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KHAN MD ANICHUL HOQUE

ESSAYS ON BANKING CRISES

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Khan Md Anichul Hoque

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I. Introduction

1 Goals and background

1.1 Goals of the thesis

This thesis aims at finding the role of *deposit insurance scheme* (DIS) and *central bank* (CB) in keeping the banking system safe. The thesis also studies the factors associated with long-lasting banking crises. Although many studies have attempted to identify the causes of banking system instability, still there is void in dealing with efficient DIS and powerful CB for the stability of banking system. The empirical study by Demirguc-Kunt and Detragiache (2002) shed partial light on the issue of efficient DIS and banking sector stability by using a smaller data set. Using a larger and updated dataset, this thesis attempts to give a more complete picture about the efficient forms of DIS with a special focus of their uses in developing countries.

This thesis illustrates empirically whether a more independent or more powerful CB is beneficial for a safe banking system. Even though there have been many studies on the effect of CB's independence for price stability, there are so far no studies that consider the role of the strength of a CB for the safety of banking system. This thesis determines the impact of CB's strength on the stability of banking system.

Finally, the target of the thesis is to identify the factors of long-lasting banking crises. The special focus is given on the crisis resolution policy measures which the government may (or may not) introduce right after the banking system is destabilized.

1.2 Background

1.2.1 Banking sector in a country

So far, banks have been the most efficient financial intermediaries in countries around the globe. A bank's most important task is to collect credit from different sources and lend money to the entrepreneurs. In most countries the banking sector is the backbone of economic development. Problems in the banking sector involve impediments to economic development and growth of a country. Being the sector of financial

intermediaries, the banking sector is the most affected sector during a financial crisis in a country, and hence "financial crisis" very often termed as "banking crisis".

1.2.2 Composition of financial crisis

To define the composition of financial crisis I begin with Minsky model as reported in Kindleberger (2000). The model follows that a financial crisis start with a displacement implied by some exogenous outside shock to the macroeconomic system. The nature of this displacement is not the same; it varies from one speculative boom to another. It can be accompanied by the outburst or end of a war, a bumper harvest or crop failure, the widespread adoption of an invention with pervasive effects, some political event or surprising financial success, or a debt conversion that precipitously lowers interest rates. If this displacement is sufficiently large and pervasive, the economic outlook will be altered with the change of profit opportunities in at least one important sector. It brings opportunities for profit in some new or existing lines, but closing out others. A boom is said to underway if the gainers from the opportunities dominate the losers, for which investment and production pick up. However, this boom is fed by an expansion of bank credit, enlarging the total money supply.

Kindleberger argues that a boom with enlarged money supply can turn into "euphoria." That is, if the effective demand for goods or financial assets gets higher (as it can), the higher will be the prices leading to higher profit opportunities, turning to more investments. And the new investments can lead to increasing income, stimulating further investments with further income increase. Then, there can be "overtrading" with a built up process that speculation for price increase is added to investment for production and sale. This overtrading may spread from one country to another. There are many factors for this spread. For instance, the increase of price of internationally traded goods and assets in one country can cause price increase in others; the income changes in a country can influence others by foreign-trade multiplier through increased or decreased imports; capital flows; psychological connections – investor euphoria in one country influences investors in others.

Kindleberger adds that interest rates, velocity of money-circulation, and prices of goods and services continue to go up while the speculative boom keeps on. At some point, a few insiders choose to take their profits and sell out. As new recruits to speculation are balanced by insiders who withdraw, there develops hesitation at the

top of the market. Prices starts to level off then, resulting an uneasy period of "financial distress". As distress persists, a considerable segment of the speculating community in an economy realize that the market cannot go higher and it is time to withdraw their money from banks. In many cases the race for money may turn into a rush. A crisis may be precipitated by different ways, e.g., with the signal of failure of a bank or firm, the revelation of a swindle by someone who sought to escape distress by fraudulent means, or a fall in the price of the primary object of speculation as it is seen to be overpriced. Bankruptcies of firms increase as prices decline with the rush on.

There can be a "lender of last resort" to convince the market that sufficient volume of money will be made available to meet the demand for cash. It can be domestic, i.e., the government or the central bank or can be international but there is no specific "world government" or "world bank" to conduct this job. However, there is debate of using the lender of last resort instrument – proponents worry more about the current crisis than about prevention some future one and opponents argue that it encourages the speculation in the first place.

Kindleberger raises the question of validity and relevance about the Minsky model at some extents. For instance, he argues that structural changes in the institutional underpinnings of an economy, including the rise of corporations, big labour union, big government, modern banking, speedier communications, and so on make a model of crisis based on the instability of credit uninteresting. He also argues that there can be no price bubbles because market prices reflect fundamentals, and that sharp falls in prices frequently reflect "policy switching" by government or central bank.

1.2.3 The countries with financial crises

Financial crises have been the concern of economic analysts for centuries. Kindleberger (2000) shows the record of financial crises taken place since the beginning of 17th century. The century's very beginning financial crisis took place in the Holy Roman Empire during the period of 1618-23, and the others in Dutch Republic and England during 1636-37 and 1690-96 respectively. All of these crises were seriously related with different wars.

There have been many financial crises through the 18th and 19th centuries. However, most of the crises took place in Europe, especially in England. One of the reasons for

the most crises in England could be that as World's trade and financial activities were mostly dominated by England, the financial conditional up-down was also mostly affected by England. Remarkably, the other European countries or business cities experienced financial crises are France, Germany, Italy, Austria, and Amsterdam. With the independence in 1776 the USA gradually turned to be an economic power in the world. Gradually it has been the most powerful country to influence the world' trade and financial activities for years. The USA's economy is as well not unaffected by financial crises and it has experienced many.

During the 18th and 19th centuries, most of the financial crises were explicitly related with the political factors rather than the economic factors. For instance, the crises of Amsterdam (1763 and 1772), England (1815-16 and 1857), and of France (1864) were related with different wars. Similarly the crises of England (1720), France (1720), the USA (1792), England (1793), Hamburg (1799), England (1810), the USA (1837), France (1838), and the USA (1873) were respectively related with the Treaty of Utrecht in 1713, death of Louis XIV in 1715, constitution adopted in 1789, the Reign of Terror after the onset of French revolution, the break of continental blockade, Wellington's peninsula campaign, Jackson presidency, the Monarchy of 1830, and the fraud exposed in 1872 campaign.

One of the most discussing and severe financial crises during the 20th century was the crisis of the USA in 1929. The crisis, often called "The Great Depression", was preceded by an extended economic boom (see e.g. Richardson 2006, Hori 1996, Cecchetti and Karras 1994, and Stricker 1984 for details about the crisis). The crisis inflicted immense damage not only upon the USA but also the entire world. Especially, it caused financial crises in Britain, Germany, Austria, and Japan in the early 1930s. The major reason of the crises in other countries was the cutting-off of the U.S. foreign lending.

Until the 80s of the 20th century the financial crises were mostly experienced by some European countries and the USA (see the record of Kindleberger, 2000, and Caprio and Klingebiel, 2003). Financial crises have been experienced by other countries mostly since the 1980s. Many developing countries around the globe have begun to experience financial crises since the 1980s. According to Lindgren at al (1996), at least two-thirds of the IMF member countries have experienced some form of systematic financial crisis during 1980-96. In many regions, almost every country has experienced at least one financial crisis. Thus the widely used terms are, e.g., the

"Nordic Financial Crises", "Latin American Financial Crises", "East Asian Financial Crises" and so on. Financial crises have also been classified according to the country's economic development, e.g. Transition Economic Financial Crises, Emerging Economic Financial Crises.

Another point to note that, unlike the crises of 17th to 19th centuries, almost all of the crises in the 20th century are explicitly related with economic or financial factors instead of the political factors. For instance, the crisis of the USA (1929) related with extended economic boom, Europe (1931-33) with cut-off of U.S. foreign lending, the USA (1974-75) with collapse of Bretton Woods and OPEC 1973 oil price rise, the USA (1979-82) with the Third World syndicated bank loans, OPEC 1979 oil price rise, real estate in Southwest U.S., the farmland of U.S. and so on. Similarly the crisis of Japan (1990) explicitly related with Nikkei shares index and real estate, and the crisis of Mexico, East Asia, Russia and Brazil in 1990s with the financial deregulation, capital inflow and outflow, and the domestic boom (see Kindleberger 2000 for details).

1.2.4 Region based causes of recent banking crises

So far, there have been numerous studies attempting to identify the causes of banking crises and to design efficient mechanisms for crisis-prevention.[1] The list of causal factors has increased after every drive of crises occurrences. Rojas-Suarez and Weisbrod (1996), and Rojas-Suarez and Hausmann (1996), for instance, show that the crises in Latin American countries of the 1980s brought emphasis on the need for appropriate macroeconomic fundamentals, especially on the fiscal and monetary policies. They argue that these crises lasted longer, affected a larger segment of the banking industry and brought higher costs for the public. On the other hand, the Mexican crisis of 1994 identified that the lack of appropriate regulatory and supervisory frameworks in the context of financial liberalization contributed significantly to the crisis (see among others Guidotti et al 2004).

The East Asian crisis in the late 1990s popularized the role of "contagion" in the emergence of a crisis (see e.g. Cathie 1998 and Kawai et al 2001).[2] Krugman (2001),

[1] See for example, Gavin and Hausmann (1996), Rojas-Suarez and Weisbrod (1995), Sundararajan and Balino (1991).

[2] The issue of contagion has been analyzed in a large number of papers, including, Calvo (2000), Claessens, Dornbusch and Park (2000), Pericolli and Sbracia (2002), Perry and Lederman (1999) and Reinhart and Kaminsky (2000).

Summers (1999), and Corsetti et al. (1998) argue that due to the government's implicit guarantee, the East Asian countries had substantial investments in unproductive sectors and these investments created vulnerability both in the real and financial sectors of the countries. Simultaneously, in order to protect depositors in banks and other financial institutions, the governments accumulated large contingent liabilities. The strong trade linkages among these economies induced the contagious effect, spreading the crisis throughout the region.

Many studies have examined the Nordic banking crises (see e.g. Drees and Pazarbasioglu 1995, and Pesola 2001). As the crises elsewhere in the world, these were also caused by bad banking, inadequate market discipline, weak banking regulation and supervision, premature financial liberalization, and inadequate macro policies (Ingves, 2002). However, the severity of the causes of Nordic crises differs from the other crises, e.g. the crises of emerging economies.[3]

1.2.5 Causes of banking crises in general

In addition to studies focusing specifically on case-wise or region-wise banking crisis, a number of studies have examined the common causes of banking crises irrespective of individual cases or regions. Demirguc-Kunt and Detragiache (1999, 2002 and 2005) and Kaminsky and Reinhart (1999) were the ground breaking studies examining the common causes of banking crises. The first two essays of my dissertation rely on studies by Demirguc-Kunt and Detragiache (*DKD henceforth*) extensively.

So far, DKD (1999) has been the first study that defines the common causes of banking crises empirically irrespective of developing or developed country context. They show that a banking crisis tends to erupt in the following cases: weak macroeconomic environment combined with low economic growth, high inflation, and high real interest rate; the vulnerability of the economy to balance-of-payment crisis; the use of explicit deposit insurance scheme in the country; and weak law enforcement in the country. DKD (2005) is an extended version of DKD (1999). In that paper, they, with a new dataset, verify and uphold the parameters found in their earlier paper.

[3] For instance, the severity of the above mentioned causes of crises is higher in developing countries. See, e.g. Komulainen and Lukkarila (2003) for details about the factors of developing economies' financial crises.

DKD (2002) also builds on their 1999 version, but with the special reference to the deposit insurance scheme (*DIS henceforth*). The study confirms their previous finding that the use of explicit DIS adversely affects the bank stability. In addition, the study shows that this adverse impact is stronger, the more extensive the coverage offered to depositors. The impact is also stronger if the scheme is funded instead of it unfunded and if the scheme is run by the government rather than by the private sector.

1.2.6 The studies of this dissertation relative to other studies

The first essay of my dissertation builds on DKD (2002) by using a larger dataset both in terms of the time period and the number of countries. In particular, the number of developing countries is much higher in my dataset than in DKD (2002). Given that the fundamentals affecting banking crises in developing countries may differ from those in developed countries (see e.g. Ingves 2002), the presence of a large number of developing countries in a sample could change the estimation results found in DKD (2002). This essay attempts to examine this change by a logit estimation model. Explicitly, taking a sample comprising a large number of developing countries, the essay examines the impacts of explicit DIS forms on banking crises and also examines the impacts when the DIS forms handled by a country with less economic development. In the analysis, this essay includes some new, previously unexamined, forms of explicit DIS. These forms, for instance, include as follows: whether the scheme has power to intervene in bank's operation; whether it has power to cancel or revoke the deposit insurance of banks; and whether it has power to take legal action against bank officials.

The second essay of the dissertation examines the effect of CB's autonomy, i.e. the degree of CB's independence from executive body, on banking crises. Neither DKD (1999, 2002 and 2005) or Kaminsky and Reinhart (1999), nor any other study has considered this issue. There have been many studies on the influence of powerful CB, but most of these deals with the relationship of powerful CB over inflation, economic growth or government fiscal deficit (see e.g. Alesina and Summers 1993, Cukierman et al 1992 and 1993, Cukierman 1993 and 1994, De Long and Summers 1992, Doi 1998). However, according to Padoa-Schioppa (2002), Freixas et al (2000), and Goodhart (1987), there are many reasons to expect that the CB's role has impact on banking crises. Some studies, for instance Blejer and Schumacher (1998), Mishkin

(2000), Quintyn and Taylor (2003), Doi (1998), Cukierman (1994) and Lohmann (1992), argue that a powerful CB can reduce the likelihood of financial crisis.

Banking crises can last for a long period or for a short period. A long lasting banking crisis may generate massive costs to the economy. The third essay of my dissertation examines the factors correlated with long-lasting banking crises. This is closely related to Honohan and Klingebiel (2003) which deals with the relation between different crisis resolution policy measures[4] and the costs of banking crises. Crisis resolution policy measures are usually undertaken immediately after the eruptions of banking crises in order to contain the panicking stage of the crises and then attempting to rapid recovery. Honohan and Klingebiel show that these measures increase the costs of banking crises. In this essay, the resolution measures are the key factors explaining the lengths of banking crises. It is plausible that these measures prolong banking crises. Other studies closely related to this essay are Abderrezak (2000) and Frydl (1999). Abderrezak deals with the explanatory factors of the durations of banking crises but does not consider the crises resolution policy measures. Frydl studies the relation between the lengths and the costs of banking crises.

2 Contents of the dissertation

2.1 Deposit insurance scheme and banking crises: a special focus on less developed countries

The aim of each country is to keep banking sector stable. With that aim, a country may exercise *explicit deposit insurance scheme* (*EDIS*), where rules and regulations are defined in advance to insure the deposited funds in banks. Otherwise, the country is said to use *implicit deposit insurance scheme* (*IDIS*), because it establishes a *de facto* insurance system to depositors of banks. The first paper of my thesis examines the impact of EDIS on banking crises empirically, with special reference to less developed economies. There is disagreement among researchers on whether an EDIS

[4] Crisis resolution policy measures are termed as “accommodating approaches” in Honohan and Klingebiel (2003).

increases the likelihood of a banking crisis.[5] DKD (2002) show, by a dataset of 61 countries for 1980-1997, that an EDIS compared to IDIS increases the banking crisis probability. This probability is even greater if the EDIS is implemented in an inefficient form (or design).

Despite of this controversial evidence, countries, especially the less developed countries (LDCs), have used EDIS increasingly (12 countries in 1974, 71 in 1999, and 87 in 2003). On the other hand, a large number of LDCs with both EDIS and IDIS have experienced and are still experiencing banking crises (Caprio and Klingebiel 2003). DKD (2002) included a small number of LDCs, especially the LDCs exercising EDIS, in their sample. The inclusion of a larger number of LDCs in a sample could establish the result that IDIS causes banking crises. If EDIS causes the crises, the main reason could be that the EDIS handled by countries with less-developed institutional framework. In such a case, including more LDCs, especially those with EDIS, in a sample can make the estimation results of DKD (2002) more robust.

By a sample of about 150 countries, of which over 70% are developing economies, this study examines the impact of EDIS with its different forms on banking crises for the period of 1980-2003. The additional speciality of this study is that, besides the previously studied forms of EDIS, it also examines the impact of some forms of EDIS newly detected by Berth et al (2004). These include the power of EDIS to intervene in bank operations, to cancel or revoke the deposit insurance of banks, and to take legal action against bank officials. These newly detected forms also include the payout time to depositors and the information of whether the EDIS provides any compensation to deposits in the event of bank failure, which were not explicitly covered earlier. I also examine the effect of EDIS on the probability of banking crisis when the EDIS handled by a country with its less developed institutional structure. Finally, I am interested to see how my estimation results differ from those found in DKD (2002).

I use a logit estimation model controlling for yearly fixed effects and a set of other explanatory variables. I find that the EDIS in general (i.e. without taking EDIS's forms into account) is strongly significant in increasing the banking crisis probability. This significance level is stronger than what is found in DKD (2002). The probability is even stronger if the EDIS formed with ex ante funding, or with the coverage of

[5] For instance Diamond and Dybvig (1983) and Bhattacharya et al (1998) argue in favour of EDIS's decreasing crisis probability and Kane (1989) argues in favour of EDIS's increasing the probability.

inter-bank deposits, or with high level of coverage in average. The crisis probability also becomes greater if the EDIS is not legally authorized to directly intervene in banks' operation, or to cancel or revoke the banks' deposit insurance, or if the scheme allows deposits to be compensated after bank failure although the deposits were not explicitly covered before the failure.

Next, this study finds that the crisis probability increases if the EDIS handled by a country with less developed institutional structure. Thus using the EDIS in a LDC is more risky than its use in an industrialized country. This probability is greater if the EDIS provides coverage to the inter-bank deposits, or if the EDIS lacks legal power to directly intervene banks, or if the EDIS compensate uncovered deposits after a bank failure. Interestingly this study finds that once a country's less-development to handle an EDIS is controlled, the EDIS separately is not a significant factor of banking crisis any more. That is, a country's overall economic development is so important to handle the EDIS efficiently. This result is in line with Chen and Fishe (1993), who argue that an EDIS cannot play its appropriate role in a LDC because of its less diversified economic base, making the country more tended to liquidity crisis which the EDIS cannot prevent. The result is also supported by Gropp and Vesala (2001), who show that an EDIS significantly reduces the risk taking of banks in the EU countries, which are mostly developed.

In addition, this study shows that the crisis probability decreases if a country with less corruption handles the EDIS. However, once the corruption level of a country handling the EDIS is controlled, the EDIS separately is still a significant factor to increase the banking crisis probability. This implies that, for a more efficient use of EDIS, the LDC needs to remove, not only the corruption but also other setbacks of being less developed, e.g. the government's vulnerability to international and internal pressure, unskilled personnel in institutions, unemployment pressure, autocracy and repression of press, bureaucracy, poor contract enforcement, and so on.

By using an empirical model similar to DKD (2002), this study shows that the coefficient of an EDIS handling by countries with differing GDP-per-capita is larger in magnitude and also more strongly significant than the coefficient found in DKD (2002).

2.2 Central bank autonomy and banking sector's instability

The second paper of my thesis examines empirically the relationship between the level of central bank (CB) autonomy and the instability of banking system as defined by the systemic banking crisis. The CB, the *bankers' bank*, is one of the core institutions of a country to uphold its monetary policy. A CB's major role is to keep price stability. Besides, it plays a role in many other financial activities, e.g. managing the government's financial transactions, financing budget deficit through the issuing of money, funding development projects undertaken by the government, and bailing out insolvent banks and publicly-owned enterprises (see Cukierman et al, 1992). A CB can have direct influence on banking sector stability through its measure of bailing-out banks, efficient controlling over the financing of budget deficits and that over the funding of inefficient government development projects. The CB's role in stabilizing financial market is supported by many, as mentioned in the earlier subsections.

However, all CBs have not the same amount of autonomy to handle their tasks. They may have a different degree of independence granted by the executive branch of government. In one hand, studies claim that the independency of the CB can reduce the banking sector's instability. On the other hand, there is also a conflicting view that the more independent CB can rather increase the instability, as the central banker can be undemocratic or bureaucratic and may behave opportunistically (Cukierman 1994). An undemocratic, opportunistic, but independent central banker can easily destabilize the banking sector. This paper attempts to resolve the contingent role of CB's autonomy on the instability of banking sector.

I use the data of the decade 1980s from Cukierman et al (1992) in which the data on CB's independence are by decades. CB's independence is measured according to 16 different legal variables and by an aggregated legal variable which takes the weighted average of 16 variables available. I characterize a country's banking sector as unstable when the country experiences a systemic banking crisis. The dependent variable banking crisis dummy takes the value one if a country experiences systemic banking crisis for one or more years during the 1980s, otherwise zero. Each of the variables of CB's independence is tested separately along with a set of control variables.

Using a sample of 54 countries and a logit estimation model, I find that a more autonomous CB (as measured by CB's aggregated legal power) reduces the likelihood of banking crisis. When different variables for CB's independence are tested independently, I find that CB autonomy with regard to its chief executive officer's term of office and CB autonomy in setting interest rate on loans to government decrease the probability of banking crisis. I also find that the crisis probability reduces more if an autonomous CB can perform its duties in a country with stronger law and order tradition. That is, a country's improved law-and-order tradition is so important for an autonomous CB to perform its due role efficiently.

2.3 Factors correlating with long-lasting banking crises: a special focus on crises resolution policy measures

A banking crisis can last long or short. The third paper of my thesis determines the explanatory variables related to the long lasting crises. A long crisis-spell, i.e. the crisis with long duration, can have costly aftermath on the real economy. For example, after a long crisis-spell, domestic depositors and investors may lose their confidence in the banking system and transfer their funds abroad. It is therefore of the utmost importance to shield economy from the costly aftermath of long crisis spell.

In order to determine the possible explanatory variables of long crisis-spells, I highlight mostly the *crisis resolution policy* (*CRP*) measures, which are usually undertaken immediately after the occurrences of banking crises. Briefly the measures are:

(1) blanket guarantee[6] to all creditors and depositors,
(2) open-ended and extended liquidity support to all weak financial institutions,
(3) forbearance of any banking regulations,
(4) recapitalization or repeated recapitalization of weak or failed banks,
(5) public debt relief program for bank borrowers to facilitate repayment of their debts,
(6) setting up a centralized Asset Management Company.[7]

[6] This guarantee usually means a declaration by the government that all deposits and perhaps other financial instruments will be protected.
[7] See Honohan and Klingebiel (2000 and 2003) and Das and Quintyn (2002) for details.

Although different CRP measures are enacted to shorten crisis-spells, in practice they may not. The measures usually relax the existing banking regulation and are not market-oriented. Such measures may enable the bank management to abuse the measure for their personal benefit, leading rather to the longer banking sector instability. However, it is hard to see that a government not taking any CRP measures once the country is clutched by systemic banking crisis. The reason is that otherwise the government would not know how long the crisis would continue. In my dataset of 35 crisis-episodes with the information of using CRP measures, only 3 episodes are found not using any CRP measures. Hence, the aim of this study is to see which of the CRP measures associated with longer crisis-spells in comparison with the other CRP measures.

The fundamentals causing the occurrences of banking crises may also prolong the crises. To test this assertion, I take the explanatory variables used in earlier studies as the causes of banking crises' occurrences and the costs of crises (see for instance DKD 1999, 2002 and 2005).

The data on crisis-spells come from Caprio and Klingebiel (2003) and it is yearly data for the period of 1977-2002. Data on CRP measures are taken from Honohan and Klingebiel (2003). Both the industrialized and developing countries are included in the sample. The estimation model I use is a duration model. I also use the OLS model for the robustness check of the results.

From the sample of crisis-spells with CRP measures, the finding of this study is that the measure of regulation-forbearance which allows insolvent banks to remain open is strongly significant. Another measure the execution of public debt relief program helping bank borrowers to repay their public debt is also significant, but at weaker level. Both of the measures are positively related with the durations of crises, i.e. the use of the measures lengthen the crisis-spells. Rests of the measures are found to be statistically insignificant to have any relation with the durations of crises. Two of the measures, the blanket guarantee and the use of centralized Asset Management Company, are even having negative signs of relation with the durations of crises.

The results exemplify that the adverse effect in terms of the duration of crisis is relatively higher in using the measures the regulation-forbearance allowing the insolvent banks remain open and the execution of public debt relief program helping bank borrowers to repay their public debt. I therefore propose that a government grasped with banking crisis better to avoid using the said two measures. If it has no

alternatives other than using some CRP measures, it can use some measures which are found statistically insignificant to have any relation with the durations of crises. Evidently, it can use the blanket guarantee, the liquidity support, recapitalization of banks, or a centralized Asset Management Company. It can also use some regulation forbearance allowing the lesser degree of lenience towards banks (e.g. over looking violations of laws by individual banks or the business deregulation on banking designing to introduce new profit opportunities to weak banks, and so on).

Amongst the explanatory variables other than CRP measures, this study finds that a crisis lasts longer with the following factors: if the crisis begins with a higher real interest rate; if it begins when the banking sector has larger exposure to the private sector borrowers; and if it begins in the presence of explicit deposit insurance scheme. On the other hand, a crisis does not last long with the following factors: if the crisis begins with high growth (lagged by two years) of real domestic credits in the private sector; and if the crisis begins with high liquidity shortage in banks. Finally, similar with Abderrezak (2001), I find that the probability of crisis-spell termination increases as the spell gets older.

3. Contributions and further research

3.1 Major contributions of the thesis

This thesis shows that using an EDIS instead of IDIS increases the banking system instability. The argument for introduction of EDIS could be the inevitably need of some form of depositors' explicit safety net. This safety net is needed to stop the chance of bank runs for the greater and long-term economic interest of a country. Instead of focusing on the long-term cost-benefit analysis of using the EDIS, this thesis rather attempts to point out the forms (or designs) of EDIS and also other interacting factors that make the EDIS more risky. EDIS works better if it provides low coverage and if its authority is powerful enough to take punitive actions against banks. The most important finding is that the EDIS measure is rather efficient for the industrialized countries which are capable to prevent possible moral hazard in EDIS by their superior institutional structures. On the other hand, EDIS is no good for the LDCs, because of their inferior institutional structures.

The CB can affect the banking sector stability in many ways. I show that curtailing the CB's power (which implies its independence from the executive body) to performing its due role increases the risk of banking sector instability. The CB's power measured by its chief executive officer's long-term contract and its power in setting interest rate on government loans are especially relevant for the banking sector stability. I also show that an autonomous CB can perform its due role more efficiently to reduce the banking sector instability if the country's law-and-order tradition is stronger.

In the final essay, I pay attention to the major causes of the long lasting banking crises. I show that, amongst the CRP measures used, the regulation-forbearance allowing the insolvent banks to remain open and the execution of public debt relief program helping bank borrowers to repay their public debt are respectively strongly and weakly significant to increase the durations of crises. Hence, I suggest governments with banking crises to avoid using these two measures. However, it can choose the measures for instance the blanket guarantee, the liquidity support, the recapitalization of banks, or using a centralized Asset Management Company because of their insignificant relations with crises' durations. I also show that some factors not only cause banking crises to occur (as found in earlier studies), but also prolong the crises. These factors include e.g. high real interest rate, large exposure of the banking sector to the private sector borrowers, and the use of explicit deposit insurance scheme.

3.2 Suggestions for further research

This section presents some general and particular suggestions for further research. In line with many other empirical studies, I have investigated the fundamentals of systemic banking crises where the crises are defined by multiple decisive factors and are designed by financial expertise related with the crises experienced countries. It would be easier to examine the causes of banking crises if the crises occurrences could be defined based on a single decisive factor. However, the single decisive factor needs to be uniquely defined before conducting such a study.

Very often it happens that a crisis could have been averted if the central authority would intervene in time. Proper actions and well-timed information to the depositors and investors could minimize to a great extent the overall economic loss. In this, the

freedom of the press could play a pivotal role. The relationship between freedom of press and the banking sector stability would be an interesting issue.

Demirguc-Kunt and Detragiache (1999) showed that the occurrence of banking crisis is more frequent in the countries with EDIS. Policymakers of the countries across the world should be aware about this adverse effect of EDIS. Even after this, countries, especially the LDCs, around the globe are introducing EDIS increasingly. At this point a study would be interesting if it examines the long-term economic benefit of an economy with EDIS compared to a similar economy with IDIS.[8]

There are still some fundamentals which may influence the banking sector's stability. For instance, supervision of banks is not uniform in countries across the globe. In some countries the CB supervise banks and in others ministry of finance does this alone or jointly with CB. I leave for further examination to show whether the banking sector stability is influenced by this variation of banks' supervision, or whether the banking sector's stability is influenced by discipline, provision and capital structures of banks.

