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Long Run Macroeconomic and Sectoral Determinants of Systemic Banking Crises

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Abstract

In a panel comprising 61 countries covering the years 1980-2010 we show that macroeconomic variables such as GDP and real-interest rates lose potency as systemic banking crisis determinants when estimated over a full business cycle and that the choice of panel time-span is of high relevance. Using a shorter panel (1998-2011) involving 75 countries, we show that sectoral variables such as Bank Z-Score, private-credit-to-GDP ratio, bank credit-to-deposit ratio and non-performing loan levels represent an improved model-fit over their macroeconomic-focused counterparts, yielding improved in-sample crisis predictions. Whereas sectoral-centric models may over-estimate the likelihood of systemic banking crises this does not constitute a model weakness if not overlooking embryonic crises is the key objective. Future research is facilitated via the establishment of a control cluster of determinants with both sectoral as well as macroeconomic constituents.

Key Words: Systemic Banking Crises; Determinants; Sectoral variables; Stability

JEL Classification: G21 G28

1. Introduction

The weaknesses of the regulatory framework for banks, as encapsulated within the, then prevailing, Basel II accord, became glaringly obvious as the Global Financial Crisis (GFC) of 2008 unfolded and wealth levels in many countries reduced dramatically. Since then academics and regulatory authorities have focused upon identifying key regulatory gaps as well as recommending appropriate new measures geared toward ensuring such a crisis could not be repeated in future (see Bank for International Settlements (2010), Wellink 2009) and Brunnermeier et al. (2009). Prior to 2008 banks were generally risk-assessed on a micro-prudential basis, where market-based measures such as Value-at-Risk and institutional measures such as loan write-off ratios formed the basis for bank credit-worthiness ratings (see Jorion (2007) and Hoggarth et al. (2005)). But to assess risk, and especially systemic risk (i.e. involving externalities), on a bank-by-bank basis and to conclude that the system is safe so long as each individual institution appears to be safe is to overlook important aspects of systemic risk. Banks can behave in systemically risky ways even though they appear to be sound from a micro-prudential perspective (see Brunnermeier et al. (2009) and Goodhart (2008)).

Given the failure of pre-2008 stress-testing models and the prevailing regulatory framework, coupled with the criticism levelled at the post-crisis regulatory community's response, it is important that we understand how and why the 2008 crisis was so unexpected and if there are lessons that can be learned to help shape future policy initiatives (see Flannery (2009), Haldane (2010), Goodhart (2008), Brunnermeier et al. (2009) and Duttweiler (2010)).

The purpose of this paper is to re-examine the determinants of systemic banking crises in the wake of the GFC placing a particular emphasis on identifying those sectoral factors most closely associated with such crises. These are more amenable to regulatory-control than their

macroeconomic counterparts which, by now, are well-established in the literature (see Diamond and Dybvig (1983), Demirgüç-Kunt and Detragiache (1998, 2002), Demirgüç-Kunt et al. (2006) and Eichler and Sobański (2012)).

In so doing we extend the work of Barrell et al. (2010) to include not just OECD countries but focusing specifically upon systemic banking crises as per the most up-to-date database available (see Laeven and Valencia (2013)).[1] Our primary objective is to identify and establish the most important bank balance-sheet-based (i.e. sectoral) variables which are most closely associated with systemic banking crises. We make use of other recently-available bank-related databases for this purpose (see Cihák et al. (2013) and Barth et al. (2013)). However before we can establish whether or not these sectoral variables are comparable with their macroeconomic counterparts we are obliged to first replicate the work of Demirgüç-Kunt and Detragiache (1998, 2002) and then to extend their analysis to a period that includes the 2008 GFC.

By so doing we are able to empirically test and report on the following questions: 1) whether or not the previously-established macroeconomic determinants retain their significance over a longer period (30 years) than has been examined to-date, 2) whether established systemic-crisis determinants are sensitive to the business cycle or whether they hold generally in the long-run, 3) which sectoral variables are most informative in terms of helping to predict systemic crises and 4) how sectoral variables compare with macroeconomic variables in terms of in-sample crisis prediction? Our results should provide guidance towards the recalibration of stress-tests and other early-warning systems as the lessons of the GFC continue to be absorbed.[2] We find that previously-established macroeconomic crisis determinants, such as the level of real-interest rates,

[1] In their paper the authors include systemic as well as non systemic crises in their logit model's dependent variable

[2] Throughout the paper a reference to a crisis or bank crisis is intended to mean a *systemic* bank crisis. The shorter form is used for readability purposes. The definition of what constitutes a systemic bank crisis is described in the literature review of Chapter 2 (see section 2.2).

lose explanatory power in the long run and that inflation loses its significance entirely. Whereas in the short run (i.e. over a 14 year period spanning the GFC) macroeconomic factors remain significant, in models where they are augmented / replaced by sectoral variables such models perform at least equally as well in terms of predicting in-sample crises. We demonstrate that where shorter panels are used the choice of time-span / business cycle is highly relevant. From a sectoral perspective we find the most important determinants to be: 1) levels of private credit extended to borrowers, 2) bank distance-to-default as measured by aggregate Z-score and 3) bank non-performing loan levels.

As part of global efforts geared towards avoiding any recurrence of a crisis on the scale of the GFC researchers are adopting new systemic banking risk indices. A useful leading signal of crises ought to reflect and quantify the accumulation of systemic risk over time ***prior*** to the onset of a crisis and thus could augment future stress-test models. New measures to enhance / supersede value-at-risk (VaR) have been proposed. Acharya et al. (2010) recommend Systemic Expected Shortfall, whereas Adrian and Brunnermeier (2011) favour a measured termed Delta CoVaR.[3] Our contribution lies in enabling researchers to ascertain the empirical relationship between any proposed systemic risk measure (SRM) and the sectoral crisis determinants we identify. In turn this will help establish which SRM is most appropriate for a particular country based upon the composition of that country's banking sector (see Wosser 2015a). Our final contribution is to establish what we term a "*control cluster*" of up-to-date crisis determinants which will facilitate an in-depth analysis of the effectiveness of the regulatory communities' response to the GFC (see Wosser 2015b).

[3] Systemic Expected Shortfall attempts to estimate the degree to which banks may be undercapitalised during crises periods. Delta-CoVaR measures the value-at-risk distributional shift that occurs within the returns of the financial sector as a whole conditional upon institution "i" meeting or exceeding its individual 1% value at risk.

This paper proceeds as follows. In Section 2 we present a review of the econometric methodology, with our data described in section 3. Detailed results are provided in section 4. An outline of the robustness checks carried out is provided in section 5 with section 6 concluding.

2. Methodology

To test whether a regulatory measure represents a systemic banking crisis determinant we use a pooled logit model (see Demirgüç-Kunt and Detragiache (1998), Beck et al. (2006) and Von Hagen and Ho (2007)). Here the dependent variable P(i,t) is a dummy variable that has a value of "1" if country "i" experiences a systemic banking crisis in year "t" and "0" otherwise. The coefficients are determined by maximising the following log likelihood function:

$$\text{Argmax}(\beta): \quad LnL = \sum_{t=1}^{T} \sum_{i=1}^{N} \mathrm{P}(i,t) \ln[F(X_{i,t}\beta')] + [1 - P(i,t)] \ln[1 - F(X_{i,t}\beta')] \; . \qquad \textbf{(1.1)}$$

Here $\mathbf{X_{i,t}}$ represents a vector of explanatory variables (which can be either macroeconomic factors or Balance sheet metrics), β is a vector of K unknown coefficients and $F(\mathbf{X_{i,t}}\beta)$ is the cumulative probability distribution function evaluated at $\mathbf{X_{i,t}}\beta$. In this model F is logistic and is evaluated as $\frac{e^{X_{i,t}\beta}}{1+e^{X_{i,t}\beta}}$.

T represents the number of years covered by the panel and N the number of countries. The use of the logit model is widespread and remains preferred whenever country panels form the basis of the crisis-determinants analysis (see Davis and Karim (2008)). The sign of coefficient β_i illustrates whether a variable contributes positively or negatively to the odds of a systemic crisis and the p-value for each β_i indicates whether or not the corresponding factor is statistically significant at1%, 5% and 10% levels. Each regression is estimated with cluster-controlled standard errors. Fixed-effects regressions are not utilised because they force the removal of non-changing data (by country) from the analysis. Therefore a country would have to be excluded if it didn't experience a crisis, restriction which results in the loss of significant amounts of relevant

data. As per Demirgüç-Kunt and Detragiache (1998), once a country has experienced its first systemic crisis all subsequent panel rows relating to that country are excluded from our regressions. Doing so mitigates a modelling criticism that dependent variable and explanatory variables become jointly-determined (endogenous) once a systemic crisis has emerged.

3. Data

To undertake our analysis we use two separate but related panels. Panel A aims to replicate, by country / year composition, the original panel formulated by Demirgüç-Kunt and Detragiache (1998) which covered the period 1980-1994. However Panel A also includes data up to 2010 as required for our analysis. We have tweaked the composition of Panel A slightly compared with Demirgüç-Kunt and Detragiache's (1998) panel. Whereas Chile, Peru and Turkey formed part of the 1998 panel those countries were not included in any of the regressions we replicate.[4]Consequently, these countries are omitted from Panel A. Furthermore, in 1996, Zaire disintegrated politically and was reconstituted as the Democratic Republic of Congo. However this event resulted in several data anomalies which cannot be reconciled back to the original data for Zaire, therefore the Democratic Republic of Congo is also omitted.[5] The countries are listed in alphabetical order with mean, min and max values per country for the key macroeconomic variables of interest. These include GDP growth-rate, real-interest rate, inflation, M2 money to foreign exchange reserves ratio and private-credit-to-GDP ratio. A sectoral variable, i.e. private-credit-growth-rate is also included as it formed part of Demirgüç-Kunt and Detragiache's (1998) analysis.

[4] These are regressions 1) to 3) of Demirgüç-Kunt and Detragiache (1998) Table 2. Sectoral data for these countries could not be adequately sourced for the sample period we investigate.

[5] We included this country as part of our robustness checks and noted that its inclusion does not materially impact our key findings.

We present summary data for Panel A in Table 1 below. Column 2 depicts the systemic crisis episodes by country and year as originally defined by Demirgüç-Kunt and Detragiache (1998). This data, based upon an earlier survey conducted by Caprio and Klingebiel (1996), underpins their logit model's dependent variable and we re-constitute it for result replication purposes. However their definition of what constitutes a *systemic* banking crisis has been criticised for being somewhat subjective (see Eichler and Sobański (2012)). Instead, we utilise a comprehensive systemic financial crisis database (see Laeven and Valencia (2013)), made available under the auspices of the IMF. This establishes precisely when systemic crisis episodes occurred in country / year pairings based upon detailed specific criteria. Thus, a systemic banking crisis is defined more objectively as an event meeting only two conditions; 1) there are significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations) and 2) significant banking policy intervention measures in response to significant losses in the banking system are evident.

Both of these conditions are objective rather than subjective, therefore the dataset represents a benchmark for future research employing pooled logit techniques where the dependent variable is driven by consistent globally-applicable criteria. We detail the systemic crisis episodes as per Laeven and Valencia's (2013) database in column 3. Having replicated the Demirgüç-Kunt and Detragiache (1998) results we rely exclusively upon this column for all subsequent Panel A analysis. The summary statistics show that up to 29 systemic crisis episodes were identified in 1998, whereas Laeven and Valencia (2013) now identify 57 crises over the extended 1980-2010 period. The overall summary statistics relate to the full 1980-2010 time frame. All countries experience positive GDP growth of 3.5% on average with average inflation of 10.5%. M2-money-to-foreign-exchange-reserves is used to assess the potential exposure of countries to sudden capital outflows (see Calvo (1998) and Bruno and Shin (2013)). Over our sample this averages at 60 times foreign reserves. Private-credit-to-GDP ratio has an average of 54%,

however average credit growth of 9.5% is reported over this period, representing almost 3 times the corresponding GDP growth-rate. This increase in leverage is considered by many to be one of the major sources of systemic risk, especially when it outstrips the GDP growth rate over the same period (see Brunnermeier et al. (2009)). We also note that average inflation-adjusted interest rates are a modest 1.98%, this being a signal that high rates are unlikely to feature as crisis determinants in our study. However there is considerable variation across the countries making up our sample and the standard deviation of inflation is just under 9%. Overall, Panel A comprises 61 countries with up to 1830 observations depending upon the particular regression specification.

