International propagation of the credit crisis*

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Abstract

We use a large sample of non-US banks to examine the propagation of the 2007-2009 crisis. Using both stock market and structural variables we test whether the relative incidence of the crisis was better explained by crisis models or by the VaR-type analysis of the Basel system. Consistent with crisis models, we find that comovement, interbank linkages, leverage, and fragility of funding structure are related to crisis impact. Contrary to the assumptions of the Basel system, we find that asset risk, measured by the risk weightings of the Basel, has a perverse relationship with crisis impact when considered alone and no relationship when other variables are included. We provide evidence of both a direct linkage between banks and an indirect linkage which could either represent linkages in the real economy or common demands by investors for liquidity. We also investigate whether the relative impact of the crisis on banks was related to a shift in correlations and find that it was not. We discuss the implications of our findings for regulation.

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1. Introduction

The 2007-2009 financial crisis provides a natural experiment with which to test hypotheses about the origination, propagation, and incidence of such crises. There has been a vigorous debate about the factors which caused some banks and countries to suffer more than others. This debate has important implications, both for modelling financial crises and for economic management and the design of regulation.

In this study we use a combination of share price and structural variables to explain the relative impact of the crisis for a large sample of 381 non-US banks. We measure impact both by the bank's share return, and by the variability of the share return during the crisis. We test whether the relative impact of the crisis on different banks is better explained by the VaR-based approach of the Basel system or by crisis models, such as Allen and Gale (2000). The main difference is that crisis models emphasize the importance of bank return comovement, interbank linkages, and the fragility of the liability structure, whereas the Basel system emphasizes measures of the volatility of the assets of an individual bank.

Our results are consistent with crisis theories but not with the ideas underlying the Basel system. We find the most important structural variables to be a bank's international linkages, its leverage based on a narrow definition of capital, and the fragility of its funding structure. However, unlike some crisis models that emphasize deposit flight as a source of crisis contagion, we find that non-deposit liabilities are the main source of fragility. In line with crisis models we find that a share-price-based measure of comovement, the pre-crisis correlation with the US banking sector, is related to crisis impact. We also test the extreme comovement measure suggested by Acharya et al (2010b), but find that the simple correlation performs better.

We investigate whether the Basel system of risk-weighted capital ratios captured these factors, and find that it did not. The asset risk measures used in the Basel system had no (or a perverse) relationship with crisis impact. We show that one reason for this was the focus of the system on measuring asset volatility during normal times, whereas the principal determinants of relative crisis impact were not related, or perversely related, to this. Also, the broader definition of capital used in the Basel

capital adequacy ratio had less relationship to crisis impact than a narrower definition based on equity alone.

We find that both stock-market and structural variables need to be combined to give a complete specification of the relationships that caused differential crisis impacts. Omitting either can lead to misidentification of the causes. For example, we show that the perverse relationship between some pre-crisis risk measures and crisis impact disappears once structural variables are included.

We test a number of hypotheses that have been supported by other studies. For example, it has been suggested that high exposure to the crisis was associated with aggressive use of the Basel rules (IMF (2008)), high pre-crisis share returns (Beltratti and Stulz (2009)), high pre-crisis levels of GDP growth, and high economic development (Lane and Milesi-Ferretti (2010)). All these have important implications for policy, but are in several cases counterintuitive. The different empirical approach and different sample of our study enables us to test the robustness of these propositions. Importantly, we find that the negative link between the degree of economic development and crisis impact disappears once our explanatory variables are included.

Our approach is most closely related to Beltratti and Stulz (2009), but it differs from theirs in two important respects. First, our main focus is on the performance of risk measures and the reasons that these failed to predict crisis impact, whereas their focus is on the impact of governance and regulatory systems. Second, their sample is a mixed sample of 98 US and non-US banks, whereas we use a broader sample of 381 non-U.S. banks. We use exclusively non-US banks since we are interested in crisis propagation rather than origination. Also, much of the analysis of the crisis has been developed using U.S. data, so our sample offers an independent test of those conclusions. We also use country-level data for 50 countries to confirm that the individual bank results are robust at the aggregate level.

Our results are also related to the macroeconomic literature examining the crisis (Rose and Spiegel (2009, 2010), Frankel and Savelos (2010), Lane and Milesi-Ferretti (2010)). This finds that the cross-country impact of the crisis is related to the level of

central bank reserves, real exchange rate overvaluation, past credit growth, current accounts and savings rates, and external and short-term debt, although some of these results are not robust across different crisis incidence measures and specifications.

Other studies have examined specifically the role of multi-national banks in the transmission of the crisis. Some of these (Popov and Udell (2010), Navaretti et al. (2010), and Allen, Hryckiewicz, and Kowalewski (2010)) have looked at the general issue of whether foreign-owned banks serve as a stabilising influence and what causes them to adjust their activity in the host country. They show that the activities of the bank in the host country are affected by characteristics of the parent bank, such as its fragility, its losses on financial assets, and its reliance on interbank borrowing.

The above studies focus on the recent crisis. There is in addition a more general literature on the transmission of banking crises both domestically and cross-border. Of most direct relevance here is the body of work that views transmission as a consequence of linkages in financial institutions or investor portfolios.[1] For example, Allen and Gale (2000) show how financial crises can spread as a result of the impact on the interbank market of changing demands for liquidity. In this case, the degree to which particular regions are affected by a crisis in one region depends on the particular structure of the linkages between regions. Liquidity shocks can also work directly through financial markets if an increase in demand for liquidity obliges investors to reduce their exposure in a number of markets (e.g., Calvo (2005) and Yuan (2005)). However, the role of international linkages in the recent crisis is unclear. Lane and Milesi-Ferretti (2010) find that measures of international linkages such as trade openness have little explanatory power with respect to differential crisis impact. Rose and Spiegel (2010)) reach the counterintuitive conclusion that "if anything, countries seem to have benefited slightly from American exposure."

A related literature on contagion emphasizes that there are shifts in the degree of comovement in crisis periods that may be unrelated to fundamentals (Bennett and Kelleher (1988), King and Wadhwani (1990), Wolf (2000), Forbes and Rigobon (2002), Corsetti et al (2002)). If that is the case, the severity and pattern of a crisis

[1] For a review of the literature on the transmission of financial crises, see Allen and Gale (2007).

cannot be predicted simply from comovement in non-crisis periods combined with fundamentals. We test whether shifts in comovement in the crisis period that were unrelated to fundamentals explain relative crisis impact and find that they do not.

The remainder of the paper is organized as follows. Section 2 describes our empirical approach and Section 3 the data. In Section 4 we examine the determinants of crisis returns and in Section 5 the determinants of volatility during the crisis period. Section 6 examines alternative measures of covariance, Section 7 examines the role of governance, Section 8 tests the information contained in Basel ratios, and Section 9 provides some robustness tests. In Section 10 we state the principal conclusions.

2. Measuring the International Propagation of the Crisis

We denote the stock market return of bank j during the crisis period, R_C^j, (the "raw crisis return"). This may be decomposed into two parts: one related to the level of share price volatility prior to the crisis, σ_j , and the other being the return during the crisis period standardized by its prior volatility, $r_C^j = R_C^j / \sigma^j$. We call the latter the "standardized crisis return". The volatility prior to the crisis measures the bank's risk in "normal" times, which would be influenced primarily by the bank's asset mix and leverage. These are the focus of the Basel ratios used in bank regulation. The standardized crisis return measures the extent to which differences in returns during the crisis period were due to factors *not* captured by volatility measured in the "normal" period prior to the crisis.

We find below that the correlation of volatility prior to the crisis, σ_j, with the crisis return, R_C^j, is only 0.12. It is in the wrong direction, in the sense that a higher volatility prior to the crisis predicted a less adverse crisis impact. Hence volatility prior to the crisis has no (or even a perverse) predictive power for the relative impact of the crisis. Consistent with this, the correlation of the standardized crisis return, r_C^j, with the raw crisis return, R_C^j, is 0.90. Thus the relative impact of the crisis was caused primarily by factors which operated only during the crisis. These were not captured by volatility differences prior to the crisis. In order to understand these

factors we develop a simple empirical approach to explain the standardized crisis return.

A full test of a model of crisis returns, such as Allen and Gale (2000), would require detailed information on the complex linkages between banks. Our interest is to develop a parsimonious representation in which the incidence of the crisis can be explained by a small number of observable variables. We derive our empirical approach from knowledge of the mechanism that led to the development of the crisis. Two important features of the crisis are:

1. The crisis was primarily a banking-sector crisis which then spread to the remainder of the economy. So we look for transmission via the banking sectors of different countries.
2. The crisis originated in the US, so its propagation should depend on linkages with the US.

So we consider a crisis emanating from the US concentrated in the banking industry. We assume that the propagation of the crisis takes place via linkages between banks in different countries. Initially, we describe these links by the relationship that exists prior to the crisis between bank j and the US banking industry. We measure this by a regression of the stock returns of bank j on the returns of an index of U.S. bank stocks:

$$R_{j,t} = a_j + b_j R_{US,t} + e_{j,t} \qquad (1)$$

Where: $j = 1,..J$, $e_{j,t} \sim N(0, s_j^2)$, $R_{US,t} \sim N(0, \sigma_{US}^2)$, $R_{j,t}$ is the return on bank j in period t, and $R_{US,t}$ is the return on the US bank stock index in period t. The key parameter in this regression is b_j, which measures the responsiveness of bank j to the US bank index. In normal times we have the standard expression for b_j:

$$b_j = \rho_j \sigma_j / \sigma_{US} \qquad (2)$$

ρ_j is the correlation between $R_{j,t}$ and $R_{US,t}$, and σ_j is the standard deviation of $R_{j,t}$.