[8] For instance, the long-term economic growth of LDCs with EDIS compared to the long-term growth of LDCs with IDIS.

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II. Deposit insurance scheme and banking crises: a special focus on less developed countries

Prepared by Khan Md. Anichul Hoque*
Department of Economics, Helsinki University, HECER

Abstract

This study analyzes the effect of using explicit deposit insurance scheme (EDIS), instead of using implicit deposit insurance scheme (IDIS), on banking crises. The panel data for the period of 1980-2003 includes all countries for which the data on EDIS or IDIS exist. 70% of the countries in the sample are less developed countries (LDCs). About 55% of the countries adopting EDIS also come from LDCs. The major finding is that the using of EDIS increases the crisis probability at a strong significance level. This probability is greater if the EDIS is inefficiently designed allowing higher scope of moral hazard problem. Specifically, the probability is greater if the EDIS provides higher coverage to deposits and if it is less powerful from the legal point of view. This study also finds that the less developed a country is to handle EDIS, the higher the chance of banking crisis. Once the underdevelopment of an economy handling the EDIS is controlled, the EDIS separately is no longer a significant factor of banking crises.

Author's e-mail: anichul.khan@helsinki.fi

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1 Introduction

This paper is about the relation between different forms of deposit insurance scheme (*DIS henceforth*) and the banking sector instability with a special focus on the less developed countries (LDCs). There can be explicit DIS (*EDIS henceforth*) where the rules and regulations are defined to insure the deposited funds in banks, or can be implicit DIS (*IDIS henceforth*) as the governments usually step in after banking crises to rescue the depositors and banking sectors on an ad hoc basis. However, there is some controversy among researchers about the effect of EDIS on the bank stability. Many researchers believe that the EDIS is an optimal policy to protect bank stability when the stability is threatened by depositor run (see, e.g., Diamond and Dybvig 1983, Bhattacharya et al 1998).[9] Researchers, on the other hand, acknowledge that the EDIS is a source of moral hazard, as banks are encouraged to finance high-risk, high-return projects. This moral hazard problem may cause additional bank failures, leading to a systemic banking crisis (see, e.g., Kane 1989).

Regardless of the ambiguities about the effects of EDIS on banking crises, countries around the world have been using EDIS increasingly (12 countries in 1974, 71 in 1999, and 87 2003). There is also wide cross-country variation regarding the types of EDIS. For instance, a scheme can be administered by the government, privately, or jointly. Bank membership in the scheme can be compulsory or voluntary. The scheme can be funded ex ante or ex post, and funding source can be the government or banks or a combination of both. Bank premium to the scheme can be fixed or risk based. Schemes also vary in their coverage, e.g. foreign currency deposits covered or not, inter-bank deposits covered or not, the overall coverage limits high or low. There are also some EDIS designs noted by Berth et al (2004), the effects of which on banking crises have not been examined yet. Those concern the EDIS's legal power. For instance, EDIS's power to intervene banks, power to cancel or revoke a bank's deposit insurance contract, and power to take legal action against bank officials. Those also concern the time of EDIS to pay out depositors and the compensation (or not) of uncovered deposits after a bank failure.

[9] Golembe (1960) finds that the goal of DIS is more focused on restoring confidence in the liquidity of bank deposits than to protect small depositors.

Demirguc-Kunt and Detragiache (2002; *DKD will stand for Demirguc-Kunt and Detragiache henceforth*) attempt to resolve the ambiguities regarding the EDIS's impact on banking crisis.[10] They find that the EDIS in general increase the probability of banking crisis and this probability is greater when the EDIS is designed inefficiently (namely the banks' membership voluntary, the administration by govt, EDIS funded *ex ante*, govt. as the funding source, and provision of high coverage). In addition, they show that the probability of crisis increases if the EDIS handled by a country with weak institutional environment. Their sample, however, leaves out a large number of LDCs, especially the LDCs utilizing EDIS (their sample of 61 countries includes only 16 LDCs with EDIS).

More than 75% of the countries in the world are classified as LDCs and a growing number of these countries utilize the EDIS. On the other hand, as Caprio and Klingebiel (2003) note, a large number of LDCs have experienced and are still experiencing banking crises. The number of these LDCs with IDIS is as large as their number with EDIS. Thus the inclusion of larger number of LDCs in a sample could result in finding differently from that of DKD (2002). In that the IDIS could be the cause of banking crises, or if the EDIS causes the crisis, the major reason could be the EDIS handled by the LDC's inadequate institutional framework. A LDC's institutional framework can be inadequate as a result of weak government, financial setbacks, non-skilled personnel, high corruption, heavy bureaucracy, weak law-and-order tradition, unemployment pressures, and so on. In this case, the inclusion of additional LDCs as well as those with the EDIS in a sample could make the estimation results more robust than the results found by DKD (2002).

With a large dataset that takes almost all countries with the information of EDIS and IDIS (thus most of the sample countries, especially the countries with EDIS, come from LDCs) this study addresses the following questions. The first question: what is the effect on banking crisis if a country uses EDIS instead of using IDIS? Second question: does an EDIS have additional effect on banking crisis when it is inefficiently designed from the moral hazard point of view? Third question: do these effects depend on countries' overall economic developments? Then we compare the effects depending on countries' overall economic developments with those effects depending on countries' corruption levels, as we know corruption implies merely a

[10] Demirgúc-Kunt and Kane (2002) also focus in resolving the ambiguities of the EDIS's impact on banking crisis.

single kind of institutional deficiency rather than the structural institutional deficiency. Finally, we examine the extent to which the effects of some of the fundamentals on crises we find with our dataset differ from the effects found in DKD (2002). In that, we use the estimation model and the set of control variables similar with DKD (2002).

The panel data includes about 150 countries for the period of 1980-2003. However, the number of countries or observations in the regression models differs because of missing data of the explanatory variables we use. Using a logit estimation model with yearly fixed effects, we estimate the effects of EDIS (in general and with its inefficient designs) on the probability of systemic banking crisis (the data from Caprio and Klingebiel 2003). We use a set of control variables which have been defined by previous studies (e.g. DKD 1999, 2002, and 2005). The salient control variable for this study is the variable that represents the less-developed institutions. To formulate the variable, we classify the sample countries according to their ranking in different income groups as reported by Demirguc-Kunt et al (2005), i.e. high, upper-middle, lower-middle, and low income groups.

A zero-one dummy is used to test the impact of EDIS on banking crises; the value zero refers to IDIS and one to EDIS. In practice this impact could differ according to variation of moral hazards for different forms of EDIS. For instance, an EDIS with higher coverage to deposits is less effective because of the higher scope of moral hazard on the part of banks. For a similar reason, all other forms of EDIS can also be more or less effective. To take into account the impact of ineffective forms of EDIS we use more refined dummies, as DKD (2002) did, than the dummy of simple zero-one. Each of these dummies takes zero for IDIS observations and rest of the values are assigned in accordance with the scope of moral hazard ensued by the forms of EDIS.[11]

Our finding is that use of EDIS instead of IDIS strongly significantly increases the probability of banking crisis. The probability is even greater if the EDIS has the form of ex ante funding, or inter-bank deposits covered, or if its average coverage is higher. The crisis probability is also greater if the EDIS is not empowered for the direct intervention in bank-operations, or not empowered to cancel or revoke banks' deposit

[11] For instance, a dummy for the membership form of EDIS takes zero for IDIS, one for EDIS based on compulsory membership, and two for EDIS based on voluntary membership.

insurance contracts, or if deposits are not explicitly covered before bank failure but are compensated after the failure.

Next, the study finds that the less developed a country is to handle the EDIS the higher is the chance of banking crisis. This chance is greater if the EDIS provides coverage to the inter-bank deposits, or if the EDIS lacks legal power to directly intervene banks, or if the EDIS compensate uncovered deposits after a bank failure. An interesting result is that when a country's economic development to handle an EDIS is controlled for, the EDIS separately is not a significant factor of banking crisis any more. That is, a country's overall economic development is so important to handle the EDIS efficiently. This finding is in line with Chen and Fishe (1993) and Gropp and Vesala (2001). Chen and Fishe argue that an EDIS cannot play its appropriate role in LDCs because of their less diversified economic base, which make these countries more prone to liquidity crises which the EDIS cannot prevent. Gropp and Vesala find that an EDIS significantly reduces the risk taking of banks in the EU countries.

In addition, this study finds that the inadequate institutional infrastructure of a LDC cannot be offset by improving only a single indicator of institutional weakness, such as the corruption. This is proven by the fact that the use of an EDIS separately is still significant to increase the crisis probability even after the EDIS handled by a country with low corruption is controlled for.

Finally, we find that the coefficients of DIS dummies interacted with countries' GDP per capita are larger in magnitude and stronger in significance levels in comparison to those coefficients found in DKD (2002). Note that the coefficients of the interaction variables have the expected signs, i.e., the EDIS (in general or with its inefficient designs) handled by a country with high GDP per capita decreases the banking crisis probability.

The remaining paper is structured as follows. The next section presents some theoretical background and hypothetical views for this empirical paper. Section three explains the data and the variables of this study. Section four outlines the estimation model, the results and the robustness of the results. Finally, the concluding remarks are given in section five.

2 Theoretical background and hypotheses

A DIS (*deposit insurance scheme*) is a guarantee to the bank depositors. The guarantee is that a partial or total amount of the principal and also the ensued interest on sheltered accounts will be paid. This guarantee may be *explicit* for which it is called EDIS (i.e. explicit DIS). The guarantee may also be *implicit* and then it is called IDIS (i.e. implicit DIS). In EDIS the law and regulation about DIS's administration, banks' membership and premium, the coverage to depositors, and about the legal power of the DIS are already defined. However, in IDIS the country establishes a *de facto* insurance system to the depositors and banks.[12]

Incorporating EDIS into a country's depositors' safety net is controversial. According to Diamond and Dybvig (1983), the EDIS is an optimal policy in an environment where bank stability could be threatened by self-fulfilling depositor run, which leads to bank failure and thus to *banking crisis*. Note that a bank failure occurs when the bank becomes insolvent (i.e. the net present value of its assets falls short of the net present value of its liabilities) and a banking crisis occurs when a sufficient number of banks fail (it can also be weighed by the failed banks' share in total deposits or assets) within a given period (see e.g. González-Hermosillo, 1996).[13] However, the depositor run could be triggered by depositors because of lack of transparent information and because gathering this information is costly for the depositors.

Following Allen and Gale (1998) it can be established that even if the depositors are capable of gathering proper information, still there could be a run because of actual deterioration in bank asset quality. In such a case bank's dealing with loans, i.e., the performance of bank's management, with an aim of quality assets is important for the protection of the bank from a run. However, a bank failure may occur in absence of depositor run, just because of high non-performing loans which imply the insolvency of bank.

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[12] (see, for instance, Kyei 1995, Garcia 1996, DKD 1999 and 2002, Demirguc-Kunt et al 2005)

[13] Gonzaleze-Hermosillo (1996) follows that in a broad sense a bank failure is said to occur when the regulator recognise the bank as insolvent and decides to liquidate it, or assist in order to keep it in operation. Different instruments are usually followed to assist an ailing bank. These are, for instance, (1) merger or acquisition of the bank with other healthy banks; (2) direct injections of additional capital or other recapitalization schemes; and (3) different restructuring schemes. The restructuring schemes usually include change in bank-management; assisted generalized rescheduling of loan maturities; and removal of banks' bad loans.

On the other hand, enforcing an EDIS does not even ensure the stop of depositor runs. Following González-Hermosillo (1996) the view point can be established that the depositors' decision to withdraw their deposits depends not only on the coverage limit of their deposits (the lower the coverage the higher the chance of self-fulfilling run), but also on the effective endowments which are and will be available in the deposit insurance fund. It also depends on the expected probability of failure of a significant number of other banks simultaneously.

While the role of EDIS to prevent depositor runs is already ambiguous, monetary economists find the EDIS to generate moral hazard. This moral hazard is mainly generated on the side of banks and their regulators. Demirguc-Kunt and Kane (2002) follows that the bankers can take advantage of weaknesses in transparency and deterrence of supervisors. The regulators, controlling the supervisory rudiments, can have insufficient incentive to monitor banks. There can be weak enforcement of prudential regulations as well. As a result the bankers can take inefficient risks in disbursement of loans. They can even engage in fraudulent activities, e.g. making loans to themselves or to their close associates at lower than market price or at weak terms and conditions. The moral hazard can also be generated on the side of depositors. The EDIS can cause depositors to be less careful in choosing better performing (e.g. in terms of asset quality) banks as they know that their deposited funds are insured.

Hence, it can be assumed that the use of an EDIS in a country increase the likelihood of banks to be insolvent because of higher non-performing loans. This likelihood of insolvency gets even higher if the EDIS is inefficiently designed. An EDIS is inefficiently designed if it allows higher scope of moral hazard on the bankers' side (the next section discusses different designs differing with the scope of moral hazard). Broadly an EDIS is said to increase the moral hazard, (i) if it allows higher coverage to the depositors, (ii) if it generates higher promising insurance to the bankers, and (iii) if the scheme is weak from the legal point of view (see, e.g. DKD 2002, Demirguc-Kunt and Kane 2002, Demirguc-Kunt et al 2005, and Kyei 1995).

However, the institutional development of a country is vital to allow an EDIS to work efficiently for the banking sector's stability. While there are incompetent institutional framework for an EDIS to be inefficient in a LDC (see e.g. Chen and Fishe 1993 shows an EDIS to be inefficient in LDCs), there are competent institutional framework for the scheme to be efficient in a developed country (see e.g.

Gropp and Vesala 2001 which shows an EDIS to be relatively efficient in EU countries). The institutional development can generate enough reliability among the depositors about the insurance of their funds under the EDIS. At the same time the development can check the moral hazard ensued by the bank-management and regulators.

Thus, the more a country is economically developed, the more efficient its institutional framework, the better its institutional performance, and then the more reliability the general people (or depositors) have about the institutional performance. The tendency of intentional moral hazard or fraudulent activities of the people in a developed country is also lower because of the state supported secured and better living standard even in the worst possible economic condition of its citizens. In addition, wrong doing by any banker or regulator is more difficult as s/he knows it will be more difficult to be successful because of non-cooperation from other related officials and institutions.

Hypotheses

Based on the above discussions the empirical part of this study works with the hypotheses as follows:

(1) Given all other factors remaining constant, a banking crisis is more likely in a country with EDIS than with IDIS.
(2) This crisis is even more likely, the more inefficiently the EDIS is designed.
(3) The less developed a country with EDIS is, the more likely is banking crisis.

3 The data

3.1 The data of DIS

This subsection provides the data source of DIS, and gives a brief description and formulation of the DIS variables.

We use Demirguc-Kunt et al (2005) for the data source of DIS variables. Demirguc-Kunt et al built the data based on the earlier studies by Demirguc-Kunt and Sobaci (2001), Garcia (1999), Kyei (1995) and Talley and Mas (1990). The database is further complemented and improved with the data from various other countries and online sources, as well as by Barth et al's (2004) survey. The cross-country data of IDIS-EDIS, including different forms of EDIS, for the countries of our sample are reported in Table A1 and Table A3-A4 of the appendix.

EDIS or IDIS

The first perceptible characteristic of the data is that EDIS is still not common in countries across the world. However, increasing number of countries has been adopting EDIS since 1980s: 88 countries in 2003, which is four times the number in 1984 (Demirguc-Kunt et al 2005). We assume that a country follows IDIS if not EDIS, because the country establishes a *de facto* insurance system to depositors of banks (see, for instance, Kyei 1995, DKD 1999 and 2002, Demirguc-Kunt et al 2005).

The proportion in our dataset between countries with EDIS and countries with IDIS, and between high-income countries and middle-to-low income countries is very different from the proportion in the dataset used by DKD (2002). In Table A1 there are 150 countries, 44% of which practice EDIS (dates of EDIS enactment or revision are also reported). About 40% of the countries with EDIS belong to the high income country group. The rest are middle-to-low income countries. This figure is much different in DKD, in which 60% of their 61 countries' sample enforces EDIS, and about 55% of the countries with EDIS belong to the high income group.

A variable called "*IDIS-EDIS*" is used in the regression model to examine the effect of EDIS on banking crises. The variables take the value 0 for the country-period with IDIS and 1 with EDIS.

We expect the variable to be positively associated with the probability of banking crisis for our hypothesis not to be rejected.

An EDIS can be designed or formed in many ways. The forms we take for our empirical analysis are as follows[14]:

- **EDIS's administration:** An EDIS can be administered exclusively privately, or exclusively by government, or jointly by the government and banks. In a privately administered system, a competitive market premium is expected to be set optimally and execution of the closure rule is also expected to be appropriate (Carisano 1992). On the other hand, a government administered scheme allows moral hazard on the part of banks (Demirguc-Kunt and Kane 2002, DKD 2002). The possible reason of the moral hazard is that the administration implicitly provides higher promising insurance to the bankers but with relatively weaker monitoring and inappropriate closure rules of banks. In our dataset 12 schemes are administered privately, 18 jointly, and 34 by government. A variable for regression, called "*EDIS's administration*", takes 0 for IDIS, 1 for EDIS with private administration, 2 for joint administration, and 3 for governmental administration. We hypothesize that the EDIS increases the probability of a banking crisis even more if the EDIS is administered by the government.
- **Banks' membership:** Banks' membership in EDIS can be compulsory or voluntary. If the membership is voluntary, there can be an adverse selection problem as sounder banks may opt out of the system (see e.g. Demirguc-Kunt and Kane 2002, DKD, 2002, Garcia 1999). Thus an EDIS with banks' membership voluntary can increase the banking sector instability. In our dataset there are only 6 countries with voluntary membership. The variable "Banks' *membership*" takes the value 0 for IDIS, 1 for EDIS with compulsory membership, and 2 for voluntary membership. We expect that the EDIS increases the banking crisis probability even more if the membership in the scheme is voluntary.
- **EDIS's funding:** An EDIS can be funded ex ante, or unfunded but funding ex post to any bank's failure. In a funded scheme, banks pay premium into a recognized fund. In an unfunded scheme, either the government reimburses depositors of the failed bank, or the insured financial institutions are called upon to contribute (see Kyei 1995). However, the scheme with ex ante funding makes

[14] We have taken only those forms of EDIS for which the number of observations and cross-country variations are sufficient for regression analysis. Demirguc-Kunt et al (2005) has outlined additional forms of EDIS but their cross-country variation is too little to estimate their effects on banking crises.

the scheme more promising against contingency. Then it widens the scope of moral hazard on the part of banks as they take excessive risks in disbursing loans (DKD 2002). Demirguc-Kunt and Kane (2002) also advocate the ex post funding as a better option as it allows relatively less moral hazard. In our dataset 11 EDIS countries are funded ex post and 55 countries are funded ex ante. The variable "*EDIS's funding*" takes the value 0 for IDIS observations, 1 for EDIS with funding ex post, and 2 for EDIS with funding ex ante. We hypothesize that the EDIS increases the probability of a banking crisis even more if the scheme is funded ex ante.

- **EDIS's fund-source:** Funding for a scheme can come from three sources – exclusively from banks, from banks and government joint, and exclusively from government. The best option for a scheme is to collect funds exclusively from banks (see e.g. DKD 2002). Then the moral hazard on the part of banks is minimized as banks themselves pay for their own management. In our dataset there are 19 EDIS countries for which the funding source is banks, 43 countries for which the funding source is joint, and in only one country the funding source is the government. The variable "*EDIS's fund-source*" assigns the value 0 for IDIS, 1 for the EDIS funded by banks, 2 for the jointly funded EDIS, and 3 for the government funded EDIS. We hypothesize that the EDIS's increasing effect on the banking crisis probability is even greater if the scheme is funded by the government.
- **Banks' premium:** Banks' premium to EDIS could be risk adjusted or fixed. Risk adjusted premium is more efficient than fixed premium system as it reduces the moral hazard on the part of banks (see e.g. Freixas and Rochet 1997 p. 267, Kyei 1995, Garcia 1999, DKD 2002). Given the premium fixed in a scheme, banks can take more risks in their dealings, e.g. in allocating loans. Our dataset has 14 EDIS countries where the bank premium is risk-based and in 51 schemes the bank premium is fixed. The variable "*Banks' premium*" takes the value 0 for IDIS, 1 for EDIS with risk-based premium, and 2 for the EDIS with fixed premium. We hypothesize that an EDIS increases banking crisis probability even greater if the bank premium in the scheme is fixed.

Low coverage is the best option for an EDIS (Demirguc-Kunt and Kane 2002, DKD 2002, Garcia 1999). High coverage in a scheme allows greater scope for moral hazard on the part of banks. The higher the coverage to deposits, the higher the amounts insured, the higher the scope of banks to take excessive risks in dealing with loans. The coverage of an EDIS can be extended in the following forms.

- **Foreign currency deposits covered:** An EDIS can increase its coverage by providing coverage to foreign currency deposits. In our dataset 22 EDIS countries have no coverage to foreign currency deposits while 42 countries do cover foreign currency deposits. The variable "*Foreign currency deposits covered*" assigns the value 0 for IDIS, 1 for the EDIS without coverage to foreign currency deposits, and 2 for the EDIS with this coverage. The hypothesis we work with is that the EDIS increases the banking crisis probability even more if the scheme extends coverage to foreign currency deposits.
- **Inter-bank deposits covered:** An EDIS can extend its coverage to inter-bank deposits. 51 countries in our dataset which practice EDIS are without coverage of inter-bank deposits and 13 countries include that coverage. The variable "*Interbank deposits covered*" assigns the value 0 for IDIS, 1 for the EDIS without the inter-bank deposits covered, and 2 for the EDIS with this coverage. We believe that the EDIS adds to banking crisis probability even more if the scheme covers inter-bank deposits.
- **Coverage with co-insurance:** An EDIS can increase its coverage by assigning co-insurance in addition to the original coverage. In our dataset there are 50 EDIS countries that have not assigned co-insurance and 15 countries with co-insurance. The variable "*Coverage with co-insurance*" assigns the value 0 for IDIS, 1 for the EDIS without co-insurance, and 2 for the EDIS with co-insurance. We assume that the EDIS increases the risk of a banking crisis even more if the scheme assigns co-insurance.
- **Average coverage of deposits to GDP-per-capita ratio:** As a rule of thumb, the IMF typically proposes an amount equivalent to 1 to 2 times GDP per capita as an appropriate coverage limit (Garcia 1999). However, it was noted in our dataset that many countries do not follow the IMF's coverage limit. There are 31 EDIS countries in which the ratio is below 2 and in another 31 the ratio is more than

two. It should be mentioned that we take the average ratio for the latest 5 years available if the adoption date of EDIS is older than 5 years, otherwise that average from the date of adoption.[15] The variable "*Average coverage / GDP-per-capita*" is not in fact a dummy variable as it takes the value 0 for IDIS, but the remaining values are the ratio of deposits under coverage to GDP per capita. Our hypothesis is that the EDIS's increasing effect on the banking crisis probability is even stronger if the scheme applies a greater coverage ratio.

- **Average coverage of deposits to deposit-per-capita ratio:** Another way of measuring the coverage limit is the ratio of average coverage of deposits to deposits-per-capita. We prefer to examine this variable as well because the ratio in terms of deposits per capita may be different from the ratio in terms of GDP per capita. Of the available data, there are 31 countries in which the average ratio is below 5 and 29 countries where the ratio exceeds 5. Similarly to the variable above, we have taken the average ratio of latest 5 values available[16]. The variable "*Average coverage / deposit-per-capita*" is also not a dummy variable like the above one. It takes 0 for IDIS and the remaining values are the coverage ratios of the schemes. Our hypothesis is similar to the one just presented above.

EDIS's best policy is to avoid incentive problems (Garcia 1999). However, Barth et al's (2004) survey finds that some forms of EDIS which clearly enable incentive problems and also allow greater scope of moral hazard on the part of banks. It should be mentioned that no previous studies have tested the influence of these forms of EDIS on the banking sector's instability. The forms are as follows[17],

- **EDIS's power to intervene bank:** Surprisingly, not all EDIS countries have the legislation empowering the scheme's authority to decide on bank intervention directly. Logically, this implies an incentive problem as the scheme provides insurance to banks, whereas it lacks the authority to decide to intervene when necessary. This also allows more scope of moral hazard on the part of banks.

[15] Note that we drop Mexico as an outlier from the sample when we take this variable in the regression. The reason is that the coverage ratio for Mexico is extremely high compared to other countries and the estimation result for this variable is radically changed if Mexico is included.
[16] Again Mexico is dropped as an outlier.
[17] Demirguc-Kunt et al (2005) include additional forms of EDIS taken from Berth et al (2004), but their cross-country variation are too small for testing.

Bankers can exploit this problem for their own interest by taking risk in their dealing with loans. We have the data on this variable for 58 countries with EDIS. In 8 countries the scheme is authorized to make the intervention decision, but this is not the case in rest 50 countries. The variable "*EDIS's power to intervene bank*" assigns the value 0 for IDIS, 1 for the EDIS that are authorized to decide on intervention, and 2 for the schemes that lack this authority. We hypothesize that the EDIS's increasing banking crisis probability is even more if the scheme is not authorized to decide on bank intervention.

- **EDIS's power to cancel insurance**: Many of the countries practicing EDIS have stipulated that the authority of the scheme is not authorized to cancel or revoke the deposit insurance for any participating banks. Like the above one, this one also implies incentive problems and then the moral hazard problem on the part of banks. According to the available data with EDIS, 24 countries enjoy the cancelling power and 34 do not. The variable "*EDIS's power to cancel insurance*" takes the value 0 for IDIS, 1 for the EDIS having the cancelling or revoking power, and 2 for the EDIS not having that power. We assume that the EDIS increases the banking crisis probability even more if the scheme has no power to cancel or revoke the deposit insurance for any participating banks.
- **EDIS's power to take action against bankers:** In many countries with EDIS, the authority of EDIS does not have the authorization to take legal action against bank directors or other officials. Similar to the two forms just mentioned above, this type of scheme also creates incentive problems because the scheme provides insurance to banks, but cannot initiate legal action against bank directors or other officials for any of their faults. Such a scheme, as a result, allows scope of moral hazard on the part of banks in the same manner we have mentioned above. According to the available data, 24 EDIS countries have that power to take legal action against officials and 34 do not. The variable "*EDIS's power to take action against bankers*" takes the value 0 for IDIS, 1 for the EDIS with that empowerment, and 2 without that empowerment. Our hypothesis is that the EDIS's increasing banking crisis probability is even more if the scheme has no power to take legal action against bank directors or other officials.

The following forms of EDIS noted by Berth et al (2004) do not have the incentive problems as mentioned above, but they may induce other kinds of problems.

- **Average time to payout depositors**: Quick reimbursement to depositors can reveal the effective power of an EDIS. The shorter the pay-out duration, the greater the effective power of the scheme. Kyei (1995) and Garcia (1999) argue that paying depositors as quickly as possible is the best policy for an EDIS. The data on this variable are available for 36 schemes only. Among these, 9 applications have the pay-out time of 0 to less than 1 month; it is between 1 to less than 3 months in 16 cases; in 7 cases it is between 3 to less than 12 months; and in 4 cases it exceeds 12 months. The variable "*Average time to payout depositors*" assigns the value 0 for IDIS, 1 for 0 to less than 1 month, 2 for 1 to less than 3 months, 3 for 3 to less than 12 months, and 4 for pay-out time exceeding 12 months. Our hypothesis is that the banking crisis probability is further increased if the EDIS's pay-out time is longer.
- **Compensation of uncovered deposits:** It is observed that there are EDISs that compensate bank depositors even if their deposits were not covered before or during bank failure. Such action by schemes clearly widens the scope of moral hazard on the part of banks. Then banks can take higher risk in dealing with their loans by considering all of their deposits implicitly covered by the EDIS. The data on this variable are available only for 42 schemes. Of these, 30 schemes have no such coverage, while the rest do. The variable "*Compensation of uncovered deposits*" assigns the value 0 for IDIS, 1 for the EDIS that do lack such compensations, and 2 for those with the compensations. We hypothesize that the EDIS's increasing banking crisis probability is even more if the EDIS has such compensations.

3.2 Sample selection and the variables other than DIS

The period covered in our sample is 1980-2003. To select the sample countries we begin by taking all the countries listed by the IMF in their IFS (International Financial Statistics) data series. Then we drop countries (or periods) because the countries (or

periods) were centrally planned economies (so called socialist countries),[18] or were not sovereign nations,[19] or were affected by civil war,[20] or because of missing data on the necessary control variables.[21] The countries in our sample are reported in Table A1. Furthermore, parts of the study period for some sample countries are dropped because of their transitional state[22] or because of non-systemic banking crises[23] (see Table A2 of the appendix).