In terms of the key variables outlined in Table 1 we focus upon those which, if subjected to a large shock, are theorised to adversely impact bank asset values.[6] Demirgüç-Kunt and Detragiache (1998) believe these to be inextricably linked to GDP growth-rate disturbances, the consequences of which are assumed to be: 1) lack of investor confidence, 2) downturn in the business cycle leading to reduced investment activity, 3) higher unemployment levels and 4) increasing inability of borrowers to meet repayment obligations. As asset values decline investors are less inclined to meet payment obligations, therefore non-performing loan levels rise. Because banks often rely upon inter-bank deposits as a primary source of funding an unexpected increase in real-interest rates reduces the repayment capacity of borrowers and increases bank operating costs via higher weighted-average cost of capital. Rates shocks can also make private-sector investment projects more difficult to justify via increased hurdle rates. The overall impact entails reduced asset values (mark-to-market accounting requires that revenue streams be reappraised

[6] Under fair value accounting rule 157 (FAS 157) banks must mark asset values to market, therefore any asset valuation disturbances must immediately be reflected in their balance sheets. Brunnermeier et al. (2009) recommend a relaxation / suspension of FAS 157 to help prevent short-term liquidity issues spiralling into asset valuation / insolvency crises.

using higher discount factors), increased loan default rates and lower or non-existent bank profits.

According to Fisher (1930) interest rates and inflation are indelibly linked, therefore inflationary measures are included as part of the analysis. M2 money to foreign exchange reserves level is included because it is a proxy variable for banks' exposure to unexpected capital outflows following an unexpected devaluation of the local currency. In turn, capital flows have been shown to be associated with past financial crises, where large outflows have been observed during periods when bank credit-worthiness issues emerged (see Calvo (1998), Lane and McQuade (2014) and Bruno and Shin (2013)). As short-term inter-bank funding weakens and/or becomes more expensive banks may be forced to de-leverage their balance sheets by selling off assets, often all of them acting in unison. Thus funding-liquidity shortages may drive asset de-leveraging spirals to such an extent that asset values fall (sometimes temporarily) below liabilities and banks become insolvent (see Brunnermeier et al. (2009)).

Private-credit-to-GDP and private-credit-growth-rates feature because, during business cycle upswings, the level of private credit in an economy drives bank revenues and, in turn, earnings. Private credit levels reflect current asset valuations and investment appetite. They also help fuel asset "bubbles". Theory suggests that where economies become increasingly leveraged relative to GDP, systemic risk is increasing.

Other factors included in Panel A but which demonstrate weak crisis explanatory power are outlined for the sake of completeness and because they form part of our efforts to replicate (and extend) the results of Demirgüç-Kunt and Detragiache (1998). Bank profitability can be adversely affected whenever there is an unexpected mismatch between expected return-on-assets and cost of capital. If banks raise finance in a foreign currency but lend predominantly locally, then an unexpected depreciation of a country's currency reduces the value of any assets held in the local currency whilst increasing debt service costs. Therefore a measure of currency

depreciation is considered. A deposit-insurance dummy variable, taking the value of "1" if the deposits of a country's banking system are insured and "0" otherwise, is included to test Diamond and Dybvig's (1983) theory that bank runs constitute a primary source of systemic risk. Budgetary-surplus-to-GDP ratios are included because theory suggests that stable economies, where inflation levels remain under control and where borrower credit-worthiness concerns are moderate, are less likely to experience systemic banking shocks. Finally terms-of-trade-deterioration is included as a result of its pre-1998 significance in earlier papers (see Caprio and Klingebiel (1996) and Gorton (1988)).[7]

Our second panel, Panel B, is similar in certain respects to the first in that many of the countries from Panel A are retained, along with Panel A's most significant explanatory variables. The purpose of maintaining a second panel is to enable higher levels of scrutiny regarding the role played by (recently-available) sectoral variables as systemic crisis determinants (see Cihák et al.(2013) and Laeven and Valencia (2013)).

However, in contrast with Panel A, those variables with poorly-demonstrated explanatory power are omitted, as are countries with sparsely-reported sectoral data. New countries are added in line with geo-political developments such as the collapse of the Soviet Bloc. Panel B is shallower than Panel A in that it only spans the period 1998-2011. This is necessary because of a shortage of generally available bank-sector data, including important variables such as Tier-1 capital ratios, Bank Z-scores (i.e. distance-to-default) and risk-weighted assets prior to 1998 (this being the year they were introduced as part of the amended Basel I accord, Basel II). The capital-to-asset ratio (CAR, sometimes called leverage ratio) is included because of its regulatory importance. It reflects the level of bank credit extended per unit of capital held.

[7] See Appendices for a list and description of the variables used in this paper

Theory reflects how sectoral shocks impact bank non-performing loan levels (NPL). If NPL increases banks may often experience large trading losses, which in turn must be absorbed by bank capital or reserves. If losses become so severe that capital is fully depleted then the bank is insolvent and must be "resolved", a euphemistic term that can have several meanings such as "wound up", "nationalised", "re-capitalised" or some combination of the three. A bank's Z-score is a measure of distance-to-default.[8] The higher the Z-score the further the distance-to-default becomes, therefore we anticipate a significantly negative coefficient reported in our regressions.

Notable by its absence in many of the studies described earlier is an examination of liquidity from a systemic risk perspective. Demirgüç-Kunt and Detragiache (1998) include a liquidity measure in their regressions, this being the ratio of liquid bank assets to total assets, but this ratio is shown to be insignificant from a crisis perspective. We therefore consider two alternative liquidity measures, both of which include bank deposits based on the following rationale. The bank credit-to-deposit ratio (a.k.a. loans-to-deposits) is one such measure and is also an alternative (to CAR) leverage measure. Similar to the credit-to-GDP ratio described above, the greater the leverage the higher the risk-exposure to sharp asset-value reductions and the greater the dependency upon debt (or Repos see Duffie (2010)) as a finance instrument. In recent years, as central banks have strived to maintain low inflation and interest rates (see Table 1 summary information), debt financing has become more expensive than deposit financing, even taking debt tax shields into account, therefore higher leverage is associated with higher risk exposure. However, in circumstances where there is a tightening of liquidity and/or concerns over bank credit-worthiness, mark-to-market accounting rules and higher margin-posting requirements can cause liquidity shocks to eventually worsen to such an extent that inter-bank activity disappears

[8] Calculated as $(ROA_{i,t} + CAR_{i,t})$ / StDev(ROA) where ROA is return on assets and CAR is the capital-to-assets ratio for country "i" in year "t".

entirely, i.e. the "credit crunch" phenomenon now synonymous with the GFC. Likewise, the deposits-to-total-assets ratio is another liquidity measure, but one which includes non-loan-related assets in the denominator. Examples of this class of assets are Government bonds, subsidiary holdings and ownership positions taken in other firms or ventures. In theory this ratio's asset base represents more highly-diversified assets, thereby lowering the overall risk profile of banks.

Tier-1 capital is high-quality (unencumbered capital plus highly liquid reserves) capital as a proportion of risk-weighted assets. Its purpose is to absorb unexpected bank losses and to shield depositors and their insurance underwriters (usually the sovereign) from large shocks. Regulatory authorities place great emphasis on monitoring minimum standards for this measure and have ratcheted up minimum Tier-1 capital levels over the years. Opinion is divided on this microprudential measure. Regulatory authorities such as the Basel Committee for Banking Supervision (BCBS) believe higher Tier-1 capital helps to stabilise banking systems (see Wellink (2009) and Bank for International Settlements (2011a)). Others believe that by increasing minimum capital levels, meeting return-on-equity (ROE) analyst expectations requires a corresponding increase in earnings, causing bank managers to adopt more risky loan and investment portfolios (see Brunnermeier et al. (2009) and Wosser (2015b)). Net-interest-margins are included as they are proxy variables for earnings generally whilst simultaneously capturing an aspect of interest rate risk. The sample average of 4%, coupled with a small standard deviation of 2.5% illustrates how difficult it is for banks to generate large earnings from their traditional lending activities, especially in the context of low GDP growth levels (see Table 1 summary).

We also examine other sectoral variables not summarised in Table 2. Bank deposits-to-GDP ratios are included as a (wealth-controlled) liquidity measure which also acts as a proxy variable for investment activity. Bank concentration is included because the literature has, on occasion,

shown this variable to be significant, although opinion is divided about the sign of the regression coefficient. Beck et al. (2006) first theorise (and subsequently demonstrate) that low concentration is associated with crises (i.e. a negative coefficient) on the basis that higher asset concentration will result in monopoly-like profits being enjoyed by the main sectoral participants and therefore more highly-concentrated banking sectors ought to demonstrate relatively greater stability. By contrast, Schaeck et al. (2009) find that more competitive banking sectors are less likely to experience a systemic crisis (see also Allen and Gale (2003)).

We also analyse the proportion of lending activity in an economy undertaken by non-resident banks. This variable is an alternative capital-flow disturbance proxy variable. We anticipate non-resident banks as being more likely to wind up their operations during cyclical or shock-related downturns than local banks would be, therefore we anticipate a positive regression coefficient. Finally, a house price index is included because financial crises often develop in the wake of real-estate "bubbles" where property has become overvalued and borrowers over-extended. According to Minsky (1986) there is a "euphoric" phase inherent in such bubbles where caution is thrown to the wind and long-standing bank lending rules are either relaxed or ignored. All Panel B variables are described in detail in Appendix 2, including their source dataset.

4. Results

Table 3 highlights the results achieved via the first set of regressions using Panel A. The sample size is comparable to the original 1998 sample (656 in our initial regression compared with 546 in the corresponding original) and the number of crisis episodes identical (i.e. 28). The finding that low GDP growth-rates are significantly associated with systemic bank crises is reconfirmed. The importance of real-interest rate levels to the well-being of banks is also validated in that high real-interest rates are significantly associated with bank crises. We also successfully replicate their finding that the presence of explicit deposit-insurance is associated with sectoral instability. A

degree of support is found for the view that high levels of the private-credit-to-GDP ratio has sectoral stability implications in that the coefficient is reported as statistically significant at the 5% level in one out of two regressions. Also reconfirmed are the findings that depreciation of a country's currency, its budget-deficit-to-GDP and lagged credit-growth rates do not appear to be significant crisis determinants.

Where Table 3 differs markedly from the original paper is in relation to inflation and reversals of capital flows. Demirgüç-Kunt and Detragiache (1998) find that high inflation is positively associated with systemic banking crises at a 1% level of significance, a result which we do not confirm. Similar outcomes for reversals of capital flow (M2-to-foreign-exchange-reserves) and deteriorating terms-of-trade are observed. In neither case do we find these variables to be significant, at least as far as our Panel A analysis is concerned. The terms-of-trade finding is likely to have been influenced by our inflation result, and the others we ascribe to data replication differences. To compare model-fit the Akaike Information Criterion, or AIC scores, are considered. The AIC score is a commonly-used goodness-of-fit measure for logistic regressions. Those reported in Table 3 are similar to the original paper. The lower the AIC score the better the model-fit. In 1998 the AIC scores ranged from 204 to 131 (see Demirgüç-Kunt and Detragiache (1998) and Table 2), whereas Table 3 reports AIC scores in the range 196 to 101, representing a moderate model-fit improvement.

Demirgüç-Kunt and Detragiache (1998) describe their method for predicting in-sample crises as follows: A sample threshold crisis probability is established, this being the ratio of crises to total observations (approx. 5%). For each regression the corresponding predicted crisis probabilities are determined.[9] If the predicted probability exceeds the sample threshold probability the model is assumed to "*predict*" a crisis. As a result, correct as well as incorrect predictions can be

[9] We make use of the Stata analytical package for this purpose. Predictions are made via the "*Predict*" command.

quantified. A good model should predict a high proportion of actual in-sample crises without over-predicting them.[10] They should do so by also simultaneously correctly predicting a high proportion of no-crisis outcomes.

As far as comparative crisis-prediction outcomes are concerned our results are mixed. The original 1998-reported total correct predictions (i.e. correct crisis as well as correct no-crisis predictions) are marginally higher than we achieve (reported as 74%, 77% and 79% accuracy rates compared with our corresponding rates of 66%, 46% and 47%). One explanation for this difference could be the significant inflation and capital flow coefficients as are reported in 1998, but which we do not reproduce. However, in terms of correctly predicting actual sample crises, some improvement is achieved. We correctly predict crises 68%, 70% and 81% of the time depending upon the specification. These compare favourably with the original paper's 61%, 58% and 55% crisis-accuracy levels. As far as our overall replication efforts are concerned Table 3 reports outcomes broadly compatible with Demirgüç-Kunt and Detragiache's (1998) findings. Where differences exist, these are invariably resolved via subsequent analysis.

Table 4 illustrates the results obtained by extending Panel A's coverage to 2010. Identical explanatory variables to Table 3 are again assessed, this time with the dependent variable determined by Laeven and Valencia's (2013) dataset. Several interesting results now emerge. Low GDP growth, though still significant at the 10% level, is not as significant as heretofore. A

similar result is apparent in terms of the real-interest rate which was reported as being significant at up to the 1% level in Table 3 but is only significant in one out of three regressions in Table 4. Deposit-insurance remains significant at the 5% level. In regression three, controlling for the

[10] This is characterised as the model consistently returning predicted crisis probabilities that are higher than the threshold probability coupled with low no-crisis prediction accuracy.

presence of deposit-insurance, we now find support for the significance of capital flow reversals, private-credit-to-GDP and real-GDP-per-capita as systemic crisis determinants (see Lane and McQuade (2014), Calvo (1998) and Bruno and Shin (2013) regarding capital flows and Beck et al. (2006) regarding deposit-insurance). Overall, these results are very similar to Demirgüç-Kunt and Detragiache's (1998) findings, albeit being driven by an alternative dependent variable. However, as the summary section of Table 4 demonstrates, when measured over a thirty year time span these variables lose efficacy as *predictors* of in-sample crisis events compared with their predictive power over the shorter 1980-1994 period.

