, and Figure 4 plots household loans-to-total loans, and mortgages-to-total loans. Figure 3 shows that loans-to-assets growth tends to be more positive later in the sample period, although the same is not as apparent for debt-to-assets Figure 4 shows relatively rapid growth in the fractions of loans to households or the fraction of mortgage loans. Thus, on average, increases in systemic risk have coincided with increases in the spread of deposit insurance and its generosity over time.

Table 4 reports the first step analysis of our model: probit model estimates of deposit insurance adoption.[16] Appendix Table B1-B4 reports the second step analysis of our model: the prediction of the generosity of deposit insurance with exogenous instruments (with sample selection correction, using the probit model results from Table 4). The instruments generally do well in forecasting both the adoption of deposit insurance and its generosity. This is also true for subsample splits of advanced and emerging economies, which are not reported here.

Tables 5 to 8 report the third step analysis of our model, which uses predicted deposit insurance generosity from Table 4 to forecast banking system risk.[17] Control variables (which we will not discuss in detail) are often statistically significant. In Table 5, we report estimates for the effect of instrumented deposit insurance generosity on banking system *loans-to-assets ratio*. Estimates are positive and statistically significant. They are also large. A standard deviation increase (0.25) in *DI score* results in a 0.50 increase in ln of loans-to-assets, which is roughly 1.25 of a standard deviation increase in *loans-to-assets*.

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[16] We estimate an unbalanced panel of country years, and report robust standard errors. The number of years per country, and the number of countries per year are too small to reliably cluster errors either by country or by year. For example, the median number of years per country in the mortgage sample is 9, and the median number of countries per year in the mortgage sample is 5. Furthermore, we cannot reliably cluster standard errors by year in the presence of country fixed effects: There is no guidance from the literature on what is the appropriate way to adjust the degrees of freedom with fixed effects. In results not reported here, our findings regarding statistical significance are generally robust to clustering errors by country, but results on mortgages are not robust to clustering by country.

[17] Our results are estimated using a Limited-Information Maximum Likelihood (LIML) estimator. We use the LIML instead of the two-stage least squares (TSLS) estimator because we have many instruments (six) and the set of instruments are somewhat weak in some specifications. For example, in models with loans-to-assets ratio as dependent variable, the F statistics is 9.2 in the simplest specification, even though they are much stronger in models with other dependent variables (the F statistics is above 20 in the above specification). LIML is a good alternative to 2SLS with weak instruments or many instruments because it is median-unbiased and consistent under many-instrument asymptotics (Stock, Wright, and Yogo, 2002).

Table 6 reports results for the *household-loans-to-total-loans ratio*. We find that the effect of instrumented deposit insurance generosity is positive and highly statistically significant in predicting the *household-loans-to-total-loans ratio*. Table 7 reports similar findings for the *mortgage-loans-to-total-loans ratio*. In both cases, the magnitudes of the effects are large. A standard deviation increase in *DI score* raises the log of *household-loans-to-total-loans ratio* by 1.5 of its standard deviation, and raises the log of *mortgage-loans-to-total-loans ratio* by about 76 percent of its standard deviation.

Table 8 reports results for banking system debt relative to assets. Instrumented deposit insurance generosity positively affects *debt-to-assets*. The effect is not highly statistically significant. We are able to conclude, however, that leverage does not decline (e.g., due to tightening prudential regulation) in reaction to expanded deposit insurance generosity. Leverage, if anything rises with asset risk as insurance coverage expands, and does not offset the effects of rising asset risk on the riskiness of the banking system. The magnitude of the estimated effect is large. A standard deviation increase in *DI score* raises *debt-to-assets* by 41 percent of its standard deviation.

In Tables 5-8 we also report tests of the instruments, including the Kleibergen-Paap (2006) *rk* statistic for under-identification, the Cragg-Donald Wald (non-robust) and Kleibergen-Paap Wald (heteroskedasticity-robust) statistics for weak instruments. In all specifications, the Kleibergen-Paap LM test rejects the null hypothesis that the equation is under-identified. The weak instrument statistics also exceed the Stock and Yogo (2005) tabulation, suggesting that weak instruments are not a concern.

As a robustness check, we treat *World Bank loan* as a control variable instead of an exogenous instrument. As we discussed in Section 3, the purpose of this robustness check is to alleviate the concern that *World Bank loan* may have a direct effect on bank risk independent of deposit insurance. Appendix Tables B5-B9 report the results.[18] Our results remain largely the same.

4.2 "Macro" Bank Risk: The Asset Risk Channel of Banking Crises

Our findings in Tables 5-8 show that the increasing generosity of deposit insurance promoted increased asset risk in banking systems, which is not offset by lower leverage. A natural question to ask is to what extent the increased asset risk contributes to the positive association between deposit insurance and the likelihood of banking crises, which was found in prior studies? First, we examine whether increases in deposit insurance generosity affected credit risk relative to GDP (which captures the macroeconomic significance of the effects). Second, we estimate the impact of deposit insurance-induced increases in asset risk on the likelihood of banking crises.

Tables 9-11 report results for instrumented regressions, identical in structure to those in Tables 5-7, but which divide each of the three macro credit measures (loans, household loans and mortgage loans) by GDP. *DI score* is positive and statistically significant in influencing all three measures. In all three cases, the economic magnitudes of the effects are large. A one standard deviation increase in *DI score* results in more than a standard deviation increase in each of the macro credit measures.

[18] Robustness tables for the mortgage-loans-to-total-loans ratio and mortgage-loans-to-GDP ratio are omitted because they are identical to the baseline tables.

Next, we examine the impact of external influence on deposit insurance generosity, and how this response affects the likelihood of crises and crisis severity. For the likelihood of crises, we follow Wooldridge (2002, p. 623) in using linear estimation of the final-stage crisis risk rather than a probit in the third stage of the model. When estimating these effects it is necessary to decide how to treat the observations in the data base for the years of crises after the first year. Including the second, third, fourth or fifth years of a crisis identified by Laeven and Valencia is problematic: in the years of crisis after the first one, deposit insurance cannot contribute to the risk that a crisis will occur. For this reason, as noted before, we delete the observations for country years of crisis after the first year of crisis.

In Table 12, *DI score* is instrumented by the external influence variables. In Table 13, the three macro asset risk measures (expressed relative to GDP) are instrumented by the external influences on deposit insurance generosity. In Table 12, we show that exogenous increases in the generosity of deposit insurance produce an increase in crisis risk and crisis severity. In Table 13, we find that the exogenous influences that produce an increased risk of crisis through increases in deposit insurance coverage also produce an increase in crisis risk and crisis severity through their effects on all three of the macro asset risk measures. The magnitudes of the effects in Tables 12 and 13 are large. In Table 12, a one standard deviation increase in *DI score* results in an increase of roughly 40% of a standard deviation of crisis risk and crisis severity. In Table 13, the magnitudes of the effects are also substantial. For *loans-to GDP*, a standard deviation increase results in 24% of a standard deviation increase in crisis risk and 37% of a standard deviation increase in crisis severity. For *household-loans-to-GDP*, the effect is 32% of a standard deviation of crisis risk and 26% of a standard deviation of crisis severity, and for *mortgage-loans-to-GDP*, the effect is 50% of a standard deviation of crisis risk and 43% of a standard deviation of crisis severity. We conclude that exogenous increases in deposit insurance generosity produce increases in crisis risk and crisis severity at least partly through their effects on bank asset risk.

4.3 Robustness

In Table 14, we summarize the robustness of our result for separately estimating the two subsamples for countries: advanced economies and emerging markets. We report results only for the full model, which includes all controls. Many results remain statistically significant for both subsamples when estimated separately, but there are exceptions. Given the smaller sample size it is hard to determine whether the loss of statistical significance for some subsample estimates reflect true differences between the two groups of countries or reduced precision of estimation because of smaller sample sizes.