After the first adoption of the EDIS, about one-third of the countries reported in Table A1 revised their designs. However, after the first adoption, in all countries except Argentina, the EDIS remain in operation. The Argentine EDIS was suspended for the period of 1991-95. Unfortunately, the data do not offer much information on the revisions undertaken by the countries. At this point, to be robust, we use the data on EDIS with its applied designs from the date they were enacted if not revised, or from the date of the latest revision if the EDIS was revised for one or more times. For instance, the EDIS of Finland revised at the latest in 1998, and thus we use the data of Finland since 1998.

Defining banking crises

We consider a banking sector as unstable when it experiences a systemic banking crisis. The data on systemic banking crises come from Caprio and Klingebiel (2003). A systemic crisis is said to occur when a sufficient number of banks fail within a given period and threatens the rest of the banks in the sector[24]. Different studies[25] find that because of limited information, banking crises are difficult to identify. For instance, many banking crises are accompanied by bank runs. However, the potential for a bank run cannot be observed directly. On the other hand, banking crises in recent

[18] China, Cuba, Laos, and Vietnam are completely dropped because of their centrally planned economies.
[19] Hong Kong, Micronesia, and Taiwan are not totally sovereign states yet.
[20] Afghanistan, Somalia, and Sudan have been affected by civil conflicts throughout most of our study period.
[21] Albania, Azerbaijan, Belarus, Brunei Darussalam, Isle of Man, Kiribati, Liechtenstein, Marshal Islands, and Serbia Montenegro dropped due to lack of data series on the control variables we need.
[22] We do not drop the entire period of transitional economies, only the first two years when they transform from centrally planned to market economy
[23] Periods of non-systemic crises are dropped because: 1) non-systemic crisis may affect the systemic crisis and the explanatory variables in our regressions; 2) we are interested in estimating the probability of systemic banking crisis given that the economy is otherwise in tranquil period.
[24] See Gonzalez-Hermosillo (1996) for details.
[25] See for example Glick and Hutchison (1999)

years are associated not only with bank runs, but also with deterioration in asset quality and subsequent government intervention. However, information on these causes is also limited.

Given the information and conceptual limitations, most studies have employed a combination of events to identify and date the occurrences of banking crises. Following the detailed information for each of the systemic crises reported in Caprio and Klingebiel (2003), we find that to distinguish a systemic crisis at least one of the following conditions holds:

1 The ratio of non-performing loans to total assets in the banking system is at least 10 percent, or banks with at least 10 percent of the total assets are insolvent
2 The costs of rescue operation was at least 2.5 percent of GDP
3 Banking sector problems resulted in government intervention with measures such as large-scale nationalization of banks, or prolonged bank holidays, or closing banks, or merging large number of banks.

The variable "*Bank crisis*" takes the value 0 when an economy is in tranquil state and 1 when it experiences a systemic crisis. The years during which systemic crises were under way are excluded from the data, because the crisis itself may affect the behaviour of the explanatory variables.

Country's less development

The most important explanatory factor for this study, other than the DIS, is the overall economic development of a country. The less developed a country economically is, the more inadequate the country's institutional structure is, and then the poorer the performance of the institutions. The reasons are, (1) the government usually becomes vulnerable to domestic and international pressure to implement some inefficient measures, (2) the higher share of unskilled personnel, (3) greater limitation of financial capabilities, (4) higher level of corruption and bureaucracy, (5) lower standard of law and order tradition, (6) higher unemployment pressure, and so on.

If the overall institutional efficiency is weaker, we cannot expect better performance in banks' dealings with the deposited funds, nor can we expect better outputs of the projects invested by the bank loans. Thus the probability of a banking crisis is already higher in a country with less economic development regardless of whether the country practices IDIS or EDIS.

We generate a variable called "*Less development*" to examine the effect of countries' less economic developments on banking crisis. The variable assigns the values of 1, 2, 3, and 4 for high income, upper-middle income, lower-middle income, and low income countries, respectively. Thus all the developed nations belong to the group of high income countries and all the LDCs belong to the groups of upper-middle income to low income countries. Countries with the assigned values are reported in Table A1 (the data source is Demirguc-Kunt et al 2005).

What happens if the EDIS is handled by a country with less economic development? As already discussed in section two, an EDIS is usually used to reduce the risk of banking crisis, because it prevents bank-run by depositors. On the other hand, it can increase the crisis probability because of its moral hazard problems on the part of banks. However, it is possible that the EDIS increases the crisis probability because it is operated in a LDC, where the EDIS interacts with the weaker institutional structure, widening the scope of moral hazard on the part of banks. To examine the effects of such interactions on banking crisis, we generate interaction variables by multiplying the DIS dummies with the variable for countries' less developments.

We use also cross-country time series indexes of *corruption* and then multiply with DIS dummies to examine how much the corruption's interaction with EDIS can explain the probability of crisis. Corruption indexes, in which the index ranges from zero to six, increase with the quality of institutions, i.e., higher the index value lower the corruption. The data of corruption index is taken from the International Country Risk Guide. It should be noted that we have the data until 1997, after which we apply the 1997 corruption index to the years 1998 to 2003.[26]

[26] As can be seen from the data series on corruption, the corruption index of a country does not change frequently or even annually.

Other Control variables

We use a set of control variables to test the effect of EDIS with its different forms on banking crises. A similar set of control variables is also used by DKD (2002). The variables, their formulation, and the data sources are reported in Table 1. Expected signs of the impacts of the control variables on banking crises, and sources of the expected signs are reported in Table 2.

Table 1. Formulation and data sources of the control variables

Variables	Definition	Sources
GDP growth	= $\{(G_t - G_{t-1})/G_{t-1}\}$*100, G_t = *g/(GDP deflator)* at time *t*, where *g* = yearly GDP at current price	International Financial Statistics (IFS)
Terms of trade change (*Tot change*)	=$\{(T_t - T_{t-1})/T_{t-1}\}$*100, T_t = *E/I* at time *t*, where E and I is the total merchandise-export value and total merchandise-import value respectively	IFS
Inflation	= $\{(p_t - p_{t-1})/p_{t-1}\}$*100, where *p* = consumer price index	IFS
Depreciation	= $\{(D_t - D_{t-1})/D_{t-1}\}$*100, D_t = exchange rate (national currency per SDR) at time *t*.	IFS
Real interest	= *d* – *i*, where *d* = central bank discount rate (or nominal deposit rate, or money market rate, or treasury bill rate, or govt. bond rate, or saving rate, or lending rate if the previous one is not available) and *i* = contemporaneous rate of inflation	IFS
M2/reserves	= (*M2/F*), where *M2* = the broad money and is drawn from line 34 + the quasi-money in line 35 in IFS and *F* = foreign exchange reserves (both converted to national currency)	IFS
Growth of real private domestic credit lagged by two years (*Credit growth*$_{t-2}$)	Credit growth = $(C_t - C_{t-1})/C_{t-1}$, C = (total domestic-credits used by private sectors)/*cpi,* where *cpi* = consumer price index	IFS
GDP per capita (*GDP/Capita*)	Ratio of GDP (in US Dollar) to total population	IFS

Table 2. Expected signs of the control variables

Explanatory variables	Expected signs	References and short explanations
GDP growth	-	Kaminsky and Reinhart (1999), Gorton (1988): cyclical output downturns increase banking sector problems; DKD (1999, 2002, 2005): -ve relation with occurrence and costs of BC
Tot change	-	Kaminsky and Reinhart (1999), Gorton (1988): terms of trade deteriorations increase banking sector problems; DKD (1999): -ve relation with occurrence and costs of BC
Inflation	+	Obstfeld (1986): 2nd generation theory; Komulainen and Lukkarila (2003): +ve relation with CC; DKD (1999, 2005): +ve relation with BC occurrence and its cost.
Depreciation	+	DKD (1999, 2002): +ve relation with occurrence and costs of BC.
Real interest	+	DKD (1999, 2002, 2005): +ve relation with occurrence and costs of BC.
M2/reserves	+	Calvo (1998): it causes vulnerability to sudden stop; DKD (1999, 2002, 2005): +ve relation with occurrence and costs of BC; Komulainen and Lukkarila (2003): + ve relation with CC
Credit growth$_{t-2}$	+	DKD (2002, 2005): +ve relation with occurrence of BC
GDP/Capita	-	DKD (1999, 2005): -ve relation with occurrence of BC

NB: BC and CC refer to "banking crises" and "currency crises" respectively; -ve = negative, +ve = positive.

4. Empirical evidence

4.1 Estimation model

A logit model is used. The model we wish to fit is

$$\text{Prob}(y = 1|\mathbf{x}) = \frac{e^{\beta'\mathbf{x}}}{1+e^{\beta'\mathbf{x}}} \equiv \text{F}(\boldsymbol{\beta}'\mathbf{x})$$

The dependent variable is banking-crisis dummy y, and $y = 1$ for a country in a year if the country experiences banking crisis in that year, otherwise $y = 0$. Vector $\mathbf{x}$ is the set of explanatory variables we have discussed in the previous section. The parameter vector $\boldsymbol{\beta}$ reflects the impact of changes in $\mathbf{x}$ on the probability. The notation F(.) is the cumulative logistic distribution.

The log-likelihood in the logit model is

$$\ln L = \sum_{j \in S} \ln F(\mathbf{x}_j\mathbf{b}) + \sum_{j \notin S} \ln \{1 - F(\mathbf{x}_j\mathbf{b})\}$$

where S is the set of all country-years j such that $y_j = 1$, i.e. country-years with banking crises. Thus the set of *"j not belonging to S"* implies the set of all country-years not-experiencing banking crises.

We use robust standard errors. The calculation formula for the robust variance is

$$\hat{V} = q_c \hat{\mathbf{V}}(\mathbf{u}_j'\mathbf{u}_j)\hat{\mathbf{V}}$$

Where, $\hat{\mathbf{V}}$ is typically a conventionally calculated variance matrix; $\mathbf{u}_j = \{1–\text{F}(\mathbf{x}_j\mathbf{b})\}\mathbf{x}_j$ for the positive outcomes and $\mathbf{u}_j = –\text{F}(\mathbf{x}_j\mathbf{b})\mathbf{x}_j$ for the negative outcomes; and $q_c = N/(N-1)$ is a constant finite sample adjustment, which is the asymptotic-like formula.

We include yearly fixed effects by taking yearly dummies in the regression models to allow the possibility that the probability of banking crisis may change cross-year independently of the explanatory variables. Country fixed effects can also be included in the empirical model to allow the possibility that the crisis-probability may change

cross-country independently of the explanatory variables. In logistic estimation model, including country fixed effects would require all the countries omitting from the panel that did not experience banking crises (or if it experienced banking crises for the whole period). Since many of the countries in our dataset did not experience any banking crisis during the study period and thus would be omitted from the panel, we do not estimate country-fixed effects.

When interpreting the regression results it is important to remember that the estimated coefficients do not indicate the increase in the probability of a crisis given a one-unit increase in the corresponding explanatory variables. Instead the coefficients reflect the effect of a change in an explanatory variable on the probability function, as in the above expression. However, the sign of the coefficient does indicate the direction of the change.

4.2 Estimation results

In our regressions, the sample size is largest when we estimate the simple IDIS-EDIS dummy (i.e. zero-one dummy). On the other hand, the sample sizes are smaller and unbalanced when we estimate different designs of EDIS because of their missing values. We estimate the simple IDIS-EDIS dummy with the similar sample sizes of different designs the EDIS has. The reason of this estimation is to determine whether the coefficient of any designs of EDIS is estimated more precisely than the coefficient of simple EDIS. The estimation results of the simple IDIS-EDIS dummy for different sample sizes are reported at the bottom of the regression models. The results are distinguished with **bold** and *italic* style. Due to space limitations, we omit the results of control variables with these estimations.

The quality of a regression model is assessed by the following values: (1) log-likelihood value – the higher the value, the better the model; (2) Wald Chi-squared value – the higher the value, the better the model; (3) joint significance level (Prob > Chi-square) – the lower the value is, the stronger is the model's joint significance level; (4) model's goodness of fit (Pseudo R-squared value) – the higher the value, the better the model; and (5) Akaike's Information Criterion (AIC) [27] – the lower the

[27] In the general case, AIC = 2k – 2ln(L), where *k* is the number of parameters in the statistical model and *L* is the maximized value of the likelihood function for the estimated model.

value, the better the model. We also report the value of model's overall prediction accuracy and the value of prediction accuracy of crises for the main models.[28]

4.2.1 DIS and banking crises

At first we estimate the effect of DIS variables taking all of the possible control variables and also the yearly dummies. The estimation results are reported in Table 3. We have not reported the results of the yearly dummies lacking enough space. Many of the observations are lost because of missing data of the control variables. A few observations, as listed in Table A9 of the appendix, are dropped since they are outlier with respect to the results of some explanatory variables. The number of countries in the samples for different regression models ranges from 98 to 104. The lists of the countries included in the regressions are reported in Table-A8 of the appendix.

The dummy for IDIS-EDIS is strongly significant with the expected positive sign. That is, the banking crisis probability is higher in a country with EDIS than a country with IDIS. This finding is already confirmed in the previous empirical studies (e.g. DKD 1999, 2002 and 2005). However, the level of significance of the EDIS's effect is much stronger, in our study (at 0.5% level) than that found, for instance, in DKD 2002 (at 8% level). The reason of this stronger significance could be our different dataset as mentioned in the first section; it could also be the different estimation model as we take yearly fixed effects and the slightly different set of other control variables. The predicted crisis-probability of Philippines (1998), Thailand (1997), and Japan (1991) decrease from 10.10%, 28.79%, and 3.13% to 4.99%, 15.41%, and 1.56% respectively for switching from EDIS to IDIS.

In order to infer that the crisis probability is even higher for any inefficient design of EDIS, its coefficient should be estimated more precisely than the coefficient of EDIS in general. The sign definitely has to be positive as well. We consider the coefficient to be more precisely estimated when we see: (1) the coefficient's level of significance is as strong as the level of significance of the simple IDIS-EDIS dummy; (2) the log-likelihood value of the model is higher; (3) the model's goodness of fit is better

[28] We take a crisis (no-crisis) correctly estimated if the predicted value of the crisis (no-crisis) more (less) than the crude probability of crisis, i.e. number of crises divided by total number of observations. Thus, for the overall prediction accuracy we take the percentage value of both crises and no-crises correctly estimated and for the prediction accuracy of crises the percentage value of crises correctly estimated.

(higher pseudo-R-squared value). Measured in this way, the more precisely estimated coefficients of the forms of EDIS and their interpretations are as follows:

- *EDIS's funding* The banking crisis probability is higher if an EDIS is funded ex ante than if it is funded ex post. Thus, this study supports the viewpoint developed and verified by Demirguc-Kunt and Kane (2002) and DKD (2002) that ex post funding is better than ex ante funding. The possible reason is, as the theory suggests, an *ex ante* funded EDIS grants higher promising security to the deposited funds, causing higher moral hazard on the part of banks. The predicted crisis-probability of Korea (1997) and Philippines (1998) decrease from 6.63% and 10.55% to 4.06% and 6.64% respectively for switching from *ex ante* funding system to *ex post* funding.
- *Inter-bank deposits covered* Our data evidences that the banking crisis probability is higher when the scheme provides coverage to the inter-bank deposits than when it does not. Theory suggests, as we have found in the previous section, that moral hazard problem on the side of bankers increases with the coverage limits. It is likely that the moral hazard increases, increasing the crisis probability, as EDIS offers coverage to the deposited funds in terms covering inter-bank deposits. Like the parameter of simple IDIS-EDIS dummy, this parameter is also strongly significant in our paper (at 1% level), while its significance level is weak in DKD (2002; at 10% level). When checked, we find that this stronger significance level comes partly for our different dataset, partly for the different estimation model, and partly for the slightly different set of control variables. The estimated probability of crisis of Philippines (1998) and Thailand (1997) would have decreased from 13.25% and 35.41% to 7.41% and 21.71% respectively if the countries chose not to offer rather than offering the coverage to the inter-bank deposits.
- *Average coverage of deposits* Either of the measures, *Average coverage/ GDP-per-capita* and *Average coverage/ deposits-per-capita*, evidence that the crisis probability increases with the increase of average coverage of deposits. The variables are strongly significant. This finding is similar with DKD (2002), who find that crisis probability increases with the increase of explicit coverage limits to deposits. The predicted crisis-probability of Korea (1997) and Turkey (2000)

would decrease from 4.9% and 6.5% to 3.19% and 0.84% respectively if the countries reduced the "average coverage of deposits to GDP-per-capita" ratio from 3.86 and 12.59 to 2. Note that the IMF proposes that the average coverage of deposits should be 1-2 times of GDP per capita.

Table 3. Estimating the effects of EDIS on banking crisis probability

Dependent var. = Bank crisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP growth	-0.146*** (0.047)	-0.140*** (0.047)	-0.138*** (0.046)	-0.130*** (0.049)	-0.147*** (0.047)	-0.139*** (0.047)	-0.134*** (0.048)	-0.134*** (0.049)
Inflation	-0.0125* (0.0068)	-0.0121* (0.0069)	-0.0120* (0.0069)	-0.0096 (0.0066)	-0.0126* (0.0068)	-0.0121* (0.0070)	-0.0100 (0.0065)	-0.0104 (0.0066)
Tot change	0.0076 (0.0071)	0.0073 (0.0072)	0.0075 (0.0072)	0.0068 (0.0071)	0.0076 (0.0071)	0.0073 (0.0072)	0.0070 (0.0069)	0.0068 (0.0069)
Depreciation	0.0134** (0.0064)	0.0130** (0.0064)	0.0128** (0.0064)	0.0110* (0.0063)	0.0135** (0.0063)	0.0129** (0.0065)	0.0114* (0.0063)	0.0117* (0.0063)
Real interest	0.0016 (0.0010)	0.0015 (0.0010)	0.0015 (0.0010)	0.0010 (0.0009)	0.0016 (0.0010)	0.0015 (0.0010)	0.0011 (0.0009)	0.0011 (0.0009)
M2/reserves	-0.0024 (0.0032)	-0.0021 (0.0032)	-0.0020 (0.0028)	-0.0021 (0.0031)	-0.0024 (0.0035)	-0.0020 (0.0028)	-0.0023 (0.0030)	-0.0025 (0.0036)
Credit growth$_{t-2}$	0.0025 (0.0078)	0.0023 (0.0083)	0.0020 (0.0079)	0.0034 (0.0088)	0.0023 (0.0077)	0.0024 (0.0082)	0.0039 (0.0087)	0.0037 (0.0086)
Less development	0.4077*** (0.1353)	0.3677*** (0.1312)	0.3714*** (0.1323)	0.3873*** (0.1358)	0.3955*** (0.1320)	0.3671*** (0.1308)	0.3971*** (0.1382)	0.4034*** (0.1377)
IDIS-EDIS	1.004**$^{2\%}$ (0.4094)							
EDIS's administration		0.2959** (0.1448)						
Banks' membership			0.5926* (0.3137)					
EDIS's fund-source				0.3793* (0.2075)				
EDIS's funding					0.5340*** (0.2058)			
Banks' premium						0.3624* (0.2169)		
Foreign currency deposits covered							0.4704** (0.2197)	
Interbank deposits covered								0.6659*** (0.2505)
Constant	-4.533*** (1.1205)	-4.401*** (1.1156)	-4.399*** (1.0672)	-4.459*** (1.1045)	-4.502*** (1.1148)	-4.372*** (1.1201)	-4.448*** (1.1448)	-4.539*** (1.1474)
obs	1134	1133	1133	1078	1134	1133	1079	1079
Log likelihood	-149.73	-148.81	-149.11	-146.48	-149.52	-149.37	-147.97	-147.05
Wald chi2	98.95	100.54	104.74	96.6	102.45	98.03	93.71	96.16
Prob > chi2	0	0	0	0	0	0	0	0
Pseudo R2	0.1665	0.156	0.1544	0.1434	0.1677	0.1529	0.151	0.1563
AIC	359.46	357.62	358.22	350.96	359.04	358.74	353.94	352.1
No. of crises	42	41	41	40	42	41	41	41
% overall correct	73.54	73.17	73.43	71.15	73.63	72.73	72.01	72.47
% crises correct	73.81	73.17	73.17	70.00	73.81	73.17	70.73	73.17
IDIS-EDIS		***.922**$^{3\%}$ (.417)***	***.922**$^{3\%}$ (.417)***	***.851** (.427)***	1.004**$^{2\%}$ (0.4094)	***.922**$^{3\%}$ (.417)***	***.939**$^{3\%}$ (.418)***	***.939**$^{3\%}$ (.418)***
Log likelihood		***-148.37***	***-148.37***	***-146.07***	-149.73	***-148.37***	***-147.52***	***-147.52***
Pseudo R2		***0.1585***	***0.1585***	***0.1458***	0.1665	***0.1585***	***0.1536***	***0.1536***

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance.

(Table 3 continued)

Dependent variable = Bank crisis	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
GDP growth	-0.132*** (0.048)	-0.128*** (0.048)	-0.126*** (0.047)	-0.136*** (0.049)	-0.135*** (0.048)	-0.131*** (0.048)	-0.112** (0.049)	-0.125*** (0.047)
Inflation	-0.0097 (0.0066)	-0.0101 (0.0062)	-0.0102* (0.0062)	-0.0101 (0.0065)	-0.0102 (0.0063)	-0.0093 (0.0067)	-0.0114* (0.0067)	-0.0105 (0.0068)
Tot change	0.0071 (0.0069)	0.0068 (0.0071)	0.0069 (0.0071)	0.0070 (0.0069)	0.0070 (0.0068)	0.0072 (0.0068)	0.0037 (0.0070)	0.0062 (0.0069)
Depreciation	0.0110* (0.0063)	0.0114* (0.0060)	0.0114* (0.0060)	0.0115* (0.0062)	0.0116* (0.0061)	0.0107* (0.0064)	0.0127* (0.0068)	0.0118* (0.0069)
Real interest	0.0010 (0.0009)	0.0011 (0.0008)	0.0011 (0.0008)	0.0011 (0.0009)	0.0011 (0.0009)	0.0010 (0.0009)	0.0011 (0.0011)	0.0011 (0.0012)
M2/reserves	-0.0021 (0.0026)	-0.0019 (0.0031)	-0.0016 (0.0027)	-0.0023 (0.0029)	-0.0022 (0.0030)	-0.0021 (0.0028)	-0.0018 (0.0025)	-0.0020 (0.0027)
Credit growth$_{t-2}$	0.0039 (0.0084)	0.0031 (0.0097)	0.0032 (0.0095)	0.0033 (0.0081)	0.0040 (0.0085)	0.0039 (0.0081)	0.0075 (0.0130)	0.0073 (0.0132)
Less development	0.3907*** (0.1332)	0.3504*** (0.1329)	0.3300** (0.1351)	0.4253*** (0.1372)	0.4511*** (0.1375)	0.3931*** (0.1308)	0.3413** (0.1381)	0.4116*** (0.1468)
Coverage with co-insurance	0.5043* (0.2721)							
Average coverage/ GDP-per-capita		0.2094*** (0.0827)						
Average coverage/ deposit-per-capita			0.0539*** (0.0189)					
EDIS's power to intervene bank				0.5828*** (0.2108)				
EDIS's power to cancel insurance					0.7463*** (0.2472)			
EDIS's power to take action against bankers						0.3613 (0.2262)		
Average time to payout depositors							0.3435** (0.1633)	
Compensation of uncovered deposits								1.1131*** (0.3018)
Constant	-4.405*** (1.1145)	-4.296*** (1.1559)	-4.211*** (1.1587)	-4.645*** (1.1041)	-4.655*** (1.1285)	-4.429*** (1.0780)	-3.963*** (1.0812)	-5.202*** (1.1031)
obs	1069	1076	1070	1065	1065	1065	894	939
Log likelihood	-148.47	-145.50	-145.29	-145.98	-145.88	-148.48	-135.14	-138.10
Wald chi2	91.68	118.56	122.79	99.22	97.59	90.82	92.12	101.66
Prob > chi2	0	0	0	0	0	0	0	0
Pseudo R2	0.1462	0.1488	0.1489	0.1598	0.1604	0.1454	0.1402	0.1649
AIC	354.94	349	348.58	349.96	349.76	354.96	324.28	332.2
No. of crises	41	40	40	41	41	41	38	40
% overall correct	71.19	72.40	71.78	72.86	71.74	70.52	71.14	72.63
% crises correct	73.17	72.50	70.00	73.17	75.61	73.17	73.68	72.50
IDIS-EDIS	***.998**$^{2\%}$ (.414)***	***.853** (.427)***	***.863** (.425)***	***1.025**$^{2\%}$ (.417)***	***1.025**$^{2\%}$ (.417)***	***1.025**$^{2\%}$ (.417)***	***1.03**$^{2\%}$ (.430)***	***1.230*** (.392)***
Log likelihood	***-146.90***	***-146.04***	***-145.89***	***-146.65***	***-146.65***	***-146.65***	***-134.49***	***-139.17***
Pseudo R2	***0.1552***	***0.1456***	***0.1453***	***0.1559***	***0.1559***	***0.1559***	***0.1444***	***0.1584***

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance.

- *EDIS's power to intervene bank* Once a country implements EDIS, it should empower enough the EDIS from the legal point of view. This viewpoint is established as this study evidences that the banking crisis probability is higher if an EDIS has no decision-power to intervene bank operations than the EDIS has. Perhaps the reason is the incentive problem as the theory suggests. The problem ensues in the following way. The scheme provides insurance to the bank deposits, whereas it has no power to directly intervene the banks' if they have any wrong dealings (if any) with the deposits. Then the empowered intervening authority can have less incentive, which implies the moral hazard problem, to be efficient and prudential in intervening bank operations. At the same time it will allow wider opportunity to the bankers to involve in fraudulent activities. The estimated probability of crisis of Sri Lanka (1989) and Japan (1991) would have decreased from 6.53% and 3.76% to 3.7% and 2.18% respectively if the EDIS authorities of the countries were empowered, instead of no-power, for the direct intervention of the bank operations.
- *EDIS's power to cancel insurance* This study finds the evidence that the probability of banking crisis increases if an EDIS lacks the authority to cancel the deposit insurance of the participating banks instead of the scheme have that authority. Like the design of above one and as the theory suggests, the incentive and the moral hazard problems may cause this increasing crisis probability. The EDIS guarantees to pay the dues of the banks' depositors as it sells the insurance of the deposited funds. However, it has no power to cancel the deposit insurance agreement with the banks for any of their defaults. Logically the first problem is that the authority with power to cancel the insurance will have less incentive to be efficient in dealing with the banks. Secondly, the banks will take this opportunity with wider scope of moral hazard in dealing with the deposited funds. The predicted crisis-probability of Argentina (2001) and Korea (1997) would decrease from 7.45% and 8.57% to 3.88% and 4.32% respectively for switching the EDIS without that power to with that power.
- *Compensation of uncovered deposits* The data of this study evidences that banking crisis probability is higher if an EDIS compensate for some reasons to the deposited funds of a bank which were not covered before the bank fails. This kind

of treatment by the EDIS reveals the liberalized policy of the scheme. This liberalized policy of the scheme can increase the scope of moral hazard on the part of banks because the effective coverage of the deposited funds increases. The estimated crisis-probability of Argentina (2001) and Turkey (2000) reduces from 14.27% and 3.87% to 5.65% and 1.29% respectively for the countries' EDIS to switch from compensation of the uncovered deposits to the no-compensation of that.

The findings explained above remain the same if we test the regression models of Table 3 by taking (1) only the control variables that are significant or (2) only the control variables that are significant and have the least number of missing values (i.e. dropping the control variables because of high missing values). The results are reported in Table A5 and A6 of the appendix. Note that, each time we use the yearly dummies to take into account the yearly fixed effects, but we do not report the results of them for the lack of spaces. In the first regression-models, the control variables are the GDP growth, the depreciation, and the less-development of countries. The number of observations ranges from 1054 to 1321 and the number of countries from 102 to 110. In the second regression-models, the control variables are the depreciation and the less-development of countries. Number of observations ranges from 1617 to 1992 and the number of countries from 140 to 149.

4.2.2 EDIS with economic development and banking crisis

The effect of EDIS on banking crisis when the EDIS is handled by countries with differing economic-developments is reported in Table 4. Instead of taking all of the EDIS design variables, we have taken only the variables found more precisely estimated to increase the crisis probability higher than the probability with the EDIS in general. We have used the similar set of control variables, including the yearly dummies, as used in Table 3. However, the variable for less economic development is not used separately because this is used as interacting with the DIS dummies.