Overall, how are we to interpret these results? It is possible that the factors most closely associated with systemic banking crises have changed relative to the period 1980-1994. Fiscal policy, e.g. achieving low EU inflation, might partially explain the loss of real-interest rate significance. It is also possible that bank operational diversification plays a role. We know banks compete with each other in terms of return-on-equity (ROE), this being a key performance indicator assessed by investors and analysts. However, with more stringent capital-adequacy requirements demanding banks hold more capital, achieving ROE growth is rendered increasingly difficult. Higher returns must be generated just to maintain ROE levels at historical levels in circumstances where minimum equity levels are ratcheted upwards by regulators. Yet Table 1 shows real-interest rates in leading economies such as the USA, the UK and Germany averaged at less than 3%, thus applying pressure on bank earnings derived via net-interest-margin (NIM) channels. Banks responded by diversifying their business activities so as to focus less upon NIM returns but more on complex securities-trading activities. The search for higher (or at the very least maintenance of) ROE requires asset and leverage growth, thus changing the risk profile of banks (see Brunnermeier et al. (2009) and Chapter 3).

Our view is that the business-cycle phase plays a fundamental determinants-establishing role in pooled logit models, especially whenever panels are shallow and do not span a full cycle. We provide evidence for this via Table 5. Here our sample is broken into three time-frames (termed triads), 1980-1990, 1991-2000 and 2001-2010.[11] First we consider regressions 1) to 3) wherein all country observations are discounted after the first recorded systemic crisis, as per the usual approach. The significant Table 4 variables are re-assessed over each discrete triad with the results showing the choice of time-frame to be highly relevant. For example GDP growth-rates are not significant in the period 1980-1999 but are significant during the subsequent twenty years. By contrast real-interest rates behave in the opposite way, being initially significant but then demonstrating little crisis-likelihood relevance in later years. We see similar variation in all of our key explanatory variables. Note also that this is not a consequence of having our sample observations concentrated in the first triad, as regressions 4) to 6) demonstrate. Here we have retained *all* observations and do not discard those subsequent to the first recorded crisis per country. Naturally this results in greatly increased crisis counts. However, once again we see the same patterns of coefficient variation as was observed in regressions 1) to 3). Regressions 4) to 6) also show that explanatory variable endogeneity concerns post-crisis-onset are immaterial to the primary results because, with the sole exception of the terms-of-trade variable in regression 6), we observe the same significant variables as before and with the same coefficient sign in all other cases.

Whatever the underlying reasons might be, Tables 4 and 5 indicate that macroeconomic variables lose efficacy as systemic banking crisis determinants measured over the medium to long-term and also that the choice of time-frame is fundamental in terms of results reported. In line with

[11] Note that because all entries for a country subsequent to the first observed systemic crisis are removed from the panel there are considerably more observations covering the earlier years of the overall panel than there are for the latter years. However this approach is necessary due to crisis-onset endogeneity concerns as described above.

our introductory motivation we next consider whether the replacement of potentially redundant macroeconomic variables with financial-services sector alternatives might offset some of this loss of explanatory power. With this in mind such variables as terms-of-trade, currency depreciation, inflation and fiscal deficit are no longer considered, primarily because they demonstrate either weak or else inconsistent systemic crisis explanatory power. They are replaced with sectoral variables not yet considered and include the capital-to-asset ratio (CAR) and a house price index.

The results are presented in Table 6 and should be contrasted with those of Tables 3 and 4. As before the GDP growth rate, private-credit-to-GDP rate, real-interest rate and exposure to capital flow reversals remain among the most significant variables. However neither the leverage ratio nor the deposit-insurance variable is significant. Real-estate price increases are significantly negatively associated with crises, contrary to expectations. This may illustrate that real-estate price growth is more reflective of the benefits of increased economic activity rather than as a signal of possible property bubbles and/or troubled banking sectors.

The regressions represent a better fit to our data than those of Table 4 with their redundant macroeconomic factors. The AIC scores are significantly lower, so that the improvement in terms of total correct crisis (as well as no-crisis) predictions is not surprising. These range from 73% to 81% in terms of overall correct predictions, representing a marked improvement upon the 38% to 55% achieved in Table 4. We conclude that more appropriately constituted samples, combining macroeconomic and sectoral variables, are better suited for predicting in-

sample crises. However our findings need to be set in a proper context. The number of observations and crisis episodes in Table 6 is significantly smaller than in Table 4 due to the dearth of capital-to-asset adequacy ratio and house price index data. This motivates the creation of our second panel, i.e. Panel B, and so we now turn to analysing sectoral data in more detail.

The data comprising Panel B data has been extracted (almost) exclusively from bank Balance sheets, enabling us to analyse sectoral-centric models in the absence of any macroeconomic controls. In turn we contrast the performance of such sector-centric models with their macroeconomic-centric counterparts, over the period 1998-2011. Several new explanatory variables are introduced, the rationale for which was described in section 4 above.

The results are presented in Table 7. Bank Z-score is significantly negative in all regressions as expected, highlighting the importance of earnings and capital / reserves to bank stability. Private-credit-to-GDP rates are also significant, showing that the level of indebtedness of a country relative to its income contributes strongly to the likelihood of a systemic banking crisis. The bank-credit-to-deposit ratio also takes on the expected sign, i.e. the more multiples of deposit units invested the higher the risk exposure of banks, however this is only significant at the 5% level in one out of five regressions. This result, coupled with the more-significant non-performing-loan coefficient, exposes the importance of loan quality from a systemic stability perspective.

Neither the deposits-to-total-assets variable nor the net-interest-margin is significant. So far all of our asset-dependent ratios, including the capital-to-assets ratio of Table 4, have invariably been reported as insignificant from a systemic crisis perspective. This is surprising, given our knowledge of the GFC being associated with a downwards liquidity spiral which in turn reflected institutional investors'/depositors' concerns over rapidly-declining asset values and associated

credit risk increases (see Brunnermeier (2008)). The GFC patently demonstrates the extent to which banks were exposed to a large asset-valuation shock, however if those assets are not comprehensively reported on bank Balance sheets the fact that the GFC was not signalled well in advance is perhaps not so surprising after all. Our findings show the importance of maintaining all assets "on" rather than "off" Balance sheet, or at least that all assets must be subjected to the same degree of regulatory control and are not germane only to the "on" Balance sheet items. Our concern is reinforced when one considers that one of the most important macro-prudential measures, i.e. Tier-1 Capital, has risk-weighted assets as its denominator yet this measure also does not show up as being a significant systemic crisis determinant (see Chapter 2).

Whereas Table 6 demonstrates how sudden capital flow reversals may be associated with bank instability, this result is not driven by the departure of non-resident banks in troubled times, as the Table 7 coefficient for non-resident-bank-loans-to-GDP variable illustrates. Bruno and Shin (2013) argue that it was a capital flow disturbance, resulting from a lending maturity mismatch where banks borrowed internationally but lent domestically, which was a major GFC contributory factor. Our result provides further evidence of that. We also note that bank concentration is not significant in any sectoral-centric regression, contrary to Beck et al.'s (2006) findings which are based primarily on macroeconomic variables (see also Eichler and Sobański (2012)). The model-fit results reported in Table 7 should be contrasted with those reported in Table 3. The AIC score is lower in regression 3 of Table 3 but higher in regressions 1 and 2 than any AIC score reported in Table 7. We conclude that sectoral variables fit the data at least as well as their macroeconomic counterparts. The corresponding p-values, highlighting the joint significance of all variables in our Table 7 regressions also support this contention.

As far as in-sample predictive power is concerned the results are mixed. In Table 7 the total correct prediction rate ranges from 37%-63% whereas in Table 3 the range is 46%-67%. Accurate crisis predictions range from 80%-89% versus 68%-81% in Table 3, representing a significant improvement. This is offset by the relative deterioration of correct no-crisis predictions, especially when we control for non-performing loans and non-resident-loans-to-total-loans, where Table 3 performs considerably better. One might argue that logit regressions involving exclusively Balance sheet data over-predict crises, however one could also argue that the higher crisis likelihoods reported using sectoral-centric variables represent a better alignment between systemic banking crises and their underlying sectoral variables than is the case when macroeconomic variables are employed.

Our final objective is to develop a cluster of control variables for use in future research and for assessing the appropriateness of different systemic risk index measures currently under development (see Acharya et al. (2010) and Adrian and Brunnermeier (2011)). We present these results in Table 8. The first specification contains only sectoral variables, all of which are significant, including Bank Z-Score, bank-credit-to-deposit ratio, non-performing loan levels and net-interest-margins. These four factors jointly capture several aspects of systemic bank risk exposure. The second column details those traditional macroeconomic factors invariably reported in the literature as systemic crisis determinants. These include GDP growth-rate, real-interest rate and inflation. As before, when considered in isolation, all the coefficients are significant.

Combining both sets of variables, as per regression 3), we find that Bank Z-Score is the only variable to lose its significance. The higher log likelihood and lower AIC scores of regressions 1 and 3, relative to regression 2, illustrate that sectoral variables represent a better data fit than do macroeconomic-centric models. They are also relatively more successful at predicting crises

although this is at the expense of predicting crises in years when none in fact were recorded. As always regulatory authorities must weigh the cost associated with overlooking a crisis versus the cost of taking remedial action when none in fact is warranted.

5. Robustness Checks

The results relating to the various pooled logit regressions are presented in Tables 3 thru 8, with detailed Panel A and B descriptions described in the appendices. We present alternatives to pooled logit specifications in Table 9 for comparison purposes. Whereas pooled logit has been the most common method used to identify determinants in the past the technique has been criticised for its inherent assumption that all countries have the same relationship between systemic crises and the vector of explanatory variables over the panel's time-period. A fixed-effects (FE) model (see Table 9 regression 2) can be adopted to capture inter-country differences via the intercept coefficient (the regression constant). However the use of fixed-effects estimation vis-à-vis systemic crisis determinants is not preferred because no time-invariant factors can be included. Therefore countries without any crisis during our sample period must be omitted due to model collinearity between the dependent variable (all zeroes for a non-crisis country) and the dummy variable identifying the country (all ones for that country). This restriction results in greatly reduced sample sizes (from 387 to 154) and leaves the analysis absent any non-crisis country controls, which is also not preferred. Interestingly the fixed effects specification identifies the same determinants with the same signs as the pooled logit specification, thus increasing our confidence in the pooled logit alternative. We conclude that little is gained as a result of adopting fixed effects specifications which have the considerable disadvantages of yielding reduced sample sizes as well resulting in over-predicting models (the FE specification only correctly anticipates 1% of non-crisis outcomes). Another alternative is to use a random-effects (RE) specification (see Table 9 regression 3), whereby an assumption is

made that the individual specific differences across countries are not correlated with the explanatory variables. This overcomes the difficulty of greatly reduced sample sizes but it is a strong assumption to make. We see that the random-effects estimates are essentially identical to their pooled counterparts, increasing confidence in the earlier estimates, i.e. those achieved without having to make the strong assumption described.

Using a software enhancement (see Conniffe and O'Neill (2009)) we re-estimate the models whereby missing values are inferred from the distribution parameters of the available data. Doing so does not materially alter the primary results thus reducing any concerns that missing values, as are occasionally reported in Table 2, may be yielding inaccurate outcomes. A final robustness check involves the removal of crisis episodes via the elimination of countries from the panel. The purpose of this check is to ensure that our results are not driven by factors peculiar to any individual country. Starting with regression 5 of Table 7 as the benchmark, the data for the United Kingdom, United States, Germany, Sweden and Russia are removed one at a time (non-cumulatively) and the model re-estimated each time. Every country removed will have experienced at least one systemic crisis. The results are reported in Table 10. It can be seen that in all cases the most significant variables retain their sign and significance, with only small differences reported in coefficient estimates, statistical significance and crisis prediction statistics.

6. Conclusions

This paper utilises several newly-released data sources and examines the determinants of systemic banking crises in circumstances where the explanatory data has been drawn primarily from financial-services (aggregate bank Balance sheet) datasets over a time-frame that spans the Global Financial Crisis. The results are compared and contrasted with those attained in earlier papers where explanatory variables are drawn principally from well-known sources such as the MF / World Bank. Having replicated the results of the first paper to examine systemic bank

crisis determinants (see Demirgüç-Kunt and Detragiache (1998)) we go on to show how these determinants behave when considered over a full business cycle. Tables 3, 4 and 5 show that whereas macroeconomic variables perform well as crisis determinants over a short period (up to 15 years) they lose explanatory power when measured over a longer time span (30 years). If only shallow panels are available, researchers must take the current business cycle phase into account when reporting results (see Table 5).