In the models with instrumented *DI score* as an explanatory variable for *loans-to-assets*, *loans-to-GDP*, and *household-loans-to-GDP*, the results are not statistically significant for advanced economies. For both advanced and emerging economies, the statistical significance of *DI score* on *debt-to-assets* disappears when the sample is split. However, for both subsamples, *DI score* is statistically significant in predicting *household loans-to-total loans, mortgage loans-to-total loans*, and *mortgage-loans-to-GDP*. Furthermore, in emerging economies, exogenous changes in external influence are not statistically significant for forecasting crisis risk, either through their effects on *DI score* (as in Table 12) or through their effects on all three asset risk measures relative to GDP (as in Table 13). Overall, despite the possibility of some differences across types of countries, given the broad consistency across the two subsamples, we believe that reduced precision from subsample splits rather than structural differences are the most likely explanation for subsample differences in statistical significance. We believe treating all countries together in our regression analysis is likely to result in more reliable estimation.

One potential concern about our instruments is that they may be capturing other global factors that coincide with the international influences on deposit insurance. Potential global factors that may affect bank risk during our sample period include: increased stock market volatility, increased capital flows or globalization of interbank borrowing, and increased financial liberalization.[19] We consider the robustness of our results when controlling for these factors in our model. We control for stock market volatility measured by the CBOE volatility index (i.e. VIX) and the S&P 500 realized volatility. The former is available since 1986 and the latter is available throughout our sample period (Figure 5). We control for global capital flows by including changes in total external liabilities from Lane and Milesi-Ferretti (2018). We control for the globalization of interbank borrowing by including changes in the external liabilities of "other investment" as a percentage of world GDP (Lane and Milesi-Ferretti, 2018) (Figure 6).[20]

[19]We also considered including a linear time trend as an exogenous control. We decided that doing so is not appropriate, given that there is no obvious reason to expect that other omitted exogenous influences (unrelated to any observable exogenous influence, such as deposit insurance generosity, global asset risk, capital flows, or financial liberalization) should follow a common linear global trend of increased bank risk. When we include a linear time trend as a control, the *DI score* coefficients remain positive and significant for all the "micro" and "macro" asset risk measures, and for predicting banking crisis severity. But instrumented explanatory variables for the likelihood of crises are no longer statistically significant. Given that our instruments capture common global factors that have grown over time (most obviously, emulation), it is not surprising that some of our results diminish in significance when a time trend is added. The effect of including a time trend highlights the fact that the power of our instruments for forecasting banking crises depends to some extent on their correlation with common, time-varying global factors.

[20] We use data on "other investment" as a proxy for global interbank borrowing because it is where bank loans figure prominently. Changes in "other investment" is also closely related to cross-border activities of large international banks (Lane and Milesi-Ferretti, 2018).

We control for financial liberalization using the financial liberalization index for advanced and emerging countries by Kaminsky and Schmukler (2008) (Figure 7).[21]

We summarize the robustness of our results in Table 15. When we control for VIX, stock market volatility, or capital flow, all our results in Table 5-13 still hold. Results are similar when we control for financial liberalization except in three cases (the loss of statistical significance for the DI score coefficients in the loans-to-assets and debt-to-assets regression, and the household-loans-to-GDP coefficient in the crisis severity regression, although the coefficients are still positive in all cases).

5. Conclusion

We model the origins and generosity of deposit insurance and show that international influences on the expansions of deposit insurance promoted increased asset risk in banking systems, which also increased the likelihood and severity of banking crises. We construct a new measure of the generosity of deposit insurance over time for a large sample of countries and link exogenous changes in the generosity of deposit insurance to changes in bank insolvency risk.

We consider three forms of bank insolvency risk: loans-to-assets, the proportion of lending in mortgages (also proxied by greater household lending), and bank debt-to-assets. Loans-to-assets, household loans-to-total-loans, and mortgage loans-to-total loans all respond positively to the increase in the generosity of deposit insurance. The response of debt-to-assets to a rise in the generosity of deposit insurance is positive and marginally statistically significant.

[21] Kaminsky and Schmukler (2008) find that the amplitude of stock market booms substantially increases in the aftermath of liberalization (defined as a 4-year window, and robust for 3- and 6-year windows). But markets stabilize in the long run if liberalization persists. Therefore, to capture the risk enhance effect of liberalization, we control for the average liberalization index in the 4 years prior.

More generally, none of the observed increases in risk measured by one or more indicators is offset by significant declines in the other risk measures.

We also explore the connections between increased asset risk and the risk of banking crises. Increased deposit insurance generosity results in increases in loans-to-GDP, and increases in household-loans-to-GDP and mortgage loans-to-GDP. Exogenous increases in the generosity of deposit insurance produce an increased likelihood of a banking crisis and greater crisis severity, and the same exogenous external influences that produce an increased risk of crisis through increases in deposit insurance coverage also produce an increase in crisis risk through their effects on all three of the macro asset risk measures. In particular, these findings confirm the view increases in mortgage lending promote greater systemic risk. We conclude that exogenous increases in deposit insurance generosity produce increases in crisis risk at least partly through their effects on bank asset risk.

While our data do not permit us to explore alternative explanations for why deposit insurance should produce a robust increase in risky mortgage lending, we note two obvious candidate explanations. First, it may be that high rates of mortgage lending entail liquidity risks (and perhaps other risks) that would not be feasible for banks to bear without safety net protection. Another way to think about the relationship between rising deposit insurance generosity and the greater emphasis on mortgage lending by banks is that the two phenomena are part of a political rent sharing arrangement. If rising deposit insurance generosity creates greater rents for banks from enhanced protection, then political forces may respond through regulation or other political influences to encourage banks to share those rents with mortgage borrowers.

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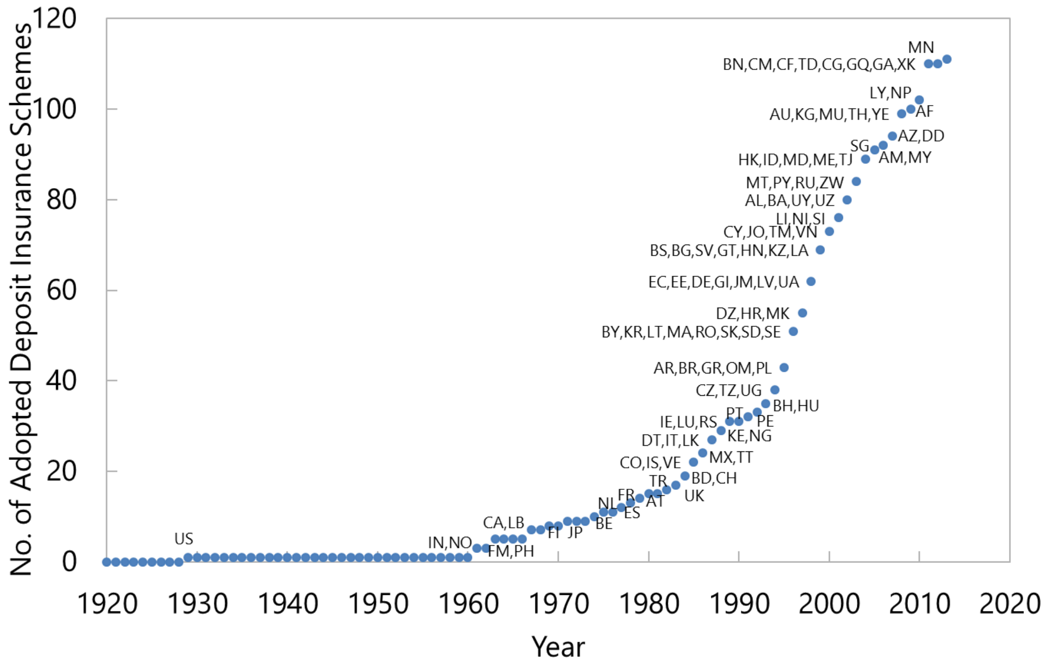
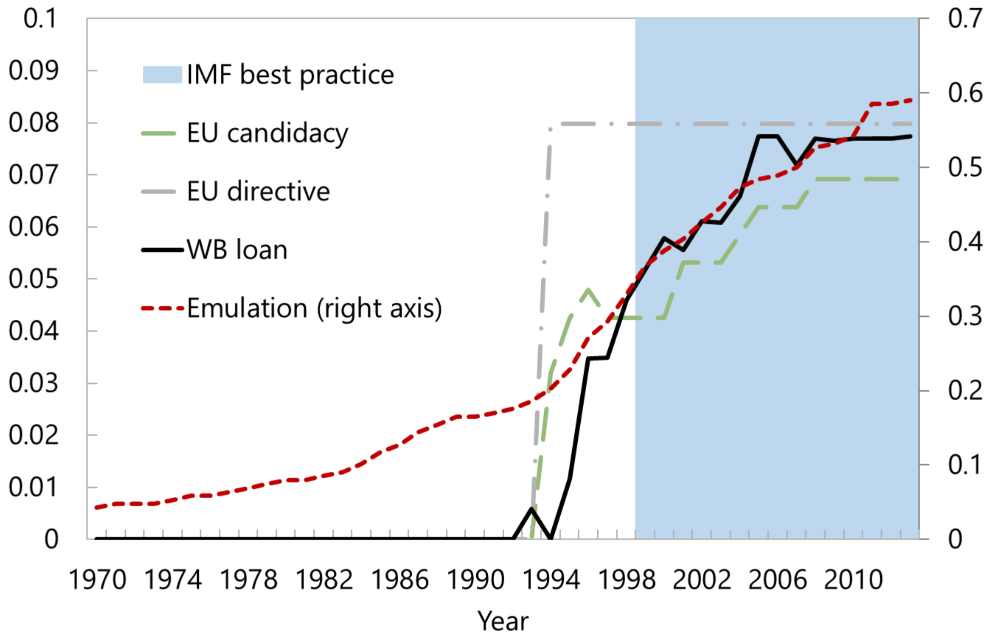
Figure 1. Deposit Insurance Adoption