Table 4. Effect of EDIS interacted with country's economic development on banking crisis probability

Dependent variable = Bank crisis	(1)	(2)	(3)	(4)
GDP growth	-0.146*** (0.047)	-0.146*** (0.047)	-0.136*** (0.048)	-0.127*** (0.048)
Inflation	-0.0144** (0.0072)	-0.0145** (0.0071)	-0.0127* (0.0071)	-0.0118* (0.0067)
Tot change	0.0075 (0.0078)	0.0076 (0.0078)	0.0062 (0.0076)	0.0071 (0.0080)
Depreciation	0.0153** (0.0067)	0.0153** (0.0067)	0.0140** (0.0067)	0.0132** (0.0065)
Real interest	0.0018* (0.0010)	0.0018* (0.0010)	0.0013 (0.0010)	0.0012 (0.0009)
M2/reserves	-0.0014 (0.0025)	-0.0015 (0.0026)	-0.0009 (0.0022)	-0.0016 (0.0026)
Credit growth$_{t-2}$	0.0018 (0.0086)	0.0020 (0.0084)	0.0031 (0.0091)	0.0037 (0.0106)
IDIS-EDIS x Less development	0.5868** (0.2887)			
IDIS-EDIS	-0.6125 (0.8237)			
EDIS's funding x Less development		0.2495* (0.1530)		
EDIS's funding		-0.1649 (0.4470)		
Inter-bank deposits covered x Less development			0.5299** (0.2240)	
Inter-bank deposits covered			-0.8251 (0.6598)	
Average coverage/ GDP-per-capita x Less development				0.0262 (0.0809)
Average coverage/ GDP-per-capita				0.1381 (0.2448)
Constant	-3.38*** (1.03)	-3.38*** (1.02)	-3.45*** (1.07)	-3.29*** (1.05)
obs	1134	1134	1079	1076
Log likelihood	-151.24	-151.52	-147.53	-148.08
Wald chi2	105.84	107.42	103.16	115.58
Prob > chi2	0	0	0	0
Pseudo R2	0.1581	0.1565	0.1536	0.1337
AIC	362.48	363.04	353.06	354.16
No. of crises	42	42	41	40
% overall correct	73.02	72.75	72.85	71.28
% crises correct	76.19	76.19	78.05	77.50
IDIS-EDIS x Less development		***0.5868** (0.2887)***	***.603** (.305)***	***.556* (.315)***
IDIS-EDIS		***-0.6125 (0.8237)***	***-.721 (.881)***	***-.677 (.906)***
Log likelihood		***-151.24***	***-149.12***	***-147.77***
Pseudo R2		***0.1581***	***0.1444***	***0.1355***

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance.

(Table 4 continued)

Dependent variable = Bank crisis	(5)	(6)	(7)
GDP growth	-0.136*** (0.049)	-0.133*** (0.048)	-0.128*** (0.048)
Inflation	-0.0122* (0.0070)	-0.0124* (0.0067)	-0.0129* (0.0073)
Tot change	0.0070 (0.0077)	0.0072 (0.0077)	0.0060 (0.0077)
Depreciation	0.0135** (0.0067)	0.0137** (0.0065)	0.0142** (0.0073)
Real interest	0.0013 (0.0009)	0.0013 (0.0009)	0.0013 (0.0011)
M2/reserves	-0.0015 (0.0026)	-0.0013 (0.0022)	-0.0012 (0.0022)
Credit growth$_{t-2}$	0.0028 (0.0087)	0.0035 (0.0092)	0.0065 (0.0143)
EDIS's power to intervene bank x Less development	0.2971* (0.1683)		
EDIS's power to intervene bank	-0.2498 (0.4988)		
EDIS's power to cancel insurance x Less development		0.4008 (0.2577)	
EDIS's power to cancel insurance		-0.2995 (0.7075)	
Compensation of uncovered deposits x Less development			0.5644** (0.2601)
Compensation of uncovered deposits			-0.2479 (0.6194)
Constant	-3.45*** (1.01)	-3.36*** (1.02)	-2.83*** (0.82)
obs	1065	1065	939
Log likelihood	-148.00	-148.40	-139.14
Wald chi2	100.7	101	105.6
Prob > chi2	0	0	0
Pseudo R2	0.1481	0.1459	0.1586
AIC	354.0	354.8	334.28
No. of crises	41	41	40
% overall correct	72.21	71.74	72.31
% crises correct	75.61	78.05	77.50
IDIS-EDIS x Less development	***.680** (.315)***	***.680** (.315)***	***.454 (.329)***
IDIS-EDIS	***-.836 (.900)***	***-.836 (.900)***	***-.025 (.913)***
Log likelihood	***-148.10***	***-148.10***	***-141.01***
Pseudo R2	***0.1476***	***0.1476***	***0.1473***

As we can see from Table 4, when DIS dummies interact with the variable for less economic development, most of the interaction parameters are significant. The interaction parameters have the expected positive sign. That is, the less developed is a country handling the EDIS (in general or with any of its inefficient designs), the higher the banking crisis probability. However, none of the DIS dummies separately

are significant any more. Most of the correlation signs even turn to be negative (i.e. decreasing the crisis probability). This implies that utilizing an EDIS does not matter on its own, but what is important is how developed the country is to run the scheme efficiently. The estimated crisis-probability of Nigeria (1990) and Kenya (1992) would decrease from 11.33% and 9.19% to 4.61% and 3.57% respectively if the EDIS in these countries interacted with the institutional framework like a developed country.

What about the additional effect for an inefficient design of EDIS? Does the increasing probability of the interaction parameter become greater with any of the EDIS's inefficient designs? We can infer this by examining whether the coefficients of the less-development's interaction with the EDIS-designs are more precisely estimated as compared to the coefficient of that interaction with the simple IDIS-EDIS dummy. The more precisely estimated parameters (based on the log-likelihood values and the values of the model's goodness of fit) are as follows:

- *Inter-bank deposits covered* x *Less development* The banking crisis probability is greater if an EDIS covering inter-bank deposits handled by a country with less economic development than if it is handled by a higher developed country. Precisely, the less developed a country is, the higher the moral hazard problem among bankers ensued from inter-bank deposits covered, and the higher the crisis probability. The predicted crisis-probability of Nigeria (1990) and Kenya (1992) would decrease from 20.31% and 18.00% to 6.21% and 4.83% respectively if the EDIS in these countries covering inter-bank deposits interacted with institutional framework like a developed country, instead of the countries' existing least-developed like institutional framework.
- *EDIS's power to intervene bank* x *Less development* The data of this study evidences that the banking crisis probability generated by an EDIS lacking the power to directly intervene bank operations is higher if the scheme handled by less developed economy. In the earlier subsection (Table 3) it was argued that if the power to intervene directly the bank operations is bestowed on other authority rather than on the EDIS itself, it creates incentive problems to the authority and then the moral hazard problems on the part of banks, and thus increases the crisis probability. Now we have found that this crisis probability increases even more if

such an EDIS is handled by less developed economy. The possible reason is, as the theory suggests, the weaker institutional framework in less developed economy exaggerates the said incentive and moral hazard problems. The estimated crisis-probability of Nigeria (1990) and Kenya (1992) would decrease from 12.48% and 10.19% to 5.73% and 4.6% respectively if the EDIS in these countries without the power to directly intervene bank operations handled by developed-country like institutional framework.

- *Compensation of uncovered deposits* x *Less development* The banking crisis probability arising from an EDIS which compensates uncovered deposits is higher if the scheme is handled by less developed economy. In the earlier subsection we argued that an EDIS compensating uncovered deposits of a bank after its failure reveals the liberalized policy of the EDIS, and this liberalized policy causes higher scope of moral hazard on the part of bankers than the scheme not compensating that. As a result the scheme causes crisis probability to increase. When such an EDIS is handled by less developed economy, the liberalization allows even higher scope of moral hazard to the bankers because of weaker institutional framework of the economy, and causes the crisis probability to increase even more. The predicted crisis-probability of Argentina (2001) would decrease from 11.83% to 6.33% if the EDIS in the country compensating uncovered deposits handled by developed-country like institutional framework rather than the country's existing institutional framework.

Next, we want to examine the degree to which an indicator representing countries' single type of institutional environment, e.g. corruption, can explain the banking crises when it interacts with EDIS. Many studies (e.g. DKD 1999, 2002, and 2005) use per capita GDP or corruption, or similar indicators to represent a country's institutional environment. However, these indicators cannot represent fully the general institutional framework which is determined by countries' overall economic developments. For instance, institutional quality in Cyprus, Korea, Kuwait, Qatar, and United Arab Emirates is not good in terms of their average corruption levels. However, in terms of financial capabilities their institutional efficiency is much similar to that of the industrialized countries and thus they all belong to the high income group. On the other hand, the corruption level in Bolivia, Nicaragua, and

South Africa is very low, but they have considerable institutional deficiency because of financial limitation and they are ranked in the second most LDC group.

Table 5. Effects of EDIS interacted with corruption on banking crises

Dependent var. = Bank crisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP growth	-0.171*** (0.064)	-0.171*** (0.065)	-0.158** (0.067)	-0.151** (0.067)	-0.157** (0.067)	-0.154** (0.065)	-0.138** (0.066)
Inflation	-0.0131* (0.0073)	-0.0132* (0.0073)	-0.0108 (0.0073)	-0.0102 (0.0070)	-0.0112 (0.0072)	-0.0113 (0.0070)	-0.0119 (0.0076)
Tot change	0.0085 (0.0093)	0.0087 (0.0092)	0.0086 (0.0091)	0.0092 (0.0095)	0.0083 (0.0091)	0.0086 (0.0092)	0.0065 (0.0092)
Depreciation	0.0138** (0.0068)	0.0139** (0.0068)	0.0119* (0.0069)	0.0113* (0.0068)	0.0123* (0.0069)	0.0124* (0.0067)	0.0129* (0.0077)
Real interest	0.0016* (0.0010)	0.0017* (0.0010)	0.0012 (0.0010)	0.0012 (0.0009)	0.0012 (0.0009)	0.0012 (0.0009)	0.0013 (0.0012)
M2/reserves	0.0005 (0.0016)	0.00005 (0.0015)	0.0002 (0.0014)	-0.0005 (0.0014)	0.0004 (0.0017)	0.0001 (0.0014)	0.0004 (0.0014)
Credit growth$_{t-2}$	0.0030 (0.0099)	0.0029 (0.0096)	0.0041 (0.0096)	0.0039 (0.0105)	0.0044 (0.0092)	0.0051 (0.0092)	0.0079 (0.0170)
IDIS-EDIS x Corruption	-0.7897** (0.3234)						
IDIS-EDIS	3.2885*** (1.0403)						
EDIS's funding x Corruption		-0.3694** (0.1643)					
EDIS's funding		1.6145*** (0.5167)					
Interbank deposits covered x Corruption			-0.4731*** (0.1852)				
Interbank deposits covered			1.9346*** (0.5737)				
Average coverage/ GDP-per-capita x Corruption				-0.2129* (0.1285)			
Average coverage/ GDP-per-capita				0.7875** (0.3459)			
EDIS's power to intervene bank x Corruption					-0.4096** (0.1917)		
EDIS's power to intervene bank					1.7495*** (0.5848)		
EDIS's power to cancel insurance x Corruption						-0.4668* (0.2536)	
EDIS's power to cancel insurance						2.0719*** (0.7216)	
Compensation of uncovered deposits x Corruption							-0.6644*** (0.2504)
Compensation of uncovered deposits							3.1064*** (0.7886)
Constant	-3.05*** (1.08)	-3.07*** (1.07)	-3.09*** (1.11)	-2.94*** (1.10)	-3.14*** (1.05)	-3.01*** (1.07)	-3.30*** (1.03)
obs	771	771	729	726	715	715	602
Log likelihood	-107.76	-107.90	-106.36	-104.54	-105.14	-105.42	-96.10
Wald chi2	92.67	96.37	83.99	96.51	90.01	88.02	101.97
Prob > chi2	0	0	0	0	0	0	0
Pseudo R2	0.1907	0.1896	0.1705	0.1634	0.176	0.1738	0.1938
AIC	271.52	271.8	266.72	263.08	264.28	264.84	244.2
No. of crises	32	32	31	30	31	31	30
% overall correct	74.19	73.93	73.66	72.45	73.99	73.29	75.91
% crises correct	68.75	68.75	70.97	70.00	70.97	67.74	73.33

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance.

Table 5 summarizes the results with corruption. The set of control variables is the same as that used in the earlier regressions (Table 3 or 4). Signs of the correlations of the interaction parameters are negative in all cases implying that the lower the corruption of a country managing the EDIS (in general or with any of its designs), the lower the banking crisis probability. All of the interaction parameters are statistically significant.

Interestingly, most of the DIS dummies separately are still significant even after the dummies interacted with the variable of corruption are controlled. This implies that targeting the low level of corruption in a LDC is not enough to offset the ineffectiveness of an EDIS in preventing the banking crises. The other setbacks of less developed economy should also be removed. The setbacks could include, (1) the government's vulnerability to international pressure that affects the rules and regulation of financial market directly or indirectly (e.g. very often governments do not want but to adopt EDIS because of the IMF's pressure), (2) the government might experience similar vulnerability with regard to domestic pressure, (3) the lack of skilled personnel in institutions, (4) high unemployment pressure, (5) the history or tradition of non-democracy or non-freedom of press, (6) heavy bureaucracy, (7) low level of law and order, (8) poor contract enforcement, and so on.

Note that the inferences we have drawn about the differences between the DIS dummies interacted with corruption and the dummies interacted with less-development could be different because of different sample sizes (see Table 5 and 4). To examine this, we run the regression models of Table 4 with the similar sample sizes as in Table 5. The findings of DIS dummies on their own and the dummies interacted with the variable of country's less-development remain much the same (the results are not reported but can be obtained from the author on request), and thus the inferences drawn are not rejected.

4.2.3 Estimation results compared to DKD (2002)

As mentioned in the first section, our sample includes more LDCs than included by DKD (2002). We want to examine how our results differ from those of DKD because of this inclusion. For this, we use the DIS variables that are common to both studies.

We also use a similar estimation model, which is logit model disregarding the country and the yearly fixed effects, and a similar set of control variables. The EDIS (in general or with its different designs) data are from the dates they were enacted first or from 1980 (if the enacting dates are prior to 1980). Table 6 reports the estimation results, but not the results of the control variables for reasons of brevity.

Table 6. The estimation results compared to DKD (2002)

	DKD	Ours		DKD	Ours		DKD	Ours
IDIS-EDIS	.859** (.470)	.817** (.399)	Coverage with co-insurance	0.500** (0.240)	.379 (.284)	Foreign currency deposits covered	0.528** (0.258)	.424* (.225)
IDIS-EDIS x GDP/Capita	-0.059 (0.037)	-.0796* (.0428)	Coverage with co-insurance x GDP/Capita	-0.033* (0.019)	-.0579[12%] (.0372)	Foreign currency deposits covered x GDP/Capita	-0.027 (0.022)	-.0439* (.0247)
Crises, N, AIC	40,898, 298	46, 1455, 388		40, 898, 298	44, 1433, 387		40,898,298	45, 1454, 387

	DKD	Ours		DKD	Ours		DKD	Ours
Interbank deposits covered	0.497* (0.285)	.761*** (.281)	EDIS's funding	0.509** (0.242)	.429** (.2002)	EDIS's fund-source	0.427** (0.224)	.317[14%] (.214)
Interbank deposits covered x GDP/Capita	-0.033 (0.028)	-.0768** (.033)	EDIS's funding x GDP/Capita	-0.026 (0.020)	-.034[13%] (.022)	EDIS's fund-source x GDP/Capita	-0.021 (0.019)	-.033 (.025)
Crises, N, AIC	40,898, 299	45, 1454, 383		40,898,298	46, 1455, 389		40,898,298	44, 1453, 383

	DKD	Ours		DKD	Ours
EDIS's administration	0.335** (0.157)	.273* (.146)	Banks' membership	0.847** (0.396)	.526* (.318)
EDIS's administration x GDP/Capita	-0.020 (0.015)	-.0378* (.021)	Banks' membership x GDP/Capita	-0.058* (0.033)	-.063* (.035)
Crises, N, AIC	40,891, 297	45, 1446, 383		40,891,297	45, 1454, 384

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance; N = No. of observations.

In the table, the DIS dummies interact with the variable of countries' GDP per capita. The coefficients of most of the interaction variables in our study are larger in magnitude than those found in DKD (2002). The levels of significance of most of them are also stronger. Note that the coefficients of the interaction variables have the expected sign, i.e. an EDIS in general or any of its inefficient designs handled by a country with high GDP per capita decreases the banking crisis probability. Perhaps the reason of this higher coefficient values and stronger significant levels is that as more LDCs are included in the sample, the degree of EDIS (in general or with its

inefficient designs) handled by LDCs with their weaker institutions increases. As a result the probability of banking crisis, in terms of magnitudes of coefficients and their significant levels, increases higher than that of DKD (2002).

4.3 Robustness

A potential criticism of the regression results is that the decision to adopt EDIS may be influenced by a banking crisis itself. Thus the adoption of EDIS and the banking crisis may be jointly determined. If this is the case, then treating the EDIS as an exogenous variable would lead to the simultaneity bias. To assess whether such bias exists, we use a two-stage logit estimation method: (1) adoption of EDIS is estimated from a set of explanatory variables where there is at least one variable that is not correlated with banking crises; (2) the IDIS-EDIS dummy is replaced by a variable called "*EDIS-predict*" in estimating the banking crisis probability. The variable *EDIS-predict* takes the predicted values of adopting EDIS.

Table 7. DIS and banking crises: two-stage estimation

	Banking Crisis	Adopting EDIS	Banking Crisis
GDP growth	-0.140*** (0.040)	-0.050* (0.026)	-0.067 (0.052)
Depreciation	0.0023*** (0.0006)	0.0002 (0.0004)	0.0020*** (0.0006)
Less development	0.4220*** (0.1459)	-0.4803*** (0.1132)	0.9201*** (0.3269)
IDIS-EDIS	1.0720*** (0.3993)		
EDIS-Contagion		9.7518*** (2.8705)	
EDIS-Predict			36.61** (17.14)
Constant	-5.00*** (1.09)	-3.6212*** (0.5331)	-7.36*** (1.89)
obs	1321	1470	1321
Log likelihood	-164.09	-203.25	-165.27
Wald chi2	99.16	29.37	98.35
Prob > chi2	0	0	0
Pseudo R2	0.1495	0.0539	0.1435

The robustness check is done by taking a fewer control variables which were found significant in the previous models, e.g. in Table 3. First regression model in Table 7

reports the results in which banking crisis is the dependent variable and IDIS-EDIS is an explanatory variable along with the control variables.[29] A logit model with yearly fixed effect is used. The result of the regression model remains the same as in Table 3, i.e. utilizing the EDIS increases the banking crisis probability and it is strongly significant.

In the first stage of the two-stage estimation in Table 7, the dependent variable "*Adopting EDIS*" takes zero for IDIS and one for adopting EDIS. Once the EDISs are adopted by countries, we drop the subsequent periods of the countries during which the EDISs remain in effect. The key explanatory variable in this regression model is the "*EDIS-Contagion*". The variable takes the year-wise proportion of the sample countries utilizing EDIS. The higher the proportion of the countries with EDIS, the more likely it is that the country adopts the EDIS. This is the instrumental variable of IDIS-EDIS, which is likely to be related to the application of EDIS, but not to the banking crisis (see DKD 2002 for supporting this view). The control variables are the same as those in the first regression model.

The logit model in the first-stage estimation disregards the yearly fixed effect because the year-wise proportions of the sample countries utilizing EDIS are different between years but are the same for all countries within the years. In this case, if we use the yearly dummies to include their fixed effects, the variable EDIS-Contagion drops from the estimation. However, we use the logit model with the yearly dummies in the second-stage of estimation.

Results of the first and second regression-columns of the table show that the probability of adopting an EDIS and the probability of a banking crisis are driven by different factors. The variable of less development is strongly significant in both columns but with different signs. The result follows that the less a country is developed, the less the chance of adopting EDIS. The levels of significance of the parameters with the GDP growth and the depreciation also differ between the two columns. Essentially, EDIS-Contagion is positively related with the probability of adopting an EDIS, as expected. This implies that the higher the countries around the globe adopt EDIS, the higher the chance of a country with IDIS to enact EDIS.

In the second-stage of the regression (3rd regression column), the variable of *EDIS-predict* is a significant (at 5% level) factor of banking crises with the expected sign.

[29] Table A5 of appendix also reports the results of this regression model.

The variables for the less development and the depreciation are also significant with the expected signs. Thus we infer that EDIS influences banking crisis, not the banking crisis itself influences the adoption of EDIS.

Further robustness check

We also estimate the effects of EDIS (in general and its different forms) on banking crises by dropping out the high income countries from the sample, i.e., including only the LDCs in the sample. The logit model taking the yearly fixed effects (but not reporting results with yearly dummies) is used. Table 8 reports the regression results only for which DIS dummies are statistically significant.

The finding is much similar to that in Table 3. Precisely, adopting an EDIS increases the banking crisis probability, and this crisis probability is higher if the EDIS provides coverage to inter-bank deposits and if the ratio of average coverage of deposits to deposits-per-capita increases. This crisis probability is also higher if the EDIS is not empowered to directly intervene bank operations and if it compensates the uncovered deposits of bank(s) after the bank(s)' failure. An additional finding within the LDC countries is that the crisis probability is higher if the EDIS provides coverage to foreign currency deposits. One reason could be the usual moral hazard problem on the part of banks ensuing from the increasing coverage to the deposits, as mentioned in the earlier sections. Another possible reason is as follows. Although deposits are in foreign currency, but banks mostly lend in local currency. The local currency devaluation is relatively higher in LDCs. The currency devaluation causes the banks to be non-performed with their loans, causing the banking sector insolvencies.

We also estimate the impacts of EDIS on banking crises by using the EDIS data from the dates of the EDIS originally enacted, instead of the dates the EDIS latest revised. The findings of the estimation results remain much the similar with that of Table 3 when we estimate the similar regression models of Table 3 (results not reported here due to space limitations, but can be obtained on request from the author).

Table 8. EDIS and banking crises within the LDC countries

Dep.Var = BankCrisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP growth	-0.1276** (0.0517)	-0.1269** (0.0517)	-0.1160** (0.0541)	-0.1167** (0.0546)	-0.1051** (0.0529)	-0.1161** (0.0544)	-0.1126** (0.0529)	-0.1046** (0.0534)
Inflation	-0.0131* (0.0072)	-0.0131* (0.0071)	-0.0106 (0.0071)	-0.0113 (0.0070)	-0.0097 (0.0071)	-0.0107 (0.0071)	-0.0103 (0.0071)	-0.0114 (0.0074)
Tot change	0.0079 (0.0072)	0.0079 (0.0072)	0.0074 (0.0070)	0.0073 (0.0071)	0.0075 (0.0072)	0.0075 (0.0070)	0.0075 (0.0069)	0.0066 (0.0071)
Depreciation	0.0138** (0.0067)	0.0138** (0.0066)	0.0117* (0.0067)	0.0124* (0.0066)	0.0109 (0.0067)	0.0118* (0.0067)	0.0114* (0.0067)	0.0123* (0.0075)
Real interest	0.0017* (0.0010)	0.0017* (0.0010)	0.0012 (0.0010)	0.0013 (0.0010)	0.0011 (0.0010)	0.0012 (0.0010)	0.0012 (0.0010)	0.0014 (0.0013)
M2/reserves	-0.0012 (0.0036)	-0.0013 (0.0036)	-0.0013 (0.0037)	-0.0011 (0.0035)	-0.0012 (0.0036)	-0.0011 (0.0035)	-0.0011 (0.0035)	-0.0012 (0.0036)
Credit growth$_{t-2}$	0.0023 (0.0091)	0.0022 (0.0090)	0.0030 (0.0094)	0.0026 (0.0093)	0.0021 (0.0107)	0.0025 (0.0086)	0.0033 (0.0090)	0.0058 (0.0145)
GDP/Capita	0.0598 (0.1319)	0.0671 (0.1294)	0.0429 (0.1373)	0.0856 (0.1366)	0.0616 (0.1420)	0.0486 (0.1369)	0.0209 (0.1424)	0.0361 (0.1444)
IDIS-EDIS	0.9745** (0.4388)							
EDIS's funding		0.5003** (0.2238)						
Foreign currency deposits covered			0.5054** (0.2288)					
Interbank deposits covered				0.7853*** (0.2841)				
Average coverage/ deposit-per-capita					0.0483** (0.0203)			
EDIS's power to intervene bank						0.5455** (0.2234)		
EDIS's power to cancel insurance							0.5469** (0.2505)	
Compensation of uncovered deposits								1.2588*** (0.3462)
Constant	-3.16*** (1.07)	-3.17*** (1.07)	-3.13*** (1.09)	-3.26*** (1.08)	-3.10*** (1.11)	-3.21*** (1.04)	-3.09*** (1.08)	-2.72*** (0.88)
obs	751	751	714	714	711	701	701	636
Log likelihood	-124.88	-124.91	-122.89	-121.63	-120.75	-121.85	-122.77	-114.03
Wald chi2	81.0	85.2	72.02	78.44	93.4	75.1	68.26	91.35
Prob > chi2	0	0	0	0	0	0	0	0
Pseudo R2	0.1531	0.1529	0.1384	0.1472	0.1345	0.1416	0.1351	0.1586
AIC	307.76	307.82	301.78	299.26	297.5	299.7	301.54	280.06
No. of crises	37	37	36	36	35	36	36	35
% overall correct	74.03	73.50	71.85	73.53	72.29	71.90	72.18	73.43
% crises correct	75.68	78.38	72.22	75.00	71.43	75.00	75.00	71.43
IDIS-EDIS		***0.9745** (0.4388)***	***0.909** (.451)***	***0.909** (.451)***	***0.799** (.465)***	***0.995** (.447)***	***0.995** (.447)***	***1.199*** (.433)***
Log likelihood		***-124.88***	***-122.96***	***-122.96***	***-121.34***	***-122.22***	***-122.22***	***-115.75***
Pseudo R2		***0.1531***	***0.1378***	***0.1378***	***0.1303***	***0.1389***	***0.1389***	***0.1458***

Numbers in the parentheses are standard errors; ***, **, and * refer to 1%, 5%, and 10% level of significance.

5. Conclusion

EDIS has been utilized by countries world wide increasingly, but its use by LDCs has increased more rapidly. On the other hand, most of the banking crises have been occurred in LDCs. With this increase a sample gets new shape or balance with the new possible effect of EDIS on banking crises. This study tests the effects of EDIS on banking crises using a sample with this new balance, although these effects were tested previously by DKD (2002) using an older dataset. The panel data we use is pretty large as it takes all the possible countries with IDIS and EDIS for the period of 1980-2003. We use a logit model with yearly fixed effects.

The finding is that undertaking EDIS in general, i.e. regardless of its specific form, increases the banking crisis probability with strong significance level. The increase of this crisis probability is greater if the EDIS is funded ex ante, or if it provides coverage on the inter-bank deposits, or if the EDIS provides higher coverage to deposits in average. It is also greater if the EDIS is not empowered for intervention of bank operations directly, or if not empowered to cancel the deposit insurance contract of any participating banks, or if it compensates for the lost of deposits of failed banks which were not covered before the failure.

This study also finds that the less developed a country is to handle the EDIS, the higher the banking crisis probability. This probability is even more if the EDIS provides coverage to inter-bank deposits, or if the EDIS has no power to intervene bank-operations directly, or if the scheme compensate for the lost deposits of failed banks which were not covered before the bank failure.

Interestingly, once the effect of a country's less development handling the EDIS (in general or with any of its designs) is controlled, the effect of the EDIS separately on the banking crises is no longer significant. The finding suggests that the implementation of an EDIS does not matter on its own, but the matter is how developed the country is to prevent the EDIS's ineffectiveness (e.g. the moral hazard problem on the part of banks). This study also finds that the EDIS handled by a country with low corruption level decreases the crisis-probability, but if this interaction is controlled, the EDIS separately increases the crisis-probability still. That

is, a measure like lowering the level of corruption in a country cannot overcome the inefficiency of an EDIS as it does by the overall economic development.

Using a similar logit model and a set of control variables with DKD (2002), this study finds that the EDIS in general or with its inefficient designs handled by a country with high GDP per capita decreases the banking crisis probability. However, the coefficients are larger in magnitude in our study than those found in DKD (2002). The levels of significance of the interaction parameters are also stronger in our study. Perhaps the reason of this larger coefficient values and of the stronger significance levels is that as more LDCs are included in our sample, the degree of EDIS (in general or with its inefficient designs) handled by the LDCs with their weaker institutional-structures increases. As a result the increase of the crisis-probability, in terms of the magnitudes of the coefficients and their significance levels, is higher in our study.