We assume that a crisis occurs in the period $(T, T+\tau)$. If the crisis period were simply a scaled-up version of a normal period, the cross-sectional relationship between returns would be the one resulting from Equation (1) with a constant term substituted for $R_{US,t}$:

$$R_{j,C} = a_j + R_{US,C} b_j + e_{j,C} \tag{3}$$

Where: $R_{j,C}$ is the return on bank j during the crisis period, $R_{US,C}$ is the return on the US bank industry during the crisis period, and $e_{j,C} \sim N(0, s_j^2 \tau)$.

Equation (3) describes the cross-sectional relationship we would expect to hold in a non-crisis period. Dividing by σ_j gives:

$$r_{j,C} = \psi_j + \theta \rho_j + u_j \tag{4}$$

Where: $r_{j,C} = R_{j,C} / \sigma_j$ is the standardized crisis return and $\theta = R_{US,C} / \sigma_{US}$. Equation (4) says that in non-crisis times the standardized return for bank j is linear in its correlation with the US bank index return.

In the crisis period we do not expect (4) to be the same as in normal times. Different banks will have standardized crisis returns that reflect their different structural characteristics. We model the other factors that affect the standardized crisis return by making the parameter ψ_j depend on structural variables:

$$\psi_j = \psi_0 + \psi_1 X_{1,j} + .. + \psi_n X_{n,j} \tag{5}$$

where $X_{i,j}$ are structural variables. The model then becomes:

$$r_{j,C} = \psi_0 + \psi_1 X_{1,j} + .. + \psi_n X_{n,j} + \psi_{n+1} \rho_j + u_j \quad (6)$$

We expect volatility during the crisis to be affected by similar variables. Therefore, we measure standardized crisis volatility by the ratio of volatility during the crisis to pre-crisis volatility, and we model this by a parallel equation to (6):

$$\sigma_{j,C} = \psi_0 + \psi_1 X_{1,j} + .. + \psi_n X_{n,j} + \psi_{n+1} \rho_j + u_j \quad (7)$$

where $\sigma_{j,C}$ is the ratio of the standard deviation of share j during the crisis period to its standard deviation prior to the crisis, σ_j. Equations (6) and (7) are the specification we use in the study.

3. Data

3.1 Sample

Our sample of banks consists of the components of the Datastream World Bank Index in 2010. Since this list is subject to potential survivorship bias, we supplement it by merging it with the 200 largest banks by total assets in 2006, based on *The Banker's* 2007 listing of the top 1,000 banks at the end of the previous year. We exclude those banks whose stocks were first listed after the start of 2005. The remaining sample includes some companies that are not principally commercial banks. For example, some are bancassurance companies, investment banks, or in large measure asset managers. We exclude three cases where a bank also acts as the central bank and one company that is solely a development bank, but otherwise we do not attempt to make what would be inevitably judgmental exclusions. The result is a sample of 381 banks from 50 countries.[2] The returns and balance-sheet data for individual banks are taken from Datastream, and are supplemented by data from Osiris and the banks' annual reports.

3.2 Dependent variables

[2] Of these banks 360 were members of the Datastream indices and 21 were added from *The Banker.*

We consider two measures of the impact of the crisis. We calculate R_C^j, as the average weekly return on bank j in the period 21 May 2007 to 9 March 2009.[3] Where a bank was acquired for stock we include the subsequent return on the stock of the acquiring company. Where a bank was nationalized or acquired for cash, we include the cash payment and assume a zero return in the subsequent weeks.[4] We standardize the returns by dividing by the standard deviation of weekly returns in the period 2005-2006.

During the crisis period the U.S. index of bank returns fell by 79%. Outside the U.S. the average return on our sample of banks was -49%, with a wide dispersion. About 1 in 10 banks actually increased in value over the period, whereas others such as Anglo Irish, Hypo Real Estate, Kaupthing, Fortis (Netherlands), and Northern Rock had to be nationalized.

We also measure the impact of the crisis by the variability of bank returns during the crisis period. We measure variability by the standard deviation of the weekly returns from May 2007 to March 2009, and we standardize this variable by scaling by the standard deviation of returns in the period 2005-2006. Thus, we seek to explain the change in variability induced by the crisis rather than the level of variability itself.

3.3 Independent Variables

International Linkages Crisis models suggest that a bank's exposure to the crisis of 2007-2009 increases with linkages to the U.S. banking sector, bank leverage, and fragility of bank funding. We measure a bank's international linkages by the correlation between its weekly returns and the returns on the Datastream U.S. banking index, using 2 years of weekly data from January 2005 to December 2006. We also use the same data to calculate the extreme comovement measure suggested by Acharya, et al (2010b). We leave a gap between this period of data measurement and the crisis period to ensure that our independent variables would have been known by May 2007 and to allow for uncertainty about the exact dating of the crisis. Banks differ considerably in their level of correlation with the U.S. banking index. For

[3] We also ran our regressions with the *cumulative* return May 2007-March 2009 as the dependent variable. The results were qualitatively similar.

[4] This assumption is largely immaterial. Payments for banks that were rescued by acquisition or nationalization were generally either zero or very small.

instance, the large European banks, such as Barclays, Deutsche Bank, Santander, and UBS were highly correlated with the U.S., whereas, despite their proximity, many of the South American banks were not.

We supplement the correlation variable with three other measures of international linkages. First, we include a measure of the assets of the banking sector in 2006 relative to GDP. Countries differ considerably in this regard. As a proportion of GDP the assets of UK and Swiss banks were about ten times as large as those of South American banks. We hypothesize that a large banking sector is more likely to have strong international linkages. In addition, it may cause other problems in the economy as the crisis evolves, so that the crisis could be accentuated by feedback between the banking sector and the other parts of the economy. Second, banks with a high proportion of foreign loans may be more exposed to foreign events. Since the amount of foreign loans is available for only a small proportion of our sample, we use the country-average ratio of foreign loans to assets. Third, a bank's involvement in the interbank market may serve as a proxy for its international linkages. We therefore collect data on interbank loans (an asset), and loans due to other banks (a liability).

Leverage We consider two measures of leverage -- the ratio of book equity to total assets, and the ratio of total capital (including hybrid debt and subordinated debt) to total assets. The effect of leverage on return variability in normal times should be captured in the pre-crisis volatility. However, crisis models suggest that leverage will also have an effect on the standardized crisis return. Banks with high leverage will become distressed more easily during the crisis and, therefore, suffer a larger standardized crisis impact. On average, in our sample equity constituted 7.4% of total assets, but some banks were much more highly leveraged. For example equity accounted for less than 3% of the assets of Deutsche Bank, UBS, and Barclays.

Fragility In crisis models a bank is fragile if its sources of funding are more likely to dry up or to suffer flight in crisis conditions. We measure fragility primarily by the liability structure of the bank. First, we hypothesize that demand and time deposits may represent more permanent sources of funding and involve fewer linkages to other banks. Although some crisis models emphasize bank runs caused by deposit flight, other liabilities are likely to represent sources of funding that are more susceptible to

early flight risk as a banking crisis emerges. In particular, interbank loans and short-term paper may be an unreliable funding source in a crisis. Banks vary considerably in their funding sources. Japanese banks on average finance about 85% of their assets with deposits. At the other end of the scale, deposits financed only 6% of IKB's assets, 8% of Hypo Real Estate's, and 19% of Kaupthing's.

Fragility may also be increased if the bank has large derivatives positions. In addition to potentially adding leverage, these positions may require additional collateral and thereby create cash-flow problems that are similar in effect to a shortage of funding sources. They may also serve to transmit risk internationally to other banks. We measure derivative positions by the gross nominal value of the bank's positions.

Basel Measures We examine whether the leverage and risk measures proposed by the First Basel Accord contain additional useful information. We consider both the Basel Tier 1 and total capital adequacy ratios. Although there was considerable dispersion in these ratios, in 2006 only one of our 381 banks failed to meet the Basel minimum Tier 1 ratio, and the average ratio was well above the minimum at 10.1%. Managers of banks appeared to take considerable comfort from meeting the Basel requirements. For instance, despite the fact that its book equity was only 2.3% of assets, the UBS Annual Report for 2006 stated that "We are one of the best capitalized financial institutions in the world, with a BIS Tier 1 ratio of 11.9."

The principal source of the difference between the Basel ratios and raw leverage ratios lies in the risk-weightings. Therefore, we look specifically at the ratio of the Basel risk-weighted assets to total assets. This risk adjustment is an important feature of the Basel system, enabling banks with low levels of capital to appear well capitalized. For our sample, risk-weighted assets were on average just under 60% of book assets, but many banks had much lower figures. For instance, the figure was 14% for UBS, 15% for Depfa, 24% for Deutsche Bank, and 31% for Northern Rock.