Note: This figure plots the year of deposit insurance adoption by country. Data labels in the figure use International Organization for Standardization (ISO) country codes.

Source: Demirgüç-Kunt, Kane and Laeven (2005), Demirgüç-Kunt, Kane and Laeven (2014), national sources, and authors' calculations.

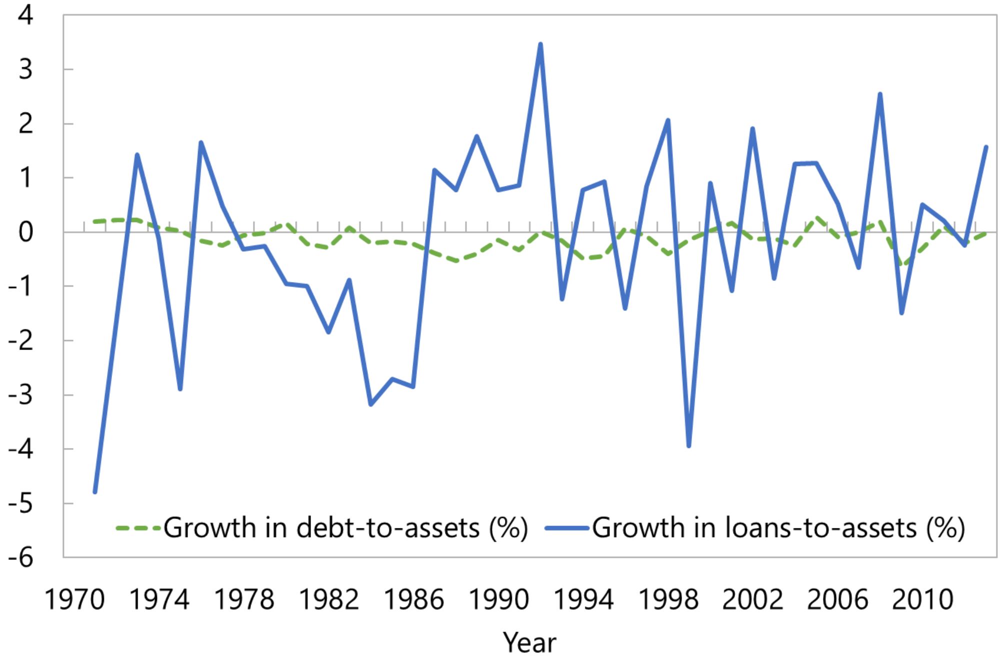
Figure 2. International Influence and Deposit Insurance Adoption



Note: This figure plots the time series of international influence on deposit insurance adoption.

Source: Demirgüç-Kunt, Kane and Laeven (2005), Demirgüç-Kunt, Kane and Laeven (2014), national sources, and authors' calculations.

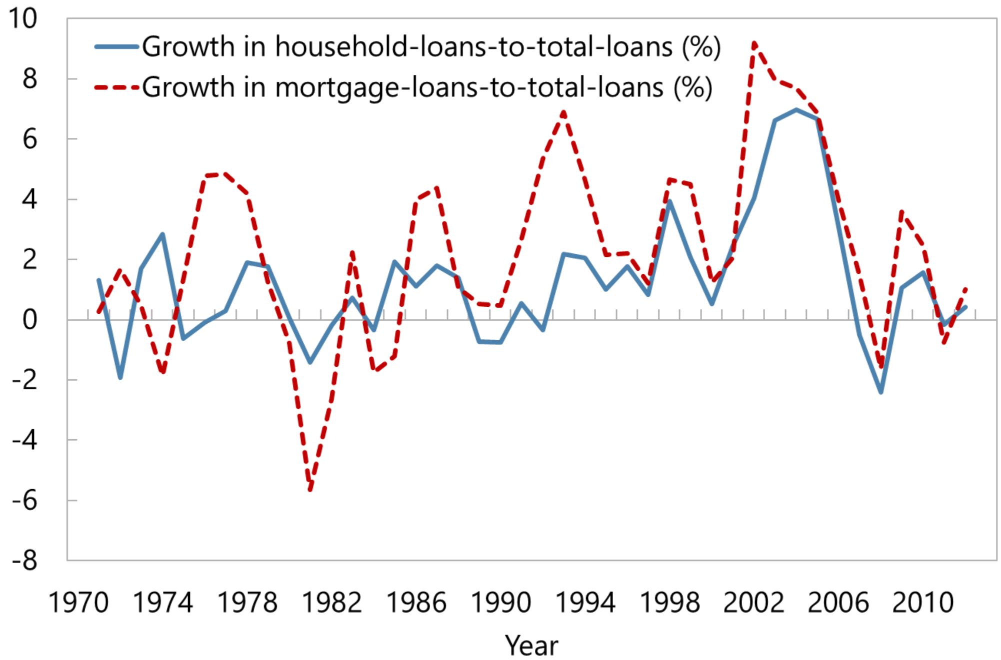
Figure 3. Growth in Loans-to-Assets and Debt-to-Assets



Note: This figure plots time series of annual growth in debt-to-assets and loans-to assets. Growth is computed as log differences.

Source: IFS and authors' calculations.

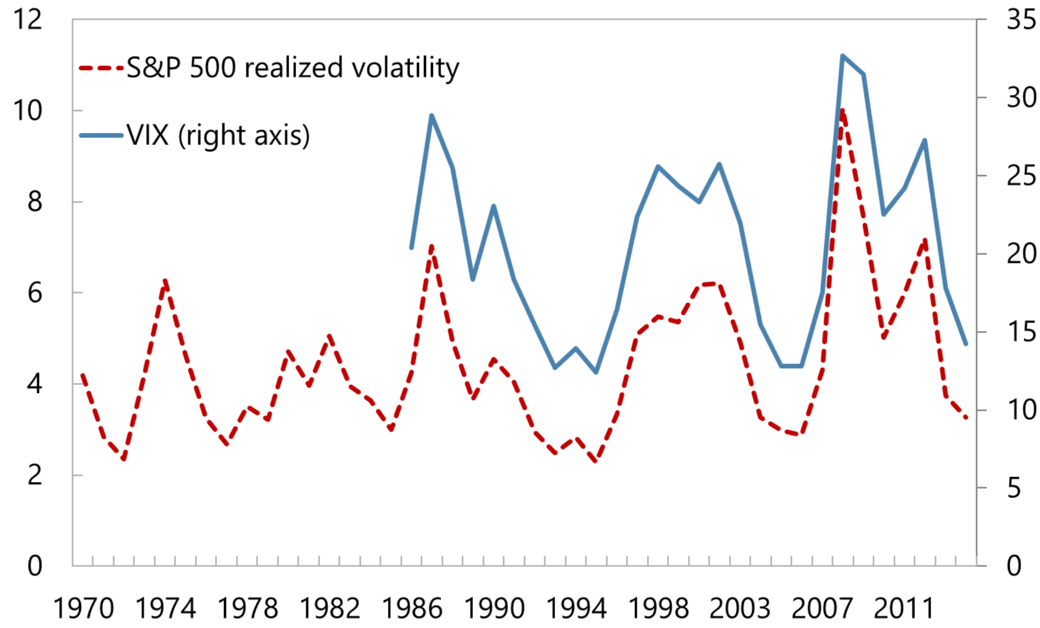
Figure 4. Growth in Household and Mortgage Loans



Note: This figure plots time series of annual growth in household loans as a fraction of total loans, and mortgage loans as a fraction of total loans. Growth is computed as log differences.