The robustness of the findings of this study is verified in multiple approaches. The major verification is determining whether the adoption of EDIS and a banking crisis occur simultaneously, i.e., if there is reverse causality problem. Our check shows that the adoption of EDIS causes a banking crisis, not the other way round. In another check we find that the inference about the effects of EDIS (in general or with its inefficient designs) on banking crises remain much the same when we use the LDCs data only, i.e., dropping out the high income or developed countries from the sample.

This study has some policy implications however. In line with Chen and Fishe (1993), we argue against the utilization of EDIS as long as the institutional-structure of a country is not developed adequately. An EDIS should not be adopted on international pressure unless the country's institutional framework is viable to run the scheme effectively. In this regard, the position of LDCs' governments should be strong enough to defy the pressure of the international organisations like the IMF or the World Bank to adopt the EDIS. The international organisations themselves should also be cautious about adopting the EDIS in LDCs due to the institutional-structural weakness of the LDCs. They should do so because very often governments of the LDCs refuse to acknowledge that the institutional-structure of the countries is weak and prefer to adopt the EDIS instead.

If for some reasons a LDC needs to adopt the EDIS, certainly it should not provide high coverage. Furthermore, the scheme should be empowered to supervise the operation of the participating banks prudentially and to take action against any misconduct of the banks. Another important point is the public awareness of the type

of DIS. The people, especially the small depositors, in LDCs are less aware about the type of DIS than the people in the developed world. Unfortunately, very often the small depositors in LDCs become aware of the type of their deposit insurance only after the failure of their banks. In this case, the government or the EDIS authority can mitigate depositors' risk, at least partly, by simply letting the general public know about the type of DIS and the related risks involved. In this regard, the countries need a strong media and free press.

The study has some limitations anyway. The banking crises data are obtained from another source (Caprio and Klingebiel 2003) and a single decisive factor to define the banking crises does not exist. The study would have been more realistic, if the definition of a banking crisis had been based on a single decisive factor.

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Appendix

Table-A1: Cross-country systemic banking crises and DIS

Income Group	Coun-tries	Crises Period	IDIS =0 EDIS=1	Date Enacted/Revised	Income Group	Countries	Crises Period	IDIS =0 EDIS=1	Date Enacted/Revised
3	Algeria#	1990-93	1	1997	4	Lesotho*	1988-90	0	
2	Argentina	1980-82, 89-90, 95-97, 2001-	1	1971/95	4	Liberia#	1991-95	0	
3	Armenia#	1994-96	0		2	Libya		0	
1	Australia*		0		2	Lithuania#	1995-96	1	1996
1	Austria		1	1979/96	1	Luxembourg		1	1989
1	Bahamas		1	1999	3	Macedonia, FYR	1993-94	1	1996/00/02
1	Bahrain		1	1993	4	Madagascar#	1988	0	
4	Bangladesh	1986-96	1	1984	2	Malaysia*	1997-	1	1998
1	Barbados		0		3	Maldives		0	
1	Belgium		1	1974/95/98	4	Mali	1987-89	0	
2	Belize		0		4	Malawi		0	
4	Benin	1988-90	0		1	Malta		1	2003
4	Bhutan		0		4	Mauritania	1984-93	0	
3	Bolivia	1986-88, 94-	1	2001	2	Mauritius		0	
2	Botswana*		0		2	Mexico	1981-91, 94-97	1	1986/90/99
3	Brazil	1990, 94-99	1	1995/2002	4	Moldova#		0	
3	Bulgaria#	1995-97	1	1996/98/01	4	Mongolia#		0	
4	Burkina Faso	1988-94	0		3	Morocco	1980-85	0	
4	Burundi#	1994-	0		4	Myanmar*		0	
4	Cambodia#		0		3	Namibia		0	
4	Cameroon	1987-98	0		4	Nepal	1988	0	
1	Canada*		1	1967	4	Nicaragua	1986-96	1	2001
3	Cap Verde	1993-	0		4	Nigeria	1990-00	1	1988
4	Central African Rep.	-1999	0		4	Niger	1983-	0	
4	Chad	1980-92	0		1	Netherlands		1	1979/96/98
2	Chile	1981-85	1	1986	1	Norway	1987-93	1	1961/97
3	Columbia	1982-87	1	1985	1	New Zealand*		0	
4	Congo D. R.	1980-	0		2	Oman		1	1995
2	Croatia	1996	1	1997	4	Pakistan		0	
1	Cyprus		1	2000	2	Panama	1988-89	0	
4	Cote d'Ivoire	1988-91	0		4	Papua New Guinea*		0	
1	Denmark*		1	1987/95	3	Paraguay*	1995-99	1	2003
3	Djibouti#	1991-93	0		3	Peru	1983-90	1	1991
3	Dominican Rep.		1	1962	3	Philippines	1981-87, 98-	1	1963
3	Ecuador	1980-85, 96-	1	1998	2	Poland#	1990-00	1	1995
3	Egypt*	1980-85	0		1	Portugal		1	1992/95
3	El Salvador#	1989	1	1999	1	Qatar		0	
4	Equatorial Guinea	1983-85	0		3	Russia#	1995, 98-99	1	2003
4	Eritrea#	1993	0		4	Rwanda#		0	
2	Estonia*#	1992-95	1	1998	3	Samoa		0	
4	Ethiopia#		0		2	Saudi Arabia		0	
3	Fiji		0		4	Senegal	1988-91	0	
1	Finland	1991-94	1	1969/92/98	2	Seychelles#		0	

1	France*		1	1980/86/99	4	Sierra Leone[#]	1990-00	0	
2	Gabon*		0		1	Singapore*		0	
4	Gambia*		0		1	Slovenia[#]	1992-94	1	2001
1	Germany		1	1966/98	4	Solomon Isl.[#]		0	
4	Ghana*	1982-89	0		3	South Africa*		0	
1	Greece*		1	1995/2000	1	Spain	1977-85	1	1977/96
2	Grenada		0		3	Sri Lanka	1989-93	1	1987
3	Guatemala*		1	1999	2	St. Lucia		0	
4	Guinea	1985, 93-94	0		3	Suriname		0	
4	Guinea Bissau	1995-	0		3	Swaziland	1995	0	
3	Guyana		0		1	Sweden	1991	1	1996
4	Haiti		0		1	Switzerland		1	1984/93
3	Honduras		1	1999	3	Syria		0	
2	Hungary[#]	1991-95	1	1993	4	Tanzania	1986-00	1	1994
1	Iceland*		1	1985/96	3	Thailand	1983-87, 97-	1	1997
4	India*		1	1961	4	Togo	1993-95	0	
4	Indonesia*	1997-	1	1998	2	Trinidad & Tobago*		1	1986
3	Iran[#]		0		3	Tunisia*		0	
3	Iraq[#]		0		3	Turkey*	1982-85, 00-	1	1983/00
1	Ireland		1	1989/95	3	Turkmenistan[#]		1	2000
1	Israel	-1983	0		4	Uganda	1994-	1	1994
1	Italy*		1	1987/96	3	Ukraine[#]	1997-98	1	1998
3	Jamaica	1994-00	1	1998	1	United Arab Emirates		0	
1	Japan	1991-	1	1971	1	United King.*		1	1982/95
3	Jordan*		1	2000	1	United States*		1	1934/91
3	Kazakhstan[#]		1	1999/03	2	Uruguay	1981-84, 02-	1	2002
4	Kenya*	1985-89, 92-	1	1988	4	Uzbekistan[#]		0	
1	Korea Rep.	1997-	1	1996	3	Vanuatu		0	
1	Kuwait	1980-90	0		2	Venezuela*	1994-95	1	1985/01
4	Kyrgyz Rep.[#]	1990-00	0		4	Yemen Rep.	1996-	0	
2	Latvia[#]	1995-	1	1998	4	Zambia	1995	0	
2	Lebanon[#]	1988-89	1	1967	4	Zimbabwe	1995-	1	2003

Income Groups = 1 for high income countries, = 2 for upper-middle income countries, = 3 for lower-middle income countries, and = 4 for low income countries; the data source Demirguc-Kunt et al (2005). The data of different designs of DIS are as of 2003.

Note1. '#' refers that "part of the study period dropped due to civil conflicts, war, centrally planned (i.e. communist) economy. '*' refers that "part of the study period dropped because non-systemic banking crises occurred during the period;

Note2. If a crisis continued after the study period ends (2003) or continued from past through the date the study period starts (1980), we mark it with the sign '-'. Some crisis episodes are considered as one continuous occurrence rather than two or more. For instance, in our sample Cameroon (1987-98) constitutes one crisis rather than two (1987-93) and (1995-98). Similarly, Congo Dem. Rep. (1980-) is considered as one crisis instead of three (1980s, 91-92, and 94-). For some crises we drop the periods after the start of the crises, because the ending of their dates are not known, e.g. Niger (1983-).

Note3. Out of 74 EDIS, 25 were revised after initial implementation. In Argentina: the DIS was abolished in 1991 and reintroduced in 1995.

Table-A2: Countries where periods were dropped from the sample

Periods dropped due to non-systemic banking crises:					
Country	Period of Crisis	Country	Period of Crisis	Country	Period of Crisis
Australia	1989-92	Greece	1991-95	Papua New Guinea	1989-
Botswana	1994-95	Guatemala	1990-	Paraguay	2001-
Canada	1983-85	Iceland	1985-86, 93	Singapore	1982
Costa Rica	1980-	India	1993-	South Africa	1989-97
Denmark	1987-92	Indonesia	1994	Trinidad & Tobago	1982-93
Egypt	1991-95	Italy	1990-95	Tunisia	1991-95
Estonia	1998	Jordan	1989-90	United Kingdom	1980-00
France	1994-95	Kenya	1996-	United States	1984-91
Gabon	1995-	Lesotho	1988-	Turkey	1994
Gambia	1985-92	Malaysia	1985-88	Venezuela	1980-90
Gambia	1985-92	Myanmar	1996-		
Ghana	1997-	New Zealand	1987-90		

Periods dropped for other reasons:									
Country	Period	Reasons	Country	Period		Country	Period		
Algeria	1991-1998	CW	Guatemala	1980-00	CW & Small-Scale Crisis	Mongolia	1980-93	Com. & Tr.Per.	
Armenia	1991-94	CW	Hungary	1980-91	Com. & Tr.Per.	Poland	1980-91	Com. & Tr.Per.	
Benin	1980-90	Com.	Iran	1980-88	War	Rwanda	1990-96	CW	
Bulgaria	1980-89	Com.	Iraq	1980-90, 03	War	Russia	1980-91	Com. & Tr.Per.	
Burundi	1993-	CW	Kazakhstan	1980-92	Com. & Tr.Per.	Seychelles	1980-94	Com. & Tr.Per.	
Cambodia	1980-91	CW	Kyrgyz Rep.	1980-92	Com. & Tr.Per.	Sierra Leone	1991-02	CW	
Congo D. R.	1994-	CW	Latvia	1980-92	Com. & Tr.Per.	Slovenia	1980-92	Com. & Tr.Per.	
Djibouti	1991-2000	CW	Lebanon	1980-90	War	Solomon Isl.	1997-01	CW	
El Salvador	1980-92	CW	Liberia	1989-	CW	Turkmenistan	1980-91	Com. & Tr.Per.	
Estonia	1980-93	Com. & Tr.Per.	Lithuania	1980-91	Com. & Tr.Per.	Ukraine	1980-92	Com. & Tr.Per.	
Eritrea	1998-00	War	Madagascar	1980-94	Com. & Tr.Per.	Uzbekistan	1980-90	Com. & Tr.Per.	
Ethiopia	1980-00	Com.,Tr.Per, & CW	Moldova	1980-92	Com. & Tr.Per.				

CW=Civil War, Com.=Communism, Tr.Per.=Transitional Period.
Source: Caprio and Klingebiel (2003) for the data on non-systemic banking crises and 'www.wikipedia.org' for others.

Table-A3: Cross-country forms of EDIS

Country	Membership, Compulsory=1 Voluntary=2	Administration, Private=1 Joint=2 Govt.=3	Funding Source, Banks=1 Banks & Govt.=2 Govt=3	Is EDIS Funded? No=1, Yes=2	Premium: Risk-based=1 Others=2	Foreign Currency Deposits Covered, No=1 Yes=2	Inter Bank Deposits Covered, No=1 Yes=2	Co-insurance: No=1 Yes=2	Deposits coverage to GDP per capita ratio (average)	Deposits coverage to deposits per capita ratio (average)
Algeria	1	2	2	2	2	1	1	1	4.506	14.385
Argentina	1	2	1	2	1	2	1	2	3.734	15.158
Austria	1	1	2	1	2	1	1	1	0.768	0.918
Bahamas, The	1	3	1	2	2	1	1	1	3.146	4.542
Bahrain, King.	1	2	1	1	2	2	1	1	3.560	4.760
Bangladesh	1	3	2	2	2	1	1	1	5.242	16.816
Belgium	1	2	2	2	2	1	1	1	0.814	0.916
Brazil	1	1	1	2	2	2	1	1	2.886	10.506
Bulgaria	1	2	2	2	1	2	1	1	2.596	10.012
Canada	1	3	2	2	2	1	2	1	1.738	2.810
Chile	1	3	3	1	2	2	1	2	0.778	2.020
Colombia	1	3	1	2	2	1	2	2	3.608	15.828
Croatia	1	3	2	2	2	2	1	1	2.696	5.754
Cyprus	1	2	1	2	2	1	1	2	2.533	2.113
Denmark	1	2	2	2	2	2	1	1	1.222	2.500
Dominican Rep.	2	2	2	2	2	2	1	1	0.213	0.740
El Salvador	1	3	2	2	1	2	1	1	2.792	57.062
Estonia	1	2	2	2	2	2	1	2	0.642	1.910
Finland	1	1	2	2	1	2	1	1	0.974	2.008
France	1	1	1	1	2	1	1	1	2.836	4.330
Germany	1	1	1	2	2	2	1	2	0.800	0.838
Greece	1	2	1	2	2	1	1	1	1.626	2.258
Guatemala	1	3	2	2	2	2	2	1	1.430	7.532
Honduras	1	2	2	2	2	2	2	1	9.480	22.160
Hungary	1	2	2	2	1	2	1	1	0.914	2.296
Iceland	1	3	1	2	2	2	2	1	0.770	1.713
India	1	3	2	2	2	2	1	1	4.530	9.510
Ireland	1	3	1	2	2	1	1	2	0.690	0.860
Italy	1	1	2	1	1	2	1	1	4.944	9.392
Jamaica	1	3	2	2	2	2	1	1	1.896	4.664
Japan	1	2	2	2	2	1	1	1	2.540	2.125
Jordan	1	3	1	2	2	1	1	1	7.903	8.210
Kazakhstan	2	3	1	2	1	2	1	1	1.144	9.934
Kenya	1	3	2	2	2	2	2	1	3.108	8.788
Korea	1	3	2	2	2	1	1	1	3.863	4.843
Lebanon	1	2	2	2	2	1	2	1	0.848	0.428
Lithuania	1	3	2	2	2	2	1	2	3.288	17.602
Luxembourg	1	1	1	1	2	2	1	2	0.388	0.122
Macedonia, FYR	2	1	2	2	1	2	1	2	n.a.	n.a.
Malta	1	2	1	2	2	1	1	1	6.628	32.176
Mexico	1	3	2	2	2	2	2	1	489.14	1955.03
Netherlands	1	3	2	1	2	2	1	1	0.768	0.780
Nigeria	1	3	2	2	2	1	2	1	1.400	7.676

Norway	1	1	2	2	2	2	1	1	6.206	12.753
Oman	1	3	2	2	2	2	1	2	6.760	21.920
Peru	1	2	2	2	1	2	1	1	9.268	36.136
Philippines	1	3	2	2	2	2	2	1	2.158	4.080
Poland	1	2	2	2	2	2	1	2	3.144	8.442
Portugal	1	3	2	2	1	2	1	2	2.076	2.176
Russia	1	n.a.	n.a.	2	2	n.a.	n.a.	2	1.080	5.160
Slovenia	1	3	1	1	2	2	1	1	1.733	3.257
Spain	2	2	2	2	2	2	1	1	1.192	1.430
Sri Lanka	2	3	2	2	2	1	1	1	1.344	3.936
Sweden	1	3	2	2	1	2	1	1	0.986	n.a.
Switzerland	2	1	1	1	2	1	1	1	0.530	0.400
Tanzania	1	1	2	2	2	2	2	1	1.068	7.152
Thailand	n.a.	n.a.	n.a.	1	n.a.	2	2	1	n.a.	n.a.
Trinidad & Tobago	1	3	2	2	2	1	1	1	1.194	2.980
Turkey	1	3	2	2	1	2	1	1	12.590	59.390
Turkmenistan	1	3	1	2	2	2	1	1	n.a.	n.a.
Uganda	1	3	2	2	2	1	1	1	7.144	53.110
Ukraine	1	3	2	2	2	2	1	1	0.326	2.618
United Kingdom	1	1	1	1	2	2	1	2	1.694	n.a.
United States	1	3	2	2	1	2	2	1	2.842	9.388
Uruguay	1	3	n.a.	2	1	n.a.	n.a.	n.a.	n.a.	n.a.
Venezuela, Rep.	1	3	2	2	2	1	1	1	1.586	10.362

Table-A4. Additional forms of EDIS

Country	Does the EDIS make the decision to intervene a bank? Yes=1 No=2	Does the EDIS have legal power to cancel or revoke DI for any bank? Yes=1 No=2	On avg., how long does it take to pay depositors in full? (t=month) 0≤t≤1=1,1<t≤3=2, 3<t≤12=3,12<t=4	Were any deposits not explicitly covered before bank failure but compen-sated afterwards? No=1 Yes=2	Can DIS take legal action against bank directors or officials? Yes=1 No=2
Algeria	1	2	n.a.	1	2
Argentina	2	2	n.a.	2	1
Austria	2	1	2	1	2
Bahamas, The	n.a.	n.a.	n.a.	n.a.	n.a.
Bahrain, King.	2	1	n.a.	n.a.	1
Bangladesh	n.a.	n.a.	n.a.	n.a.	n.a.
Belgium	2	2	3	1	1
Brazil	2	2	1	1	2
Bulgaria	2	2	2	2	2
Canada	1	1	1	1	1
Chile	2	2	n.a.	n.a.	2
Colombia	2	2	4	1	2
Croatia	2	2	3	1	2
Cyprus	2	1	n.a.	n.a.	2
Denmark	2	1	2	2	2
Dominican Rep.	n.a.	n.a.	n.a.	n.a.	n.a.
El Salvador	2	2	2	1	2
Estonia	2	2	3	1	2

Finland	2	1	n.a.	2	1
France	2	1	n.a.	n.a.	1
Germany	2	2	n.a.	2	1
Greece	2	1	2	1	2
Guatemala	2	2	n.a.	2	2
Honduras	2	2	1	2	1
Hungary	1	1	2	1	2
Iceland	2	2	n.a.	n.a.	2
India	2	1	3	1	2
Ireland	2	1	n.a.	n.a.	2
Italy	1	1	1	2	2
Jamaica	n.a.	n.a.	n.a.	n.a.	n.a.
Japan	2	2	1	1	2
Jordan	2	2	n.a.	n.a.	2
Kazakhstan	2	1	1	2	1
Kenya	2	1	3	1	1
Korea	2	2	2	1	1
Lebanon	2	2	4	1	2
Lithuania	2	1	2	2	2
Luxembourg	2	1	2	1	2
Macedonia, FYR	2	2	n.a.	1	2
Malta	2	2	n.a.	1	1
Mexico	2	2	n.a.	n.a.	1
Netherlands	2	2	2	n.a.	n.a.
Nigeria	2	1	4	1	1
Norway	2	2	1	2	2
Oman	1	1	n.a.	n.a.	1
Peru	2	2	2	1	1
Philippines	2	1	2	1	1
Poland	2	2	3	1	2
Portugal	2	2	n.a.	n.a.	2
Russia	n.a.	n.a.	n.a.	n.a.	2
Slovenia	1	2	n.a.	n.a.	1
Spain	2	2	2	1	1
Sri Lanka	2	1	n.a.	n.a.	2
Sweden	2	1	n.a.	n.a.	2
Switzerland	2	1	n.a.	n.a.	2
Tanzania	n.a.	n.a.	n.a.	n.a.	n.a.
Thailand	2	2	1	1	2
Trinidad & Tobago	2	2	2	1	1
Turkey	2	2	2	2	1
Turkmenistan	2	2	2	1	2
Uganda	n.a.	n.a.	n.a.	n.a.	n.a.
Ukraine	1	1	4	1	2
United Kingdom	2	2	3	1	1
United States	1	1	1	1	1
Uruguay	n.a.	n.a.	n.a.	n.a.	n.a.
Venezuela, Rep.	2	2	n.a.	n.a.	1

Table A5. DIS and banking crises: the control variables found to be significant in Table 3 are only taken.

Dep.Var = BankCrisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
GDP growth	-0.139*** (0.039)	-0.135*** (0.039)	-0.130*** (0.038)	-0.124*** (0.0386)	-0.140*** (0.039)	-0.133*** (0.038)	-0.126*** (0.038)	-0.129*** (0.039)
Depreciation	0.0022*** (0.0005)	0.0022*** (0.0005)	0.002*** (0.0005)	0.0022*** (0.0005)	0.0022*** (0.0005)	0.0022*** (0.0005)	0.0021*** (0.0005)	0.0022*** (0.0005)
Less development	0.422*** (0.1459)	0.3814*** (0.1419)	0.3672*** (0.1399)	0.3975*** (0.1467)	0.4061*** (0.141)	0.3777*** (0.1415)	0.4050*** (0.1479)	0.4164*** (0.1482)
IDIS-EDIS	1.07*** (0.3992)							
EDIS's administration		0.3521** (0.1464)						
Banks' membership			0.532** (0.2644)					
EDIS's fun-dsource				0.4308** (0.2016)				
EDIS's funding					0.5648*** (0.1996)			
Banks' premium						0.4096** (0.2088)		
Foreign currency deposits covered							0.4711** (0.2103)	
Interbank deposits covered								0.7113*** (0.2540)
Constant	-4.99*** (1.09)	-4.85*** (1.08)	-4.75*** (1.04)	-4.89*** (1.09)	-4.95*** (1.08)	-4.81*** (1.08)	-4.88*** (1.13)	-5.01*** (1.14)
obs	1321	1320	1320	1259	1321	1320	1260	1260
Log likelihood	-164.09	-162.62	-163.84	-159.58	-163.86	-163.58	-161.80	-160.48
Wald chi2	99.16	102.54	107.44	94.69	104.55	98.91	87.47	90.01
AIC	378.18	375.24	377.68	367.16	377.72	377.16	371.6	368.96
Pseudo R2	0.1495	0.1419	0.1355	0.1332	0.1507	0.1369	0.1370	0.1441
IDIS-EDIS		***.991** (.405)***	***.991** (.405)***	***.924** (.412)***	***1.07*** (0.39)***	***.991** (.405)***	***1.010** (.404)***	***1.010** (.404)***
Log likelihood		***-162.48***	***-162.48***	***-159.21***	***-164.09***	***-162.48***	***-160.88***	***-160.88***
Pseudo R2		***0.1427***	***0.1427***	***0.1352***	***0.1495***	***0.1427***	***0.1419***	***0.1419***

The joint significance levels of the estimated parameters, i.e. Prob > Chi^2 value, are "0" in all of the regression models. In Column 1: No. of countries = 110 (31 HIC, i.e. High Income Countries, 22 UMIC, i.e. Upper Middle Income Countries, 27 LMIC, i.e. Lower Middle Income Countries and 30 LIC, i.e. Low Income Countries), no. of crises = 44, no. countries with EDIS = 53 or approximately 48% of the total (24 HIC or approximately 45% of EDIS- countries, 12 UMIC, 13 LMIC and 4 LIC).

(Table A5 continued)

Dep.Var = BankCrisis	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
GDP growth	-0.127*** (0.038)	-0.124*** (0.038)	-0.121*** (0.037)	-0.133*** (0.040)	-0.131*** (0.039)	-0.127*** (0.038)	-0.117*** (0.038)	-0.126*** (0.039)
Depreciation	0.0022*** (0.0006)	0.0021*** (0.0006)	0.0021*** (0.0005)	0.0022*** (0.0006)	0.0022*** (0.0006)	0.0022*** (0.0006)	0.0022*** (0.0006)	0.0022*** (0.0006)
Less development	0.4028*** (0.1432)	0.3517** (0.1412)	0.3308** (0.1432)	0.4185*** (0.1451)	0.4325*** (0.1452)	0.3783*** (0.1386)	0.3289** (0.1440)	0.4022*** (0.1548)
Coverage with co-insurance	0.5711** (0.2528)							
Average coverage/ GDP-per-capita		0.2295*** (0.0735)						
Average coverage/ deposit-per-capita			0.0556*** (0.0171)					
EDIS's power to intervene bank				0.6133*** (0.2116)				
EDIS's power to cancel insurance					0.7352*** (0.2378)			
EDIS's power to take action against bankers						0.3875* (0.2206)		
Average time to payout depositors							0.3337** (0.1585)	
Compensation of uncovered deposits								1.1369*** (0.3083)
Constant	-4.85*** (1.11)	-4.68*** (1.14)	-4.59*** (1.14)	-5.00*** (1.08)	-4.99*** (1.11)	-4.75*** (1.05)	-4.09*** (1.07)	-4.02*** (0.83)
obs	1240	1257	1251	1233	1233	1232	1051	1100
Log likelihood	-161.58	-158.23	-158.43	-155.65	-155.87	-158.37	-144.63	-147.67
Wald chi2	86.76	111.39	112.29	94.27	92.38	85.73	86.26	96.78
AIC	371.16	364.46	364.86	359.3	359.74	364.74	333.26	341.34
Pseudo R2	0.135	0.1402	0.1382	0.1504	0.1492	0.1355	0.1325	0.1566
IDIS-EDIS	***1.189*** ***(.417)***	***.926*** ***(.412)***	***.935*** ***(.410)***	***1.084*** ***(.421)***	***1.084*** ***(.421)***	***1.084*** ***(.421)***	***1.063*** ***(.438)***	***1.279*** ***(.402)***
Log likelihood	***-159.20***	***-159.17***	***-159.03***	***-156.38***	***-156.38***	***-156.36***	***-143.80***	***-148.71***
Pseudo R2	***0.1477***	***0.1351***	***0.1349***	***0.1465***	***0.1465***	***0.1464***	***0.1375***	***0.1507***

The joint significance levels of the estimated parameters, i.e. Prob > Chi^2 value, are "0" in all of the regression models.

Table A6. DIS and banking crises: only one control variable and the variable for country's economic underdevelopment are included (no. of countries and of observations used are thus at the maximum level)

Dep.Var = BankCrisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Depreciation	.0014*** (.00039)	.0013*** (.0004)	.0013*** (.00038)	.0013*** (.0004)	.0013*** (.0004)	.0013*** (.0004)	.0013*** (.0004)	.0013*** (.0004)
Less development	.4659*** (.1212)	.4421*** (.1188)	.4302*** (.1184)	.4566*** (.1232)	.4553*** (.1178)	.436*** (.120)	.4600*** (.1226)	.4696*** (.1241)
IDIS-EDIS	.885*** (.333)							
EDIS's administration		.2993** (.1245)						
Banks' membership			.4697** (.2404)					
EDIS's fund-source				.3517** (.1741)				
EDIS's funding					.4718*** (.1679)			
Banks' premium						.3355* (.1798)		
Foreign currency deposits covered							.3941** (.1896)	
Interbank deposits covered								.5882*** (.232)
Constant	-5.86*** (1.04)	-5.77*** (1.04)	-5.68*** (1.00)	-5.78*** (1.04)	-5.83*** (1.04)	-5.72*** (1.04)	-5.78*** (1.07)	-5.87*** (1.08)
obs	1992	1991	1991	1886	1992	1991	1887	1887
Log likelihood	-273.40	-270.96	-272.09	-265.79	-273.15	-271.95	-268.77	-267.71
Wald chi2	71.65	69.34	72.54	65.31	75.93	62.36	67.20	65.42
AIC	596.8	591.92	594.18	579.58	596.3	593.9	585.54	583.42
Pseudo R2	0.0881	0.0860	0.0822	0.0816	0.0889	0.0826	0.0819	0.0855
IDIS-EDIS		***.813** (.342)***	***.813** (.342)***	***.762** (.356)***	***.885*** (.333)***	***.813** (.342)***	***.838** (.346)***	***.838** (.346)***
Log likelihood		***-270.97***	***-270.97***	***-265.44***	***-273.40***	***-270.97***	***-267.89***	***-267.89***
Pseudo R2		***0.0859***	***0.0859***	***0.0828***	***0.0881***	***0.0859***	***0.0849***	***0.0849***

The joint significance levels of the estimated parameters, i.e. Prob > Chi^2 value, are "0" in all of the regression models. In Column 1: No. of countries = 149 (34 HIC, i.e. High Income Countries, 25 UMIC, i.e. Upper Middle Income Countries, 41 LMIC, i.e. Lower Middle Income Countries and 49 Low Income Countries), no. of crises = 69, no. of countries with EDIS = 62 (25 HIC, 13 UMIC, 18 LMIC and 6 LIC).