Supplementary Variables We augment these measures with three supplementary independent variables that previous studies suggest may be associated with bank performance during the crisis. An OECD report argues that "the financial crisis can be to an important extent attributed to failures and weaknesses in corporate

governance arrangements" (Kirkpatrick (2008)). Beltratti and Stulz (2009) test this assertion but in contrast to the OECD they find that banks with more shareholder-friendly boards performed worse during the crisis. Erkens, Hung, and Matos (2012) obtain a similar result. We check whether this is true also for our sample. We measure corporate governance by the Corporate Governance Quotient (CGQ®). We also include as explanatory variables the average weekly return on the bank stock in 2006 (suggested by Beltratti and Stulz), and the growth in country GDP over the five years ending in 2006 (suggested by Lane and Milesi-Ferretti).

Many of our independent variables are derived from bank balance sheets. Banks in different countries vary in the presentation of their accounts. Therefore, any database of balance-sheet variables encounters an inevitable problem of consistency. This problem is likely to be particularly severe in a cross-country study such as ours and adds to the noise in the data.

In our regressions we transform those balance-sheet ratios that we expect to have a positive association with returns by subtracting them from 1.0. Therefore, for each of these independent variables the predicted sign on the coefficient is negative in the returns regressions and positive in the volatility regressions.

3.4 Summary Statistics

Tables 1 and 2 summarize the distributions of the variables used in the individual bank regressions and their pairwise correlations. The pervasive nature of the crisis is illustrated by the fact that the mean return was negative for over 90% of the observations, with a mean weekly return over the whole sample of -0.7%. Consistent with Lane and Milesi-Ferretti (2010), there was a substantial difference between the performance of banks in emerging and developing economies and those in advanced economies.[5] In the former case the mean weekly standardized return was -.29% and in the latter case it was -.10%.

[5] We use the definitions in *IMF World Economic Outlook (WEO).*

The simple correlation between the standardized return and each of the main independent variables has the predicted negative sign. As discussed above, the raw crisis return and the standardized crisis return have a correlation of 0.9, indicating that almost all of the cross-sectional variation in bank impact during the crisis came from behavior that was specific to the crisis and not captured by prior volatility. The correlation between the pre-crisis volatility and the raw crisis return, which is not reported in the table, is 0.12.

The standardized volatility is strongly negatively correlated with the standardized crisis return, indicating that relative crisis impact was experienced in both the level and volatility of returns. Correspondingly, the correlations between the standardized volatility and the main explanatory variables are all positively correlated.

Of our supplementary variables, the growth in GDP is quite strongly positively correlated with the standardized return and negatively correlated with the standardized volatility. In contrast, both the prior stock return and the governance variable are weakly negatively correlated with the standardized crisis return. In the latter case, this is mildly supportive of the hypothesis that well-governed banks were more exposed to the crisis. However, this is not consistent with the negative correlation between the governance variable and the standardized volatility.

In the case of the independent variables, the balance-sheet measures of international linkages are uncorrelated with the stock-market measures, but are positively correlated with each other. This is particularly the case for the two interbank measures, suggesting that banks that borrow heavily in the interbank market tend also to be heavy interbank lenders.

Not surprisingly, the two balance-sheet measures of leverage are strongly collinear. Both of our fragility measures are positively correlated with each other and with the stock-market measure of linkages. Consistent with our hypothesis, banks that make heavy use of derivatives seem to have closer linkages with the U.S. market. Of the supplementary variables, the corporate governance measure is only weakly correlated with other variables, but GDP growth and, to a lesser extent, prior stock market return are highly collinear with a number of the banking measures.

In the following section we summarize the results of regressing the standardized crisis returns variable on a parsimonious set of explanatory variables. Then in Section 5 we examine the extent to which the same variables can explain the change in volatility during the crisis period.

4. The Transmission Mechanism for Standardized Crisis Returns

In this section we use OLS regression to estimate Equation 6. The results are summarized in Table 3. Since we have a number of missing observations, the sample size varies between columns and therefore one should exercise caution comparing across columns.[6] To facilitate comparison between regressions, the final row in the table shows the $\overline{R}^2$ when the regression in Column 3 is rerun using the same subset of data.

4.1 International Linkages and Crisis Propagation

The simple correlations in Table 2 show that there is, as expected, a negative relationship between crisis returns and our measures of international linkages. Likewise, there is a positive univariate relationship between crisis volatility and each of the linkage variables. The three balance-sheet measures, foreign lending, interbank loans, and loans due to other banks, are collinear, so we include only one of them in the multiple regressions. We choose interbank loans because it appears to contain more information that is orthogonal to the correlation and bank sector size variables, although we show later that substituting either of the other two balance sheet linkage measures does not materially change our results.

The first column of Table 3 shows the results of regressing the standardized crisis returns on the correlation with the U.S. bank index, the ratio of country bank claims to GDP, and the ratio of interbank loans to total assets. The $\overline{R}^2$ is .29. The prior correlation with the U.S. bank index is strongly negatively related to the crisis returns and remains so in all our regressions. In addition, the size of the banking sector and

[6] If the absence of data for a bank is correlated with the value of other variables, one would need to be careful in interpreting any of the results where the number of missing observations is large.

the amount of interbank loans are negatively related to returns at the 1% and 5% significance levels respectively.

The ability of past correlation estimates to explain subsequent returns may also be reduced by possible instability in the correlations between the pre-crisis and crisis periods. Therefore, we test the hypothesis of no change in the underlying correlations and reject the hypothesis for 16% of our sample at the 5% significance level. In Section 6 below we test whether these correlation shifts explain relative crisis impact.

4.2 Bank Leverage and Crisis Propagation

Many regulatory recommendations focus on the role of bank capital in preventing banking crises. Therefore we expand our regression to include the leverage ratio based on the ratio of book equity to assets. In Section 8 we will look in more detail at the information contained in other leverage measures and compare them with the Basel ratios. The effect of adding the leverage ratio is shown in the second column of Table 3. The $\overline{R}^2$ is slightly higher at .32, and the leverage ratio is highly significant. All coefficients in the expanded regression continue to have the predicted sign and to be strongly significant.

4.3 Bank Fragility and Crisis Propagation

Column 3 of Table 3 expands the regression further to include the proportion of deposits. We first introduce demand and time deposits separately into the regression. The coefficient on (1 – demand deposits/assets) is -.213 with a t-value of -1.85 and the coefficient on (1 – time deposits) is -.306 with a t-value of -4.24. A Wald test suggests that the difference in the coefficients is insignificant with an F-statistic of .80. This has the important implication that financing with demand deposits appears to have protected banks from the crisis as much as financing with time deposits. The "stickiness" of demand deposits seems to have meant that their formal on-demand nature was less important than the behavioral characteristics of the deposit-holders. For our tests, using a total deposits measure allows us to increase the sample size from

214 to 302, so the third column in Table 3 uses (1 – total deposits)/assets as the independent variable.[7]

The $\overline{R}^2$ is now increased to .48, the coefficients on all variables remain negative as predicted. The correlation, leverage, and fragility variables are all significant at the 1% level, while the coefficients on the other two linkage variables are significant at the 5% level. We noted earlier the presence of a difference between the standardized returns of developed and emerging markets. We test whether this difference was caused by differences in the fundamental characteristics of the two groups. With the inclusion of the explanatory variables the difference between the unexplained standardized returns of the two groups largely disappears and is no longer significant. The average residual is -.014 for advanced economies, and +.025 for emerging and developing economies. A Wald test of the difference between the two means produced a t-statistic of .22.

The sample data for the regression reported in Column 3 are available for almost all our sample, and this regression provides the main test of our hypotheses concerning international bank linkages, leverage and fragility. We, therefore, refer to this test as the *principal* regression.

4.4 Derivatives and Crisis Propagation

In column 4 we expand the regression further by adding the gross nominal value of derivatives as a proportion of assets. This results in a significant reduction in sample size. Contrary to expectations and contrary to the simple correlations, the effect is not significant. It is possible that the negative univariate effect of derivatives may have simply reflected its serving as a proxy for cross-border linkages. Once this effect is allowed for, there is no indication that a large derivative portfolio exerted a negative impact on bank returns during the crisis.

[7] An alternative measure of fragility would be to use the proportion of short-term debt. For most banks deposits and short-term debt together constitute a high fraction of a bank's funding, so that including both variables would come close to over-identifying the regression. (The correlation between the two measures is -.71.) We examined the effect of substituting short-term debt for deposits. The coefficient on short-term debt was negative as predicted and strongly significant, though the $\overline{R}^2$ is reduced.

4.5 Supplementary Variables

To avoid multi-collinearity, the regressions in Table 3 employ only one of the three balance-sheet measures of international linkages. We therefore re-ran the principal regression omitting interbank loans but including in turn loans due to other banks and each country's foreign claims as a proportion of total claims. The $\bar{R}^2$ was almost unchanged and all the coefficients remained consistently negative. The coefficient on the loans due to other banks had a t-statistic of -1.34, whilst the corresponding t-statistic for the foreign-claims coefficient was -1.94.

We also augmented our principal regression by adding additional independent variables. The first two variables are prior stock return and prior GDP growth. Both are somewhat ad hoc, but were selected because previous studies suggested that they were related to crisis returns. The penultimate column of Table 3 shows that, consistent with previous findings, the crisis return appears to be negatively related to the prior stock return and positively related to prior GDP growth. However, the inclusion of the two additional variables adds nothing to the $\bar{R}^2$.

We also checked whether there was a size effect by adding log(assets) to our principal regression. The coefficient was positive suggesting that large banks fared better. However, the coefficient was again insignificant with a t-value of .85.