Source: Cerutti, Dagher, and Dell'Ariccia (2017) and authors' calculations.

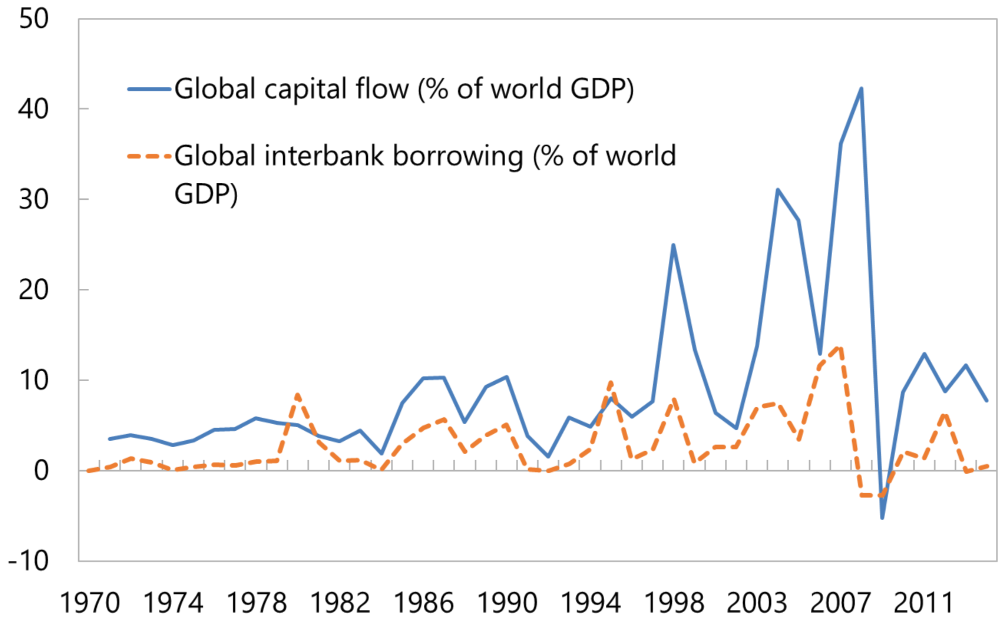
Figure 5. Stock market volatilities



Note: This figure plots the CBOE volatility index (i.e. VIX) and the S&P 500 realized volatility. Realized volatility is defined as the scaled sum of squared daily returns.

Source: Datastream and authors' calculations.

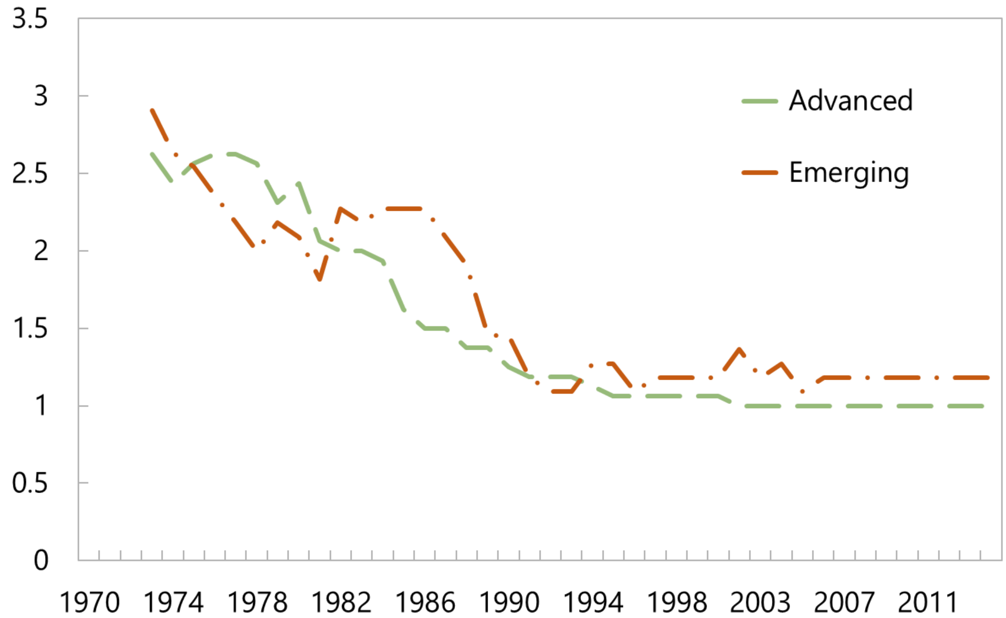
Figure 6. Capital flows



Note: This figure plots total capital flows and the annual aggregated flow of external liabilities in the "other investment" category (which consists largely of interbank borrowing) as a percentage of world GDP. Annual flow is calculated as changes in annual stock.

Source: Lane and Milesi-Ferretti (2018) and authors' calculations.

Figure 7. Financial sector liberalization



Note: This figure plots the index of financial sector liberalization. The index takes a value of 3 for repression, 2 for partial liberalization, and 1 for full liberalization. The index is a cross-country average for advanced economies and emerging markets separately.

Source: Kaminsky and Schmukler (2008) and authors' calculations.

Table 1. Variable Definitions

Variable	Definition	Source
ln(loans to assets)	Ratio of bank loans to bank assets, in natural logarithm*	IFS
ln(debt to assets)	Ratio of bank debt to bank assets, in natural logarithm*	IFS
ln(household loans to total loans)	Ratio of household loans to bank loans, in natural logarithm*	Cerutti et al. (2017)
ln(mortgage loans to total loans)	Ratio of mortgage loans to bank loans, in natural logarithm	Cerutti et al. (2017)
DI (dummy)	Equals 1 if there is no deposit insurance. Equals 0 otherwise.	Demirgüç-Kunt et al. (2014)
Coverage score	Equals 0.2 if coverage to GDP per capita ratio ranges from 0 to 1. Equals 0.4 if the ratio ranges from 1 to 2. Equals 0.6 if the ratio ranges from 2 to 6. Equals 0.8 if the ratio ranges from 6 to 20. Equals 1 if the ratio is greater than 20.	Demirgüç-Kunt et al. (2014) and national sources
Coverage ratio	Deposit insurance coverage to GDP per capita	
DI score	Index combining deposit insurance coverage and coinsurance. Equals coverage score if coinsurance is zero. Equals 0.5 times coverage score if coinsurance is greater than zero but smaller than 25%. Equals 0 if coinsurance is greater or equal to 25%.	Demirgüç-Kunt et al. (2014) and national sources
Inflation	Inflation, consumer price index (annual percent)	IFS
GDP growth	Real GDP growth rate (in percent)	IFS
GDP per capita	GDP per capita (constant 2005 US dollars)	World Bank
Post crisis	Equals 1 for the three years following the start of a systemic banking crisis.	Laeven and Valencia (2012)
Crisis severity	The loss of GDP associated with banking crisis years.	Laeven and Valencia (2012)
IMF best practice	Dummy variable that takes a value of one for the years 1999 and onwards. The year 1999 was the year that the IMF endorsed deposit insurance by publishing a paper on best practices and guidelines in deposit insurance.	Garcia (2000)
Emulation	Proportion of countries with explicit deposit insurance at a given year (in percent).	Demirgüç-Kunt et al. (2014)
World Bank loan	Dummy variable that takes the value of one during and following the year that the World Bank started an adjustment lending program with a country for reforms to establish deposit insurance, and zero otherwise. The variable takes a value of one for the following countries and periods: Albania (2002 and onward), Bolivia (1998 and onward), Bosnia and Herzegovina (1996 and onward), Croatia (1995 and onward), El Salvador (1996 and onward), Jordan (1995 and onward), Lithuania (1996 and onward), Nicaragua (2000 and onward), Poland (1993 and onward), Romania (1996 and onward), Russia (1997 and onward), Ukraine (1998 and onward).	World Bank (2004)
EU candidacy	Dummy variable that takes a value of one for the years 1994 and onwards for EU member countries only (the EU-15), and zero otherwise. The year 1994 was when the EU Directive on Deposit Insurance came into force.	Demirgüç-Kunt et al. (2008)
EU directive	Dummy variable that takes a value of one for the years 1994 and onwards for EU candidate countries only (i.e. Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovak Republic, Slovenia), and zero otherwise. The year 1994 was when the EU Directive on Deposit Insurance came into force.	Demirgüç-Kunt et al. (2008)
VIX	CBOE volatility index	Datastream
S&P realized volatility	The scaled sum of squared daily returns of the S&P 500 index	Datastream and authors' calculations
Globalization of banking systems	The annual flow in the external liabilities of "other investment" as a percentage of world GDP. Annual flow is calculated as changes in annual stock.	Lane and Milesi-Ferretti (2018)
Financial sector liberalization index	The index takes a value of 3 for repression, 2 for partial liberalization, and 1 for full liberalization. The index is a cross-country average for advanced economies and emerging markets separately.	Kaminsky and Schmukler (2008)