(Table A6 continued)

Dep.Var = BankCrisis	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Depreciation	.0013*** (.0004)	.0013*** (.0004)	.0013*** (.0004)	.0014*** (.0004)	.0014*** (.0004)	.0013*** (.0004)	.0013*** (.0004)	.0014*** (.0004)
Less development	.4542*** (.1218)	.4286*** (.1168)	.4092*** (.1182)	.4530*** (.1192)	.4617*** (.1202)	.4163*** (.1164)	.3999*** (.1188)	.4392*** (.1245)
Coverage with co-insurance	.4570** (.2300)							
Average coverage/ GDP-per-capita		.2211*** (.0674)						
Average coverage/ deposit-per-capita			.0589*** (.0143)					
EDIS's power to intervene bank				.4647** (.1889)				
EDIS's power to cancel insurance					.5663** (.2232)			
EDIS's power to take action against bankers						.2673 (.205)		
Average time to payout depositors							.2115 (.1413)	
Compensation of uncovered deposits								1.030*** (.3046)
Constant	-5.740*** (1.05)	-5.66*** (1.07)	-5.58*** (1.08)	-5.80*** (1.03)	-5.79*** (1.05)	-5.59*** (1.01)	-4.90*** (.96)	-4.50*** (.60)
obs	1866	1882	1876	1854	1854	1853	1617	1700
Log likelihood	-268.50	-263.56	-262.51	-261.02	-261.13	-263.06	-247.49	-251.94
Wald chi2	63.85	83.99	88.36	71.80	69.17	60.56	57.58	77.49
AIC	585	575.12	573.02	570.04	570.26	574.12	538.98	549.88
Pseudo R2	0.0804	0.0888	0.0918	0.0840	0.0836	0.0767	0.0703	0.0868
IDIS-EDIS	***.988*** (.354)***	***.765** (.356)***	***.770** (.355)***	***.820** (.374)***	***.820** (.374)***	***.822** (.374)***	***.821** (.411)***	***1.03*** (.370)***
Log likelihood	***-266.26***	***-265.38***	***-265.29***	***-261.53***	***-261.53***	***-261.52***	***-246.59***	***-253.44***
Pseudo R2	***0.0880***	***0.0825***	***0.0822***	***0.0822***	***0.0822***	***0.0821***	***0.0737***	***0.0814***

The joint significance levels of the estimated parameters, i.e. Prob > Chi^2 value, are "0" in all of the regression models.

Table A7. EDIS's interaction with the country's less economic development and banking crisis: the control variables found significant are included

Dep.Var = BankCrisis	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP growth	-0.141*** (0.040)	-0.140*** (0.040)	-0.130*** (0.039)	-0.123*** (0.038)	-0.132*** (0.040)	-0.129*** (0.039)	-0.129*** (0.040)
Depreciation	0.0023*** (0.0006)	0.0023*** (0.0006)	0.0023*** (0.0006)	0.0022*** (0.0006)	0.0023*** (0.0006)	0.0022*** (0.0006)	0.0023*** (0.0006)
IDIS-EDIS x Less development	0.6650** (0.3013)						
IDIS-EDIS	-0.7832 (0.8647)						
EDIS's funding x Less development		0.2888* (0.1630)					
EDIS's funding		-0.2542 (0.4799)					
Interbank deposits covered x Less development			0.5941** (0.2430)				
Interbank deposits covered			-0.9844 (0.7203)				
Average coverage/ GDP-per-capita x Less development				0.0655 (0.0955)			
Average coverage/ GDP-per-capita				0.0413 (0.2887)			
EDIS's power to intervene bank x Less development					0.3117* (0.1663)		
EDIS's power to intervene bank					-0.2655 (0.4905)		
EDIS's power to cancel insurance x Less development						0.3749 (0.2655)	
EDIS's power to cancel insurance						-0.2705 (0.7266)	
Compensation of uncovered deposits x Less development							0.5861** (0.2539)
Compensation of uncovered deposits							-0.2776 (0.6072)
Constant	-3.79*** (1.00)	-3.78*** (1.00)	-3.87*** (1.05)	-3.67*** (1.04)	-3.81*** (0.99)	-3.73*** (1.02)	-2.87*** (0.66)
obs	1321	1321	1260	1257	1233	1233	1100
Log likelihood	-165.16	-165.55	-160.44	-160.61	-157.31	-158.21	-148.32
Wald chi2	94.11	96.48	84.94	94.65	85.81	82.8	89.57
AIC	380.32	381.1	368.88	369.22	362.62	364.42	342.64
Pseudo R2	0.144	0.142	0.1443	0.1273	0.1414	0.1365	0.1529
IDIS-EDIS* x *Less development		***0.6650** (0.3013)***	***0.7045** (0.3235)***	***0.6622** (0.3363)***	***0.7066** (0.3126)***	***0.7066** (0.3126)***	***0.4794 (0.3259)***
IDIS-EDIS		***-0.7832 (0.8647)***	***-0.9572 (0.9430)***	***-0.9172 (0.9769)***	***-0.8557 (0.8900)***	***-0.8557 (0.8900)***	***-0.0534 (0.8967)***
Log likelihood		***-165.16***	***-161.90***	***-160.32***	***-157.42***	***-157.42***	***-150.24***
Pseudo R2		***0.144***	***0.1365***	***0.1289***	***0.1408***	***0.1408***	***0.142***

The joint significance levels of the estimated parameters, i.e. Prob > Chi^2 value, are "0" in all of the regression models.

Table-A8. Sample compositions

Row-1	Regression 1-8 and 10 of Table 3	Argentina, Armenia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Canada, Cape Verde, Chile, Colombia, Dem. Rep. of Congo, Croatia, Cyprus, Côte d'Ivoire, Denmark, Dominican Republic, Egypt, El Salvador, Estonia, Fiji, Finland, Germany, Greece, Guatemala, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Kyrgyz Republic, Lesotho, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Malta, Mauritius, Mexico, Mongolia, Morocco, Myanmar, Namibia, Nepal, New Zealand, Nicaragua, Nigeria, Norway, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Rwanda, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Singapore, Slovenia, South Africa, Spain, Sri Lanka, St. Lucia, Swaziland, Sweden, Switzerland, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Uruguay, Venezuela, Yemen, Zimbabwe.
Row-2	Regression 9 of Table 3	All countries of Row-1 except Finland
Row-3	Regress. 11 of Table 3	All countries of Row-1 except United Kingdom
Row-4	Reg. 12-14 of Table 3	All countries of Row-1 except Bangladesh and Dominican Rep.
Row-5	Regress. 16 of Table 3	All countries of Row-1 except Bangladesh, Dominican Rep., Finland, and United States
Row-6	Regress. 15 of Table 3	All countries of Row-1 except Bangladesh, Dominican Rep., Finland, Germany, Guatemala, Kyrgyz Rep., Poland, United Kingdom, and Venezuela

Table A9. Observations dropped as outliers: the observations are outliers with respect to the corresponding variables

Outlying observations		Corresponding variables
Lesotho Lithuania	1987 1995	GDP-GROWTH
Guinea-Bissau Benin	1993 1992	TOT-CHANGE
Bolivia	1985	INFLATION
Bolivia Suriname	1985 1994	DEPRECIATION
Bolivia	1985	REAL-INTEREST
Guinea-Bissau Luxembourg	1986 1984-88	M2/RESERVES
Congo, Dem. Rep. of	1980	GDP/CAP

Note: some of these outlying observations would already have been dropped because of missing data on other explanatory variables.

III. Central bank autonomy and banking sector's instability

Khan Md. Anichul Hoque[30]
Economics Dept of Helsinki University and HECER
E-mail: anichul.khan@helsinki.fi

Abstract

This study aims to determine whether a country's powerful central bank (CB) can lessen the instability of the banking sector by minimizing the likelihood of a banking crisis. The data used include indicators of the CB's autonomy for a set of countries over the period of 1980-89. The study finds that in aggregate a more powerful CB lessens the probability of banking crisis. When the CB's authority is disentangled with respect to its responsibilities, the study finds that the longer tenure of CB's chief executive officer and the greater power of CB in assigning interest rate on government loans are necessary for reducing the probability of banking crisis. The study also finds that the probability of crisis reduces more if an autonomous CB can perform its duties in a country with stronger law and order tradition.

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1. Introduction

The aim of this study is to examine empirically the relationship between the level of central bank's autonomy and the instability of banking system, as defined by *banking crisis*. Note that a bank failure occurs when the bank becomes insolvent, i.e. the net present value of its assets falls short of the net present value of its liabilities, and a banking crisis occurs when a sufficient number of banks fail (it can also be weighed by the failed banks' share in total deposits or assets) within a given period (see e.g. González-Hermosillo, 1996).[31]

Central bank (CB) is one of the core institutions of a country in upholding the country's monetary policy. A CB's principal objective is to keep the price stability. However, maintaining the price stability necessarily extends many other tasks which the CB can and often does perform. These include, for instance, bailing out the insolvent banks and the publicly-owned enterprises, managing the government's financial transactions, financing the budget deficits through the issuance of money, and financing the development projects undertaken by the government (Cukierman et al, 1992).

All of the tasks of CB stated above have impacts on the stability of a banking sector directly or indirectly, and thus on the banking crisis. For example, financing the inappropriate governmental development projects may hamper in various ways the banking sector's smooth functioning with respect to its loans to the private sector. First of all, the availability of funds for the loans to the private sector is reduced. Secondly, banks may be forced by the CB to increase interest rates to reimburse the losses from governmental projects, and this could trigger the non-performance of bank loans. Similarly, the smooth functioning of a banking sector may be hampered by the CB's inappropriate bailing out of insolvent banks and by financing the inappropriate budget deficits through the issuance of money.

[31] Gonzaleze-Hermosillo (1996) follows that in a broad sense a bank failure is said to occur when the regulator recognise the bank as insolvent and decides to liquidate it, or assist in order to keep it in operation. Different instruments are usually followed to assist an ailing bank. These are, for instance, (1) merger or acquisition of the bank with other healthy banks; (2) direct injections of additional capital or other recapitalization schemes; and (3) different restructuring schemes. The restructuring schemes usually include change in bank-management; assisted generalized rescheduling of loan maturities; and removal of banks' bad loans.

The instability of banking sector can be influenced both in the short and long run. For instance, a CB's timely and efficient dealing (bail out or not) of the insolvent banks not only prevents the instability at once but also prevents the instability in the future by increasing confidence among the depositors, bankers, and other economic agents.

However, not all CBs are sufficiently empowered to handle its duties. Thus the ultimate influential role of a CB depends on its level of autonomy from the government (the so called executive body). Many of the researchers support the argument that "higher independence of a CB reduces the instability of banking sector". Cukierman (1994) and Lohmann (1992) argue that greater CB autonomy is required for higher effectiveness of its commitment to price stability. Blejer and Schumacher (1998, p.4) argue that a powerful CB can increase the confidence among the economic agents about the CB's capability to maintain its commitment to safeguard the nominal regime. Mishkin (2000) argues for a more independent CB in order to ensure the fewer time inconsistent problems by the political government. Quintyn and Taylor (2003, p.261) argue for greater autonomy of the CB for more benefits in regulatory and supervisory independence, and Doi (1998) for controlling the inefficient public expenditure.

In contrast, the central banker being undemocratic or bureaucratic may behave opportunistically which will deter achieving a country's policy objectives in various sectors (Cukierman 1994), including the banking sector. Thus, a high level of autonomy to a CB may be detrimental to the banking sector, increasing rather the instability of the sector.

This paper attempts to resolve the contingent role of a CB's autonomy on the instability of banking sector. The research question is, "does a high powered CB increase (or decrease) the instability of the banking sector?" What is the effect on the banking sector stability if an autonomous CB performs its due roles in a country with stronger (or weaker) institutional environment, e.g. a country with stronger (or weaker) law-and-order tradition? Earlier studies have not shed light on this issue, although many studies have dealt with factors associated with banking sector instability (e.g. Calvo 1998, Corsetti et al 1999, Demirgúc-Kunt and Detragiache 1999 and 2002, Diamond and Dybvig 1983, Drees and Pazarbasioglu 1995, Gorton1988, Kaminsky and Reinhart 1999, Komulainen and Lukkarila 2003, Mishkin 1996, and Obstfeld 1986).

The data on CB's autonomy come from Cukierman et al (1992), and is measured according to 16 different legal variables and an aggregated legal variable (which is derived by taking weighted average of the 16 variables). Four of the 16 variables concern the CB's chief executive officer, i.e. CEO, (precisely, the term of office, appointing, dismissal, and holding other offices of the CEO). Three variables cover CB's authority to formulate policy (i.e. its power to formulate monetary policy, to resolve conflicts, and to influence government budgetary process). One variable is on its objectives, while the rest 8 variable cover CB's power to limit funding to the government and public entities (e.g., non-securitized and securitized lending, terms of lending, potential borrowers, lending amounts, maturity and interest rates of loans, and buying or selling of government securities in the primary market).

The cross-country index on CB's independence is available by decades. From the available data series, we use the latest decade (1980-89) which is one of the most severely stricken decades with regard to banking crises. The data contain 72 countries, including both the developing and the industrialized countries. However, not all countries can be used in the regressions because of missing data on different explanatory variables.

We consider a country's banking sector to be unstable when the country experiences a systemic banking crisis. The dependent variable banking crisis dummy takes the value one if a country has experienced one or more banking crises for one or more years during the decade of 1980s, otherwise zero. Each of the variables for the autonomy of CB is tested separately along with a set of control variables. The control variables have been selected from a set of explanatory variables used in earlier studies as the factors of banking crises.

Using a logit estimation model we find that a CB needs to be more powerful in order to reduce the instability of banking sector. CB's aggregated legal power is found to be negatively associated (with a strong significance level) with the probability of systemic banking crisis. This finding is in line with Cukierman (1994) and Lohmann (1992), Blejer and Schumacher (1998), Mishkin (2000), Quintyn and Taylor (2003), and Doi (1998) as mentioned above.

When the variables of the CB autonomy are tested separately, we find that the autonomy of CB with respect to its CEO's tenure of office, and with respect to assigning the interest rate on the loans to government and/or public entities also have negative relationship with the probability of banking crisis.

Finally, we find that the crisis probability reduces more if an autonomous CB can perform its duties in a country with stronger law and order tradition.

The structure of the paper is as follows. The next section provides a theoretical discussion and the hypotheses relating the autonomy of CB with the stability of banking sector. Section three analyzes the data of the dependent and the explanatory variables. Empirical evidence is given in section four, and the concluding remarks in section five.

2. Theoretical views and hypotheses

The central bank (CB) of a country is established with the major aim of maintaining price stability. However, many other macro economic and financial market factors are also influenced by the role of a CB. Following Cukierman et al (1992) we can state that the CB includes the duty of bailing out insolvent banks and also other public enterprises. It has also other roles which are already explained in section one. These roles have links with the safety and the stability of banking sector. This link is more justified by the following remarks of the literatures:

- Kapstein (1992, p. 273) observes, *"since the 1930s, central bankers have developed a common set of beliefs about the need for regulatory safety nets whose purpose is to maintain the soundness of individual banks and, when necessary, to keep financial systems functioning in the face of economic shocks."*
- Padoa-Schioppa (2002, p.11) argues, *"CB is the ultimate provider of a safe settlement medium and liquidity to ensure the orderly functioning of the financial system."*
- Freixas et al (2000, p.613) note, "*CB has a role to play as a crisis manager. When all banks are solvent, the CB's role of preventing a speculative gridlock is simply to act as coordinating device."*
- Ferguson (2002) says, *"financial stability has been and always will be a fundamental objective of CBs."*

Let's discuss in more details the link of CB's duties with banking sector stability. A CB can use its instrument of bailing out the insolvent banks to maintain the soundness

of banks and thus to keep the financial system functioning. However, the efficiency of using this instrument depends on the self-dependency of the CB. A CB is not always empowered to perform its duties properly. It depends on the level of autonomy it enjoys from the government, i.e. the executive body, which is usually formed from political party.

The executive body may want the CB to bail out (not bail out) a bank because the owner of the bank is loyalist (not loyalist) to the same political party the government is formed from even if the bank should not (should) be bailed out for the sake of banking sector stability. Similarly, for the stability, the CB could bail out the insolvent bank(s) immediately, but from the political point of view (e.g. to gain popularity among voters) the executive branch could ask to delay the bailout. Thus the banking sector stability depends on how independently a CB can perform its duties. A more independent CB has greater success in avoiding such pursuit of political government's time-inconsistent policies (see Mishkin 2000) and thus resulting in less instability of banking sector.

Banking sector's stability can be influenced simply by the CB's money issuance instrument (see e.g. Padoa-Schioppa 2002, p.3). As mentioned above, a government can ask financial support from CB through CB's money issuance mechanism to finance budget deficits, or it can borrow money from the CB to finance the development projects undertaken by the government. The higher this support or borrowing, the higher could be the ultimate pressure on commercial banks, because the CB could simply pass this government expenditure on the commercial banks and the banks may charge higher lending rates to recover.

The CB can control the financial support or the loan to government with an aim to reduce the ultimate pressure on the commercial banks for the sake of the stability of banking sector. It can control in terms of setting the amount of money the government wants to borrow, in terms of setting the interest rates on the loans, in terms of setting the period of the loans to pay back, and such other barriers on the government-loans. However, its capability to control relies on its independence from the executive body. Doi (1998) argues that inefficient public expenditure can be reduced by an independent CB. Hence, the more independent a CB, the higher control it has on the public expenditure, the less unstable the banking sector.

A CB can influence the banking sector stability simply with its commitment to defend monetary regimes. A CB is the guarantor of the stability of financial sector and

it can prevent systemic banking crises by its commitment (Blejer and Schumacher 1998, p.12). It is typically assumed that the CB is the key organization to maintain the financial stability (Watanagase, 2005). Thus it is reasonable to assume that the higher credible this commitment to the economic agents, the less panicked they are for any economic shock, and the less unstable the banking sector. However, the credibility of this commitment depends on how self-dependently the CB can perform its duties. Lack of power in a CB leads to loss in confidence on its capability to uphold its pledge to safeguard the nominal regime (see Blejer and Schumacher 1998, p.4). Thus, the more independent a CB is from the executive branch, the more capable it is to uphold its pledge to safeguard the nominal regime, the more credible is its commitment to the economic agents, and the less unstable is the banking sector.

CB's role to stabilize banking sector can also be justified with its duty to prevent moral hazard among managerial behavior of banks. Taking necessary measures against this moral hazard is not beyond the duties of a CB (Goodhart 1987, p.88). On the other hand, studies find that a CB's regulatory and supervisory independence can be benefited from the autonomy of a CB (see Quintyn and Taylor 2003, p.261). Thus the more autonomous a CB is, the higher supervisory independence it has, the less moral hazard scope among bankers because of higher control of CB over the problem, and the less unstable is the banking sector.

However, a CB's independence can cause to increase the banking sector instability. The reason is as follows. The central banker is not elected by the country's electorate. Thus it is not democratic and may not care about the welfare of the citizens, and can be bureaucratic. Being undemocratic or bureaucratic, the central banker may behave opportunistically which hampers country's policy objectives in various sectors (Cukierman 1994). It can hamper as well the policy objective of reducing the banking sector instability. Thus, the impact of CB's autonomy on banking sector instability is ambiguous.

Next a reasonable question comes up is "does the CB's independence influence the instability of banking sector differently for different levels of institutional environment of countries?" We argue affirmatively. For instance, the law and order tradition in countries are not the same. An autonomous CB's performance with the aim of reducing the instability of banking sector may be less effective in a country with weaker law and order tradition. For instance, an autonomous CB's action of not bailing out an insolvent bank, rather closing the bank, could be delayed by bank

authority's movement because of weak law and order tradition. Specifically, the bank authority may linger the closing process by using the flawed legal procedure. If the bank owner is a politically influential person, he/she could even cause the CB officials in trouble. These kinds of movements are usual phenomena in developing countries. Like the CB's bailing out instrument, CB's other actions can be less effective in reducing the instability in countries with weaker law and order tradition, because the effective parties may exploit the weaker tradition.

Hypothesis 1

As mentioned above, the theoretical discussions lead to kind of ambiguity about the effect of a CB's independence on banking sector instability. This study will attempt empirically to purge this ambiguity. As strong and most of the arguments goes in favor of the independence of CB reduces the instability, the main hypothesis is as follows:

- Given all other factors remaining the same, the more autonomous a CB, the less unstable the banking sector.

Hypothesis 2

The second hypothesis this study works with is as follows:

- Given all other factors remaining the same, the probability of increasing banking sector instability by a CB's lowering autonomy is higher if the CB is functioning in a country with weaker law and order tradition.

3. The data

3.1 CB autonomy

The data of central bank independence (CBI) comes from Cukierman et al (1992). The data is decade-wise, i.e. an index represents the level of CBI of a country for a decade. The data is available for four decades 1950-59, 1960-71, 1972-79 and 1980-

89, and it is for both the industrialized and the developing countries. We however use the data only for the last decade (1980-89), because in earlier decades there are almost no systemic banking crises (see Caprio and Klingbiel 2003) and the data of other control variables are mostly missing.

A variable called "*Aggregated-CBI*" is used to represent overall cross-country CBI. The variable is formulated by taking weighted average of the 16 variables representing CBI levels based on CB's different roles (see Cukierman et al 1992 for the process of weighted average to aggregate them). It should be noted that the weighted average is taken from the available observations while ignoring the missing observations. Of the 16 variables, some we take for test separately and some not (because the observed CBI levels in the variables do not vary sufficiently to run regressions). The variables we take for test are presented below. The higher the value of a variable, the more independent the CB it reveals.

- *CB's autonomy regarding the chief executive officer (CEO)'s term of office*: The variable called "*CBI on CEO's office-term*" takes the values 1.00, 0.75, 0.50, 0.25, and 0.00 respectively if CEO's tenure of office is more than 8 years, 6 to 8 years, 5 years, 4 years, and under 4 years or at the discretion of appointment agent.
- *CB's autonomy to appoint CEO*: The variable called "*CBI on appointing CEO*" assigns the values 1.00 if CEO is appointed by the board of CB, 0.75 if by a council of CB, executive branch and legislative branch, 0.50 if by legislature, 0.25 if by executive office collectively (e.g. council of ministers) and 0.00 if by one or two members of the executive branch.
- *CB's Autonomy to decide CEO's holding of other offices in government*: The variable called "*CBI on CEO's other office*" takes the value 1.00 if CEO's only job is with the CB; 0.50 if CEO can hold other government offices only with the permission of the executive branch; and 0.00 if there are no restrictions on the CEO holding of other positions.
- *CB's Autonomy in formulating monetary policy*: The variable called "*CBI on formulating monetary policy*" assigns the values 1.00, 0.67, 0.33, and 0.00 respectively if monetary policy is formulated by the CB alone, if CB participates in the process but has little influence, if CB merely advises the government, and if CB has no say.

- *Autonomy in exercising final word in the resolution of conflict*: The variable called "*CBI on conflict resolution*" assigns the value 1.00 if the final word in resolution of conflict comes from CB, which is clearly defined in the law as its objectives; 0.80 if the word comes from CB, but not clearly defined as the CB's goals; 0.60 if the final word comes from a council of CB, executive branch, and legislative branch; 0.40 if the word comes from the legislature; 0.20 if the word comes from the executive branch, but subject to due process and possible protest by the CB; and 0.00 if the word comes from the executive branch as its unconditional priority.
- *CB's autonomy with regard to 'Advances' or non-securitized lending to the government*: The variable called "*CBI on advances lending*" takes the value 1.00 if CB allows no advances; 0.67 if advances are permitted within strictly defined limits (e.g. up to 15% of government revenue); 0.33 if advances are permitted with flexible limits (e.g. over 15% of the government revenue); and 0.00 if there are no legal limits on lending to the government.
- *CB's autonomy regarding securitized lending to government*: The variable called "*CBI on securitized lending*" takes the value 1.00 if no securitized lending is permitted; 0.67 if the securitized loans are permitted with strict limits (e.g. up to 15% of government revenue); 0.33 if the securitized loans are permitted with flexible limits (e.g. over 15% of the government revenue); and 0.00 if there are no legal limits on lending.
- *CB's authority regarding terms of lending, i.e. designing the maturity, interest rate, and amount of lending*: The variable called "*CBI on lending terms*" takes the value 1.00 if the lending terms are controlled by the CB; 0.67 if this responsibility is specified by CB's charter; 0.33 if it is agreed between the CB and the executive branch; and 0.00 if it is decided by the executive branch alone.
- *CB's power to specify interest rates on loans*: The variable called "*CBI on loans' interest-rate*" takes the value 1.00 if the interest rate is above the minimum market rate; 0.75 if it is at the market rate; 0.50 if it is below the market rate; 0.25 if the interest rate is not mentioned; and 0.00 if there is no interest rate on government borrowing from CB.
- *CB's power on determining maturity of loans*: The variable called "*CBI on loans' maturity*" takes the value 1.00 if the loans are matured within 6 months; 0.67 if

matured within 1 year; 0.33 if matured after more than 1 year; and 0.00 if the maturity time is not specified in the law.

Besides the above mentioned CBI variables, there are still some CBI variables which we can not test. Those comprise: the CB's autonomy to dismiss CEO, autonomy in setting CB's objectives, autonomy in government's budgetary process, autonomy regarding the potential borrowers from CB, autonomy on deciding lending amounts, and the autonomy to buy or sell government securities in the primary market.

CBI indexes on different variables we take for test and also on "*Aggregated-CBI*" are reported in Table A1 of the appendix. The highest number of countries we are able to take in the sample is 54. It needs to mention that Cukierman et al (1992) contains additional countries with the data of CBI, but these are excluded because of the missing data on the control variables we need. Indonesia is ignored because of its outlying effect.[32]

3.2 Banking sector instability

As mentioned in the previous section, we consider the banking system of a country to be unstable if it experiences "*systemic banking crisis*". The variable "Bank-crisis" takes the value 1 if the country has experienced a systemic banking crisis for one or more years in the decade 1980s, otherwise 0. The data on crises come from Caprio and Klingebiel (2003). Table A1 of the appendix reports the data. 17 countries experienced crises during the 1980s. All of the crises began in the 1980s with the exception of Spain, where it began in 1977 and continued till 1985. Spain is still included since the autonomy of its CB remains the same both in the 1970s and the 1980s.

3.3 Control variables

We use control variables from a set of explanatory variables of banking crises which were tested in the previous studies (see e.g. Demirguc-Kunt and Detragiache 1999, 2002 and 2005, Kaminsky and Reinhart 1999, Komulainen and Lukkarila 2003). The control variables for the macroeconomic factors are the GDP growth rate, the terms-

[32] Inclusion of Indonesia in the sample radically changes the results of some variables of CB's independence.

of-trade change, the depreciation rate, the real interest rate, and the inflation rate. The financial variables are the ratio of M2 to foreign exchange reserves, and the rate of growth of real domestic credit in the private sector. An indicator GDP per capita is used to represent a country's institutional development. Detailed theoretical views supporting the use of these variables are given in Demirguc-Kunt and Detragiache (1999).

The formulation of yearly values of the control variables are reported in Table-A2 of the appendix. After formulating the yearly values, we take the *average* of the values available over the period of 1979-1989 if there are no systemic crises, or we take the average of 5 or fewer values available before the onset of banking crises.

4. Empirical analyses

4.1 Estimation model

A logit model is used. The model we wish to fit is

$$\text{Prob}(y = 1|\mathbf{x}) = \frac{e^{\beta'\mathbf{x}}}{1+e^{\beta'\mathbf{x}}} \equiv F(\boldsymbol{\beta}'\mathbf{x})$$

The dependent variable is banking-crisis dummy y, and $y = 1$ for a country if the country experiences one or more banking crises in the decade 1980s, otherwise $y = 0$. Vector $\mathbf{x}$ is the set of explanatory variables we have discussed in the previous section. The parameter vector $\boldsymbol{\beta}$ reflects the impact of changes in $\mathbf{x}$ on the probability. The notation F(.) is the cumulative logistic distribution.