We show that short-run models encompassing such sectoral variables as leverage ratio, deposit-insurance and real-estate prices perform at least equally as well in terms of crisis-prediction as their earlier macroeconomic-centric counterparts. In fact we show that models containing explanatory variables drawn exclusively from bank Balance sheet data (see Table 7) over the period 1998-2011 are equally as informative as were macroeconomic variables in terms of explaining systemic crises over the period 1980-1994. However several important sectoral variables such as Bank Z-scores and non-performing loan levels are not generally available pre-1998, therefore a long-run comparison of macroeconomic versus sectoral models must wait until deeper sectoral panels become available. Nevertheless, given the importance of asset-values to each of these measures it is important that all bank assets (i.e. "off" as well as "on" balance sheet) should be subject to regulatory control.

Finally, we present a control cluster of key sectoral and macroeconomic variables which may be used in future systemic banking crisis research, particularly in matters of bank stress-testing, systemic risk model calibration and in the assessment of regulatory effectiveness.

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TABLE 1

	Demirgüç-Kunt & Detragiache (1998)	Laeven & Valencia (2013)	Deposit Insurance	GDP Growth Rate			Real Interest Rate			Inflation			M2 Money to Forex Reserves			Private Credit to GDP Ratio			Private Credit Growth Rate		
Country	Crisis Year(s)	Crisis Year(s)		Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max
Australia	-	-	-	3.32	-1.06	6.28	3.70	-0.95	10.23	4.72	0.36	12.09	19.64	7.71	51.94	65.59	24.36	123.97	12.40	0.00	37.81
Austria	-	2008-2010	1980	2.24	-3.81	5.46	2.66	-0.57	5.69	2.48	0.01	6.63	62.13	25.86	107.72	92.50	64.24	123.83	3.07	-100.00	10.92
Bahrain	-	-	1993	5.17	-2.75	12.88	2.03	-10.27	24.58	2.23	-17.38	14.35	3.09	0.78	5.36	53.38	28.05	133.37	-38.15	-1344.63	261.32
Belgium	-	2008-2010	1980	2.74	-2.75	27.18	4.02	-1.71	19.33	2.32	-16.61	7.57	55.01	42.92	68.21	58.95	25.78	136.85	5.75	-100.00	118.67
Burundi	-	1994-1998	-	2.16	-8.61	10.91	-1.32	-52.07	17.47	11.07	-6.17	59.99	3.49	0.99	13.10	14.86	6.57	28.68	17.48	-18.84	84.35
Canada	-	-	1980	2.58	-2.86	5.81	1.45	-2.24	5.16	3.47	-1.95	10.78	53.17	18.25	146.26	104.62	66.29	182.58	6.96	-100.00	81.52
Colombia	1982-1985	1982, 1998-2000	1986	3.51	-4.20	6.90	1.83	-0.46	2.39	18.48	3.41	52.34	3.61	1.86	9.15	28.12	20.86	40.39	16.19	-100.00	99.29
Congo, Rep.	-	1992-1994	2007	4.38	-6.88	23.57	3.90	-39.46	40.19	8.02	-29.19	46.46	2129.73	0.55	62234.97	11.46	2.04	31.72	-21.29	-1078.22	196.44
Cyprus	-	-	2000	4.73	-1.86	9.92	0.67	-6.29	3.75	4.96	0.09	13.99	10.21	4.42	18.84	149.74	59.98	272.92	15.18	0.00	59.31
Denmark	-	2008-2010	1988	1.56	-5.67	5.53	4.12	-3.44	10.83	3.90	0.66	11.78	7.70	3.79	12.66	70.24	22.06	208.14	12.71	-6.85	164.91
Ecuador	-	1982-1986,1998-2002	-	3.10	-5.98	10.49	22.01	-11.51	87.77	4.14	-31.52	24.70	4.69	1.60	14.44	23.10	12.93	40.67	10.25	-31.87	136.87
Egypt, Arab Rep.	-	1980	-	5.47	1.11	10.01	0.18	-8.44	8.13	10.09	0.87	18.84	17.96	3.00	63.94	37.66	17.82	60.41	16.08	-7.15	51.46
El Salvador	-	1989-1990	1999	2.58	-8.67	21.26	6.89	-0.94	18.11	8.10	-1.32	37.04	4.07	1.26	6.32	5.52	2.08	10.80	8.70	-45.13	40.01
Finland	1991-1994	1991-1994	1980	2.55	-8.54	6.67	3.58	-0.31	11.81	3.86	-0.69	10.91	9.21	0.97	42.82	65.26	42.04	93.28	9.38	-8.83	24.65
France	-	2008-2010	1980	1.91	-3.05	4.75	3.08	-1.30	8.51	3.61	-1.47	11.73	80.10	54.52	105.06	90.94	72.76	111.40	3.81	-100.00	16.13
Germany	-	2008-2010	1980	2.10	-5.07	13.22	2.49	-0.55	5.79	2.06	-0.67	5.89	113.86	84.38	131.13	99.52	75.32	117.54	5.21	-1.97	15.21
Greece	-	2008-2010	1993	1.78	-4.94	5.95	0.33	-11.96	7.70	11.65	0.90	27.21	706.17	24.71	2363.45	48.14	27.14	105.92	16.56	0.00	43.04
Guatemala	-	-	1999	2.88	-3.54	6.30	1.14	-32.46	14.66	10.57	-4.08	41.46	5.36	2.40	19.98	18.44	11.25	26.38	17.57	-20.65	76.37
Guyana	1993-1995	1993	-	1.24	-11.50	8.48	-9.81	-147.42	14.44	23.00	-0.63	162.61	22.61	1.27	129.08	37.76	16.68	60.58	-23.73	-579.49	192.95
Honduras	-	-	1999	3.30	-2.13	6.57	11.37	-3.27	21.17	11.18	2.83	30.82	9.10	2.10	83.55	33.24	22.79	52.47	17.48	-14.15	123.18
India	1991-1994	1993	1980	5.69	-5.25	9.57	1.06	-15.11	9.26	8.39	3.26	24.84	15.94	3.21	115.22	28.79	21.63	44.67	16.70	0.00	29.01
Indonesia	1992-1994	1997-2001	1998	5.13	-13.13	9.88	0.63	-16.28	21.61	14.11	5.12	75.27	4.47	2.21	7.51	27.72	9.05	53.53	30.02	-56.66	313.72
Ireland	-	2008-2010	-	4.57	-5.46	11.57	2.90	-2.43	12.30	4.89	-4.64	17.44	150.88	4.28	957.64	86.76	42.83	237.15	16.60	-7.03	87.47
Israel	1983-1984	-	-	4.69	-0.18	24.00	-0.75	-167.45	158.77	46.61	-0.58	384.75	5.55	1.30	11.35	64.54	41.35	96.76	127.14	-455.54	3554.18
Italy	1990-1994	2008-2010	1987	1.70	-5.50	5.53	2.28	-8.84	9.76	6.43	0.38	21.35	23.85	0.01	72.99	65.54	47.56	115.22	9.69	0.00	20.93
Jamaica	-	1996-1998	1998	1.12	-14.08	17.09	0.14	-52.45	18.98	19.39	-3.58	86.81	9.76	3.17	34.45	22.36	13.09	30.66	21.33	-15.65	118.79
Japan	1992-1994	1997-2001	1980	2.34	-5.53	7.26	1.60	-0.22	3.99	0.42	-2.16	5.77	56.09	9.34	117.11	175.71	121.88	228.03	3.73	-13.96	13.21
Jordan	1989-1990	1989-1991	2000	5.09	-10.73	20.80	0.54	-14.41	6.62	5.43	-0.41	19.35	7.24	2.24	67.78	67.06	41.58	84.98	12.66	-12.86	49.43
Kenya	1993	1985, 1992-1994	1985	5.66	-0.80	52.55	3.65	-18.86	30.01	8.98	-27.19	41.86	9.21	3.46	84.68	29.09	25.25	34.96	16.83	-22.45	84.87
Korea, Rep.	-	1987-1988	1996	6.18	-6.85	11.10	3.38	-4.74	8.63	6.52	-1.04	23.60	6.36	2.28	13.73	67.70	38.28	104.68	16.62	0.00	42.71

TABLE 1 (Continued)

	Demirgüç-Kunt & Detragiache (1998)	Laeven & Valencia (2013)	Deposit Insurance	GDP Growth Rate			Real Interest Rate			Inflation			M2 Money to Forex Reserves			Private Credit to GDP Ratio			Private Credit Growth Rate		
Country	**Crisis Year(s)**	**Crisis Year(s)**		**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
Malaysia	1985-1988	1997-1999	2007	6.11	-7.36	10.00	0.59	-7.00	12.76	3.80	-8.64	12.06	4.66	2.40	9.99	95.72	36.38	155.17	13.78	-39.21	72.22
Mali	1987-1989	1987-1991	-	3.60	-7.23	15.16	4.17	-33.10	62.09	3.57	-57.14	38.05	20.90	1.44	233.96	15.20	4.30	29.27	6.94	-44.40	47.97
Mexico	1982, 1994	1981-1985, 1994-1996	1986	2.83	-6.17	9.16	-2.33	-43.25	18.47	30.75	4.01	140.98	9.18	2.82	69.77	17.80	8.69	33.32	-9.23	-885.95	542.13
Nepal	1988-1994	1988	-	4.17	-2.98	9.68	-3.39	-9.56	4.39	9.23	3.07	18.46	3.93	1.99	14.24	19.50	5.51	51.13	19.03	-6.77	48.65
Netherlands	-	2008-2010	1980	2.17	-3.66	4.70	3.18	-1.32	9.89	2.37	-0.26	6.50	56.04	3.88	166.26	105.96	58.17	209.45	4.02	-100.00	25.03
New Zealand	-	-	-	2.66	-3.28	8.47	4.29	-5.19	17.07	5.32	0.24	19.40	9.89	2.50	19.55	77.90	16.95	147.47	15.22	-3.43	152.84
Niger	-	1983-1985	-	1.97	-16.83	10.42	3.85	-12.37	21.68	4.77	-5.90	20.82	2.98	1.28	17.25	10.60	3.54	18.25	8.03	-15.93	118.57
Nigeria	1991-1994	1991-1995, 2009-2010	1988	3.68	-8.39	10.60	-7.11	-99.06	23.82	21.49	-6.29	111.56	5.92	0.65	27.29	14.30	8.38	35.39	48.84	-50.29	442.31
Norway	1987-1993	1991-1993	1980	2.69	-1.64	5.89	2.97	-8.93	14.82	4.93	-5.39	15.65	4.28	2.60	7.25	69.75	48.57	87.61	6.12	-100.00	29.67
Papua New Guinea	1989-1994	-	-	3.16	-6.34	18.21	4.74	-3.85	15.89	6.48	-4.27	28.94	3.67	1.48	17.17	19.31	10.52	29.43	12.04	-14.19	54.50
Paraguay	-	1995	2003	3.52	-3.84	15.05	-0.36	-15.09	10.16	15.85	-0.12	47.25	2.52	1.32	4.52	20.37	11.75	32.30	24.01	-30.83	123.55
Philippines	1981-1987	1983-1986, 1997-2001	1980	3.30	-7.32	7.63	2.82	-24.81	13.13	9.83	2.77	53.34	6.36	2.27	17.48	32.68	17.01	55.60	16.86	-43.46	136.26
Portugal	1986-1989	2008-2010	1992	2.38	-2.91	8.45	0.35	-9.14	7.73	9.16	0.91	26.17	106.85	19.84	337.82	95.25	47.99	186.46	14.95	0.00	39.37
Senegal	1983-1988	1988-1991	-	3.37	-4.00	15.35	1.74	-25.21	15.43	5.10	-6.71	30.76	91.47	2.00	794.38	23.96	14.52	36.44	7.31	-29.12	42.54
Seychelles	-	-	-	3.40	-6.64	14.96	5.15	-16.95	18.50	6.54	-4.89	34.62	10.48	2.64	25.30	18.06	8.51	30.11	13.50	-17.27	63.92
Singapore	-	-	2007	7.02	-1.62	14.76	-0.08	-6.40	4.11	2.29	-2.68	11.45	1.20	1.01	1.37	96.97	67.77	120.37	13.38	-17.22	100.49
South Africa	1985	-	-	2.48	-2.14	6.62	-0.02	-20.27	8.82	11.43	4.78	24.92	51.17	7.09	242.10	97.80	48.82	149.78	11.70	-100.00	49.92
Sri Lanka	1989-1993	1989-1990	1987	4.96	-1.55	8.02	2.30	-9.02	12.77	11.08	0.62	20.80	4.40	1.92	9.92	21.67	8.26	30.57	17.87	-14.99	69.63
Swaziland	-	1995-1999	-	4.18	-4.41	14.63	-0.91	-33.74	12.50	10.93	-1.00	44.87	1.42	0.88	2.36	17.54	10.92	24.57	29.00	-70.47	483.52
Sweden	1990-1993	1991-1995, 2008-2010	1996	2.28	-5.03	6.56	2.53	-9.59	11.86	4.46	0.31	16.39	11.57	4.19	24.29	94.69	67.54	124.47	11.01	-5.37	124.51
Switzerland	-	2008-2010	1984	1.80	-1.94	4.40	0.26	-12.92	5.63	2.45	-0.45	13.93	9.70	3.91	16.31	144.58	98.37	165.05	5.47	-0.48	18.72
Syrian Arab Republic	-	-	-	4.45	-8.96	13.47	-3.64	-17.82	7.78	10.33	-2.78	28.61	56.43	5.65	247.18	8.83	1.45	20.43	15.47	-19.31	46.05
Tanzania	1988-1994	1987-1988	1994	5.05	0.58	7.83	-0.97	-33.20	13.47	17.34	5.28	47.70	41.61	1.27	555.00	5.31	0.46	14.64	22.21	-9.66	78.57
Thailand	-	1983, 1997-2000	1997	5.60	-10.51	13.29	2.40	-5.73	11.63	4.24	-4.04	13.13	5.88	2.23	13.70	89.84	39.43	165.80	12.26	-10.65	28.11
Togo	-	1993-1994	-	2.25	-15.10	14.98	3.55	-29.74	12.35	5.33	-6.44	34.69	2.43	1.08	5.93	20.04	6.33	29.96	8.98	-28.22	99.18
Uganda	1990-1994	1994	1994	9.74	-13.62	60.22	-17.04	-193.01	37.32	36.29	-11.90	223.51	35.30	0.96	825.28	4.83	1.21	12.01	26.31	-166.64	157.81
United Kingdom	-	2007-2010	1982	2.25	-3.97	5.03	2.71	-6.54	6.92	4.72	0.67	19.54	42.48	7.24	111.93	108.28	23.01	213.66	13.71	0.00	71.98
United States	1981-1992	2007-2010	1980	2.66	-3.07	7.19	2.13	-1.44	5.82	3.23	0.87	9.37	216.41	81.37	471.34	139.85	90.49	202.75	6.89	-0.12	13.98
Uruguay	1981-1985	1981-1985, 2002-2005	-	2.53	-9.39	8.90	41.05	-9.85	144.55	37.37	0.68	107.05	8.99	1.62	51.09	31.21	19.99	60.65	-231.56	-8520.12	277.90
Venezuela, RB	1993-1994	1994-1998	1985	2.08	-8.86	18.29	-12.84	-98.82	23.96	30.54	1.44	115.52	3.18	1.25	13.56	18.74	8.13	30.66	27.65	-589.17	760.33
Zambia	-	1995-1998	-	2.49	-3.51	7.62	-0.87	-41.79	25.12	39.66	6.14	165.52	7.85	1.66	33.41	9.59	3.69	24.18	3.67	-372.00	401.09
Summary Statistics:																					
Average				3.48	-5.61	12.34	1.98	-24.28	20.13	10.52	-3.78	46.06	72.94	7.99	1172.09	53.94	29.84	90.48	9.48	-254.87	178.20
Std. Deviation				1.73	4.14	9.79	8.83	38.82	25.73	11.28	10.91	52.32	44.33	14.51	228.27	44.05	27.33	68.77	45.30	1525.51	182.21
Max Crises	29	57																			
Max Countries	61	61																			
Max Observations	854	1830																			