* See Appendix A for details.

Table 2. Country Coverage

Group	Country
Panel A. Balance sheet ratios model	
Advanced	Australia, Austria, Belgium, Canada, Hong Kong SAR, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Republic of Korea, Latvia, Luxembourg, Malta, Netherlands, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States
Emerging	Bahrain, Barbados, Belarus, Brazil, Brunei Darussalam, Bulgaria, Chile, Colombia, Croatia, El Salvador, Guatemala, Hungary, India, Indonesia, Jamaica, Jordan, Kazakhstan, Lebanon, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Oman, Paraguay, Peru, Philippines, Poland, Romania, Russia, Serbia, Sri Lanka, Thailand, Trinidad and Tobago, Turkey, Ukraine, Uruguay, Venezuela
Panel B. Household loans and mortgage loans model	
Advanced	Australia, Austria, Belgium, Canada, Hong Kong SAR, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Republic of Korea, Latvia, Luxembourg, Malta, Netherlands, Norway, Portugal, Singapore, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States
Emerging	Brazil, Bulgaria, Colombia, Croatia, Hungary, India, Indonesia, Lithuania, Malaysia, Mexico, Philippines, Poland, Russia, Thailand, Turkey, Ukraine

Table 3. Summary Statistics

	Mean	S.D	Min	Median	Max	N
Panel A: *Sample for balance sheet ratios model*						
ln(loans to assets)	-0.653	0.402	-3.320	-0.566	-0.092	1206
ln(debt to assets)	-0.098	0.060	-0.320	-0.094	0.000	1255
Crisis (dummy)	0.106	0.308	0.000	0.000	1.000	1255
DI (dummy)	1.000	0.000	1.000	1.000	1.000	1255
DI score (censored)	0.460	0.250	0.000	0.400	1.000	1255
Inflation	0.056	0.074	-0.007	0.034	0.632	1255
GDP growth	0.031	0.031	-0.074	0.032	0.140	1255
Crisis loss	2.290	10.213	0.000	0.000	106.000	1255
IMF best practice	0.653	0.476	0.000	1.000	1.000	1255
World Bank loan	0.099	0.299	0.000	0.000	1.000	1255
Emulation	0.386	0.171	0.043	0.447	0.590	1255
IMF best practice x emulation	0.326	0.244	0.000	0.447	0.590	1255
EU candidacy	0.140	0.347	0.000	0.000	1.000	1255
EU directive	0.219	0.414	0.000	0.000	1.000	1255
Panel B: *Household loans and mortgage loans model*						
ln(household loans to total loans)	-1.029	0.389	-2.673	-1.002	-0.454	774
ln(mortgage loans to total loans)	-1.621	0.687	-3.725	-1.466	-0.686	570
ln(total loans to GDP)	4.640	0.630	2.298	4.767	5.933	774
ln(household loans to GDP)	3.597	0.827	0.103	3.771	4.816	762
ln(mortgage loans to GDP)	3.055	1.054	-0.539	3.300	4.566	564
Crisis (dummy)	0.129	0.336	0.000	0.000	1.000	774
DI (dummy)	1.000	0.000	1.000	1.000	1.000	774
DI score	0.445	0.239	0.000	0.400	1.000	774
Inflation	0.038	0.033	-0.014	0.029	0.225	774
GDP growth	0.029	0.030	-0.089	0.029	0.170	774
Crisis loss	3.605	13.117	0.000	0.000	106.000	774
IMF best practice	0.632	0.483	0.000	1.000	1.000	774
World Bank loan	0.085	0.279	0.000	0.000	1.000	774
Emulation	0.371	0.170	0.043	0.426	0.585	774
IMF best practice x emulation	0.309	0.241	0.000	0.426	0.585	774
EU candidacy	0.143	0.351	0.000	0.000	1.000	774
EU directive	0.310	0.463	0.000	0.000	1.000	774

Table 4. Step 1 Results: Probit Model for Deposit Insurance Adoption

	(1)	(2)	(3)
IMF best practice	-1.036***	-1.140***	-1.143***
	[0.332]	[0.342]	[0.342]
Emulation	2.271***	2.140***	2.150***
	[0.475]	[0.493]	[0.494]
IMF best practice X emulation	2.240***	2.572***	2.569***
	[0.814]	[0.848]	[0.848]
World Bank loan	1.126***	1.072***	1.074***
	[0.141]	[0.148]	[0.148]
EU candidacy	2.715***	2.642***	2.642***
	[0.362]	[0.388]	[0.388]
EU directive	1.814**	1.283	1.277
	[0.763]	[0.786]	[0.785]
Inflation	-3.182***	-2.739***	-2.719***
	[0.722]	[0.742]	[0.743]
Inflation x Emerging	-4.252***	-4.332***	-4.325***
	[0.839]	[0.861]	[0.861]
GDP growth	1.088***	1.061***	1.066***
	[0.162]	[0.162]	[0.162]
Post crisis		0.450***	0.391**
		[0.136]	[0.177]
Output losses			0.002
			[0.004]
Observations	2,771	2,519	2,519
R2	0.278	0.221	0.221

Notes: This table shows step 1 results of a three-step model. The first step estimates the probability of enacting deposit insurance using a probit model. The second and third steps proceed as a standard IV model with the inverse Mills ratio estimated from the first step as an additional control. The independent variable is the dummy variable which takes a value of 1 if a country has adopted deposit insurance (see Table 1 for variable definitions). Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 5. Dependent Variable: Log of Loans-to-Assets Ratio

	(1)	(2)	(3)
DI score	2.010**	1.984**	2.045**
	[0.884]	[0.848]	[0.834]
Inflation	3.179***	3.153***	2.849***
	[0.860]	[0.847]	[0.774]
Inflation x Emerging	-4.956***	-4.929***	-4.531***
	[1.048]	[1.033]	[0.947]
GDP growth	1.971	1.944	2.265*
	[1.227]	[1.198]	[1.283]
Lambda	0.245***	0.243***	0.236***
	[0.064]	[0.062]	[0.060]
Post crisis		0.028	-0.121
		[0.074]	[0.096]
Output losses			0.008**
			[0.003]
Observations	645	645	645
Number of countries	62	62	62
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	11.84	11.01	9.979
Cragg-Donald Wald (weakid stat)	9.687	9.867	9.648

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the loans-to-assets ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of exogenous instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 6. Dependent Variable: Log of Household-Loans-to-Total-Loans Ratio

	(1)	(2)	(3)
DI score	1.701***	2.281***	2.332***
	[0.342]	[0.499]	[0.508]
Inflation	-0.708	-0.609	-0.643
	[0.439]	[0.567]	[0.567]
Inflation x Emerging	0.340	1.708	1.902
	[1.165]	[1.206]	[1.198]
GDP growth	1.683***	0.998*	1.142*
	[0.616]	[0.595]	[0.620]
Lambda	-0.145***	-0.186***	-0.187***
	[0.035]	[0.045]	[0.046]
Post crisis		-0.384***	-0.449***
		[0.098]	[0.124]
Output losses			0.002
			[0.002]
Observations	774	774	774
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	12.79	8.072	8.036
Cragg-Donald Wald (weakid stat)	17.40	11.23	10.91

