Real-time Monitoring of International Bank Insolvency Risk

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"Second only to its macro stability responsibilities is the central bank's responsibility to use its authority and expertise to forestall financial crises (including systematic disturbances in the banking system) and to manage such crises once they occur." Statement by Chairman Alan Greenspan before the subcommittee on Capital Markets, Securities and Government Sponsored Enterprises of the Committee on Banking and Financial Services U.S. House of Representatives, 1997.

"In practice, the policy choice of how much, if any, extreme market risk should be absorbed by government authorities is fraught with many complexities....The question is not whether our actions are seen to have been necessary in retrospect; the absence of a fire does not mean that we should not have paid for fire insurance. Rather, the question is whether, ex ante, the probability of systematic collapse was sufficient to warrant intervention. Often, we cannot wait to see whether, in hindsight, the problem will be judged to have been an isolated event and largely benign." Remarks by Chairman Alan Greenspan before the Council on Foreign Relations on International Financial Risk Management, 2002.

The stability of the banking system has been one of the major concerns of both policy makers and academics. We attempt to address at least partially the above requests of policy makers in that we present techniques of monitoring the bank insolvency risk in real time. These are sequential methods for evaluating bank risk on-line i.e. with every new observation that arrives in the sample as opposed to the retrospect or historical methods.

Real-time risk monitoring is based on the following non-exhaustive list of measures. First we consider bank systematic risk measures such as for instance credit spreads of subordinated notes and debentures (SNB) e.g. in Flannery and Sorescu (1996) and Krishnan et al. (1999). Policymakers are actively considering requiring banks to issue subordinated notes and debentures (SND), see for instance the consultative paper issued by the 1999 Basel Committee on Banking

Supervision and the Gramm, Leach and Bliley Act of 1999 on the joint Federal Reserve and US Treasury study of bank SND requirements. Recent empirical evidence by Flannery and Sorescu (1996) and Krishnan et al. (2005) shows that credit spreads of SND reflect changes in bank risk. Moreover, bank risk factors related to abnormal returns which are monitored on-line, with particular interest to the sequential analysis before and after periods of crises for both exposed and unexposed bank e.g. Kho et al., (2000) and Bartram et al., (2004). Second we use publicly available financial information that relates to market forces and can be used by market participants and regulators to identify and control the bank risk, such as bank share prices and market rates on large certificates deposits (e.g. Flannery, 1998). Market data are available for the largest banking firms. A small percentage of all banks are associated with holding companies whose equity shares trade. Similarly only a few banks have publicly traded debt outstanding. However, they represent the largest institutions and hold more than half of all banking system assets (see for instance, Flannery, 1998). The evidence on the usefulness of such market data as indicators of bank risk are mixed (e.g. Flannery, 1998, Bongini et al. 2001). In addition, a set of leading indicators is used that can provide an early warning as to the fundamental changes of the banking risk such as for instance equity prices, foreign exchange deviations from trend and real interest rates e.g. in Kaminsky and Reinhart (1999). Third we propose to monitor a measure of correlation between values of banks' asset portfolios and risks in order to address whether highly correlated asset portfolios influence the risk exposure of banks and the simultaneous failure of several banks. This empirical analysis is prompt from the theoretical model developed in Acharya (2001) shows that if banks believe that they are more likely to be bailed out if they fail at the same time as other banks they therefore choose to take risks correlated with those of other banks, thereby increasing the risks for the system as a whole. The model suggests that supervision focused on individual banks may miss the threat of systematic risk arising from a high correlation of bank exposures. A related and simple statistical point is provided by de Vries (2005) on the linkages of bank portfolios and system fragility according to which the weak or strong dependence between portfolios depends on the multivariate distribution and the tails that characterize this.

The real-time monitoring aims to provide timely and early information on the insolvency risk of banks which is useful for financial decision making of regulators and investors. To the best of our knowledge this is the first attempt to address risk monitoring sequentially. A notable exemption is Inoue ad Rossi (2003) that use real time techniques in another context namely to obtain the significant variables in constructing an index that predicts currency risk. Moreover, in order to make the monitoring as efficient and timely we use high frequency (ideally daily and when there is no data availability we resort to monthly). This high frequency data strategy aims to provide more timely information and relatively earlier warning signals to decision makers and moreover circumvents the lack of high quality and frequency of reporting of bank balance-sheet data especially from emerging market economies.

The techniques used in the paper extend the sequential methods for moni-

toring risk developed in Andreou and Ghysels (2003, 2005) and their scope of application. Similar methods are developed in Chu et al. (1996) and Leisch et al. (2000) that concentrates only on linear models. It is important to note that our analysis is not dealing with predicting the financial crises but instead of presenting an alternative method according to which the risk exposure and insolvency of banks is monitored. The approach we propose consists of monitoring indices of systematic risk. These 'prices of risk' are a function of the underlying financial risk of insolvency. We are interested in sequential testing of the premia for structural changes, meaning permanent shifts in the average premia, or shifts in their volatility. Hence, our objective is to provide Central Banking authorities with a tool to warn them of fundamental shifts in risk premia. The question we try to solve is the selection of appropriate empirical processes that identifies such shifts against a statistical control limit or boundary. It is important to note that our analysis does not involve the choice of the threshold in detecting or predicting crises as for instance in Kaminsky and Reinhart (1999) or Inoue and Rossi (2004) since we are directly interested in risk events that reject the null hypothesis of stability. Moreover, following the quality control statistics literature we propose warning lines that are more conservative than control limits and can provide earlier warning signals to financial decision makers and investors (e.g. Lai, 1995, Andreou and Ghysels, 2003).

Using unique data we study 334 banks across 28 countries that represent 80% of the global bank equity over a period that covers global financial crises in Mexico in 1994, in Asian in 1997, in Russian in 1998, in Brazil in 1999 as well as the tragic disaster of September 11, 2001. Further details on the database can be found in Bartram et al. (2004). We construct daily bank indices that measure the systematic risk based on the (i) the exposure of banks (i) the geographic location and (ii) other financial factors. We monitor the stability of such risk indices for international banks and examine whether they provide early warning signals for bank insolvency.

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