The likelihood for logit is

$$\ln L = \sum_{j \in S} \ln F(\mathbf{x}_j \mathbf{b}) + \sum_{j \notin S} \ln \{1 - F(\mathbf{x}_j \mathbf{b})\}$$

where S is the set of all countries j such that $y_j = 1$, i.e. countries with banking crises.

We use robust standard errors. The calculation formula for the robust variance is

$$\hat{V} = q_c \hat{\mathbf{V}}(\mathbf{u}_j' \mathbf{u}_j) \hat{\mathbf{V}}$$

Where, $\hat{\mathbf{V}}$ is typically a conventionally calculated variance matrix; $\mathbf{u}_j = \{1 - F(\mathbf{x}_j\mathbf{b})\}\mathbf{x}_j$ for the positive outcomes and $\mathbf{u}_j = -F(\mathbf{x}_j\mathbf{b})\mathbf{x}_j$ for the negative outcomes; and $q_c = N/(N-1)$ is a constant finite sample adjustment, which is the asymptotic-like formula.

When interpreting the regression results it is important to remember that the estimated coefficients do not indicate the increase in the probability of a crisis given a one-unit increase in the corresponding explanatory variables. Instead the coefficients reflect the effect of a change in an explanatory variable on the probability function, as in the above expression. However, the sign of the coefficient does indicate the direction of the change.

4.2 Estimation results

The estimation results of the central bank independence (CBI) variables with their effects on banking crisis are reported in Table 1. The results show that the CBI is one of the important factors to reduce the banking sector instability. Given the other factors remaining the same, the variable "Aggregated CBI", which accounts for the overall CBI levels of countries, is strongly significant (at 2% level) to reduce the probability of banking crisis.

The result implies that the more powerful a CB is in terms of its overall responsibilities, the better its performance in controlling the safety of the banking sector, and the lower the probability of the systemic instability of the sector. It could be because of the public's greater confidence on a stronger CB as Blejer and Schumacher (1998) observe and thus becoming less panicked for any financial shocks. It could be because of stronger CB's stronger insulation of the banking sector from the ineffective political interests, as Mishkin 2000 finds, and thus handling more efficiently the CB's bailing out instrument of the insolvent banks. It could be because an independent CB can reduce inefficient public expenditure, as Doi (1998) finds, and thus reducing the reimbursement pressure on banking sector. If the overall level of CBI in Morocco and Panama (respectively 0.14 and 0.22) were like the level of CBI in German (0.69, one of the most independent CBs), the estimated crises probabilities

of the countries in the 1980s would have decreased 6.54% (from 99.23% to 92.70%) and 14.98% (from 90.91% to 75.92%) respectively.

Table 1. The relationship between banking crises and the autonomy of Central Bank

Dep.Var = Bank crisis	(1)	(2)	(3)	(4)	(5)	(6)
Average GDP-growth	-0.485*** (0.181)	-0.434* (0.226)	-0.505** (0.207)	-0.428*** (0.154)	-0.445 (0.345)	-0.378*** (0.139)
Average Tot-change	-13.159*** (3.931)	-8.825*** (2.440)	-10.899** (4.279)	-11.233** (4.653)	-15.677*** (5.147)	-11.235** (4.693)
Average Inflation	-0.122 (0.113)	-0.037 (0.119)	-0.038 (0.056)	-0.004 (0.067)	-0.159 (0.160)	-0.036 (0.070)
Average Real-interest	-0.300** (0.132)	-0.311** (0.156)	-0.178** (0.070)	-0.190** (0.087)	-0.021 (0.095)	-0.136 (0.093)
Average Depreciation	0.132 (0.092)	0.022 (0.121)	0.044 (0.052)	0.011 (0.057)	0.179 (0.165)	0.047 (0.064)
Average M2/reserves	-0.524*** (0.163)	-0.385*** (0.094)	-0.405*** (0.131)	-0.410*** (0.131)	-0.971** (0.468)	-0.488*** (0.161)
Average Credit-growth$_{t-2}$	0.292*** (0.114)	0.319** (0.141)	0.272** (0.113)	0.241*** (0.091)	0.405** (0.204)	0.263*** (0.090)
Average GDP/capita	-0.444 (0.311)	-0.190 (0.217)	-0.371 (0.324)	-0.378 (0.294)	-0.486 (0.340)	-0.303 (0.306)
Aggregated-CBI	-13.918** (6.049)					
CBI on CEO's office-term		-4.195** (2.018)				
CBI on appointing CEO			0.735 (1.577)			
CBI on CEO's other office				0.942 (0.958)		
CBI on formulating monetary policy					7.782 (4.913)	
CBI on conflict resolution						1.022 (1.881)
Constant	20.17*** (4.90)	10.92*** (2.92)	12.65*** (4.69)	12.60** (5.15)	20.06*** (7.30)	13.41** (5.35)
No. of Observations	54	50	54	54	38	45
Log likelihood	-7.77	-7.09	-8.58	-8.46	-5.88	-6.98
Wald chi2	29.4	36.33	25.49	24.87	20.53	30.88
Prob > chi2	0.0006	0	0.0025	0.0031	0.0149	0.0003
Pseudo R2	0.7691	0.7524	0.7448	0.7484	0.7591	0.7562
AIC[33]	35.54	34.18	37.16	36.92	31.76	33.96
No. of crises	17	13	17	17	13	15
% overall correct	90.74	92.00	92.59	92.59	92.11	93.33
% crises correct	94.12	92.31	94.12	94.12	92.31	93.33

***, **, and * refer to 1%, 5%, and 10% level of significance

[33] In the general case, AIC = 2k – 2ln(L), where *k* is the number of parameters in the statistical model and *L* is the maximized value of the likelihood function for the estimated model.

(Table 1 continued)

Dep.Var = Bank crisis	(7)	(8)	(9)	(10)	(11)
Average GDP-growth	-0.465*** (0.140)	-0.513** (0.223)	-0.369** (0.178)	-0.644*** (0.220)	-0.844*** (0.319)
Average Tot-change	-12.036*** (4.110)	-11.808** (4.816)	-10.781** (4.734)	-10.142*** (3.787)	-14.665*** (5.273)
Average Inflation	-0.058 (0.054)	-0.043 (0.061)	0.003 (0.073)	-0.058 (0.051)	-0.069 (0.076)
Average Real-interest	-0.183** (0.092)	-0.121 (0.101)	-0.218** (0.101)	-0.211** (0.092)	-0.208* (0.111)
Average Depreciation	0.060 (0.050)	0.055 (0.056)	0.014 (0.070)	0.054 (0.048)	0.087 (0.074)
Average M2/reserves	-0.524*** (0.130)	-0.518*** (0.148)	-0.417*** (0.128)	-0.384*** (0.113)	-0.517*** (0.164)
Average Credit-growth$_{t-2}$	0.271*** (0.081)	0.283** (0.114)	0.231** (0.102)	0.263*** (0.092)	0.397*** (0.145)
Average GDP/capita	-0.316 (0.285)	-0.353 (0.281)	-0.368 (0.308)	-0.379 (0.323)	-0.428 (0.350)
CBI on advances lending	1.453 (1.476)				
CBI on securitized lending		2.253 (1.996)			
CBI on lending terms			-3.927 (3.136)		
CBI on loans' interest-rate				-4.200** (2.066)	
CBI on loans' maturity					2.712* (1.601)
Constant	14.71*** (4.59)	14.61*** (5.38)	13.30*** (4.76)	14.53*** (5.27)	15.80*** (5.62)
No. of Observations	51	50	54	53	53
Log likelihood	-7.21	-7.71	-8.27	-8.01	-8.33
Wald chi2	27.05	21.87	30.71	31.68	23.48
Prob > chi2	0.0014	0.0093	0.0003	0.0002	0.0052
Pseudo R2	0.7778	0.7595	0.7542	0.7592	0.7494
AIC	34.42	35.42	36.54	36.02	36.66
No. of crises	17	17	17	17	17
% overall correct	94.12	92.00	92.59	94.34	90.57
% crises correct	94.12	94.12	94.12	94.12	94.12

The self-dependency of CB with respect to the office-term of its chief executive officer (CEO) can also explain the banking sector instability. Given that other factors of banking sector instability are controlled, the self-dependency of CB as justified by CEO's office-term reduces the instability at 5% significance level. Precisely, the longer the terms of office of the CEO, the greater it signals the autonomy of CB, and the more independently the CEO can perform his/her duties and can decide on monetary policy, all of which can help to reduce the banking sector instability. The data shows that in the 1980s the CBs of Columbia and Argentina were among the

CBs, where the CEO's office terms were most interrupted and thus the CEOs lasted 4 years or less. The predicted crises probabilities of the countries would have decreased in that decade by 1.87% (from 77.82% to 75.94%) and 0.23% (from 98.09% to 97.85%) respectively if the CEO's office-terms were not interrupted and thus lasted more than 8 years, like German or Iceland.

A CB imposing higher interest rate on government loans is also significant (at 5% level) in reducing the banking crisis probability. This means that the greater the CB's authority to impose higher interest rate on government loans, the lower would be the pressure imposed on commercial banks to reimburse the costs of government loans, and thus the less vulnerable would be the banking sector reducing the probability of banking crisis. The data shows that the CBs in Nepal and Philippines are entitled to set the interest rate on government loans in the 1980s at almost the lowest level; the CBs were in a kind of state not to specify any interest rate on government borrowings. The estimated banking crises probabilities of the countries would have decreased by 1.31% (from 99.87% to 98.56%) and 3.94% (from 99.63% to 95.69%) respectively if the CBs are entitled to set the interest rate at the level of Austria or Australia (where the CB is empowered to set the interest rate on government borrowings above the minimum market rate).

CB's design of "loans-maturity" on the loans to government and public entities has a positive correlation with the probability of banking crisis. However, it is weakly significant (at 10% level). The result is probably due to the fact that the banking crises took place relatively more frequently in countries where the maturities of the government-loans from the CBs were relatively shorter. The rational for the result could be that the governments are more successful in projects funded by the longer-term loans.

Finally, some of the control variables are significant as well. These include the average GDP-growth, the average terms of trade change, the average real interest rate, the average ratio of the currency in circulation to the foreign exchange reserves, and the average private domestic credit growth. Note that all of these variables are taken with their average values over the decade 1980s if there were no crises, or the average before the crises began. Among them the average GDP-growth, average terms of trade change, and the average private domestic credit growth are having the expected signs, as noted in the previous studies (see e.g. Demirguc-Kunt and Detragiache 1999 or 2005, who studied with yearly data). That is, the higher the average GDP growth (i.e.

stronger economy) or the average terms of trade change (i.e. favorable trade balance), the lower the probability of banking crisis. On the other hand, the higher the average private domestic credit growth (lagged by two years), implying the more liberalized financial system, the higher the probability of banking crisis.

However, the average real interest rate and the average ratio of currency in circulation to foreign exchange reserves enter with different signs found in the previous studies (e.g. studies of Demirguc-Kunt and Detragiache 1999, 2002 or 2005 with yearly data and Komulainen and Lukkarila 2003 with monthly data)[34]. That is, the higher the average real interest rate or the average ratio of currency in circulation to foreign exchange reserves, the lower the probability of banking crisis. The reason of this different sign could be our very different dataset and the different method of formulating the variables (e.g. the values averaged over the decade).

The quality of a regression model is assessed by the following values: (1) log-likelihood value – the higher the value, the better the model; (2) Wald Chi-squared value – the higher the value, the better the model; (3) joint significance level (Prob > Chi-square) – the lower the value is, the stronger is the model's joint significance level; (4) model's goodness of fit (Pseudo R-squared value) – the higher the value, the better the model; and (5) Akaike's Information Criterion (AIC) [35] – the lower the value, the better the model. We also report the value of model's overall prediction accuracy and the value of prediction accuracy of crises.[36]

[34] With the monthly data Komulainen and Lukkarila (2003) found the ratio of currency in circulation to foreign exchange reserves to increase the probability of banking crisis in emerging economies.
[35] In the general case, AIC = 2k – 2ln(L), where *k* is the number of parameters in the statistical model and *L* is the maximized value of the likelihood function for the estimated model.
[36] We take a crisis (no-crisis) correctly estimated if the predicted value of the crisis (no-crisis) more (less) than the crude probability of crisis, i.e. number of crises divided by the total number of observations. Thus, for the "overall prediction accuracy" we take the percentage value of both crises and no-crises correctly estimated and for the "prediction accuracy of crises" the percentage value of crises correctly estimated.

4.3 CB's autonomy, institutional environment, and banking sector instability

This subsection sheds light on the effect of CB's influential role on a banking crisis when its autonomy interacts with a country's institutional environment. We use the law-and-order tradition of countries to represent their institutional environment. Higher scores indicate sound political institutions, a strong court system, and provisions for an orderly succession of power. Lower scores indicate a tradition of physical force or illegal means to settle claims, and after changes in government, new leaders may be less likely to accept the obligations of the previous regime. The values of the variable range 0 to 6 and reveal the yearly ranks of law and order tradition. We take each country's average value of the ranks available for the decade 1980s (because the data on CB's autonomy are of the decade 1980s).

The estimation results of the interaction variables are reported in Table 2. Note that the sample sizes in Table 2 are lessened by 1 as compared to the sample sizes in Table 1. The sample sizes are lessened because of missing data on law and order tradition for Nepal. We compare the effects of CBI variables having the interactions with the law and order tradition with the effects of CBI variables without the interactions. To do so, we estimate the similar regression models as of Table 1 with exactly the same sample (i.e. dropping Nepal) and report in Table A3 of the appendix. We, however, report only the results of the CBI variables which are found to be significant in Table 2.

This study finds that the banking sector instability is even lower if an autonomous CB can perform its duties in a country with stronger law and order tradition. This evidence comes up as the aggregated CBI interacted with the law and order tradition reduces the banking crisis probability at stronger significance level than the significance level found when the CBI variables are not interacted (as in Table A3 of the appendix). Not only the significance level stronger, the regression model with the interaction variable is also more precisely estimated (as justified by the model's log-likelihood value and the value of goodness of fit, i.e., the pseudo R-squared value). So we stick by our hypothesis that an autonomous CB can perform its duties more profoundly to maintain the banking sector stability when the country's law and order

tradition is stronger, which implies sounder political institutions, stronger legal system, and so on.

Table 2. CB's autonomy with different levels of law-and-order tradition and banking crises

Dep.Var = Bank crisis	(1)	(2)	(3)	(4)	(5)	(6)
Average GDP-growth	-1.727*** (0.559)	-0.434* (0.247)	-0.587*** (0.212)	-0.428*** (0.144)	-0.160 (0.264)	-0.366*** (0.142)
Average Tot-change	-40.235*** (10.992)	-8.385*** (2.820)	-14.518*** (4.078)	-11.310** (4.860)	-10.591*** (3.737)	-10.855** (4.588)
Average Inflation	-0.433** (0.205)	0.022 (0.147)	-0.028 (0.080)	-0.008 (0.066)	-0.035 (0.068)	-0.023 (0.070)
Average Real-interest	-0.548*** (0.189)	-0.395* (0.233)	-0.309*** (0.112)	-0.199** (0.085)	-0.094 (0.059)	-0.134 (0.093)
Average Depreciation	0.411** (0.188)	-0.046 (0.162)	0.040 (0.077)	0.015 (0.055)	0.050 (0.067)	0.034 (0.063)
Average M2/reserves	-1.748*** (0.559)	-0.404*** (0.113)	-0.508*** (0.137)	-0.407*** (0.138)	-0.509*** (0.144)	-0.464*** (0.143)
Average Credit-growth$_{t-2}$	0.698*** (0.192)	0.356** (0.142)	0.253*** (0.074)	0.232*** (0.082)	0.220** (0.096)	0.250*** (0.090)
Average GDP/capita	-0.269 (0.269)	-0.041 (0.159)	-0.304 (0.324)	-0.399 (0.302)	-0.289 (0.367)	-0.296 (0.336)
Aggregated CBI x Law & order	-10.063*** (2.715)					
CBI on CEO's office-term x Law & order		-1.116*** (0.424)				
CBI on appointing CEO x Law & order			-0.755* (0.438)			
CBI on CEO's other-office x Law & order				0.200 (0.249)		
CBI on formulating monetary policy x Law & order					0.390 (0.344)	
CBI on conflict resolution x Law & order						0.107 (0.549)
Constant	62.099*** (16.877)	9.611*** (3.506)	17.564*** (4.855)	12.849** (5.440)	12.549*** (4.175)	12.966** (5.127)
No. of Observations	53	49	53	53	38	44
Log likelihood	-4.85	-6.78	-8.01	-8.51	-6.51	-7.01
Wald chi2	38.8	29.17	34.8	24.12	31.2	32.36
Prob > chi2	0	0.0006	0.0001	0.0041	0.0003	0.0002
Pseudo R2	0.8505	0.7513	0.7531	0.7378	0.7332	0.7455
AIC	29.7	33.56	36.02	37.02	33.02	34.02
No. of crises	16	12	16	16	13	14
% overall correct	92.45	91.84	92.45	92.45	92.11	93.18
% crises correct	93.75	91.67	93.75	93.75	92.31	92.86

***, **, and * refer to 1%, 5%, and 10% level of significance

(Table 2 continued)

Dep.Var = Bank crisis	(7)	(8)	(9)	(10)	(11)
Average GDP-growth	-0.435*** (0.161)	-0.396* (0.203)	-0.138 (0.176)	-0.625*** (0.217)	-0.553*** (0.182)
Average Tot-change	-11.947*** (4.240)	-11.013** (4.518)	-19.331*** (4.444)	-10.531*** (4.057)	-11.685*** (4.464)
Average Inflation	-0.051 (0.061)	-0.058 (0.062)	0.004 (0.089)	-0.042 (0.050)	-0.021 (0.068)
Average Real-interest	-0.171* (0.090)	-0.154 (0.095)	-0.399*** (0.088)	-0.187** (0.087)	-0.203*** (0.075)
Average Depreciation	0.055 (0.056)	0.066 (0.055)	0.017 (0.111)	0.042 (0.047)	0.033 (0.053)
Average M2/reserves	-0.517*** (0.126)	-0.472*** (0.129)	-0.795*** (0.205)	-0.410*** (0.125)	-0.414*** (0.138)
Average Credit-growth$_{t-2}$	0.256*** (0.091)	0.259** (0.113)	0.258*** (0.090)	0.292*** (0.098)	0.285*** (0.093)
Average GDP/capita	-0.326 (0.323)	-0.356 (0.306)	-0.187 (0.217)	-0.309 (0.328)	-0.395 (0.310)
CBI on advances lending x Law & order	0.075 (0.426)				
CBI on securitized lending x Law & order		-0.053 (0.529)			
CBI on lending terms x Law & order			-4.155*** (1.625)		
CBI on loans' interest-rate x Law & order				-0.840*(6%) (0.444)	
CBI on loans' maturity x Law & order					0.151 (0.282)
Constant	14.887*** (4.566)	13.640*** (4.976)	23.488*** (5.348)	14.038*** (5.271)	13.340** (5.305)
No. of Observations	50	49	53	52	52
Log likelihood	-7.336	-7.830	-6.222	-7.995	-8.585
Wald chi2	30.5	23.55	29.4	27.12	32.16
Prob > chi2	0.0004	0.0051	0.0006	0.0013	0.0002
Pseudo R2	0.7659	0.747	0.8083	0.7509	0.7325
AIC	34.672	35.66	32.444	35.99	37.17
No. of crises	16	16	16	16	16
% overall correct	94.00	91.84	92.45	94.23	90.38
% crises correct	93.75	93.75	93.75	93.75	93.75

As mentioned in the above subsection, the estimated crises probabilities in the 1980s would have been reduced by 6.54% and 14.98% respectively if the level of aggregated CBI in Morocco and Panama were improved at the level of CBI in German. The reduction of the predicted crises' probabilities would have been higher, 12.8% (from 99.99% to 87.2%) and 29.56% (from 99.99% to 70.43%) respectively, if the countries' law and order condition in the 1980s (index 1.81 for both Morocco and Panama) were also improved concurrently at the level of Finland's law and order tradition (which has the strongest law and order tradition).

Having interaction with law and order tradition, there are also other CBI variables more precisely estimated and strongly significant. Those are the CBI in terms of CEO's office-term, in terms of appointing CEO, and in terms of designing the lending-terms on loans to the government and/or public entities. Results with the former two imply that an uninterrupted CB to remove its CEO or to appoint the CEO can perform its duties more efficiently for the safety of the banking sector if the law and order tradition of the country is stronger. Note that the CBI in terms of appointing CEO was not significant (even the sign was opposite) when it was tested without the interaction, as found in Table 1 (or Table A3 of appendix). This validates that a flawless law and order condition of a country is very important to execute the duties efficiently by the autonomous CB of the country for the stability of its banking sector.

From the above subsection we find that the estimated probabilities of crises of Columbia and Argentina would have decreased by 1.87% and 0.23% respectively if the CBs were not interrupted and thus the CEOs' office-terms were more than 8 years, like German or Iceland. These reductions would have been higher, 4.25% (from 81.28% to 77.03%) and 0.27% (from 97.95% to 97.68%) respectively, if the levels of the countries' law and order tradition (indexes 1.27 and 2.81 respectively) were also improved simultaneously at the strongest level of law and order tradition like in Finland.

Like the CBI in terms of CEO's office-term or in terms of appointing CEO, CBI in designing the lending-terms (i.e. designing the maturity, amount, and interest rate on loans to the government and/or public entities) is also effective to reduce the probability of crisis more if a country's law and order condition is stronger. Interestingly, this CBI variable is also found in Table 1 (or Table A3 in appendix) not to be significant, as it is without interaction with law and order condition. However, having the interaction it is strongly significant (at 1% level). This implies that an autonomous CB's improved designing of the lending-terms so as to reduce the vulnerability of the banking sector will not be useful unless the country's law and order condition is improved enough. The reason could be that the opportunity cost of flawed law and order condition, as both the commercial banks and the public entities can just misuse the condition in their favor, is such a high that the efficient designing of the lending-terms can not help recovering this cost.

Without taking the interaction with law and order condition, the predicted crises probabilities of Morocco and Panama would reduce by 1.86% (from 96.95% to

95.09%) and -2.32% (from 79.55% to 81.87%) respectively for switching the CBI in lending-terms from the level of most interrupted by the executive body to the level of least interrupted. Note that the crisis probability of Panama increases instead of decrease. However, these probabilities would reduce further in magnitudes, 6.44% (from 99.79% to 93.35%) and 18.5% (from 95.49% to 76.99%) respectively, if the levels of the countries' law and order tradition (index 1.81 for both of the countries) were also improved concomitantly to the level of strongest law and order condition.

Having the interaction with law and order condition, CBI in terms of setting the interest rate on loans to the government or public entities is also more precisely estimated (as justified by the log-likelihood and the pseudo R-squared values). However, the significance level of the interaction parameter (at 6% level) is slightly weaker than the significance level of the CBI parameter without the interaction (at 5% level). Perhaps, while taking the law and order condition into account, the CBI in terms of setting the interest rate is not as much useful as the CBI in terms of designing the lending-terms.

4.3 Robustness of the results

A potential criticism of the regression results is that an increase in CB's autonomy may be influenced by the banking crisis itself. Thus an increase in CBI and the banking crisis may be jointly determined. If this is the case, then treating an increase in CBI as an exogenous variable would lead to simultaneity bias. We argue against the existence of such bias in this study, because CBI is not a continuously changing variable that it will change immediately after or simultaneously with the occurrence of banking crisis. This logic becomes stronger when we see that CBI in the 1970s represented by the 16 variables mentioned in section 3 remains much the same as in the 1980s.

Table 3. Banking crises and CB's independence in the 1970s

Dep.Var = Bank crisis	(1)	(2)	(3)	(4)
Average GDP-growth	-0.481*** (0.182)	-0.433* (0.225)	-0.644*** (0.220)	-0.844*** (0.320)
Average Tot-change	-13.077*** (3.964)	-8.808*** (2.457)	-10.142*** (3.787)	-14.664*** (5.274)
Average Inflation	-0.121 (0.112)	-0.038 (0.120)	-0.058 (0.051)	-0.069 (0.076)
Average Real-interest	-0.297** (0.136)	-0.307* (0.161)	-0.211** (0.092)	-0.208* (0.111)
Average Depreciation	0.132 (0.092)	0.024 (0.123)	0.054 (0.048)	0.087 (0.074)
Average M2/reserves	-0.521*** (0.163)	-0.384*** (0.094)	-0.384*** (0.113)	-0.517*** (0.164)
Average Credit-growth$_{t-2}$	0.290** (0.114)	0.318** (0.141)	0.263*** (0.092)	0.397*** (0.145)
Average GDP/capita	-0.443 (0.312)	-0.190 (0.216)	-0.379 (0.323)	-0.428 (0.350)
Aggregated-CBI in 70s	-13.862** (5.952)			
CBI on CEO's office-term in 70s		-4.156** (2.007)		
CBI on loans' interest-rate in 70s			-4.200** (2.066)	
CBI on loans' maturity in 70s				2.711* (1.601)
Constant	20.05*** (4.90)	10.90*** (2.94)	14.53*** (5.27)	15.80*** (5.62)
No. of Observations	54	50	53	53
Log likelihood	-7.76	-7.09	-8.01	-8.33
Wald chi2	28.67	36.29	31.68	23.46
Prob > chi2	0.0007	0	0.0002	0.0052
Pseudo R2	0.7693	0.7526	0.7592	0.7494
AIC	35.52	34.18	36.02	36.66

For the robustness of our results we report the estimation results in Table 3 by taking CBI indexes lagged by one decade, i.e. the CBI indexes of the 1970s (see Cukierman et al 1992 for the data). For brevity we report only the results of the CBI variables which are found to be significant in Table 1.

As we can see, the results are much the same as in Table 1. The parameter with the aggregated CBI is still significant with the negative sign and with the similar significance level. The parameters with the CBI in connection with CEO's office-term, in connection with setting the maturity period of loans to the government and/or public entities, and in connection with setting interest rate on the loans are still significant with the similar significance levels and signs as found in Table 1. Thus we conclude that the empirical findings we have established with the CBI variables for

their effects on banking crisis are not muddled because of the reverse causality problem.

5. Concluding remarks

The major duty of a country's central bank (CB) is to maintain the price stability. However, in doing so it faces many other financial tasks, such as bailing out insolvent banks and publicly-owned enterprises, managing the government's financial transactions, financing the budget deficit with the issuance of money, and financing the government's development projects. Hence, the role of a CB has an impact not only on price stability, but also on the stability of the whole financial market to a great extent. However, not all CBs are equally empowered to perform this role. At this point the open question is how the empowerment of CB affects a country's financial market and thus the banking sector stability. This paper aims to empirically test the effect of CB's empowerment on banking sector stability by using a dataset of 54 countries.

This study finds that the CB's autonomy in aggregate reduces the likelihood of a banking crisis. CB's empowerment disentangled on the basis of its duties is also tested. CB's autonomy with regard to the chief executive officer's duration in office and autonomy to assign interest rate on government loans are necessary factors in reducing the likelihood of banking crisis.

There are some logical explanations for the negative relation of CB autonomy with banking sector's instability. Firstly, a more autonomous CB can use its instrument of bailing out the insolvent banks more efficiently for the stability of banking sector. There are some reasons to believe this. The government or the executive body is usually formed of political party. Hence the government can force a CB to act in favor of its time inconstant policies even at the expense of banking sector stability. It can force the CB to bail out a bank because the bank-owner has influential role on the government's political party. It can also ask the CB not to close down insolvent banks so as not to loose the popularity among voters, and thus to be re-elected in the office. At this end, a more autonomous CB is in a better position to avoid the pursuit of such time-inconsistent decisions of the government (Mishkin 2000), and thus maintains the banking sector stability.

Secondly, a more empowered CB can influence banking sector stability simply by exercising its power, e.g., in setting interest rate on loans to the government and public entities. A more powered CB sets higher interests rates on the loans relative to the market rates. As the interest rate on government loans gets higher, the reimbursement pressure of the interest rate loss (i.e. the difference between the interest rate to the depositors and the interest rate on the government loans) from the banking sector gets lower. Thus the vulnerability of the banking sector would be reduced, reducing the probability of banking crisis.

Thirdly, an empowered CB can influence the banking sector stability by its money issuance authority, e.g., to finance government's budget deficit which is very often resulted because of inefficient public expenditure. A CB with greater autonomy is more capable to tackle inefficient public expenditure (Doi, 1998). Through its controlling the inefficient public expenditure, the CB can reduce the burden that would otherwise be imposed on the commercial banks for the reimbursement, and thus helps maintaining the banking sector stability.