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the household-loans-to-total-loans ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 7. Dependent Variable: Log of Mortgage-Loans-to-Total-Loans Ratio

	(1)	(2)	(3)
DI score	1.686***	2.476***	2.234***
	[0.490]	[0.766]	[0.722]
Inflation	-0.083	0.365	0.005
	[0.949]	[1.249]	[1.056]
Inflation x Emerging	1.459	2.625	4.399***
	[2.190]	[2.124]	[1.651]
GDP growth	1.248	0.969	0.929
	[0.773]	[0.816]	[0.801]
Lambda	-0.349***	-0.342***	-0.412***
	[0.076]	[0.077]	[0.082]
Post crisis		-0.344***	-0.397***
		[0.114]	[0.144]
Output losses			0.004
			[0.003]
Observations	575	575	570
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	20.93	13.36	11.79
Cragg-Donald Wald (weakid stat)	31.190	21.540	20.900

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the mortgage-loans-to-total-loans ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 8. Dependent Variable: Log of Debt-to-Assets Ratio

	(1)	(2)	(3)
DI score	0.086*	0.102*	0.114*
	[0.046]	[0.062]	[0.065]
Inflation	0.202***	0.223***	0.211***
	[0.042]	[0.051]	[0.051]
Inflation x Emerging	-0.197***	-0.210***	-0.190***
	[0.045]	[0.051]	[0.050]
GDP growth	0.153*	0.149	0.188*
	[0.083]	[0.093]	[0.102]
Lambda	0.010***	0.008*	0.007
	[0.004]	[0.005]	[0.005]
Post crisis		-0.012*	-0.031***
		[0.007]	[0.011]
Output losses			0.001***
			[0.000]
Observations	1,246	1,246	1,246
Number of countries	69	69	69
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	19.76	16.86	16.32
Cragg-Donald Wald (weakid stat)	25.05	21.33	20.72

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the debt-to-assets ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 9. Dependent Variable: Log of Loans-to-GDP Ratio

	(1)	(2)	(3)
DI score	3.067***	4.277***	4.495***
	[0.692]	[1.550]	[1.696]
Inflation	-0.673	-0.562	-0.651
	[0.770]	[1.101]	[1.117]
Inflation x Emerging	2.047**	2.790**	2.877**
	[0.816]	[1.235]	[1.264]
GDP growth	1.686	1.224	1.641
	[1.071]	[1.299]	[1.461]
Lambda	-0.418***	-0.487***	-0.497***
	[0.058]	[0.102]	[0.110]
Post crisis		-0.560**	-0.745**
		[0.275]	[0.356]
Output losses			0.005
			[0.004]
Observations	766	766	766
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	10.85	6.449	6.392
Cragg-Donald Wald (weakid stat)	14.61	8.812	8.370

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the loans-to-GDP ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 10. Dependent Variable: Log of Household-Loans-to-GDP Ratio

	(1)	(2)	(3)
DI score	5.250***	6.816***	6.998***
	[1.053]	[1.716]	[1.778]
Inflation	-0.922	-0.752	-0.834
	[1.272]	[1.691]	[1.699]
Inflation x Emerging	2.366	5.469*	5.880*
	[2.770]	[3.182]	[3.267]
GDP growth	3.908**	2.377	2.818
	[1.724]	[1.769]	[1.859]
Lambda	-0.629***	-0.728***	-0.736***
	[0.101]	[0.140]	[0.144]
Post crisis		-0.999***	-1.193***
		[0.319]	[0.393]
Output losses			0.005
			[0.006]
Observations	768	768	768
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	10.87	7.097	7.087
Cragg-Donald Wald (weakid stat)	14.99	9.734	9.461

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the household-loans-to-GDP ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 11. Dependent Variable: Log of Mortgage-Loans-to-GDP Ratio

	(1)	(2)	(3)
DI score	4.206***	5.316***	5.353***
	[0.938]	[1.451]	[1.469]
Inflation	0.996	1.621	1.745
	[1.906]	[2.434]	[2.456]
Inflation x Emerging	5.301**	6.723**	7.126**
	[2.593]	[3.043]	[3.060]
GDP growth	2.204	1.704	2.246
	[1.506]	[1.579]	[1.652]
Lambda	-0.628***	-0.617***	-0.620***
	[0.128]	[0.135]	[0.136]
Post crisis		-0.527**	-0.771**
		[0.221]	[0.311]
Output losses			0.009
			[0.006]
Observations	568	568	568
Number of countries	46	46	46
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	19.55	12.57	12.01
Cragg-Donald Wald (weakid stat)	30.51	21.17	21

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the mortgage-loans-to-GDP ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 12. Dependent Variable: The Likelihood and Severity of Crises

	(1)	(2)
	Likelihood of crises	Crisis severity
DI score	0.581**	23.416**
	[0.232]	[9.898]
Inflation	1.663***	74.324**
	[0.563]	[35.753]
Inflation x Emerging	-1.352**	-60.837*
	[0.552]	[35.186]
GDP growth	-0.088	-12.752
	[0.342]	[19.124]
Lambda	-0.096***	-3.536***
	[0.027]	[1.270]
Observations	1,201	1,201
Number of countries	70	70
Kleibergen-Paap rk LM (underid pval)	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	13.20	13.20
Cragg-Donald Wald (weakid stat)	17.19	17.19

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The first dependent variable is a dummy variable which takes a value of 1 in the first year of a system banking crisis, and 0 in other years except for years immediately after the start of a banking crisis (the next two years or until the end of a crisis, whichever is greater), which are treated as missing. Crisis severity is measured as GDP loss associated with banking crisis years. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 13. Dependent Variable: The Likelihood and Severity of Crises

	Likelihood of crises			Crisis severity		
	(1)	(2)	(3)	(4)	(5)	(6)
ln(loans/GDP)	0.207***			7.718***		
	[0.054]			[2.011]		
ln(household loans/GDP)		0.131***			4.189***	
		[0.037]			[1.448]	
ln(mortgage loans/GDP)						
			0.157***			5.303***
			[0.038]			[1.172]
Inflation	0.162	0.163	-0.191	32.673**	25.158*	88.883***
	[0.228]	[0.242]	[0.458]	[15.227]	[14.444]	[32.958]
Inflation x Emerging	0.001	0.025	0.659	8.622	8.229	-84.929**
	[0.255]	[0.535]	[0.560]	[23.063]	[29.457]	[33.626]
GDP growth	-1.263***	-1.111***	-1.364***	-39.833**	-48.611**	-49.739**
	[0.283]	[0.294]	[0.346]	[18.640]	[21.478]	[23.531]
Observations	1,017	1,000	617	1,017	1,000	617
Number of countries	51	51	49	51	51	49
Kleibergen-Paap rk LM (underid pval)	0	0	0	0	0	0
Kleibergen-Paap rk Wald F (weakid stat)	107.5	77.76	154.1	108.6	77.76	154.1
Cragg-Donald Wald (weakid stat)	96.97	96.44	128.4	99.62	96.44	128.4

Notes: This table shows step 2 of a standard IV model. The dependent variable measuring the incidence of a crisis is a dummy variable which takes a value of 1 in the first year of a system banking crisis, and 0 in other years except for years immediately after the start of a banking crisis (the next two years or until the end of a crisis, whichever is greater), which are treated as missing. The dependent variable of crisis severity measures the lost GDP associated with crisis years. The instrumented endogenous variables are the natural logarithms of the loans-to-GDP ratio, the household-loans-to-GDP ratio, and the mortgage-loans-to-GDP ratio. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table 14 – Subsample Robustness of Regression Results

Dependent Variable	Coefficient (full model)	All	Advanced	Emerging
Loans/assets	DI score	++	0	+++
Household loans/Total loans	DI score	+++	++	+++
Mortgage loans/Total loans	DI score	+++	++	+++
Debt/assets	DI score	++	0	+
Loans/GDP	DI score	+++	0	+++
Household loans/GDP	DI score	+++	0	+++
Mortgage loans/GDP	DI score	+++	+++	++
Likelihood of crisis	DI score	++	++	0
	Loans/GDP	+++	+++	0
	HH Loans/GDP	+++	+++	0
	Mortgages/GDP	+++	+++	0
Crisis severity	DI score	++	0	0
	Loans/GDP	+++	+++	0
	HH Loans/GDP	+++	+++	0
	Mortgages/GDP	+++	+++	0

Notes: This table reviews results for regressions similar to those in Tables 5-13, but for separate subsamples of Advanced or Emerging economies. 0 indicates that the estimated coefficient is not statistically significantly different from zero. + indicates that the coefficient is positive and statistically significant at the 10 percent level. ++ indicates that the coefficient is positive and statistically significant at the 5 percent level. +++ indicates that the coefficient is positive and statistically significant at the 1 percent level.