Panel 1 presents summary statistics of key variables used in the original Demirguc-Kunt and Detragiache (1998) study. The data driving the two alternatives for the dependant variable are shown in cols 2 and 3 with the Demirguc-Kunt and Detragiache (1998) crises listed in column 2 and the Laeven and Valencia (2013) crises shown in column 3. The variables shown became central to future research and invariably show up as being significantly associated with crisis likelihood. These include GDP growth rates, real interest rates, inflation and money to foreign exchange reserves. Demirguc-Kunt and Detragiache (1998) also included two sectoral variables, these are the ratio of total lending (credit extended) to GDP as well as total lending growth rates.

TABLE 2

	Laeven & Valencia (2013)	CAR			Bank Z-Score			Credit to Deposits			Deposits to Total Assets			Non-performing Loan %			Tier 1 Capital Ratio			Net Interest Margin		
Country	**Crisis Year(s)**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
Argentina	2001-2003	12.25	10.60	13.50	4.12	0.43	5.45	68.67	44.52	97.75	77.54	68.30	93.82	7.84	1.20	18.10	14.16	0.00	20.80	3.64	-0.73	8.81
Australia		5.88	5.00	7.60	11.18	4.45	14.68	133.07	124.72	144.23	97.00	94.37	98.50	0.90	0.20	2.20	10.54	9.60	11.90	2.02	0.59	4.30
Austria	2008-2011	5.67	4.70	7.50	24.44	17.97	40.86	116.19	0.00	130.01	99.28	98.90	99.56	2.51	1.70	3.00	13.61	11.80	15.80	1.61	0.81	2.18
Bahrain		-	-	-	18.92	14.84	25.99	79.54	64.36	98.65	96.92	94.41	99.24	-	-	-	13.51	11.55	16.54	1.86	1.58	2.35
Belgium	2008-2011	3.60	2.70	5.00	5.83	2.56	7.74	80.20	0.00	94.58	99.54	98.98	99.78	2.44	1.40	3.00	13.83	11.20	19.30	1.26	0.93	2.16
Brazil	1998	10.56	8.90	12.10	18.67	15.49	20.20	71.04	59.16	87.22	82.40	76.30	85.73	4.87	2.90	10.20	17.26	13.80	19.00	6.38	3.44	8.00
Bulgaria		11.26	7.30	15.30	19.14	14.16	28.11	62.49	0.00	129.21	83.54	63.50	99.85	7.49	2.00	26.70	22.82	13.80	41.80	4.91	3.97	5.77
Burundi	1998	-	-	-	18.27	13.78	21.48	102.36	66.85	143.95	63.00	51.43	70.09	-	-	-	-	-	-	8.83	4.50	13.78
Canada		4.53	3.50	5.60	20.60	14.63	25.60	74.69	0.00	113.95	97.37	96.41	98.28	1.00	0.40	1.60	13.36	10.60	15.90	2.08	1.12	3.87
Colombia	1998-2000	12.32	9.40	14.30	7.05	4.50	8.58	153.64	92.70	200.95	97.64	94.70	99.50	6.12	2.50	13.60	14.43	10.30	17.30	5.13	3.70	6.49
Congo, Rep.		-	-	-	0.00	0.00	0.00	55.06	21.07	152.63	55.82	33.18	96.18	-	-	-	-	-	-	2.72	1.45	3.49
Croatia	1998-1999	12.05	8.60	18.30	38.22	30.32	46.74	97.53	71.55	110.08	99.92	99.58	99.99	8.23	4.80	12.30	17.00	12.70	21.30	3.80	3.20	4.42
Cyprus		6.15	4.90	6.90	3.89	-0.74	7.81	101.21	92.63	121.57	94.68	92.36	97.52	5.23	3.60	7.20	10.73	5.40	12.84	2.83	-0.23	5.67
Czech Republic	1998-2000	5.75	5.20	6.50	7.98	4.21	9.77	55.84	0.00	108.39	97.26	95.12	99.65	9.34	2.70	29.30	13.56	11.40	17.40	3.04	2.52	3.88
Denmark	2008-2011	5.55	4.20	6.30	15.52	10.34	18.80	203.46	0.00	313.33	98.98	96.52	99.90	1.52	0.20	4.10	12.78	9.27	17.00	1.41	1.08	1.89
Ecuador	1998-2002	9.80	8.10	14.50	-1.40	-6.68	2.90	114.52	89.57	237.35	89.15	76.76	99.60	9.19	3.20	31.00	14.47	8.14	19.80	3.60	-6.45	7.08
Egypt, Arab Rep.		5.39	4.80	6.20	35.76	30.96	40.32	63.98	48.06	81.94	73.95	62.72	82.14	17.94	11.00	26.50	12.50	7.55	16.40	1.72	1.23	2.43
El Salvador		10.97	6.90	13.90	21.61	14.85	31.04	99.35	88.86	109.16	90.38	88.26	92.07	2.98	1.90	4.30	14.08	11.50	17.50	5.87	2.47	10.38
Estonia		10.77	8.20	16.20	7.68	3.77	10.24	163.01	125.64	206.01	99.90	99.75	99.98	1.74	0.20	5.40	15.83	11.50	22.30	3.19	2.05	5.25
Finland		7.06	4.40	10.90	17.86	10.05	29.84	137.11	107.42	158.39	99.74	99.10	99.99	0.55	0.20	1.20	14.23	10.50	19.10	1.16	0.28	2.00
France	2008-2011	5.32	3.70	6.80	16.75	9.71	21.45	127.54	0.00	149.70	99.49	98.39	99.77	4.19	2.70	6.30	12.02	10.20	15.81	0.87	0.41	1.17
Germany	2008-2011	4.26	4.00	4.80	12.23	7.18	16.67	115.29	90.04	178.87	99.84	99.58	99.87	4.12	2.70	5.20	13.04	11.40	16.40	1.05	0.78	1.34
Guatemala		9.23	8.20	10.50	16.23	9.81	20.95	83.61	59.62	134.07	78.60	68.88	87.01	4.05	1.60	8.10	11.47	0.00	15.90	6.83	5.53	7.73
Guyana		-	-	-	16.38	14.09	19.68	59.74	48.35	80.16	68.58	51.37	83.43	-	-	-	3.14	0.00	12.12	4.79	4.11	5.94
Honduras		10.24	8.80	11.20	29.83	27.75	33.49	99.06	90.21	111.24	89.69	84.84	96.99	6.19	2.90	11.20	8.39	0.00	15.30	7.63	6.34	10.02
Hungary	2008-2011	9.09	8.20	10.00	14.91	11.27	18.00	80.32	0.00	143.02	87.41	55.43	99.18	4.50	1.80	13.30	13.10	10.40	16.50	4.22	3.31	5.20
India		6.32	5.30	7.30	31.58	24.46	37.70	68.40	59.93	76.42	92.18	80.37	97.47	7.19	2.30	14.70	12.45	11.10	14.20	3.26	2.72	3.72
Indonesia	1998-2001	9.57	6.00	11.40	0.60	-7.31	1.88	62.68	38.64	95.86	78.99	67.24	93.69	15.16	2.20	48.60	19.08	16.10	22.30	4.16	-3.86	6.64
Ireland	2008-2011	5.56	4.40	7.30	3.13	0.45	7.34	169.10	120.29	222.69	99.81	99.31	100.00	3.14	0.70	14.70	12.43	10.60	19.20	0.71	0.18	1.26
Israel		5.99	4.90	7.30	24.29	20.78	27.34	100.69	93.76	107.88	98.03	96.76	99.50	3.66	1.40	9.90	10.95	9.20	14.30	2.30	1.40	3.02
Italy	2008-2011	7.44	6.40	9.40	12.53	8.15	28.14	149.79	134.42	167.44	95.35	91.20	97.06	7.88	5.30	11.80	11.03	10.10	12.80	1.94	1.35	3.45
Jamaica	1998	-	-	-	3.46	0.00	11.62	59.00	30.73	76.57	77.65	68.17	84.77	11.00	11.00	11.00	10.62	0.00	26.63	8.35	6.31	11.78
Japan	1998-2001	4.21	2.40	5.30	10.26	5.99	13.42	59.46	47.29	89.59	91.53	88.77	95.70	3.80	1.40	8.40	11.87	9.40	13.80	1.24	1.01	1.49
Jordan		8.76	6.20	11.30	36.69	23.26	52.90	78.18	68.33	88.26	91.61	86.97	95.80	10.62	4.10	19.30	19.03	15.90	21.70	2.99	2.10	3.47
Kenya		11.99	8.90	13.20	12.11	8.74	16.38	78.60	72.60	88.16	91.46	86.21	96.13	19.05	4.40	34.90	14.46	0.00	20.80	7.71	5.50	10.49
Korea, Rep.		6.39	2.80	9.30	5.37	1.29	9.24	137.01	115.69	168.46	98.56	95.81	99.39	3.09	0.70	8.90	12.07	8.20	14.60	2.35	0.51	4.98
Kuwait		11.66	10.30	13.00	16.66	12.44	19.42	88.09	66.62	112.61	99.80	99.51	100.00	8.58	3.80	19.20	19.82	15.60	23.70	2.80	2.24	3.60
Latvia	2008-2011	7.21	2.00	9.10	3.35	0.32	4.08	128.29	0.00	278.41	95.66	89.38	98.52	5.89	0.50	19.00	13.42	10.10	17.40	3.36	1.26	6.49
Lithuania		9.62	7.60	13.90	6.23	1.46	8.97	89.79	0.00	197.41	99.58	96.25	99.98	8.39	0.60	19.70	14.45	10.30	23.80	3.42	1.45	6.28
Mali		-	-	-	18.33	10.97	29.37	102.70	86.52	119.73	84.71	71.41	97.28	-	-	-	-	-	-	5.65	2.13	6.88
Mexico		9.69	8.00	11.40	25.87	18.67	33.79	69.82	56.99	81.26	-	-	-	4.00	1.50	11.30	15.21	13.80	16.90	5.78	2.04	13.19