Given the role in the crisis of the U.S. real estate market, we expect exposure to real estate to have played a role in crisis transmission. We have mortgage data on only 87 of our banks, and these data are for direct mortgage loans and exclude mortgage-backed securities. When we include mortgages as a proportion of assets in our principal regression, the coefficient on mortgages is negative, but is not significant (t-value = -1.42).

5. Explaining Changes in Volatility

In this section we repeat the regressions of Section 4 except that the dependent variable is redefined as the return volatility during the crisis period as a proportion of

the pre-crisis volatility. We expect that variables that exerted a negative impact on the return variable would also have a positive impact on volatility. The results are summarized in Table 4. They are largely consistent with the return regressions.

Column 3 of the Table summarizes the equivalent of our principal return regression. All the coefficients have the predicted positive sign and in the case of the correlation, size of the banking sector and proportion of deposits the coefficients are significant at the 1% level.[8] By contrast, the coefficients on the interbank loans and the equity capital ratio are not significant. The $\overline{R}^2$ at .39 is a little lower than in the principal returns regression, but it suggests that a parsimonious equation based on simple observable proxies for bank linkages, leverage, and fragility can explain a substantial proportion of the differential impact of the crisis on the variability of bank returns.[9]

In column 4 we show the effect of adding derivatives to our explanatory variables. The negative sign on the coefficient is consistent with the evidence from the return regressions that derivative use had the effect of moderating the effect of the crisis. However, as in the case of the return regressions the coefficient on derivatives is insignificant.

In the final two columns of Table 4 we drop the derivatives variable and add the supplementary variables suggested by previous research. The 2006 returns variable is no longer significant and the GDP growth variable is significant only at the 10% level. The two additional variables contribute nothing to the equation's explanatory power. We expect that any variable that reduces crisis return would also increase the volatility in a crisis. This was the case for our main independent variables, where the signs on the coefficients were consistently different between the two sets of regressions. By contrast, the signs on the coefficients on both the 2006 returns and GDP growth variable are the same in the two sets of regressions.

[8] We again combine the two deposit measures to maximize sample size, though the case for doing so is now less strong. The coefficient on (1 – demand deposits/assets) is 1.23 with a t-value of 2.37 and the coefficient on (1 – time deposits) is .44 with a t-value of 1.36. A Wald test produces an F-statistic of 2.86.

[9] Including in the regression loans due to other banks or foreign claims instead of interbank loans gives positive coefficients with t-values of .25 and 1.56 respectively.

As in the case of the returns regression, we look at the effect of adding the size variable to the principal standard deviation regression. The sign of the coefficient in this case was positive, implying that large banks experienced a greater increase in volatility. The t-value was 1.59.

We also considered the effect of adding the proportion of mortgage loans to the principal volatility regression. The coefficient on mortgages was positive which was consistent with our finding in the return regression, but it was again insignificant (t-value = .51).

6. Measures of Comovement

If the comovement between banks differs during periods of turbulence, then simple measures of correlation during normal periods may not be the best predictor of comovement during the crisis. In this section we first examine whether an alternative measure of comovement has more predictive power. We then explore further the role of the correlation variable. We first ask how far the predictive power of our model relies on the knowledge that the crisis emanated from the United States. We go on to ask whether the relationship between crisis impact and the prior correlation with the US banking index stemmed from direct linkages between banks or resulted indirectly either through linkages in the real economies or in investor liquidity demands. Finally, we look at whether those shifts in comovement during the crisis period that were not related to fundamentals explain relative crisis impact.

6.1 Extreme Comovement

Acharya et al (2010b) propose a measure equal to the mean return on a bank stock in the worst 5% of weeks for the index return during the pre-crisis period.[10] We check whether this extreme value measure of exposure to the crisis performs better than the correlation. Translated to the current context, we measure the extreme value as the mean standardized bank return in the 5% of weeks that the US bank stock index gave the worst returns in the period prior to the crisis (the "extreme comovement"). Panels A and B of Table 5 compares the effect of using this variable instead of the correlation coefficient. Columns 1 and 2 show the results for a simple regression of

[10] For similar studies that have focused on extreme values to measure contagion, see Bae et al (2003) and Gropp and Moerman (2003).

the standardized return on the two measures of comovement, whilst Column 3 includes both measures of comovement in the one regression.

The simple regression of standardized return on the extreme comovement gives a lower adjusted R^2, indicating that this variable captures less information about the international transmission of the crisis than the simple correlation measure. Table 5A shows that the correlation coefficient continues to have greater explanatory power when both variables are included in the regression. This result is robust to the inclusion of other control variables.

Panel B shows a similar regression with standardized volatility as the dependent variable. The Pearson correlation coefficient again performs better, and in the simple regression the extreme value coefficient takes on the wrong sign.

The relatively poor performance of the extreme comovement variable differs from the result that Acharya et al find in a test of the domestic US impact across different financial institutions.[11] Their variable is derived from the worst days for the US bank stock index in the period June 2006 to June 2007. We use weekly rather than daily data because time-differences between stock exchanges make daily data unreliable in international studies. In our context, the failure of the extreme comovement variable to predict the cross-sectional impact of the crisis indicates that the bad weeks that happened during generally good times did not contain useful information about the behavior in a crisis. So there must have been a difference between the international linkages that operated during those "bad weeks in good times" and those that operated during the crisis. The success of this variable in a domestic US context compared with its failure internationally illustrates the potential danger of extrapolating US results to the international context.

6.2 Knowledge of the Crisis Source

The regressions in Tables 4 and 5 assume knowledge that the crisis emanated from the United States. To examine how much predictive power would be lost if the source of the crisis were not known, we substitute in our regressions the correlation with the

Datastream index of the world ex the USA.[12] The results are only marginally weaker. In the principal return regression all coefficients have the correct sign and are significant at the 1% or 5% level. The adjusted R^2 falls from .48 to .46. The corresponding regression for the standardized variability shows a similar modest loss of predictive power. This suggests that non-US banks with close linkages to the USA also have broader international exposure.

6.3 Disaggregation of Bank Correlations

We examine whether the relationship between crisis impact and the prior correlation with the US banking index stemmed from direct linkages between banks or resulted indirectly, either through relationships in the real economies or in investor liquidity demands. For each of our sample banks we calculate two correlation measures for the period 2005-2006 – the correlation with the US banking index and the correlation with the Datastream index of the U.S. market ex financials. We use the latter measure to break the correlation with the U.S. bank index into two orthogonal components. The indirect effect of the crisis on a non-U.S. bank is measured by the correlation with the U.S. market ex financials. The direct component is measured by the residual from a regression of the correlation with the banking index on the correlation with the U.S. market ex-financials. We then substitute these two orthogonal components of the correlation as independent variables in our two principal regressions. The results are given in Table 6. Both components of the correlation with U.S. banks are strongly significant. This suggests that part of the crisis impact resulted from direct linkages between banks that were not captured by our other linkage variables, and part stemmed from the fact that bank returns were more broadly linked to market-wide movement in U.S. stock prices. The latter may reflect both linkages between the real economies and common demands by investors for liquidity.

6.4 Tests for shifts in correlation

We look now at the shifts in correlation over the crisis period and test whether there is a shift in correlations which is not caused by fundamentals and, if there is, whether that correlation shift caused differential returns. We first regress the difference in the correlation between the crisis period and the pre-crisis period on fundamental

[12] We use the world market excluding the USA since the broader world index is highly correlated with the US market.

variables. This is shown in Table 7 Column (1). This shows that the shift in the correlation of the sample banks with the US banking sector index was largely unrelated to the fundamental characteristics of the banks. However, in Column (2) we regress the standardized crisis return on the residuals from this first regression, including fundamental variables as controls. If the relative impact of the crisis were caused by correlation shifts we expect to see that the correlation shift is related to the crisis returns. However, the unexplained correlation shift from Column (1) is *unrelated* to standardized crisis returns. This is consistent with the relative impact of the crisis being largely driven by fundamental differences between banks and not by correlation shifts unrelated to fundamentals.

7. Governance and Bank Exposure to the Crisis

We have shown that bank exposure to the crisis, measured both in terms of the standardized returns and variability, was related to some fundamental bank characteristics. A related question is what determined whether a bank would adopt a particular degree of exposure. One possibility, suggested by Beltratti and Stulz, is that governance is an additional factor that added to crisis vulnerability. Another possibility is that differences in bank governance might be associated with more risky strategies. This would also be consistent with the hypothesis that governance was related to bank exposure, but the channel would be the variables we have already identified.

To test whether governance was a separate factor causing crisis vulnerability we added the Corporate Governance Quotient to our principal regressions. For both regressions it was insignificant, with t-statistics of 1.36 for the returns regression and .75 for the variability regression.

To test whether governance exercised its influence through the variables in our principal regressions, we measure the predicted impact of a crisis on bank returns and volatility by the fitted values from our two principal regressions. We then regress these fitted values on the Corporate Governance Quotient. Table 8 shows that the predicted impact of the crisis on standardized returns was significantly and negatively related to the quality of bank governance, while the impact on volatility was

significantly and positively related to governance We checked this result by substituting as independent variables two country-level governance measures from Djankov et al (2005, 2008). The first is their anti-self-dealing index, which measures the degree of protection that each country provides against a specified tunnelling transaction. The second measure is their revised index of anti-directors rights, which updates and extends La Porta et al. (1998). The fitted values were negatively correlated with the anti-self-dealing index but positively related to the anti-directors-rights measure. Neither coefficient was significant. The results for volatility were much stronger. Here the fitted values were positively correlated with the two Djankov measures with t values of 7.0 and 3.1.