Table 15 –Robustness of Regression Results to Inclusion of Time-Varying Global Factors

Dependent Variable	Coefficient (full model)	VIX	S&P volatility	Global capital flows	Global interbank borrowing	Financial liberalizat ion
Loans/assets	DI score	++	++	++	++	0
Household loans/Total loans	DI score	+++	+++	+++	+++	+++
Mortgage loans/Total loans	DI score	+++	+++	+++	+++	+++
Debt/assets	DI score	++	++	++	++	0
Loans/GDP	DI score	++	++	+++	+++	+++
Household loans/GDP	DI score	+++	+++	+++	+++	+++
Mortgage loans/GDP	DI score	+++	+++	+++	+++	+++
Likelihood of crises	DI score	+++	+++	++	++	+++
	Loans/GDP	+++	+++	+++	+++	+
	HH Loans/GDP	+++	+++	+++	+++	++
	Mortgages/GDP	+++	+++	+++	+++	+++
Crisis severity	DI score	+++	+++	++	++	++
	Loans/GDP	+++	+++	+++	+++	+
	HH Loans/GDP	+	++	+++	+++	0
	Mortgages/GDP	+++	+++	+++	+++	+++

Notes: This table reviews results for regressions similar to those in Tables 5-13, but which add time-varying controls that capture other global factors (which are the VIX, S&P realized volatility, capital flows, global interbank borrowing, or indices of financial liberalization). 0 indicates that the estimated coefficient is not statistically significantly different from zero. + indicates that the coefficient is positive and statistically significant at the 10 percent level. ++ indicates that the coefficient is positive and statistically significant at the 5 percent level. +++ indicates that the coefficient is positive and statistically significant at the 1 percent level.

Appendix

A. Data source and definitions for balance sheet variables

The data source for aggregate banking system balance sheets is IMF's International Financial Statistics (IFS) database. We use the IFS's monetary data on *Other Depository Corporations*, which includes all depository corporations of a country except the central banks.

Our definition of bank assets and liabilities follows the IMF's Monetary and Financial Statistics Manual. We measure bank loans by claims on private sector (line 22d). We measure bank assets as the sum of claims on central banks (line 20), claims on nonresidents (line 21), claims on central government (line 22a), and claims on other sectors (line 22s). We measure bank liabilities as the sum of demand deposits included in broad money (line 24), other deposits included in broad money (line 25), securities other than shares included in broad money (line 26a), deposits excluded from broad money (line 26b), liabilities to nonresidents (line 26c), liabilities to central government (line 26d), securities other than shares excluded in broad money (line 26s), loans (line 22l), financial derivatives (line 26m), insurance technical reserves (line 26r). We measure bank equity using shares and other equity (line 27a). The IFS has a residual item—other items (net) (line 27r)—to classify other unspecified, or country-specific amounts. To minimize inconsistency due to misreporting, missing values, or other data issues, we check the following balance sheet identity:

$$assets = equity + debt + residual,$$

and delete all country-year observations in which the discrepancy is larger than 1 percent of bank assets.[22]

B. Additional tables

[22] Inconsistency occurs primarily due to missing values for countries that have not adopted IMF's standard reporting forms. If an item from our standard definition is missing, we replace with the sum of detail components when available.

Table B1. Step 2 Results: Predicting Deposit Insurance Generosity Through Exogenous Instruments (Loans-to-Assets Regression Sample)

	(1)	(2)	(3)
IMF best practice	-0.423***	-0.430***	-0.423***
	(0.0509)	(0.0502)	(0.0500)
Emulation	0.463***	0.200	0.187
	(0.147)	(0.142)	(0.141)
IMF best practice X emulation	0.768***	0.863***	0.855***
	(0.137)	(0.133)	(0.133)
EU candidacy	-0.0678	-0.0564	-0.0399
	(0.0433)	(0.0396)	(0.0450)
EU directive	0.278***	0.204***	0.198***
	(0.0447)	(0.0415)	(0.0413)
World Bank loan	0.188***	0.139***	0.138***
	(0.0464)	(0.0439)	(0.0440)
Inflation	0.170	-0.105	-0.0802
	(0.274)	(0.280)	(0.275)
Inflation X Emerging	-0.498	-0.185	-0.213
	(0.331)	(0.329)	(0.326)
GDP growth	-1.784***	-1.455***	-1.490***
	(0.189)	(0.200)	(0.203)
Lambda	0.343***	0.255***	0.250***
	(0.0484)	(0.0440)	(0.0435)
Post crisis		0.113***	0.144***
		(0.0222)	(0.0292)
Output losses			-0.00118
			(0.000834)
Observations	1,215	1,215	1,215
Number of countries	69	69	69

Notes: This table shows step 2 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the deposit insurance (DI) score. The set of exogenous instruments used to predict DI score include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B2. Step 2 Results: Predicting Deposit Insurance Generosity Through Exogenous Instruments (Household-Loans-to-Total-Loans Regression Sample)

	(1)	(2)	(3)
IMF best practice	-0.464***	-0.435***	-0.436***
	(0.0737)	(0.0745)	(0.0745)
Emulation	0.273	-0.0586	-0.0830
	(0.199)	(0.170)	(0.172)
IMF best practice X emulation	0.995***	1.016***	1.024***
	(0.206)	(0.197)	(0.197)
World Bank loan	-0.146***	-0.0938**	-0.0947**
	(0.0436)	(0.0448)	(0.0459)
EU candidacy	0.200***	0.0694	0.0567
	(0.0664)	(0.0508)	(0.0502)
EU directive	0.203***	0.131**	0.123**
	(0.0638)	(0.0583)	(0.0582)
Inflation	-0.207	-0.346	-0.351
	(0.285)	(0.289)	(0.289)
Inflation X Emerging	-0.215	-0.430	-0.423
	(0.434)	(0.439)	(0.439)
GDP growth	-1.169***	-0.567**	-0.553**
	(0.247)	(0.232)	(0.235)
Lambda			4.95e-05
			(0.000872)
Post crisis	0.266***	0.124**	0.110**
	(0.0689)	(0.0516)	(0.0510)
Output losses		0.135***	0.133***
		(0.0230)	(0.0335)
Observations	774	774	774
Number of countries	47	47	47

Notes: This table shows step 2 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the deposit insurance (DI) score. The set of exogenous instruments used to predict DI score include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B3. Step 2 Results: Predicting Deposit Insurance Generosity Through Exogenous Instruments (Mortgage-Loans-to-Assets Regression Sample)

	(1)	(2)	(3)
IMF best practice	-0.481***	-0.461***	-0.472***
	(0.0700)	(0.0716)	(0.0717)
Emulation	0.528***	0.252	0.224
	(0.186)	(0.168)	(0.176)
IMF best practice X emulation	0.967***	0.974***	1.001***
	(0.191)	(0.189)	(0.189)
EU candidacy	-0.142***	-0.120**	-0.123**
	(0.0532)	(0.0520)	(0.0512)
EU directive	0.443***	0.314***	0.270***
	(0.0583)	(0.0539)	(0.0494)
Inflation	-1.025***	-1.037***	-1.210***
	(0.365)	(0.372)	(0.354)
Inflation X Emerging	0.360	0.175	0.429
	(0.492)	(0.500)	(0.480)
GDP growth	-1.292***	-0.866***	-0.825***
	(0.193)	(0.190)	(0.185)
Lambda	0.376***	0.236***	0.241***
	(0.0591)	(0.0513)	(0.0571)
Post crisis		0.0912***	0.122***
		(0.0225)	(0.0318)
Output losses			-0.00113
			(0.000870)
Observations	575	575	575
Number of countries	46	46	46