TABLE 2 (Continued)

	Laeven & Valencia (2013)	CAR			Bank Z-Score			Credit to Deposits			Deposits to Total Assets			Non-performing Loan %			Tier 1 Capital Ratio			Net Interest Margin		
Country	**Crisis Year(s)**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**
Nepal		-	-	-	3.65	-6.17	10.22	75.68	64.51	88.69	90.95	81.95	95.81	-	-	-	5.67	-1.40	10.27	3.90	3.18	4.82
Netherlands	2008-2011	4.22	3.00	5.10	9.31	2.36	26.25	138.48	0.00	159.38	99.86	99.66	99.95	2.34	1.50	3.20	12.35	10.70	14.90	0.98	0.26	1.73
New Zealand		-	-	-	17.80	6.35	26.25	137.36	0.00	162.03	97.80	96.84	98.26	-	-	-	4.33	0.00	10.23	2.00	1.46	2.80
Niger		-	-	-	18.05	12.50	21.94	92.33	76.49	119.36	62.09	45.60	83.14	-	-	-	6.54	0.00	14.70	4.83	2.53	7.14
Nigeria	2009-2011	10.70	3.20	18.50	3.10	-4.51	5.18	90.03	69.53	104.66	77.83	48.13	96.52	18.82	7.20	36.10	14.27	0.00	23.40	7.55	4.92	10.47
Norway		6.66	5.90	7.60	23.91	18.70	27.36	93.88	0.00	160.37	99.13	98.18	99.98	1.21	0.50	2.00	12.32	11.20	14.20	1.82	1.28	2.49
Papua New Guinea		-	-	-	5.52	0.00	9.66	54.27	44.77	64.41	91.31	67.54	97.42	-	-	-	-	-	-	6.64	3.74	9.25
Paraguay		10.74	8.50	14.90	12.34	8.98	15.01	113.49	84.94	150.36	80.13	69.74	93.38	7.83	1.10	20.60	15.33	0.00	20.90	8.86	7.68	10.55
Peru		9.38	8.30	10.20	12.08	9.83	13.72	87.42	75.59	105.51	99.64	98.78	100.00	6.13	2.20	14.80	12.69	11.20	14.00	6.44	4.97	9.76
Philippines	1998-2001	12.53	10.60	14.50	29.89	19.53	47.49	61.96	49.93	87.20	91.23	86.53	95.18	11.64	3.30	27.70	16.88	15.50	18.40	4.00	1.00	5.92
Portugal	2008-2011	6.06	5.50	6.60	16.43	11.51	26.05	151.13	112.75	169.77	99.80	99.38	99.95	3.20	1.50	6.90	10.36	9.20	12.50	1.76	1.01	2.51
Romania		10.29	8.60	12.90	4.91	-1.96	7.86	81.56	36.17	130.63	94.84	79.51	100.00	6.54	1.40	14.10	19.10	13.40	28.80	7.37	3.76	13.58
Russian Federation	2008-2011	12.77	7.30	15.70	8.14	2.00	12.76	105.48	85.56	134.56	89.04	57.53	98.82	6.72	2.40	17.30	17.21	11.50	20.90	4.22	0.06	7.94
Senegal		8.91	7.60	10.30	37.20	33.63	41.50	89.35	78.65	101.07	81.24	65.37	93.38	16.72	11.90	20.20	14.85	11.10	20.60	5.96	3.63	7.27
Seychelles		8.35	6.60	9.90	5.82	0.00	15.85	30.75	17.77	49.86	79.94	73.80	82.98	4.35	2.00	8.10	8.16	0.00	24.20	3.74	2.29	5.83
Singapore		9.76	8.30	11.00	21.78	8.29	26.88	91.95	77.93	109.47	97.60	97.05	98.54	3.93	1.20	8.00	17.06	13.50	20.60	1.76	0.14	3.73
Slovak Republic	1998-2001	8.51	4.60	11.10	7.35	-0.75	9.51	80.02	56.22	100.77	99.55	97.24	99.97	9.01	2.50	31.60	14.62	6.60	22.40	3.09	1.27	4.34
South Africa		7.84	5.60	9.30	16.93	8.13	65.36	123.39	110.12	140.07	98.04	93.21	99.52	3.37	1.10	5.90	12.91	10.10	14.90	4.11	1.92	11.67
Spain	1998,2008-2011	6.84	5.90	8.50	22.92	18.07	27.44	133.76	119.11	143.87	98.53	96.98	99.26	2.01	0.70	5.30	11.99	11.00	12.90	1.89	0.87	2.58
Sri Lanka		-	-	-	9.95	5.54	14.67	86.21	73.57	94.69	89.89	81.98	95.44	-	-	-	0.76	0.00	10.61	4.63	3.50	5.37
Swaziland	1998-1999	14.92	11.70	17.60	11.64	3.02	16.66	82.65	55.30	107.43	97.97	92.23	99.83	7.16	2.00	9.30	14.11	0.00	33.80	6.67	4.78	7.54
Sweden	2008-2011	5.11	4.70	6.50	19.47	16.66	23.03	133.63	0.00	241.00	97.40	96.75	98.22	1.42	0.60	2.60	10.18	7.00	12.70	1.37	0.90	2.00
Switzerland	2008-2011	5.17	4.30	6.00	7.46	3.73	9.23	121.20	111.05	135.92	99.30	98.67	99.84	1.85	0.30	5.20	13.34	11.30	17.90	0.91	0.51	1.35
Syrian Arab Republic		-	-	-	4.09	0.00	12.72	26.31	0.00	42.11	62.87	50.97	80.48	-	-	-	-	-	-	2.20	0.06	4.37
Tanzania		5.15	3.8	6.5	9.81	7.49	17.17	47.02	30.85	64.82	80.60	67.82	88.70	24.05	22.90	25.20	8.11	0.00	19.52	7.68	5.78	10.10
Thailand	1998-2000	8.41	5.90	11.30	3.02	0.08	4.45	103.38	90.13	148.18	97.74	97.05	98.62	13.96	2.90	42.90	13.48	10.90	16.00	2.51	0.73	3.56
Togo		-	-	-	3.96	-1.43	8.91	82.91	61.30	125.56	80.85	68.78	95.74	-	-	-	11.30	0.00	22.30	4.80	2.15	9.76
Turkey	2000-2001	11.04286	5.2	15	6.22	-0.43	26.43	61.37	35.89	99.56	93.12	74.40	98.85	8.11	2.70	29.30	20.22	8.20	30.90	6.73	1.58	12.40
Uganda		11.6	7.000	15.800	15.02	10.85	19.91	61.09	46.33	83.81	53.59	29.84	66.74	5.77	2.10	20.20	18.85	11.00	23.10	10.59	6.72	13.39
United Kingdom	2007-2011	6.585714	4.4	9.9	11.04	4.62	18.72	99.60	99.33	99.95	99.60	99.33	99.95	2.44	0.90	4.00	13.56	12.60	15.90	1.37	0.91	2.25
United States	2007-2011	9.764286	8.4	11.2	22.82	19.87	25.65	77.21	69.55	83.22	89.75	79.21	95.50	2.00	0.70	5.40	13.24	12.20	15.30	3.70	3.07	5.45
Uruguay	2002-2004	9.791667	7.2	15.3	1.84	-3.78	3.17	82.77	55.76	125.90	72.90	56.57	86.57	7.41	1.00	33.90	16.51	10.20	22.70	5.04	-3.35	8.11
Venezuela, RB		11.84286	8.6	15.9	12.39	7.45	21.32	68.76	45.96	83.34	92.27	76.85	99.22	4.26	1.10	9.20	16.26	12.90	25.10	11.60	3.40	25.49
Zambia	1998	-	-	-	11.78	10.36	14.04	49.59	33.11	73.00	47.89	12.42	83.82	-	-	-	16.20	0.00	27.94	7.05	3.07	11.23
Summary Statistics:																						
Average		8.44	6.33	10.66	13.86	8.53	20.01	94.08	57.94	126.64	89.15	80.98	95.30	6.56	2.73	14.58	13.28	8.33	18.70	4.08	2.06	6.25
Std. Deviation		2.73	2.29	3.74	9.46	9.10	12.70	33.67	38.58	50.12	12.49	19.59	6.99	5.02	3.57	11.12	3.87	5.18	5.63	2.50	2.30	4.16
Max Crises	36																					
Max Countries	75																					
Max Observations	1050																					

Panel B comprises data on 75 countries over the period 1998 to 2011 as shown. Our dependent variable is driven by the Laeven and Valencia (2013) database with crisis years listed in column 2. For each of our key variables of interest we itemise Average, Minimum and Maximum values and provide overall sample statistics at the bottom of the Table.

TABLE 3

	(1)	(2)	(3)
GDP Growth Rate	-0.093*	-0.120**	-0.223***
	(0.052)	(0.048)	(0.066)
Terms of Trade Change	-0.013	-0.001	-0.015
	(0.012)	(0.011)	(0.014)
Depreciation of Currency	0.011	0.011	0.011
	(0.010)	(0.010)	(0.013)
Real Interest Rate	0.036**	0.030***	0.048**
	(0.015)	(0.011)	(0.019)
Inflation	0.004	0.010	0.019
	(0.011)	(0.010)	(0.015)
Surplus Govt. Budget to GDP %	0.018	0.000	0.028
	(0.040)	(0.035)	(0.063)
M2 Money to Forex Reserves %		-0.000	0.007
		(0.000)	(0.007)
Private Credit to GDP %		0.021**	0.034
		(0.010)	(0.022)
Ratio of bank liquid reserves to bank assets		-0.018	-0.006
		(0.018)	(0.032)
Private Credit Growth rate, lagged 2 years		-0.001	0.000
		(0.002)	(0.002)
Real GDP Per Capita	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Deposit Insurance Dummy Variable			2.266***
			(0.706)
Constant	-3.268***	-3.529***	-4.777***
	(0.437)	(0.519)	(0.891)
Summary Results:			
No. Observations	656	451	333
No. Systemic Crisis Episodes	28	27	21
Akaike Information Criterion (AIC Score)	196.0	150.7	100.6
Model Chi2	14.29	32.28	68.08
Total Correct In-Sample Predictions %	66.67	46.11	47.48
Correct Crisis Predictions %	67.86	70.37	80.95
Correct No-Crisis Predictions %	66.62	45.13	46.11
Degrees of Freedom	7	11	12
Model Significance - P Value	0.05	0.00	0.00
Log Likelihood Score	-94.00	-69.36	-43.81

This table replicates the first 3 regressions Demirguc-Kunt & Detragiache (1998) Table 2 regressions. The dependent variable takes the value of "1" if a country experienced a systemic banking crisis in a year. The time frame covered by these regressions is 1980 to 1994 as per the original paper. The country composition is also the same as in 1998. The definition of what constitutes a systemic crisis comes from the definition supplied by the authors in 1998 plus a table of crisis events described in the paper. All rows for a country are removed after the first crisis is recorded due to endogeneity concerns post crisis. Statistical significance is denoted by ***, **, * for the 1%, 5%, 10% levels respectively. Robust standard errors clustered by country are reported in parentheses below the coefficients.

TABLE 4

	(1)	(2)	(3)
GDP Growth Rate	-0.116*	-0.119*	-0.132
	(0.062)	(0.064)	(0.087)
Terms of Trade Change	0.004	-0.005	-0.023*
	(0.012)	(0.012)	(0.014)
Depreciation of Currency	-0.000	0.009	0.014*
	(0.010)	(0.007)	(0.008)
Real Interest Rate	0.014	0.012	0.020**
	(0.008)	(0.008)	(0.010)
Inflation	0.001	-0.010	-0.013
	(0.013)	(0.012)	(0.014)
Surplus Govt. Budget to GDP %	-0.011	-0.004	0.036
	(0.022)	(0.024)	(0.044)
M2 Money to Forex Reserves %		-0.000	0.003***
		(0.000)	(0.001)
Private Credit to GDP %		0.007	0.015**
		(0.005)	(0.006)
Ratio of bank liquid reserves to bank assets		-0.007	0.013
		(0.010)	(0.015)
Private Credit Growth rate, lagged 2 years		-0.002*	-0.001
		(0.001)	(0.002)
Real GDP Per Capita	-0.000	-0.000	-0.000**
	(0.000)	(0.000)	(0.000)
Deposit Insurance Dummy Variable			0.976**
			(0.490)
Constant	-2.768***	-2.664***	-3.529***
	(0.299)	(0.419)	(0.647)
Summary Results:			
No. Observations	1,080	785	608
No. Systemic Crisis Episodes	48	46	37
Akaike Information Criterion (AIC Score)	382.9	314.6	236.3
Model Chi2	13.59	16.03	86.21
Total Correct In-Sample Predictions %	55.24	38.33	40
Correct Crisis Predictions %	60.42	78.26	75.68
Correct No-Crisis Predictions %	55.01	36.54	38.39
Degrees of Freedom	7	11	12
Model Significance - P Value	0.06	0.14	0.00
Log Likelihood Score	-187.5	-151.3	-111.7

This table extends the results of Table 1.1 for a time span that now runs from 1980 - 2010. Refer to Table 1.1 for details. The dependent variable takes the value of "1" if a country experienced a systemic banking crisis in a year but comes from the Laeven and Valencia (2013 Updated) database. The country composition is also the same as in 1998. All rows for a country are removed after the first crisis is recorded due to endogeneity concerns post crisis. Statistical significance is denoted by ***, **, * for the 1%, 5%, 10% levels respectively. Robust standard errors clustered by country are reported in parentheses below the coefficients.