The only strong result to emerge from this is the positive association between governance and the expected change in volatility during the crisis. One interpretation of these results is that well-governed banks are more likely to run into difficulties in a crisis. A more plausible interpretation is that a bank needs to be well–governed in order to undertake activities that are particularly risky in crisis conditions.

8. Basel Ratios and Leverage Measures

Column 3 of Tables 3 and 4 suggest that for a large sample of banks proxies for international linkages, leverage and bank fragility can explain nearly 50% of the variation in crisis returns and 40% of the change in variability. The coefficients on each variable consistently had the predicted sign. In both sets of regressions the coefficients on the prior correlation and the ratio of deposits were significant at the 1% level, while the coefficients on the size of bank claims were significant at either the 1% or 5% level. We turn now to the issue of whether the measures specified in the Basel Accord can provide further insight into the variation in crisis returns and volatility.

The Basel Accord places considerable emphasis on the role of risk-weighted capital ratios as measures of bank exposure. In their 2006 reports, banks state risk-weighted capital ratios in conformity with Basel I. These ratios use risk-weighted assets as the denominator and therefore seek to capture the differing asset characteristics of the

banks. An obvious question is how well these ratios predict bank returns or volatility during the crisis period.

In Panel A of Table 9 we separately regress the standardized returns on the two book measures of leverage and the two Basel measures. Panel B repeats the regression for the balanced sample of banks for which we have all four leverage measures. It therefore provides a horse race between the four measures.

All the leverage variables in Table 9 have the expected sign and are significant at the 1% level, though none explains a substantial proportion of the variation in returns. The horse race in Panel 9B suggests that the equity ratio is more informative than the book capital ratio. Neither the Basel Tier I ratio nor the Basel capital adequacy ratio offers any improvement over a simple book measure of leverage in explaining the effect of the crisis on bank returns. This result is robust in tests that include other variables in the regression.

In its 2008 *Global Financial Stability Report* the IMF[13] suggests that banks which made aggressive use of the Basel rules were punished by the capital markets in the crisis. The final column in Panels A and B tests this hypothesis. It includes the difference between the Basel ratio and the simple leverage measure, as well as the leverage measure itself. If banks were punished for making aggressive use of the Basel rules, we expect this coefficient to be negative rather than just zero. Although the estimated coefficient is indeed negative, it is not significantly so.

Table 10 repeats the regressions in Table 9 except that the dependent variable is now the standardized volatility of bank returns during the crisis. The story is much the same. Each measure is significantly related to volatility, though the Basel measures perform less well than simple book measures of leverage. The explanatory power of the regressions remains fairly small.

The principal difference between our book leverage measures and the Basel measures lies in the denominator. The risk-weighted assets are on average only 60% of the

[13] See the discussion of Figure 1.17 in the IMF report.

book assets, and the correlation between the book equity ratio and the ratio of book equity to risk-weighted assets is only .32. If the Basel weightings are capturing differences in asset risk, we should find that the ratio of risk-weighted assets to total assets would help to explain the crisis return and volatility. The results are summarized in Table 11. In the first column we show the results of a simple regression of the crisis returns on the risk-weighted-assets ratio. The results are perverse and highly significant. The higher the ratio of risk-weighted assets (i.e., the higher their risk), the better that the bank performed during the crisis. Likewise, column 3 shows that a simple regression of standardized crisis volatility on the risk-weighted-assets ratio produces an equally perverse result.[14] Thus, *unconditional* predictions of bank performance based on the Basel risk-weightings would have been highly misleading.

These two simple regressions ignore the quite strong relationships between the risk-weighted assets ratio and other explanatory variables. For example, Table 2 suggests that the risk-weightings are negatively related to the international linkage measures, book leverage, and use of derivatives. Columns 2 and 4 of Table 11 shows that, when our principal other explanatory variables are included in the regression, the perverse results largely disappear. The coefficients on the risk-weighted-assets ratio are now close to zero. Thus, even when the impact of other variables is allowed for, the Basel weightings appear to add no additional information.

9. Robustness

When the dependent variable is the mean crisis return, the coefficients on our principal variables uniformly have the predicted sign and are generally highly significant. The size of each coefficient generally varies little with changes in model specification and sample size. The explanatory power of the regressions is somewhat weaker when the dependent variable is the standard deviation of returns during the crisis period. Nevertheless, with only one exception, the coefficients on the principal variables have the predicted sign. They are generally significant, and remain impressively stable across different sample sizes and model specification.

[14] These results are not a consequence of the scaling of the dependent variable. They are also true of the raw returns and volatility.

We perform several robustness checks. We check for outliers, test for thin-trading bias, and repeat our regressions using country-level data.

9.1 Outliers

The extreme value for the standardized crisis return is only 4.3 standard deviations from the mean, while that for the standardized crisis volatility is 6.2 standard deviations from the mean. In the case of our principal regressions all the independent variables, with the exception of bank assets/GDP, are bounded [0,1]. For most of these variables there is no serious problem of outliers. The exceptions lie in the book leverage and Basel ratios, where several firms with heavy involvement in investment banking and asset management had very high capital ratios. In the case of each of the regressions incorporating these ratios, we reran the regressions progressively dropping extreme values. The results were essentially unchanged.

9.2 Thin Trading

Thin trading is a potential problem in our sample, particularly where some of the banks have a large majority shareholder and a small free float. The principal effect of this thin trading is to bias downward estimates of the correlation and bias upward estimates of the standard deviation both before and after the onset of the crisis.

We, therefore, repeated our analysis using bi-weekly returns. The results were little affected. For the principle regression with standardized return as the dependent variable, all the coefficients were negative and all except the coefficient on interbank loans were significant at the 1% level. The adjusted R^2 was reduced from .48 to .47. Where the dependent variable was the standardized variability, all the coefficients remained positive and the R^2 was unchanged at .39.

For both regressions we also assessed the potential thin-trading bias by omitting the 11 banks where there were (arbitrarily) 30 or more weekly returns of zero. The results were almost identical.

9.3 Country-level Regressions

The framework we use is linear in the characteristics of individual banks, and should provide an aggregate measure of systemic risk that is consistent with the measures for individual banks. Country-level data therefore provide an opportunity to check our results with a different data set and to confirm the assumption of the linear model.

For the country-level tests we include all countries for which the following data are available: (1) Datastream bank industry equity return indices for the period January 2005 to March 2009; (2) IMF *International Financial Statistics* data covering banking-sector Total Assets, Foreign Claims, Demand Deposits, and Time Deposits for the end of 2006; (3) IMF aggregate capital ratios for the banking sector; (4) IMF aggregate Basel regulatory capital ratios for the banking sector. The 50 countries in our sample cover 91% of world GDP excluding the U.S. (using IMF data for 2009).

Table 12 summarizes the country-level regressions that correspond as closely as possible to the two principal regressions for individual banks. The results are stronger than for the individual banks, probably because some of reduced noise. The regression of crisis returns on the independent variables has an adjusted R^2 of .58, while the corresponding regression for crisis volatility has an adjusted R^2 of .73. Only one of the coefficients has the wrong sign and that is not significant.

10. Conclusions

We measure the incidence of the crisis on non-US banks by both the stock returns and their variability. In each case we standardize by the standard deviation of returns in the pre-crisis period.

We have shown that the cross-sectional incidence of the crisis was related to:

- The pre-existing correlation of the banking sector with the US;
- Banking assets as a proportion of GDP;
- Interbank loans as a proportion of bank assets;

- The equity ratio measured relative to an unadjusted balance sheet;
- The fragility of financing as measured primarily by the proportion of assets funded by deposits.

These results are for the most part strongly significant and robust to changes in sample and model specification.

Our results are also economically significant. This is most simply illustrated by the bivariate analysis in Table 13, which shows the effect of our principal explanatory variables on the returns of individual banks. The table groups the banks into quartiles based on the magnitude of each variable and shows the mean weekly bank return for each quartile. With one modest exception the average decline in the value of the first quartile banks (those with the lowest ratios) is less than half that of banks in the fourth quartile.[15]

We examined whether the measures specified in the Basel Accord could provide additional insight into banks' exposure to the crisis. We found that they could not, though we found no evidence that banks were punished for making aggressive use of the Basel rules. In a horse race between the Basel ratios and raw leverage ratios, the raw leverage ratios won out. Moreover, the ratio of risk-weighted to unweighted assets was perversely related to crisis exposure, and even after controlling for other factors contained no useful information.

We have also shown:

1. Volatility prior to the crisis had no (or even a perverse) predictive power for the relative impact of the crisis.
2. The most informative measure of exposure derived from past returns was the Pearson correlation coefficient , not the extreme value measure proposed by Acharya et al.

[15] Perhaps the most striking indication of the economic relevance of the results is the identity of the banks with the lowest predicted returns. Top of the list are UBS, IKB, Hypo Real Estate, Barclays, Deutsche bank, Credit Suisse, Depfa, ABN Amro, Allied Irish, BNP Paribas, Northern Rock, and Natixis.

3. The impact of the crisis on banks was associated both with direct linkages between banks and indirect linkages either through the real economies or through a common demand by investors for liquidity.
4. The relative crisis impact cannot be explained by shifts in comovement in the crisis period that were unrelated to fundamentals.
5. There is no evidence that large derivative positions increased bank exposure to the crisis.
6. There is some evidence that crisis returns were negatively related to prior stock returns and positively related to GDP growth, but both variables were perversely related to crisis volatility.
7. There was no evidence that governance was a separate factor causing crisis exposure. However, the quality of governance was negatively related to the bank's *predicted* exposure. We suggest that this reflects the fact that banks undertaking risky, international operations required good governance systems.