Notes: This table shows step 2 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the deposit insurance (DI) score. The set of exogenous instruments used to predict DI score include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B4. Step 2 Results: Predicting Deposit Insurance Generosity Through Exogenous Instruments (Debt-to-Assets Regression Sample)

	(1)	(2)	(3)
IMF best practice	-0.431***	-0.441***	-0.436***
	(0.0498)	(0.0490)	(0.0489)
Emulation	0.395***	0.147	0.135
	(0.145)	(0.141)	(0.140)
IMF best practice X emulation	0.821***	0.917***	0.912***
	(0.138)	(0.135)	(0.135)
EU candidacy	-0.0544	-0.0454	-0.0297
	(0.0427)	(0.0400)	(0.0445)
EU directive	0.269***	0.198***	0.193***
	(0.0441)	(0.0413)	(0.0411)
Inflation	0.181***	0.134***	0.133***
	(0.0454)	(0.0432)	(0.0433)
Inflation X Emerging	-0.0697	-0.337	-0.314
	(0.282)	(0.289)	(0.286)
GDP growth	-0.208	0.0953	0.0664
	(0.339)	(0.337)	(0.337)
Lambda	-1.666***	-1.366***	-1.403***
	(0.185)	(0.196)	(0.199)
Post crisis	0.332***	0.248***	0.244***
	(0.0466)	(0.0425)	(0.0421)
Output losses		0.103***	0.134***
		(0.0218)	(0.0286)
Observations	1,254	1,254	1,254
Number of countries	69	69	69

Notes: This table shows step 2 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the deposit insurance (DI) score. The set of exogenous instruments used to predict DI score include IMF best practice, emulation, an interaction term of IMF best practice and emulation, World Bank loan, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B5. Step 3 Robustness: Estimates for Loans-to-Assets Ratio

	(1)	(2)	(3)
DI score	0.602**	0.779**	0.818**
	[0.262]	[0.324]	[0.344]
Inflation	1.325***	1.459***	1.430***
	[0.280]	[0.313]	[0.309]
Inflation X Emerging	-2.198***	-2.289***	-2.239***
	[0.302]	[0.333]	[0.328]
GDP growth	0.943**	1.076**	1.182**
	[0.465]	[0.503]	[0.543]
World Bank loan	0.241***	0.224***	0.221***
	[0.040]	[0.046]	[0.048]
lambda	0.137***	0.121***	0.119***
	[0.023]	[0.028]	[0.029]
Post crisis		-0.061	-0.112*
		[0.041]	[0.062]
Output losses			0.002
			[0.001]
Observations	1,215	1,215	1,215
Number of countries	69	69	69
Kleibergen-Paap rk LM (underid pval)	0	0	0
Kleibergen-Paap rk Wald F (weakid stat)	20.94	17.02	16.31
Cragg-Donald Wald (weakid stat)	28.04	23.31	22.47

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the loans-to-assets ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B6. Step 3 Robustness: Estimates for Household-Loans-to-Total-Loans Ratio

	(1)	(2)	(3)
DI score	1.707***	2.293***	2.341***
	[0.346]	[0.506]	[0.510]
Inflation	-0.701	-0.596	-0.642
	[0.441]	[0.571]	[0.569]
Inflation X Emerging	0.345	1.725	1.909
	[1.167]	[1.212]	[1.200]
GDP growth	1.693***	1.011*	1.149*
	[0.621]	[0.600]	[0.623]
World Bank loan	-0.110	-0.202	
	[0.102]	[0.141]	
lambda	-0.146***	-0.188***	-0.188***
	[0.035]	[0.046]	[0.046]
Post crisis		-0.386***	-0.450***
		[0.099]	[0.124]
Output losses			0.002
			[0.002]
Observations	774	774	774
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	6.22e-09	7.63e-06	6.96e-06
Kleibergen-Paap rk Wald F (weakid stat)	13.73	7.963	8.022
Cragg-Donald Wald (weakid stat)	20.73	13.29	12.95

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the household-loans-to-total-loans ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B7. Step 3 Robustness: Estimates for Debt-to-Assets Ratio

	(1)	(2)	(3)
DI score	0.089**	0.105**	0.114**
	[0.037]	[0.046]	[0.047]
Inflation	0.209***	0.230***	0.216***
	[0.041]	[0.047]	[0.046]
Inflation X Emerging	-0.197***	-0.210***	-0.189***
	[0.044]	[0.048]	[0.047]
GDP growth	0.174**	0.171**	0.205***
	[0.071]	[0.074]	[0.079]
World Bank loan	-0.011**	-0.012**	-0.013**
	[0.005]	[0.006]	[0.006]
lambda	0.009**	0.007*	0.006
	[0.003]	[0.004]	[0.004]
Post crisis		-0.012**	-0.031***
		[0.006]	[0.009]
Output losses			0.001***
			[0.000]
Observations	1,254	1,254	1,254
Number of countries	69	69	69
Kleibergen-Paap rk LM (underid pval)	0	0	0
Kleibergen-Paap rk Wald F (weakid stat)	22.70	19.12	18.47
Cragg-Donald Wald (weakid stat)	30.09	25.58	24.84

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the debt-to-assets ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B8. Step 3 Robustness: Estimates for Loans-to-GDP Ratio

	(1)	(2)	(3)
DI score	3.048***	4.237***	4.451***
	[0.676]	[1.497]	[1.635]
Inflation	-0.645	-0.533	-0.620
	[0.766]	[1.091]	[1.107]
Inflation X Emerging	2.029**	2.761**	2.844**
	[0.812]	[1.220]	[1.247]
GDP growth	1.677	1.214	1.628
	[1.055]	[1.272]	[1.428]
World Bank loan	-0.558***	-0.710**	-0.740**
	[0.192]	[0.310]	[0.331]
lambda	-0.421***	-0.490***	-0.500***
	[0.058]	[0.101]	[0.109]
Post crisis		-0.554**	-0.737**
		[0.266]	[0.346]
Output losses			0.005
			[0.004]
Observations	766	766	766
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	11.45	6.266	6.192
Cragg-Donald Wald (weakid stat)	17.38	10.40	9.871

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the loans-to-GDP ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.

Table B9. Step 3 Robustness: Estimates for Household-Loans-to-GDP Ratio

	(1)	(2)	(3)
DI score	5.250***	6.814***	6.994***
	[1.049]	[1.702]	[1.762]
Inflation	-0.882	-0.703	-0.783
	[1.275]	[1.693]	[1.701]
Inflation X Emerging	2.408	5.527*	5.939*
	[2.772]	[3.184]	[3.269]
GDP growth	3.924**	2.393	2.835
	[1.723]	[1.764]	[1.853]
World Bank loan	-0.764**	-0.994**	-1.027**
	[0.324]	[0.445]	[0.459]
lambda	-0.633***	-0.734***	-0.742***
	[0.102]	[0.141]	[0.145]
Post crisis		-1.000***	-1.194***
		[0.318]	[0.391]
Output losses			0.005
			[0.006]
Observations	768	768	768
Number of countries	47	47	47
Kleibergen-Paap rk LM (underid pval)	0.000	0.000	0.000
Kleibergen-Paap rk Wald F (weakid stat)	11.40	6.822	6.805
Cragg-Donald Wald (weakid stat)	17.82	11.49	11.16

Notes: This table shows step 3 results of a three-step model. The first step estimates the probability of enacting deposit insurance. The second and third steps proceed as a standard IV model with the inverse Mills ratio (lambda) estimated from the first step as an additional control. The independent variable is the natural logarithm of the household-loans-to-GDP ratio. Deposit insurance (DI) score is treated as an endogenous variable. The set of instruments include IMF best practice, emulation, an interaction term of IMF best practice and emulation, EU candidacy, and EU directive (see Table 1 for variable definitions). All variables except for the exogenous instruments are winsorized at the 1 and 99 percent. Robust standard errors are shown in brackets. ***, **, and * represent statistical significance at the 1 percent, 5 percent, and 10 percent, respectively.