TABLE 5

	(1) (1980-1990)	(2) (1991-2000)	(3) (2001-2010)	(4) (1980-1990)	(5) (1991-2000)	(6) (2001-2010)
GDP Growth Rate	0.041	-0.212***	-0.490***	-0.082	-0.198***	-0.274***
	(0.094)	(0.058)	(0.190)	(0.055)	(0.033)	(0.064)
Real Interest Rate	0.019*	-0.006	-0.070	0.018***	-0.010	0.016
	(0.010)	(0.021)	(0.047)	(0.006)	(0.013)	(0.019)
Terms of Trade Change	0.004	0.018	-0.167***	-0.010	-0.002	-0.018
	(0.013)	(0.022)	(0.063)	(0.010)	(0.012)	(0.015)
M2 Money to Forex Reserves %	-0.000	-0.002	0.004***	-0.001	-0.000	0.005***
	(0.000)	(0.012)	(0.001)	(0.004)	(0.001)	(0.001)
Constant	-3.544***	-2.068***	-2.356***	-2.344***	-1.126***	-2.011***
	(0.457)	(0.345)	(0.415)	(0.319)	(0.221)	(0.278)
Summary Results:						
No. Observations	470	262	223	537	525	588
No. Systemic Crisis Episodes	17	18	13	44	84	55
Akaike Information Criterion (AIC Score)	141.7	120.9	77.89	284.7	413.0	292.8
Model Chi2	5.000	16.73	42.97	17.37	43.52	72.40
Total Correct In-Sample Predictions %	22.74	43.77	71.12	36.36	50.33	72.91
Correct Crisis Predictions %	88.24	55.56	92.31	77.27	61.90	72.73
Correct No-Crisis Predictions %	20.77	43.09	69.86	33.49	48.48	72.92
Degrees of Freedom	4	4	4	4	4	4
Model Significance - P Value	0.29	0.00	0.00	0.00	0.00	0.00
Log Likelihood Score	-68.37	-57.95	-36.44	-139.8	-204.0	-143.9

This table should be considred in conjunction with Table 1.4. We take the significant factors from Table 1.4 and subject them to a timeframe analysis, showing the importance of the analysis time-frame. Regression 1) covers the years 1980-1990, regression 2) covers 1991-2000 and regression 3 covers the 2000 - 2010 timeframe. In regressions 4), 5) and 6) we repeat the same regressions but this time leave all crisis years in the panel. Whether or not a variable is a significant crisis determinant appears to be time (or business cycle) dependent. Statistical significance is denoted by ***, **, * for the 1%, 5%, 10% levels respectively. Robust standard errors clustered by country are reported in parentheses below the coefficients.

TABLE 6

	(1)	(2)	(3)	(4)	(5)
Capital to Assets (Leverage) Ratio %	-0.107	-0.080	0.055	0.079	-0.176
	(0.115)	(0.115)	(0.115)	(0.125)	(0.194)
GDP Growth Rate	-0.337***	-0.356***	-0.352***	-0.361***	-0.313*
	(0.075)	(0.079)	(0.081)	(0.085)	(0.188)
Real Interest Rate	0.066**	0.067**	0.083*	0.091*	0.026
	(0.031)	(0.031)	(0.044)	(0.047)	(0.243)
M2 Money to Forex Reserves %		0.003***	0.002***	0.002***	0.002***
		(0.001)	(0.001)	(0.001)	(0.001)
Private Credit to GDP %			0.017***	0.017***	0.028***
			(0.005)	(0.005)	(0.009)
Deposit Insurance Dummy Variable				0.696	0.028
				(0.621)	(1.284)
House Price Index Growth Rate					-0.320*
					(0.176)
Constant	-1.575**	-1.911**	-4.618***	-5.298***	-4.379**
	(0.752)	(0.784)	(1.106)	(1.390)	(2.045)
Summary Results:					
No. Observations	417	400	398	387	162
No. Systemic Crisis Episodes	24	24	24	24	13
Akaike Information Criterion (AIC Score)	151.0	142.2	133.1	132.2	58.66
Model Chi2	29.56	53.68	34.20	36.12	45.97
Total Correct In-Sample Predictions %	73.47	75.55	75.18	75.51	80.86
Correct Crisis Predictions %	70.83	75	79.17	79.17	84.62
Correct No-Crisis Predictions %	73.63	75.58	74.93	75.27	80.54
Degrees of Freedom	3	4	5	6	7
Model Significance - P Value	0.00	0.00	0.00	0.00	0.00
Log Likelihood Score	-73.48	-68.62	-63.55	-62.60	-25.33

This table introduces some modifications to Tables 1.3 and 1.4. Non significant variables from Tables 1.3 and 1.4 are omitted and some new sectoral specific variables are introduced including leverage ratio (capital to asset ratio) and house price index. The panel is panel A data (with time frame 1980 - 2010) and using the same countries as per Tables 1.3 and 1.4. The definition of what constitutes a systemic crisis is based upon Laeven & Valencia (2013) as per Table 1.1. All rows for a country are removed after the first crisis is recorded due to endogeneity concerns post crisis. Statistical significance is denoted by ***, **, * for the 1%, 5%, 10% levels respectively. Robust standard errors clustered by country are reported in parentheses below the coefficients.

TABLE 7

	(1)	(2)	(3)	(4)	(5)	(6)
Bank Z-Score	-0.086**	-0.106**	-0.104*	-0.105**	-0.090*	-0.113*
	(0.044)	(0.051)	(0.055)	(0.052)	(0.048)	(0.061)
Private Credit to GDP %	0.015***	0.011**	0.011*	0.009	0.009	0.018**
	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.009)
Private Credit Growth Rate lagged 2 years	0.008	-0.002	0.003	0.004	-0.002	0.002
	(0.008)	(0.012)	(0.011)	(0.011)	(0.013)	(0.011)
Bank Concentration	-0.007	-0.008	-0.010	-0.011	-0.015	-0.012
	(0.006)	(0.007)	(0.007)	(0.007)	(0.010)	(0.011)
Bank Credit to Deposit Ratio		0.011**	0.007	0.005	0.003	0.000
		(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Bank Deposits to Total Assets Ratio			0.020	-0.003	0.066	0.047
			(0.034)	(0.034)	(0.053)	(0.056)
Net Interest Margin				-0.196	-0.148	-0.156
				(0.191)	(0.166)	(0.186)
Non-performing Loans to Total Loans %					0.137***	0.131**
					(0.050)	(0.052)
Non-resident Loans to Total Loans %						-0.008
						(0.005)
Constant	-3.139***	-3.798***	-5.171*	-1.937	-6.595	-4.790
	(0.573)	(0.627)	(3.013)	(3.035)	(5.803)	(6.142)
Summary Results:						
No. Observations	541	541	499	480	347	347
No. Systemic Crisis Episodes	35	35	35	35	35	35
Akaike Information Criterion (AIC Score)	143.3	138.9	129.4	127.1	112.3	111.5
Model Chi2	14.49	50.54	47.24	41.64	26.02	20.23
Total Correct In-Sample Predictions %	62.84	63.66	57.51	52.73	37.02	37.02
Correct Crisis Predictions %	80	88.57	88.57	85.71	85.71	88.57
Correct No-Crisis Predictions %	61.98	62.41	55.95	51.08	34.58	34.43
Degrees of Freedom	4	5	6	7	9	10
Model Significance - P Value	0.01	0.00	0.00	0.00	0.00	0.03
Log Likelihood Score	-69.16	-66.43	-61.18	-59.55	-50.64	-49.73

This table reports the results of regressing bank Balance Sheet data against a binary dependent variable that takes the value of "1" if a country experiences a systemic banking crisis in a panel with one row per country / year combination and "0" otherwise. The panel is Panel B as described in Appendix 1 below, covering the period 1998 to 2011. The dependent variable data comes from Laeven & Valencia (2013 Updated) database of systemic banking crises. Bank Z Score data comes from the Financial Structures and development database (Demirguc-Kunt, Beck & Levine (2013). All rows for a country are removed from the panel after the first occurrence of a systemic banking crisis is recorded to mitigate feedback from dependent variable to control variables. Statistical significance is denoted by ***, **, * for the 1%, 5% and 10% levels respectively. Robust standard errors clustered by country in parentheses below the coefficients.

TABLE 8

	(1)	(2)	(3)
Bank Z-Score	-0.069**		-0.053
	(0.031)		(0.035)
Bank Credit to Deposit Ratio	0.009***		0.009***
	(0.003)		(0.003)
Non-performing Loans to Total Loans %	0.094***		0.068**
	(0.023)		(0.030)
Net Interest Margin	-0.211**		-0.231**
	(0.098)		(0.100)
GDP Growth Rate		-0.235***	-0.142**
		(0.046)	(0.061)
Real Interest Rate		0.030*	0.040*
		(0.016)	(0.023)
Inflation		0.017**	0.028**
		(0.007)	(0.011)
Constant	-2.969***	-2.783***	-2.908***
	(0.732)	(0.269)	(0.778)
Summary Results:			
No. Observations	511	732	511
No. Systemic Crisis Episodes	35	35	35
Akaike Information Criterion (AIC Score)	196.5	245.7	186.4
Model Chi2	32.63	42.94	36.13
Total Correct In-Sample Predictions %	41.53	76.64	47.81
Correct Crisis Predictions %	74.29	65.71	77.14
Correct No-Crisis Predictions %	39.89	77.19	46.34
Degrees of Freedom	4	3	7
Model Significance - P Value	0.00	0.00	0.00
Log Likelihood Score	-95.76	-120.8	-89.19

This table presents the control cluster results using Panel B data. The model is logistic with a binary systemic crisis dependent variable as driven by the Laeven & Valencia (2013) database. Regression 1 shows only sectoral variables all of which are significant. Regression 2 shows only macroeconomic variables which past research have shown to be consistently significant, as repeated here. Regression shows both sets of variables combined. Statistical significance is denoted by ***, **, * for the 1%, 5% and 10% levels respectively. Robust standard errors clustered by country in parentheses below the coefficients.

TABLE 9

	(1)	(2)	(3)
Capital to Assets (Leverage) Ratio %	0.079	0.131	0.079
	(0.125)	(0.434)	(0.101)
GDP Growth Rate	-0.361***	-0.517***	-0.361***
	(0.085)	(0.189)	(0.085)
Real Interest Rate	0.091*	0.083	0.091**
	(0.047)	(0.187)	(0.039)
M2 Money to Forex Reserves %	0.002***	0.029	0.002**
	(0.001)	(0.028)	(0.001)
Private Credit to GDP %	0.017***	0.227***	0.017***
	(0.005)	(0.081)	(0.005)
Deposit Insurance Dummy Variable	0.696	-0.595	0.697
	(0.621)	(11.927)	(0.672)
Constant	-5.298***		-5.299***
	(1.390)		(1.309)
Summary Results:			
No. Observations	387	154	387
No. Systemic Crisis Episodes	24	24	24
Akaike Information Criterion (AIC Score)	132.2	24.63	133.2
Model Chi2	36.12	53.12	31.33
Total Correct In-Sample Predictions %	75.51	7.071	75.51
Correct Crisis Predictions %	79.17	100	79.17
Correct No-crisis Predictions %	75.27	1.075	75.27
Model Degrees of Freedom	6	6	6
Model Significance - P Value	0.00	0.00	0.00
Log Likelihood Score	-62.60	-9.314	-62.60

This table illustrates a model robustness check. Compare the results with regression 4 of Table 1.6. In (1) the same values are reported where the model is estimated with pooled logit coefficients. In (2) the same variables are estimated using a Fixed Effects specification. In (3) a random effects specification is employed. (1) and (3) match closely with no tangible gain from the strong assumption of random effects models that individual effects are not correlated with the explanatory variables. The fixed effects model results in a large loss of observations and over-predicts crisis. Pooled logit is preferred (see Davis & Karim (2008))