Our results illustrate the value of using the international impact of the crisis as a natural experiment to test the robustness of empirical results found using US data. Since recent international policy recommendations such as those in Acharya et al (2010a), Financial Economists Roundtable (2010), Kane (2010), Squam Lake Group (2010), and Scott (2010) are based either explicitly or implicitly on assumptions about empirical relationships, it is important that their empirical foundations be robust to this type of analysis.

We also show the importance of deriving the empirical test of the propagation mechanism from an understanding of the specific mechanism that operated. Our results are not intended to be a model of the propagation of all international financial crises. We derived the test from knowledge that the crisis was primarily a banking-sector crisis which then spread to the remainder of the economy and that the crisis originated in the US, so its propagation should depend on linkages with the US. Future crises will not necessarily share these characteristics. However, when we reran our principal regression for the individual banks using the correlation with the stock market index for the world ex the USA rather than the US banking index, the regression had only modestly less explanatory power.

The implications of our results for controlling future risks depend on which features of the recent crisis are likely to operate in a similar way in future crises. Policymakers can influence four of the variables which we find to be important, -- capital ratios, how banks are financed, international transactions between banks, and to a lesser extent the size of the banking sector. They do not have direct control over the correlation with other banking sectors, though they may have influence over the international linkages between banks.

Since it was the differential impact of the banking crisis in different countries that led to broader differences in their economic performance during the crisis, our findings could be extended to attempt to measure the impact on other economic variables, such as GDP. To do that it would be necessary to embed our model of banking sector linkages in an extended model which includes the linkage between the banking sector and aggregate economic activity.

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Table 1
Summary statistics

All returns are from Datastream, Osiris, and annual reports. Raw crisis returns are average percentage weekly returns in the period May 2007 to March 2009. Standard deviations (percent per week) are calculated using weekly data for the calendar years 2005-2006. The standardized return is calculated as the ratio of the raw crisis return to the 2005-2006 standard deviation. Raw crisis volatility is the standard deviation of percentage weekly returns in the period May 2007 to March 2009. Standardized crisis volatility is calculated as the ratio of the raw volatility to the 2005-2006 standard deviation.. Correlation is the correlation of the bank return with the return on the U.S. bank industry index using weekly data from January 2005 to December 2006. Extreme comovement is the mean return on the bank common stock in the 5% of weeks in 2005-2006 during which the U.S. bank index had the worst returns. This is standardized by the standard deviation of returns. Bank Claims/GDP is the ratio of total bank assets to GDP. Foreign Claims/Assets is the ratio of total foreign claims held by banks to total bank assets. Interbank Loans is the ratio of interbank assets to total bank assets. Due Other Banks is the ratio of interbank funding to total bank assets. Equity ratio is (Book Value of Equity)/Total Assets). Capital ratio is (Book Value of Equity + Hybrid Debt + Subordinated Debt)/Total Assets). The Basel Tier 1 and capital adequacy ratios are the reported Basel I ratios. The risk-weighted assets ratio is the ratio of Basel risk-weighted assets to total book assets. Return in 2006 is the average weekly stock return in 2006. GDP growth is the rate of growth in percent over the period 2001-2006. Governance is the CGQ index. Unless otherwise indicated, all independent variables are measured at the end of 2006, with the exception of the balance sheet variables which are the latest year-end figures at December 2006. Data sources are given in the Appendix.

Variable	Number of obs.	Mean	Std. Dev.	Median	Maximum	Minimum
Raw crisis return	381	-.007	.007	-.006	.007	-.032
Standardized crisis return	381	-.213	.233	-.157	.271	-1.211
Raw crisis volatility	381	.064	.026	.064	.224	.000
Standardized crisis volatility	381	1.841	1.107	1.585	10.094	.003
Standard deviation 05/06	381	.040	.017	.038	.093	.003
Linkage Measures:						
Correlation	381	.162	.137	.163	.580	-.160
Extreme comovement	380	1.995	1.939	2.004	6.525	-3.131
Bank claims/GDP	369	1.925	1.273	1.784	6.815	.361
Foreign claims/assets	369	.313	.174	.276	.777	.005
Interbank loans/assets	331	.072	.085	.050	.628	.000
Due to other banks	323	.093	.079	.080	.550	.000
Leverage Measures:						
1 - Equity ratio	354	.926	.056	.936	1.000	.264
1 - Capital ratio	274	.905	.067	.913	.982	.194
Fragility Measures:						
1 - Total deposits/assets	358	.366	.213	.335	1.000	.059
Derivatives/assets	204	2.027	4.032	.471	35.351	.000
Basel Measures						
1 - Basel Tier I ratio	325	.899	.048	.910	.963	.440
1 – Basel Capital Adequacy Ratio	315	.872	.044	.882	1.000	.440
Ratio of risk-weighted to total assets	317	.595	.150	.600	1.043	.001
Supplementary Measures:						
Return in 2006	381	.004	.006	.004	.031	-.012
GDP growth	381	.081	.078	.063	.347	0.004
Governance (CGQ)	119	52.243	28.918	51.920	99.950	.790

Table 2
Correlation Matrix for the individual bank sample
The table provides the matrix of correlation coefficients for our individual bank sample. Variables are as defined in Table 1.

Variable	#	1	2	3	4	5	6	7	8	9	10
Raw crisis return	1	1.00	.90	-.45	-.43	-.39	.25	-.16	-.18	-.11	-.07
Standardized crisis return	2	.90	1.00	-.41	-.61	-.49	.19	-.26	-.20	-.14	-.09
Raw crisis volatility	3	-.45	-.41	1.00	.62	.31	-.14	.11	.02	.04	.05
Standardized crisis volatility	4	-43	-.61	.62	1.00	.47	-.09	.40	.17	.10	.04
Correlation	5	-.39	-.49	.31	.47	.18	-.44	.17	-.07	.01	-.01
Extreme comovement	6	.25	.19	-.14	-.09	-.44	1.00	.14	.00	-.08	-.03
Bank claims/GDP	7	-.16	-.26	.11	.40	.17	.14	1.00	.37	.12	.10
Foreign claims	8	-.18	-.20	.02	.17	-.07	.00	.37	1.00	.43	.35
Interbank loans	9	-.11	-.14	.04	.10	.01	-.08	.12	.43	1.00	.79
Due to other banks	10	-.07	-.09	.05	.04	-.01	-.03	.10	.35	.79	1.00
1 – Equity/assets	11	-.18	-.20	.16	.22	.17	.02	.24	-.03	-.17	-.20
1 – Total capital/assets	12	-.13	-.16	.08	.17	.13	.09	.22	-.02	-.17	-.11
1 - Basel Tier I ratio	13	-.16	-.18	.12	.18	.18	.15	.10	-.13	-.25	-.31
1 – Basel capital adequacy ratio	14	-13	-.15	.04	.12	.12	.16	.17	-.15	-.21	-.32
Basel risk-weighted assets ratio	15	.11	.16	-.18	-.25	-.27	-.03	-.31	-.08	.00	-.13
1 - Total deposits	16	-.48	-.53	.17	.32	.31	-.23	.02	.23	.10	.15
Derivatives	17	-.26	-.33	.13	.24	.46	-.23	-.01	.11	-.00	.11
Return in 2006	18	-.10	-.05	.06	-.08	-.08	.09	-.20	.43	.24	.30
GDP growth	19	.20	.26	-.02	-.27	-.25	-.09	-.57	.25	-.01	.06
Governance (CGQ)	20	-.11	-.10	.22	.23	.27	-.23	.09	.08	.03	.07

Note: Sample sizes may differ among cells

Table 2 (Continued)
Correlation Matrix
The table provides the matrix of correlation coefficients for our sample of banks. Variables are as defined in Table 4.