TABLE 10

	Country Removed					
	Benchmark	UK	USA	Germany	Sweden	Russia
Bank Z-Score	-0.090*	-0.088*	-0.120**	-0.081*	-0.090*	-0.086*
	(0.048)	(0.051)	(0.059)	(0.046)	(0.048)	(0.052)
Private Credit to GDP %	0.009	0.008	0.008	0.010	0.009	0.010
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Private Credit Growth Rate lagged 2 years	-0.002	-0.003	-0.008	-0.000	-0.002	-0.007
	(0.013)	(0.013)	(0.015)	(0.012)	(0.013)	(0.016)
Bank Concentration	-0.015	-0.016	-0.012	-0.016	-0.015	-0.012
	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)	(0.010)
Bank Credit to Deposit Ratio	0.003	0.005	0.006	0.004	0.003	0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Bank Deposits to Total Assets Ratio	0.066	0.065	0.087	0.071	0.066	0.074
	(0.053)	(0.054)	(0.070)	(0.055)	(0.053)	(0.063)
Net Interest Margin	-0.148	-0.166	-0.175	-0.125	-0.148	-0.221
	(0.166)	(0.169)	(0.208)	(0.166)	(0.166)	(0.187)
Non-performing Loans to Total Loans %	0.137***	0.143***	0.163***	0.142***	0.137***	0.169***
	(0.050)	(0.052)	(0.059)	(0.051)	(0.050)	(0.065)
Constant	-6.595	-6.527	-8.536	-7.258	-6.595	-6.895
	(5.803)	(5.863)	(7.379)	(5.875)	(5.803)	(6.402)
Summary Results:						
No. Observations	347	340	340	339	347	339
No. Systemic Crisis Episodes	35	34	34	34	34	34
Akaike Information Criterion (AIC Score)	112.3	105.9	101.1	104.9	111.3	103.8
Model Chi2	26.02	26.35	28.10	28.60	26.02	21.17
Total Correct In-Sample Predictions %	37.02	37.40	37.26	37.45	37.31	37.73
Correct Crisis Predictions %	85.71	85.29	88.24	85.29	85.29	88.24
Correct No-crisis Predictions %	34.58	35.03	34.74	35.08	34.93	35.23
Model Degrees of Freedom	9	9	9	9	9	9
Model Significance - P Value	0.00	0.00	0.00	0.00	0.00	0.01
Log Likelihood Score	-50.64	-47.95	-45.57	-47.45	-50.64	-46.88

This table illustrates the effect of removing crisis episodes from the panel on a country by country basis. The benchmark regression is regression 5 of Table 1.7. Then all observations for the UK are removed and the regression re-run. Having reinstated the UK observations, those for the United States are removed and the process repeated for each of Germany, Sweden and Russia. Standard errors are reported in parentheses below the coefficients. Significance levels are denoted by ***, ** and * at the 1%, 5% and 10% significance levels respectively. Results are robust to country of origin effects.

Appendices

Appendix 1 – Description of Variables in Panel A

	Variable Type	Description and Source
Dependent Variable – Crisis	Binary	Takes the value of 1 if a country experiences a systemic banking crisis in a particular year and 0 otherwise. This definition of a systemic crisis follows Demirgüç-Kunt and Detragiache's (1998) definition as described in their paper.
GDP Growth Rate	Continuous	Year on year growth rate of real (inflation adjusted) GDP. Source is the International Monetary Fund (IMF) International Financial Statistics (IFS) database. Values are percentages and typically fall in the range 0 – 100 (i.e. 9% appears as 9 and not 0.09). The IFS code for this variable is NGDP_R. Calculate the GDP growth rate by using the following formula GDP Growth Rate $i_{,t+1}$ = (($NGDP\_R\ i_{,t+1}$ – $NGDP\_R\ i_{,t}$) / $NGDP\_R\ i_{,t}$)*100 where "i" represents a country and "t" a year.
Terms-of-trade Change	Continuous	Changes in the terms-of-trade. Source data comes from the World Bank's World Development Indicator (WDI) database. The indicator code is TT.PRI.MRCH.XD.WD with description "Net Barter Terms-of-trade Index" which is referred to in the following equation as NBTOTI. The formula used to calculate this field is:- Terms-of-trade Change $_{i,t+1}$ = (NBTOTI $_{i,t+1}$- NBTOTI $_{i,t}$) / NBTOTI i,t) * 100.
Depreciation of Currency	Continuous	Year on year rate of change of the national currency to the US $ exchange rate (for USA use the Nominal Effective Exchange Rate as reported in the IFS database and as directed by Demirgüç-Kunt and Detragiache (1998). The data is held in the IMF's IFS database with code NUSD and with description "National Currency per US Dollar". Formula used to calculate the figure is :- Depreciation of Currency $_{i,t+1}$ = (($NUSD\ i_{,t+1}$ – $NUSD\ i_{,t}$) / $NUSD\ i_{,t}$)*100.
Real Interest Rate %	Continuous	The real interest rate (inflation adjusted interest rate). Comes from the World Bank's WDI database with variable code FR.INR.RINR which is described as Real Interest Rate %. An interest rate of, e.g. 2.5% is stored as 2.5 and not as .024.
Inflation	Continuous	Level of inflation in percentage terms experienced by country "i" in year "t". The data source is the IMF's IFS database with code NGDP_D which has the corresponding description "Gross Domestic Product, Deflator". Different values of this field are stored for different country / year combinations. I select only values that have the additional specification of "Percent Change over Corresponding Period of Previous Year". Panel B uses an alternative source of inflation data where the source is the World Bank's WDI database. The IFS values in Panel A are used to replicate Demirgüç-Kunt and Detragiache (1998) as faithfully as possible, whereas in Panel B the WDI data is more tractable and for that reason is preferred.

Appendix 1 – Description of Variables in Panel A

	Variable Type	Description and Source
Surplus Govt Budget to GDP %	Continuous	Represents the Government Current Account balance as a % of GDP. The data source is the World Bank's WDI database. The data code for this variable is BN.CAB.XOKA.GD.ZS which has the description "Current Account Balance (% of GDP) as a description. Values are percentages such that a figure of, e.g. 8% is stored as 8 and not as 0.08.
M2 Money to Forex Reserves %	Continuous	The ratio of a country's M2 (broad money supply) to its Foreign Exchange Reserves position. M2 money comes from the WDI database, with code FM.LBL.MQMY.CN which is described as "Money and quasi money (M2) (current Local Currency Units)". This is converted to US $ using the prevailing rate of exchange (see Depreciation of Currency variable for data source). The Foreign Exchange Reserves are sourced via the IFS database with field code RAXGFX, described as "Foreign Exchange Reserves". Several variants of this field are held, the one selected for the denominator in this ratio has the further description "US Dollars". The ratio is then easily calculated.
Private Credit to GDP %	Continuous	Level of private credit afforded by banks as a proportion of GDP. Data is in local currency for both numerator and denominator and comes from the IFS database. The relevant IFS code is 32D__ with description "Claims on Private Sector". GDP is also from the IFS and is as described above. If data is not available for a particular year and country combination an alternative data source is the Financial Development and Structures Database (see Cihák, Demirgüç-Kunt, Feyen and Levine 2013)), field code "pcrdbgdp".
Ratio of bank liquid reserves to bank assets	Continuous	This ratio measures the level of bank liquid reserves (e.g. cash or assets easily converted to cash) as a percentage of total assets of the bank. Data is sourced via the World Bank's WDI database. The code for the requisite field is FD.RES.LIQU.AS.ZS described as "Bank liquid reserves to bank assets ratio (%)". In 1998 this field was calculated using several IFS variables – this WDI value used here is more accessible.
Private Credit Growth Rate	Continuous	This variable measures the growth rate in the levels of indebtedness of the private sector of an economy from the previous year to the current year. The data in Panel A comes from three separate sources. In order of priority these are 1) Financial Development and Structures Database (see Cihák et al. (2013)), field code is "pcrdbgdp" 2) World Bank's WDI Database data on private credit growth rates (access code FM.AST.DOMS.CN and 3) IMF's IFS database with code 22D described as "claims on private sector" .
Real GDP per-capita	Continuous	Measures the average level of wealth per person in a country in a given year in US$. The data is sourced via the World Bank's WDI database with variable code NY.GDP.PCAP.KD described as "GDP per-capita (Constant US$)".
Deposit Insurance	Binary	Takes the value of 1 if country "i" has an **explicit** (i.e. has procured via an insurance policy) deposit insurance scheme in place for banking sector deposits in year "t" and 0 otherwise. The data for this variable comes from two sources which are, in order of priority 1) Deposit Insurance around the world database

Appendix 1 – Description of Variables in Panel A

	Variable Type	Description and Source
Dummy Variable		by Demirgüç-Kunt et al. (2005) and 2) Bank Regulation and Supervision Database (see Barth et al. (2013)). The first dataset formalises the data supplied by Demirgüç-Kunt and Detragiache (1998) and extends the data to 2003. The second dataset covers the period from 1999 to 2011 over which period the data for 4 regulatory surveys, which included questions on deposit insurance schemes in situ in 180 countries, are provided.
Capital-to-asset (Leverage) Ratio	Continuous	A ratio used to measure how leveraged a bank is, in that the bank's assets (the bulk of which are loans they have extended) are financed via capital. This ratio is a measure of the proportion of the asset base of the bank that has been financed by capital (owners equity, retained earnings etc.) versus how much of the financing for the assets that has come from debt. Here assets are not risk weighted in any way however some academics believe this simpler measure of the loss absorbing ability of a bank's capital is more informative and less prone to manipulation than the more complicated Tier – 1 Capital ratio. Panel A has a timeframe extending from 1980 to 2010, as such the only viable source for leverage ratio data extending back that far is the World Economic Outlook's Financial Development database, field code "GFDD.SI.03".
House Price Index Growth Rate	Continuous	Representing the growth in house prices (in % terms) year over year in a country. The purpose of this variable is to help capture the risk to the banking system of real-estate prices over-heating / property bubbles. Data for this variable is quite scarce and limited primarily to the OECD countries although additional data has been provided by the Bank for International Settlements in recent years. This is why the number of observations in the table drops off whenever this variable is included. I use the BIS data as the primary source of data, supplemented where possible via data provided by the OECD.
Alternative Dependent Variable – crisis dummy variable #2	Binary	The source for this data is Laeven and Valencia's (2013) dataset that accompanies their 2012 IMF Working Paper entitled "Systemic Banking Crises Database: An Update". The dataset provides worksheets for Crises Years, including the country name, start date of a systemic banking crisis, fiscal cost of the crisis, whether support was provided by the sovereign and other useful data. The definition of a systemic banking crisis is more rigorous than that outlined by Demirgüç-Kunt and Detragiache (1998). Two conditions have to be simultaneously met "1. Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and/or bank liquidations)" and "2) Significant banking policy intervention measures in response to significant losses in the banking system".

Appendix 2 – Description of Variables in Panel B

(Note, only those variables not already described in Appendix 1 are described here)

Variable	Variable Type	Description and Source
Bank Credit to Bank Deposit %	Continuous	This ratio essentially measures the extent of loan levels as a proportion of the banks deposit base. (An alternative view is how many times on average a euro of deposit money has been loaned out.) Data comes from the Financial Development and Structures Database (see Cihák et al. (2013)), field code "bcbd – Bank Credit to Bank Deposits (%)".
Bank Z Score	Continuous	A measure of risk incorporating earnings and capital adequacy into one value. The term is defined as Bank Z Score $_t$ = (Return on Assets $_t$ + Capital Asset Ratio $_t$) / (Standard Deviation of Return on Assets). The value returned is sometimes described as a "Distance to Default" measure, thus larger values imply further distance to default and consequently a less risky bank profile. The denominator incorporates the return on assets over a period of time (depending upon availability of data). Data for this variable comes from two sources, the primary source is the WEO Financial Development Database (code = GFDD.SI.01 "Bank Z-score"), supplemented where possible by data aggregated to country level from individual bank level data held in Bankscope. The country level Bank Z score is aggregated based upon asset weights.
Bank Concentration	Continuous	Measures proportion of total assets in a banking system held by the 3 largest banks. Data is sourced via the Financial Development and Structures database (see Cihák et al. (2013)), field code "concentration".
Net Interest Margin	Continuous	The difference between what a bank earns as loan interest income and what it pays to depositors (both individual and institutional). It is a useful indirect measure of earnings but also acts as a proxy for interest rate risk as banks may have lent on fixed rates or have tied loan products to LIBOR or central bank lending rates (e.g. "tracker" mortgages). Source data from Financial Development and Structures database (see Cihák et al. (2013)) field code "netintmargin".
Non-performing loans to Total Loans %	Continuous	The percentage of total loans in the banking sector that are at risk of being written-off, usually defined as loan repayments have not been made for 90 days or more. Source data from World Economic Outlooks Financial Development Database, field code GFDD.SI.02.
Non-resident loans to GDP %	Continuous	A measure of competition in the banking sector and degree to which financial liberalisation has progressed. Also a proxy for the potential exposure of the banking system to a reversal of capital flows as non-resident banks leave stressed markets. Source data from Financial Structures and Development Database (see Cihák et al. (2013)) field code "nrbloan".