		11	12	13	14	15	16	17	18	19	20
Standardized crisis return	1	-.18	-.13	-.16	-.13	.11	-.48	-.26	-.10	.20	-.11
Raw crisis return	2	-.20	-.16	-.18	-.15	.16	-.53	-.33	-.05	.26	-.10
Standardized crisis volatility	3	.16	.08	.12	.04	-.18	.17	.13	.06	-.02	.22
Raw crisis volatility	4	.22	.17	.18	.12	-.25	.32	.24	-.08	-.27	.23
Correlation	5	.17	.13	.18	.12	-.27	.31	.46	-.08	-.25	.27
Exreme comovement	6	.02	.09	.15	.16	-.03	-.23	-.23	.09	-.09	-.23
Bank claims/GDP	7	.24	.22	.10	.17	-.31	.02	-.01	-.20	-.57	.09
Foreign claims	8	-.03	-.02	-.13	-.15	-.08	.23	.11	.43	.25	.08
Interbank loans	9	-.17	-.17	-.25	-.21	.00	.10	-.00	.24	-.01	.03
Due to other banks	10	-.20	-.11	-.31	-.32	-.13	.15	.11	.30	.06	.07
1 – Equity/assets	11	1.00	.94	.83	.71	-.32	-.04	.21	-.13	-.24	.29
1 – Total capital/assets	12	.94	1.00	.56	.61	-.53	-.16	.37	-.11	-.32	.21
1 - Basel Tier I ratio	13	.83	.56	1.00	.83	.03	-.09	.07	-.10	-.26	.04
1 – Basel capital adequacy ratio	14	.71	.61	.83	1.00	.05	-.11	.06	-.21	-.39	.07
.Basel risk-weighted assets ratio	15	-.32	-.53	.03	.05	1.00	-.03	-.39	.16	.30	-.27
1 - Total deposits	16	-.04	-.16	-.09	-.11	-.03	1.00	.42	.14	.02	.18
Derivatives	17	.21	.37	.07	.06	-.39	.42	1.00	.06	-.13	.21
Return in 2006	18	-.13	-.11	-.10	-.21	.16	.14	.06	1.00	-.17	.04
GDP growth	19	-.24	-.32	-.26	-.39	.30	.02	-.13	-.17	1.00	.15
Governance (CGQ)	20	.29	.21	.04	.07	-.27	.18	.21	.04	.15	1.00

Table 3
Determinants of crisis returns

This table presents regressions of the standardized crisis return on firm-level variables, as defined in Table 1. The standardized crisis return is the average weekly return over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. Balance sheet variables are measured at the close of the fiscal year ending in 2006. The other independent variables are measured at the end of 2006, with the exception of the correlation with the US index, which is estimated from weekly data for 2005-2006, and the rate of GDP growth, which is measured over the period 2001-2006. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

Dependent variable: *Standardized crisis return*

	(1)	(2)	(3)	(4)	(5)
Constant	.00	1.19***	1.39***	1.60***	.1.27***
	(.09)	(3.44)	(4.56)	(2.78)	(4.05)
Correlation	-.83***	-.79***	-.48***	-.56***	-.47***
	(-9.53)	(-8.93)	(-5.61)	(-4.24)	(-5.48)
Bank	-.03***	-.02**	-.02**	-.03**	-.02
claims/GDP	(-3.39)	(-1.98)	(-2.51)	(-2.20)	(-1.55)
Interbank	-.32**	-.51***	-.33**	-.44**	-.26*
loans	(-2.37)	(-3.41)	(-2.53)	(-2.53)	(-1.88)
1 - Equity		-.1.29***	-1.38***	-.1.56**	-.1.29***
ratio		(-3.42)	(-4.14)	(-2.49)	(-3.82)
1 - Total			-.50***	-.54***	-.49***
deposits			(-9.42)	(-6.54)	(-9.05)
Derivatives				.003	
				(.70)	
Return					-4.43**
2006					(-2.01)
GDP					.44**
growth					(2.03)
Adjusted R^2	.29	.32	.48	.46	.48
N	317	303	302	174	300
Comparable adjusted R^2 for regression (3)	.28	.33	.46	.46	.46

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 4
Determinants of crisis variability

This table presents regressions of the standardized crisis volatility on firm-level variables, as defined in Table 1. The standardized volatility is the standard deviations of weekly returns over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. Balance sheet variables are measured at the close of the fiscal year ending in 2006. The other independent variables are measured at the end of 2006, with the exception of the correlation with the US index, which is estimated from weekly data for 2005-2006, and the rate of GDP growth, which is measured over the period 2001-2006. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

Dependent variable: *Standardized crisis volatility*					
	(1)	(2)	(3)	(4)	(5)
Constant	.61***	-1.50	-2.02	-3.42	-2.86*
	(5.13)	(-.92)	(-1.27)	(-1.06)	(-1.73)
Correlation	3.31***	3.30***	2.46***	3.10***	2.53***
	(8.25)	(7.81)	(5.53)	(4.19)	(5.64)
Bank	.36***	.34***	.34***	.41***	.40***
claims/GDP	(7.90)	(6.54)	(6.89)	(5.91)	(6.84)
Interbank	.62	1.02	.55	-.09	.57
loans	(.99)	(1.44)	(.79)	(-.09)	(.78)
1 - Equity		2.31	2.52	3.74	3.17*
ratio		(1.29)	(1.45)	(1.07)	(1.79)
1 - Total			1.35***	1.78***	1.28***
deposits			(4.83)	(3.84)	(4.48)
Derivatives				-.02	
				(-.91)	
Return 2006					-4.66
					(-.40)
GDP growth					2.22*
					(1.93)
Adjusted R^2	.34	.34	.39	.39	.39
N	317	303	302	174	300
Comparable adjusted R^2 for regression (3)	.34	.34	.39	.39	.41

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 5
Regression of the standardized return during the crisis period on alternative measures of comovement before the crisis

Panel 5A shows OLS regressions of the standardized crisis return on two different measures of risk. Panel 5B shows regressions of standardized volatility on the same measures of risk. Correlation coefficient is the Pearson correlation coefficient between bank returns and the U.S. index, and is estimated from weekly data for 2005-2006. Extreme comovement is the average return in the 5% of weeks where the U.S. bank stock index gave the worst returns in 2005-06. T-statistics are given in parentheses.

Panel 5A

	(1)	(2)	(3)
Constant	-.08***	-.19***	-.08***
	(-4.86)	(-15.23)	(-4.78)
Correlation coefficient	-.83***		-.85***
	(-10.90)		(-9.90)
Extreme comovement		.56***	-.06
		(3.84)	(-.45)
Adjusted R^2	.24	.03	.23
N	381	380	380

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Panel 5B

	(1)	(2)	(3)
Constant	1.21***	1.79***	1.19***
	(15.63)	(29.00)	(15.31)
Correlation coefficient	3.84***		4.41***
	(10.48)		(10.87)
Extreme comovement		-1.29*	1.96***
		(-1.83)	(2.86)
Adjusted R^2	.22	.01	.24
N	381	380	380

*, **, and ***, significant at the 10, 5, and 1 percent level

Table 6

This table presents OLS regressions of the standardized crisis return and standardized crisis volatility on firm-level variables. The standardized return is the average weekly return over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. The standardized volatility is the standard deviations of weekly returns over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. Balance sheet variables are defined in Table 1 and are measured at the close of the fiscal year ending in 2006. The other independent variables are measured at the end of 2006, with the exception of the correlation components, which are estimated from weekly data for 2005-2006, and the rate of GDP growth, which is measured over the period 2001-2006. The indirect correlation component is the correlation between bank returns and the Datastream index of the U.S. market excluding financials. The direct component is the residual from a regression of the correlation between bank returns and the U.S. banking index on the indirect correlation component.
The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

	(1)	(2)
Dependent variable:	Standardized crisis return	Standardized crisis variability
Independent variables:		
Constant	1.42***	-2.27
	(4.62)	(-1.42)
Indirect correlation component	-.34***	1.82***
	(-4.93)	(5.07)
Direct correlation component	-.43***	2.00***
	(-3.29)	(2.95)
Bank claims/GDP	-.02**	.34***
	(-2.50)	(6.87)
Interbank loans	-.33**	.55
	(-2.52)	(.79)
1 - Equity ratio	-1.40***	2.69
	(-4.17)	(1.54)
1 - Total deposits	-.50***	1.35***
	(-9.42)	(4.84)
Adjusted R^2	.47	.39
N	302	302

*, **, and ***, significant at the 10, 5, and 1 percent level respectively

Table 7
A test of the effect of correlation shifts

Column (1) shows the regression of the change in correlation on measures of bank fundamentals prior to the crisis. The change in correlation is the correlation between the share and the U.S. bank stock index in the crisis period minus the same correlation in 2005-06. Independent variables are as in Table 1. Column (2) shows the result of regressing the standardized crisis return on fundamental variables plus the residual from regression (1). Estimation is by OLS. T-statistics are given in parentheses.

	(1)	(2)
Dependent variable:	Correlation shift	Standardized crisis return
Independent variables:		
Constant	0.049	1.677***
	(0.21)	(5.32)
Bank claims/GDP	-0.009	-0.031***
	(-1.20)	(-3.15)
Interbank loans	0.090	-0.282**
	(0.87)	(-2.03)
1 - Equity ratio	0.098	-1.718***
	(0.38)	(-4.99)
1 - Total deposits	0.028	-0.623***
	(0.74)	(-12.09)
Residual from (1)		-0.050
		(-0.64)
Adjusted R^2	-0.00	0.42
N	302	302

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 8
A test of governance effects

In Column (1) the dependent variable is the fitted values from the regression of the standardized return on the principal explanatory variables (col 3 of Table 3). The independent variable is the Corporate Governance Quotient. Column (2) shows the corresponding result of regressing the fitted values from the regression of the standardized crisis variability on the principal explanatory variables (col 3 of Table 4) on the corporate governance quotient Estimation is by OLS. T-statistics are given in parentheses.

Fitted crisis returns and governance

	(1)	(2)
Dependent variable:	Standardized crisis return (fitted)	Standardized crisis variability (fitted)
Independent variables:		
Constant	-.21***	2.00***
	(-6.11)	(14.8)
CGQ	-.002***	.008***
	(-3.61)	(3.58)
Adjusted R^2	.10	.10
N	110	110

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 9
Regression of the standardized return during the crisis period on book leverage and Basel measures

This table presents regressions of the standardized crisis return using three different leverage measures. Panel A is for the total available sample, and Panel B uses a common sample for all regressions. Equity ratio is the ratio of the book value of equity to bank assets. Capital ratio is the ratio of the book value of (equity + hybrid debt + subordinated debt) to bank assets. Basel Tier 1 is the Basel Tier 1 ratio and Basel ratio is the Basel capital adequacy ratio. Basel-equity ratio is the difference between the Basel Tier 1 ratio and the equity ratio, and Basel – capital ratio is that difference between the Basel capital adequacy ratio and the capital ratio). Standardized crisis return is the average weekly return over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. The independent variables are measured at the end of 2006. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

Panel 9A: Variable sample

Dependent variable: *Standardized crisis return*

	(1)	(2)	(3)	(4)	(5)
Constant	.58***	.30	.54**	.47*	1.08***
	(2.80)	(1.51)	(2.17)	(1.78)	(3.55)
1 - Equity ratio	-.86***				-1.40***
	(-3.88)				(-4.30)
1 - Capital ratio		-.60***			
		(-2.75)			
1 – Basel Tier 1 ratio			-.86***		
			(-3.13)		
1 - Basel capital adequacy ratio				-.81***	
				(-2.67)	
Basel Tier 1 - Equity ratio					-.39
					(-.79)
Adjusted R^2	.04	.02	.03	.02	.05
N	354	274	311	315	309

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 9 (continued)

Panel 9B: Common sample

Dependent variable: *Standardized crisis return*

	(1)	(2)	(3)	(4)	(5)
Constant	2.36***	1.43***	1.04**	.78**	2.32***
	(4.94)	(3.20)	(2.60)	(2.11)	(4.78)
1 - Equity ratio	-2.80***				-2.74***
	(-5.49)				(-5.27)
1 - Capital ratio		-1.86***			
		(-3.79)			
1 – Basel Tier 1 ratio			-1.44***		
			(-3.26)		
1 - Basel capital adequacy ratio				-1.19***	
				(-2.82)	
Basel Tier 1 - Equity ratio					-.35
					(-.59)
Adjusted R^2	.11	.05	.04	.03	.11
N	239	239	239	239	239

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 10
Regression of the standardized variability during the crisis period on different leverage measures

This table presents regressions of the standardized crisis volatility using three different leverage measures. Panel A is for the total available sample, and Panel B uses a common sample for all regressions. Equity ratio is the ratio of the book value of equity to bank assets. Capital ratio is the ratio of the book value of (equity + hybrid debt + subordinated debt) to bank assets. Basel Tier 1 is the Basel Tier 1 ratio and Basel ratio is the Basel capital adequacy ratio. Basel-equity ratio is the difference between the Basel Tier 1 ratio and the equity ratio, and Basel – capital ratio is that difference between the Basel capital adequacy ratio and the capital ratio). Standardized crisis variability is the standard deviation of weekly returns over the period May 2007 to March 2009 divided by the standard deviation of weekly returns in 2005-2006. The independent variables are measured at the end of 2006. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

Panel 10A: Variable sample

Dependent variable: *Standardized crisis variability*

	(1)	(2)	(3)	(4)	(5)
Constant	-2.17**	-.85	-1.81	-.86	-4.94***
	(-2.22)	(-.87)	(1.52)	(-.67)	(-3.40)
1 - Equity ratio	4.38***				7.34***
	(4.16)				(4.71)
1 - Capital ratio		3.13***			
		(2.91)			
1 – Basel Tier 1 ratio			4.21***		
			(3.18)		
1 - Basel capital adequacy ratio				3.23**	
				(2.21)	
Basel Tier 1 - Equity ratio					3.05
					(1.29)
Adjusted R^2	.04	.03	.03	.01	.07
N	354	274	311	315	309

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 10 (continued)

Panel 10B: Common sample

Dependent variable: *Standardized crisis variability*

	(1)	(2)	(3)	(4)	(5)
Constant	-10.15***	-6.48***	-3.69*	-1.62	-9.86***
	(-4.16)	(-2.87)	(-1.81)	(-.86)	(-3.99)
1 - Equity ratio	13.08***				12.70***
	(5.02)				(4.78)
1 - Capital ratio		9.41***			
		(3.79)			
1 – Basel Tier 1 ratio			6.37***		
			(2.84)		
1 - Basel capital adequacy ratio				4.24**	
				(1.97)	
Basel Tier 1 - Equity ratio					2.29
					(.76)
Adjusted R^2	.09	.05	.03	.01	.09
N	239	239	239	239	239

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 11
Regression of the standardized return and variability during the crisis period on the ratio of risk-weighted to total assets and other variables

This table presents regressions of the standardized crisis return and standardized crisis variability on our principal explanatory variables plus the ratio of risk-weighted assets to book assets. Standardized crisis return is the average weekly return over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. Standardized crisis variability is the standard deviation of weekly returns over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. The other independent variables are as in Table 1. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

	Dependent variable:			
	Standardized crisis return		*Standardized crisis variability*	
	(1)	(2)	(3)	(4)
Constant	-.39***	.1.40***	3.09***	.68
	(7.14)	(3.32)	(12.03)	(.31)
Correlation		-.41***		1.48***
		(-4.29)		(3.03)
Bank claims/GDP		-.04***		.48***
		(-4.09)		(8.75)
Interbank loans		-.18**		-.20
		(-2.14)		(-.27)
1 - Equity ratio		-1.30***		-.11
		(-2.84)		(-.05)
Risk-weighted assets/book assets	.26***	-.09	-1.89***	-.57
	(2.91)	(-1.08)	(-4.52)	(-1.37)
1 - Total deposits		-.54***		1.69***
		(-9.79)		(5.97)
Adjusted R^2	.02	.51	.06	.45
N	317	276	317	276

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 12 Country-level determinants of crisis returns and variability

This table presents regressions of the standardized crisis return and standardized crisis variability for the country bank indices on country-level variables. The standardized return is the average weekly return over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. Standardized crisis variability is the standard deviation of weekly returns over the period May 2007 to March 2009 divided by the weekly standard deviation in 2005-2006. All the independent variables are measured at the end of 2006, with the exception of the correlation with the US index, which is estimated from weekly data for 2005-2006, and the rate of GDP growth, which is measured over the period 2001-2006. Estimation is by OLS. The table also reports the adjusted R-square and number of observations. T-statistics are given in parentheses.

	Dependent Variable	
	Standardized crisis return	*Standardized crisis volatility*
Constant	2.99***	-11.86***
	(2.97)	(-3.22)
Correlation coefficient	-.53**	3.11***
	(-2.61)	(4.20)
1 - capital ratio	-3.10***	13.53***
	(-2.83)	(3.39)
1 - deposits	-.37*	-.53
	(-1.92)	(-.75)
Bank claims/GDP	-.05*	.48***
	(-1.82)	(4.98)
Foreign claims	-.29	.60
	(-1.39)	(.78)
Adjusted R^2	.58	.73
N	47	47

*, **, and ***, significant at the 10, 5, and 1 percent level respectively.

Table 13
Economic significance of key measures

The table shows mean weekly returns 2007-2009 for individual banks grouped into quartiles by the magnitude of their prior correlation with the U.S. market and by key balance-sheet ratios. Correlation with the U.S. is the correlation of the bank return with the return on the bank industry index for the U.S.using weekly data from January 2005 to December 2006.

	Correlation with US	1 - equity ratio	(1 – total deposits)/assets
Quartile 1	-.44%	-.55%	-.36%
Quartile 2	-.62	-.63	-.56
Quartile 3	-.64	-.62	-.66
Quartile 4	-1.14	-1.02	-1.21

Appendix
Variable definitions and data sources

Variable	Description	Source of data
Raw crisis return	Average percentage weekly return in the period May 2007 to March 2009	Datastream
Standardized crisis return	Ratio of the raw crisis return to standard deviation. Standard deviations (percent per week) calculated using weekly data for calendar years 2005-2006	Datastream
Raw crisis volatility	Standard deviation of weekly returns in the period May 2007 to March 2009	Datastream
Standardized crisis volatility	Ratio of the raw crisis volatility to standard deviation.of weekly returns 2005-2006	Datastream
Correlation	Correlation of bank weekly returns with returns on the U.S. bank industry index January 2005 to December 2006	Datastream
Bad weeks return	Standardized bank return in the 5% of weeks in 2005-2006 during which the US bank index had the worst returns.	Datastream
Interbank loans	Interbank Loans/Total Assets for fiscal year ending in 2006	Osiris
Due other banks	Interbank Liabilities/Total Assets for fiscal year ending in 2006	Osiris
(1 – book equity)/assets	(1 - book value of equity)/assets for fiscal year ending in 2006	Datastream
(1 – capital)/assets	(1 – (book value of equity + hybrid debt + subordinated debt))/assets for fiscal year ending in 2006	Osiris
Basel Tier 1 ratio and Basel capital adequacy ratio	Basel I ratios	Company annual reports, and Osiris
Basel risk-weighted assets ratio	Basel I Risk-weighted Assets/Total Assets	Company annual reports
1 - Total deposits/assets	(1 - book value of deposits)/assets for fiscal year ending in 2006	Datastream
Derivatives/assets	Ratio of gross nominal value of derivatives positions to total bank assets for fiscal year ending in 2006	Company annual reports
Bank claims/GDP	Ratio of total bank assets for country to GDP	IMF *International Financial Statistics*, country tables
Foreign claims	Ratio of total bank assets for country to GDP	IMF *International Financial Statistics*, country tables
Return in 2006	Average weekly share return in 2006	Datastream
GDP growth	GDP growth in local currency 2001-2006	IMF *International Financial Statistics*
Governance	CGQ governance index for individual bank	Bloomberg