Fourthly, a CB can influence the banking sector stability with its commitment to the general public especially the depositors to defend the monetary regime. However, the credibility of this commitment depends on how self-dependently the CB can perform its duties. Lack of autonomy in a CB leads to loss in confidence on its capability to uphold its pledge to safeguard the nominal regime (Blejer and Schumacher 1998, p.4). Thus, the more independent a CB is from the executive branch, the more capable it is to uphold its pledge to safeguard the nominal regime, the more credible is its commitment to the economic agents, the less panicked the depositors are to any financial shock, and the less unstable is the banking sector.

This study also finds that an autonomous CB can perform its duties more effectively to reduce the banking sector instability when the country's law and order condition is stronger. Especially, CB autonomy, as justified by the autonomy in designing the lending-terms on loans to the government and the public entities, would not be useful in reducing the banking sector instability unless the country's law and order condition is improved enough.

The study has some limitations, however. The data on the CB autonomy are aggregated by decades. Hence, the probability of banking crisis in a country is estimated for the decade we have included in the sample. The study could have been more realistic if the data on CB autonomy had been available on yearly basis.

Furthermore, data on CB autonomy are not available for a large number of countries, neither are the data of the sample countries for the latest decade (e.g. 1990s). Given the availability of the said data, the estimation result would be more realistic.

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Appendix

Table A1. Cross-country data of CB's autonomy and systemic banking crises in the 1980s

Country	Bank-Crisis, Yes=1	CEO's Office-Term	Appointing CEO	Dismiss-CEO	CEO's Other-Office	Formulate-Monetary-Policy	Conflict-Resolution	Objectives
Argentina	1	0.25	0.25	0.83	1	0.33	0	0.4
Australia	0	0.75	0	0.83	1	0.33	0.2	0.4
Austria	0	0.5	0	0.83	1	1	0.6	0.6
Bolivia	1	0	0	0.83	1	0.67	0.2	0.6
Botswana	0	0.5	0	0.83	0.5	n.a.	0	0.2
Brazil	0	0	0.5	0	0	0.33	n.a.	0
Canada	0	0.75	0.75	0.83	1	0.33	0.2	0.2
Chile	1	0.5	0	0.83	0.5	0.67	0.2	0.8
Colombia	1	0	0.75	0.83	0	0	0.2	0
Costa Rica	1	n.a.	1	0.67	1	n.a.	n.a.	0.6
Denmark	0	0	0	0.33	0	n.a.	1	0.6
Egypt	1	0.5	0.5	1	0	0.33	0	0.6
Ethiopia	0	0	0.25	0	0	n.a.	1	0
Finland	0	1	0	n.a.	0	n.a.	0	0.8
France	0	0	0.25	1	0.25	0.67	0.6	0
German	0	1	0.75	1	0	0.67	1	1
Greece	0	0.25	0.75	0.67	0.5	0.33	0.6	0.8
Honduras	0	0.75	0	0.83	1	0.33	1	0
Hungary	0	0.5	0.25	1	0	0.33	0	0.4
Iceland	0	1	0.75	0.83	0.5	0.33	0.2	0.4
India	0	0.5	0.25	0.83	0.5	n.a.	0	0.4
Ireland	0	0.75	0.5	0.83	1	n.a.	n.a.	0.8
Italy	0	0	0.75	0.67	1	n.a.	n.a.	0.2
Japan	0	0.5	0.25	0.83	0.5	0.67	0	0
Kenya	1	0.25	0	0.83	0.5	n.a.	0.2	0.4
Korea	0	0.25	0.25	0.83	0.5	0.33	n.a.	0.6
Malaysia	0	0.5	0	0.83	0	0	0.2	0.6
Mexico	1	n.a.	1	0.83	1	0.67	0.2	0
Morocco	1	n.a.	0.25	0	0	n.a.	n.a.	0.2
Nepal	1	0.5	0.25	0	0	n.a.	0	0.2
Netherland	0	0.75	0	0.17	1	0.33	0.2	0.8
New Zealand	0	0.5	0	0.83	1	0	0	0.4
Nigeria	0	0.5	0	0.83	0.5	0.33	0.2	0.6
Norway	1	0.75	0	0.33	1	0.33	0.2	0
Pakistan	0	0.5	0.25	0.83	0.5	0	0	0.4
Panama	1	n.a.	0.25	0.83	1	0.33	0	0.4
Peru	1	0	1	0.83	1	0.67	0.2	0.4
Philippines	1	0.75	0	0.83	0.5	0.67	0.2	1
Poland	0	0.5	0.25	0	0	0.67	0	0
Portugal	0	0	0.25	1	0	0.33	0.6	0
Qatar	0	0.5	0.25	0.83	0.5	0.33	0	0.4
Singapore	0	0.25	0	0.83	0	n.a.	n.a.	0.6

South Africa R..	0	0.5	0	0.83	0.5	n.a.	n.a.	0.2
Spain	1	0.25	0	0	1	0.33	0	0.6
Sweden	0	0	1	n.a.	0.5	n.a.	n.a.	0.2
Switzerland	0	0.75	0.25	n.a.	1	n.a.	1	0
Thailand	1	0.25	0.5	0	0	0	0.2	0.6
Uganda	0	0.5	0.5	0.83	0.5	0	0.2	0.4
UK	0	0.5	0	0.83	1	0	0	0.2
Uruguay	1	0.25	0.25	0.83	0	0.67	0.2	0.4
USA	0	0.25	0.5	0	1	n.a.	0.2	0.4
Venezuela	0	0.5	0	0.83	0.5	0.33	1	0.4
Zaire	0	0.5	0	1	1	0.67	0.6	0.4
Zimbabwe	0	0.75	0	0	0.5	0	0	0

(Table A1 continued)

Country	Advances-Lending	Securitized-Lending	Lending-Terms	Potential-Borrowers	Lending-Amounts	Loan-Maturity	Loans' Interest-rate	Aggregated-CBI
Argentina	0.33	0.33	0.33	1	0.33	1	0.5	0.4
Australia	0.33	0	0.33	0	n.a.	0.67	1	0.36
Austria	1	0.67	0.33	0.33	0.33	1	1	0.61
Bolivia	0.33	0	0	0	0	1	0.25	0.3
Botswana	0.33	0.67	0.33	0.67	0.33	0.33	0.25	0.33
Brazil	0.67	0	0	1	n.a.	0	0.25	0.21
Canada	0.33	0.33	0.67	0.67	0.33	0.67	0.75	0.45
Chile	0.33	0.33	0.67	1	n.a.	0	0.25	0.46
Colombia	0.67	0	0.33	0	0.67	0.67	0.25	0.27
Costa Rica	0.67	0.33	0.33	0.33	0	0.67	0.25	0.47
Denmark	1	0.33	0.67	0	n.a.	1	0.25	0.5
Egypt	0.67	0.67	0.33	1	0.67	0.67	0.25	0.49
Ethiopia	0.33	0.33	0.67	1	0.33	0.67	0.5	0.4
Finland	0	0	0.67	n.a.	n.a.	0	0.25	0.28
France	0	0	0.33	1	n.a.	n.a.	n.a.	0.24
German	0.67	0.67	0.67	0.33	1	1	0.25	0.69
Greece	0.67	0.67	0.33	0	1	1	0.75	0.55
Honduras	n.a.	0.33	0.67	0.33	0.33	0.67	0.25	0.43
Hungary	0	0	0	0.33	1	0.67	1	0.24
Iceland	0	0	0.33	1	n.a.	0.33	0.25	0.34
India	0.33	0	0.67	0.33	1	0.33	0.25	0.34
Ireland	n.a.	0	0.33	0.33	n.a.	0.67	0.75	0.44
Italy	0.33	0	0.33	n.a.	0	0	0.25	0.25
Japan	0	0	0.33	n.a.	n.a.	0	0.25	0.18
Kenya	0.67	0.67	0.33	0.33	1	0.67	0.75	0.44
Korea	0	0	0.33	0	n.a.	0.67	0.25	0.27
Malaysia	0.33	n.a.	0.67	0	0.33	0.67	0.25	0.36
Mexico	0	0	0.33	1	n.a.	0.67	0.25	0.34
Morocco	0.33	0	0	0.33	0.33	0.67	0.25	0.14
Nepal	0	0	0.33	1	n.a.	0.67	0.25	0.18
Netherland	0.67	0	0	1	1	0	0	0.42
New Zealand	0	0	0	1	n.a.	0	0.5	0.24
Nigeria	0.33	0.33	0.33	0	0.33	0.67	0.75	0.37
Norway	0	0	0	0	n.a.	0.67	0.5	0.17
Pakistan	0	0	0	0.33	n.a.	0.67	0.25	0.21
Panama	0	0	0	0	n.a.	0	0.25	0.22

Peru	0	0.67	0.67	0.33	0.33	1	0.25	0.43
Philippines	0.33	0	0.33	0.67	0.33	0.33	0.25	0.43
Poland	0	0	0.33	0	n.a.	0	0.25	0.1
Portugal	0.67	0.67	0.67	0	1	1	0.25	0.41
Qatar	0	0	0	0.33	n.a.	0	0.25	0.2
Singapore	n.a.	n.a.	0.33	0	n.a.	1	0.25	0.29
South Africa R.	0	0	0.33	1	n.a.	1	0.25	0.25
Spain	0.33	0	0	0.33	0	0	0	0.23
Sweden	0.33	0	0.67	0	1	0.67	0.25	0.29
Switzerland	1	n.a.	1	1	n.a.	1	0.25	0.64
Thailand	0.33	0	0.33	0.33	0	0.67	0.25	0.27
Uganda	0.33	n.a.	0.33	0.33	0.33	1	0.75	0.38
UK	0	0	0	1	1	1	0.75	0.27
Uruguay	0	0	0.67	0	n.a.	0	0.25	0.24
USA	1	0.33	0.33	1	n.a.	1	0.25	0.48
Venezuela	0.67	0	0.67	0	0.33	0	0.5	0.43
Zaire	0.33	0.33	0.33	0.33	0.33	0.67	0.75	0.43
Zimbabwe	0.33	0.33	0	0.67	0.33	0.33	0.25	0.2

Table A2. Formulation of the control variables and their data sources

Variables (the name used)	Definition	Sources
Growth rate of GDP (GDP-growth)	= $\{(G_t - G_{t-1})/G_{t-1}\}$*100, $G_t = g/p$ at time t, where g = yearly GDP at current price, p = consumer price index[37]	IFS
Terms of trade change (Tot-change)	=$\{(T_t - T_{t-1})/T_{t-1}\}$*100, $T_t = E_t/I_t$ at time t, where E_t and I_t is the total export value and import value of merchandise at time t respectively	IFS
Inflation rate (Inflation)	= $\{(p_t - p_{t-1})/p_{t-1}\}$*100, where p = consumer price index	IFS
Depreciation rate (Depreciation)	= $\{(D_t - D_{t-1})/D_{t-1}\}$*100, D_t = exchange rate (national currency per SDR) at time t (period average).	IFS
Real interest rate (Real-interest)	= $d - i$, where d = central bank discount rate (or nominal deposit rate, money market rate, treasury bill rate, govt. bond rate, saving rate, lending rate if the previous one is not available) and i = contemporaneous rate of inflation	IFS
Ratio of M2 to foreign exchange reserves (M2/reserves)	= ($M2/F$), where $M2$ = broad money and is drawn from line 34 + the quasi-money in line 35 in IFS and F = foreign exchange reserves (both converted to national currency)	IFS
Rate of growth of real private domestic credit (Credit-growth)	= $\{(PVTC_t - PVTC_{t-1})/PVTC_{t-1}$ and $PVTC_t$ = (total domestic-credit used by private sectors) /(consumer price index) at time t	IFS
Per capita GDP (GDP/capita)	Ratio of GDP (in US Dollar) to total population	IFS
Law and order tradition (Law-&-order)	Higher scores indicate sound political institutions, a strong court system, and provisions for an orderly succession of power. Lower scores indicate a tradition of reliance on physical force or illegal means to settle claims and after changes in government, new leaders may be less likely to accept the commitments of the previous regime.	ICRG

IFS = International Financial Statistics; ICRG = International Country Risk Guide

[37]GDP deflator can be used in order to obtain the real GDP value. However, in our data source GDP deflator values are missing for many of the sample countries.

Table A3. The relationship between banking crises and the autonomy of the CB (the sample excludes Nepal)

Dep.Var = Bank crisis	(1)	(2)	(3)	(4)	(5)
Average GDP-growth	-0.485*** (0.181)	-0.404* (0.226)	-0.505** (0.208)	-0.367** (0.181)	-0.643*** (0.221)
Average Tot-change	-13.157*** (3.934)	-8.151*** (2.657)	-10.882** (4.309)	-10.747** (4.807)	-10.129*** (3.807)
Average Inflation	-0.122 (0.113)	-0.021 (0.136)	-0.037 (0.056)	0.004 (0.072)	-0.058 (0.051)
Average Real-interest	-0.300** (0.132)	-0.342* (0.207)	-0.178** (0.070)	-0.218** (0.100)	-0.211** (0.093)
Average Depreciation	0.132 (0.092)	0.001 (0.146)	0.044 (0.052)	0.013 (0.071)	0.053 (0.048)
Average M2/reserves	-0.524*** (0.163)	-0.368*** (0.107)	-0.404*** (0.133)	-0.416*** (0.131)	-0.383*** (0.114)
Average Credit-growth$_{t-2}$	0.292*** (0.114)	0.320** (0.140)	0.271** (0.114)	0.230** (0.103)	0.262*** (0.093)
Average GDP/capita	-0.444 (0.311)	-0.186 (0.210)	-0.371 (0.325)	-0.367 (0.310)	-0.378 (0.324)
Aggregated-CBI	-13.915** (6.052)				
CBI on CEO's office-term		-4.387** (2.068)			
CBI on appointing CEO			0.736 (1.576)		
CBI on lending terms				-3.933 (3.142)	
CBI on loans' interest-rate					-4.197** (2.070)
Constant	20.167*** (4.902)	10.049*** (3.549)	12.625*** (4.737)	13.251*** (4.862)	14.506*** (5.305)
No. of Observations	53	49	53	53	52
Log likelihood	-7.77	-7.05	-8.58	-8.26	-8.01
Wald chi2	29.33	31.62	25.08	30.1	31.21
Prob > chi2	0.0006	0.0002	0.0029	0.0004	0.0003
Pseudo R2	0.7607	0.7414	0.7356	0.7454	0.7505
AIC	35.54	34.1	37.16	36.52	36.02

***, **, and * refer to 1%, 5%, and 10% level of significance

Table-A4. Sample compositions

Regressions 1, 3, 4 & 9 of Table 1	All countries reported in Table A1
Regression 2 of Table 1	All countries reported in Table A1 except Costa Rica, Mexico, Morocco and Panama.
Regression 5 of Table 1	All countries reported in Table A1 except Botswana, Costa Rica, Denmark, Ethiopia, Finland, India, Ireland, Italy, Kenya, Morocco, Nepal, Singapore, South Africa, Sweden, Switzerland, and the USA.
Regression 6 of Table 1	All countries reported in Table A1 except Brazil, Costa Rica, Ireland, Italy, Korea Rep., Morocco, Singapore, South Africa, and Sweden.
Regression 7 of Table 1	All countries reported in Table A1 except Honduras, Ireland, and Singapore.
Regression 8 of Table 1	All countries reported in Table A1 except Malaysia, Singapore, Switzerland, and Uganda.
Regression 10 & 11 of Table 1	All countries reported in Table A1 except France

IV. Factors correlating with long-lasting banking crises: a special focus on crisis resolution policy measures

Prepared by Khan Md. Anichul Hoque*
Economics Dept of Helsinki University and HECER

Abstract

The costs of long-lasting banking crises are high because both the depositors and the investors lose confidence in the banking system. For a rapid recovery of the crisis, the government very often undertakes one or more crisis resolution policy (CRP) measures. Existing studies have paid little attention to the CRP and other explanatory variables correlated with the durations of banking crises. This study examines such explanatory variables. The major finding is that the CRP measure allowing the regulation forbearance to keep the insolvent banks operative and the public debt relief program are respectively strongly and weakly significant to increase the durations of crises. Some other explanatory variables, which were found by previous studies to be related with the probability of crises to occur, are also correlated with the durations of crises.

Keywords: Duration model, banking crisis, crisis resolution policy

JEL Classification: C41, E58, G28

Author's E-mail: anichul.khan@helsinki.fi

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1. Introduction

This paper examines different explanatory variables related to the durations of banking crises. An economy is affected not only by the occurrence of banking crisis, but also by the long duration of crisis. A long crisis-spell can have costly repercussions on the real economy and that costs can be large and difficult to measure. For example, due to a longer crisis-spell, both the domestic depositors and the investors lose confidence in the banking system and move their funds abroad. To address this problem the government needs to find credit outside the domestic source, e.g. from the IMF or the World Bank, but at a high cost.[38] The government can also attract the inflow of international private capital – e.g. foreign direct investment (FDI), portfolio equity and debt flows. However, this attempt can also be rather costly, because the more distressed the country's banking system is, the tougher the terms and conditions imposed by the foreign creditors or investors.[39]

It is thus of the utmost importance to shield the economy from paying such a high price for a long crisis-spell. We attempt to find empirically the possible explanatory variables correlated with the length of crises. We mostly highlight the crisis resolution policy (*CRP henceforth*) measures which are usually undertaken right after the banking crises take place. To date there is no study which sheds light on the relation between CRP measures and the durations of crises. Briefly the CRP measures are (1) a blanket guarantee to all creditors and depositors, (2) an open-ended and extended liquidity support to all weak financial institutions, (3) forbearance of any banking regulations, (4) recapitalization or repeated recapitalization of weak or failed banks, (5) public debt relief program for bank borrowers to facilitate repayment of their debts, and (6) setting up a centralized Asset Management Company.[40]

For an early recovery of crises, the authorities can be strict with the existing banking regulation, or can take one or more CRP measures which would breach the existing

[38] There are studies that support the assumptions that loan from the IMF or the World Bank is becoming more and more costly.

[39] Portfolio equity and debt flows were subject to large reversals during the 1997-98 global financial crises (Dadush et al 2000 and Lipsey 2001). It is natural for the countries affected by the crises to face tougher terms and conditions in order to regain such private capital flows. On the other hand, Loungani and Razin (2001) follow that FDI is not only a transfer of ownership from the domestic to the foreign residents, but also a mechanism that makes it possible for the foreign investors to exercise the management and control over the host country firms.

[40] See Honohan and Klingebiel (2000 and 2003) and Das and Quintyn (2002) for details.

bank regulation. Although different CRP measures are enacted to shorten the durations of crises, in practice they may not do so. The reason is that most of the measures relax the existing banking regulations and the bank managements can use the relaxed regulations for some inappropriate advantages. In addition, they may not be fully market-oriented and very often the outcomes of using such measures are unknown or unpredictable. Most of the CRP measures are found to be positively and significantly related with the costs of banking crises (see Honohan and Klingebiel 2003). On the other hand, the costs of banking crises are found to be positively, although not statistically significant, related with the length of banking crises (see Frydl 1999). Thus our research question is "do the CRP measures increase (or decrease) the lengths of crises as well?"

However, it is very difficult for a government not to take any CRP measures once the country is clutched by systemic banking crisis. Almost all of the banking crises in our dataset, for which the information of CRP measures' use are available, include at least one of the CRP measures. Hence, our aim is to see which of the CRP measures are associated with longer crisis-spells in comparison with the other CRP measures used.

Explanatory variables other than the CRP measures may also cause a crisis-spell to be long. This study examines these explanatory variables as well. The variables included in this test are those examined by earlier studies as being the causes of banking crises to occur and of the costs of crises (see for instance Demirguc-kunt and Detragiache 1999, 2002 and 2005; *DKD stands for Demirguc-kunt and Detragiache henceforth*). Some, but not all, of these explanatory variables have already been tested and found to be associated with the durations of banking crises (see Abderrezak 2000).[41]

We use a duration estimation model.[42] The data on the durations of crises are yearly and for the period of 1977-2003. The data come from Caprio and Klingebiel (2003). Both the industrialized and the developing countries are included in the sample. Applying Honohan and Klingebiel (2000), we obtain the data on the durations of crises with CRP measures for 35 crisis episodes. The data for most of the explanatory

[41] Abderrezak (2000) estimates a duration model by using monthly data on 32 international banking crises. The study finds that the back-dated financial sector reforms and the government fiscal deficits are the major factors associated with long lasting banking crises.

[42] Certain episodes of the sample are incomplete. A duration estimation model is able to produce robust result since it takes into account the censoring problem caused by incomplete spells

variables other than the CRP measures come from IFS (International Financial Statistics).[43]

Amongst the CRP measures used, we find that the regulation forbearance in order to keep the insolvent banks open enlarge at a strong significance level the durations of crises relative to the use of other CRP measures. The reason could be that this forbearance allows the bank managements of the insolvent banks to play undue role for the personal benefit on their own, i.e. the moral hazard problem. This problem may deteriorate the already distressed banking system, enlarging the crisis-spell. Besides, the managements of the solvent banks may also take the advantage of the forbearance by signifying themselves as insolvents.

Like the regulation forbearance to keep the insolvent banks open, the CRP measure to relieve the borrowers at wider scale from paying their debts back also enlarges (at weak significance level) the durations of crises. The possible reason is again the moral hazard problem among the bank managements. To be more precise, the bank managements may classify the borrowers, who wouldn't otherwise be benefited from this debt relief program, in return of unjustified personal benefits. This classification may worsen the already distressed banking system.

The other CRP measures are not found statistically significant to be associated with the enlarged durations of banking crises. Some of them even have different signs of relationship.

To check the reverse causality, an instrumental variable estimation approach is used to purge the endogenous components of the CRP measures. We find that the purged CRP measures (i.e. the predicted values of CRP measures) have the similar impacts on the durations of crises like the impacts of the real CRP measures.

Amongst the explanatory variables other than the CRP measures, we find that some but not all are related with the durations of crises in a fashion similar to how they are related with the occurrences or the costs of crises. Specifically, a crisis lasts longer when it begins during a period of higher real interest rates, or with the banking sector having larger exposure to private sector borrowers, or in the presence of deposit insurance scheme (DIS). All these three explanatory variables are found by DKD (1999, 2005 and 2002) to increase the probability of banking crisis to occur. According to DKD (1999), these factors also increase the costs of banking crises.

[43] The data on deposit insurance scheme (DIS) come from Garcia (1999), McCarthy (1980), Talley and Mas (1990), De Lange (1992), and Kyei (1995).

On the other hand, a crisis is found to be short, i.e. recovery is faster, if it begins with a lagged (by two years) growth of real domestic credits in the private sector. It is also short if it begins during a period of high liquidity shortage of banks in proportion to the banks' total assets. Finally, like Abderrezak (2000) we also find that the probability of a crisis-exit increases by itself as the crisis gets older.

This paper is structured as follows. Section two briefly analyzes the theoretical views about the potential sources of long-lasting crises. Section three explains the dataset and the measurement of different variables. Descriptive statistics of the durations of crises in conjunction with the CRP measures present or absent, the required estimation model, estimation results, and the robustness of the results are illustrated in section four. Section five concludes.

2. Theoretical discussions and the hypothesis

Crises resolution policy (CRP) measures and the long-lasting crises

With the aim of minimizing the possible fiscal and financial costs resulting from a long-lasting crisis, governments usually step in to deter the continuation of the panicking stage of a crisis first and then to rehabilitate and restructure the distressed banking sector. They may or may not enact any kind of CRP measures. There are different kinds of CRP measures, but the theoretical literature which analyses the CRP measures in details is lacking. Following Honohan and Klingebiel (2000; *HK stands for Honohan and Klingebiel* henceforth) and Das and Quintyn (2002), we can develop the following conception on different CRP measures.

The government can maintain a strict policy instead of enacting any CRP measures. This strict policy choice usually encompasses decisive action without hasty or unexpected measures. The strict policy regulation is usually stringent – e.g. discontinue the operation of a failed bank immediately without any opportunity for the failed bank to continue. On the other hand, the government may enact some CRP measures that relax the existing banking regulation, with the aim to ensure that other healthy banks are not contagiously affected or to prevent depositors of both insolvent and solvent banks from panicking.

CRP measures can be classified into two phases – the containment phase, and the rehabilitation and restructuring phase. The containment phase, usually short-termed and occurs at the panicking stage of a crisis. During this phase the government enacts the CRP measures with the aim of restoring public confidence in the banking system and thus minimizing the costly economical repercussion. However, instead of this costly repercussion minimized, the cost can rather increase as the beneficiary groups, e.g. the banks, can take advantage of the CRP measures. To be more specific, the CRP measures included in this phase and the possible effects of using these measures are as follows:

- *Blanket guarantee*. Under a blanket guarantee the government usually provides a guarantee to all financial institutions regardless of whether they are solvent or insolvent. However, there is a real possibility of an adverse effect, in which such guarantee may reduce the incentive of the creditors to monitor their financial institutions. In addition, having failed on their own, the management of the institutions may gamble for resurrection. For instance, being aware of the government guarantee, the bank management may be more careless with funds already allocated. They may even attempt a private settlement with the loss-making borrowers which would benefit both of them causing a more destabilized banking system. However, arguments in favour of this measure state that a short-term timely guarantee can protect the economy from much greater fiscal and economic costs. These costs can result from widespread panic triggered by the closing of few banks.
- *Open-ended, extensive liquidity support*. This is another CRP measure to limit the panicking stage of a crisis in a shorter time span. The government may have difficulties in identifying the failed banks. In this case, they can provide liquidity support which is unrestricted to both the solvent and the insolvent financial institutions. The critiques of this option find that in applying this measure the government delay recognition of the crisis. It avoids intervention in already failed banks and this measure may instead worsen the problem. The reason is it merely provides more funding to nonviable borrowers and allows the management of the financial institutions to engage in the misappropriation of funds.

During the restructuring and rehabilitation phase, the aim of a government in enacting CRP measures is to restore the capital position of the banking institutions, and to recover the bad assets. However, like the CRP measures of the containment phase, there could be bad consequence on the already destabilized banking sector of using any CRP measures of this phase. The CRP measures with the possible effects are as follows:

- *Regulation forbearance*. The government may try to rehabilitate the failed financial institutions by allowing the regulation forbearance instead of the strict application of prudential banking regulations. The forbearance of banking regulations implies a degree of lenience towards banks. The most accommodating forbearance allows the banks generally known to be insolvent to remain open. The medium level forbearance can be characterized by government's allowing a severely under-capitalized bank to remain open for an extended period. There is also a lesser level of forbearance that includes, e.g., i) a temporary relaxation of other regulations – e.g. loan classification and loan loss provisioning requirements; ii) over looking violations of laws, standards and regulations by either individual banks or the entire banking system; iii) rapid business deregulation on banking, designing to introduce new profit opportunities to weak banks by permitting them to engage in non-traditional banking businesses such as securities trading, investment banking, credit card and travel services.

  One of the purposes of such forbearance is to protect bank customers from the disruption of financial services that may result from widespread suspension or bank closure. However, it may generate an apparent contradiction which involves relaxation of requirements just when they need the opposite, i.e., the stringent action. The management of financial institutions may misuse this forbearance in the similar manner of gambling for resurrection.
- *Recapitalization of financial institutions*. The government may implement a recapitalization program. Under this programme, insolvent or marginally solvent financial institutions are bailed out through immediate recapitalization supported by the government. With this measure the government aims to restore the solvency of these institutions. If needed, the recapitalization may be repeated. However, with recapitalization there might be a greater risk of moral hazard. The

cost of implementing such a programme is that the bank management in the hope of being bailed out may be careless in collecting their allocated loans. At the same time, borrower may have less incentive to repay loans. The argument in favour of this program is that this type of recapitalization constitutes only a part of the magnitude of costs compared to the fiscal pressure that can result from immediate recognition of the complete need for additional capital.

- *Public debt relief programs*. The government may also implement a public debt relief program. With this program, the government targets assistance to the borrowers of the financial institutions, not the financial institutions through their management. The government undertakes this measure to relieve borrowers from their public debt obligations. Since the direct assistance to bank management is bypassed, the opportunity of the gambling for resurrection is relatively smaller with this measure than the other CRPs. However, if the program is open-ended, there is the danger that it will attract the borrowers who would not be able to pay off even in good times.
- *Asset Management Company (AMC)*. The government has two choices for asset resolution strategies: i) a centralized AMC under which there is a government agency with full responsibility for acquiring, restructuring, and selling assets; ii) a decentralized approach under which the banks themselves are responsible for managing their own non-performing assets. There are a number of setbacks to using a centralized AMC effectively. For instance, 1) there might be difficulties to avoid political pressure, especially if political entities hold a large portion of corporate claims; 2) transfer of loans to a centralized AMC may break the link between banks and corporations, which can create problems for banks' as they lose privileged access to corporate information. Arguments in favour of the centralized AMC are: 1) such a centralization promotes the consolidation of skills and resources; 2) supervising and monitoring of asset management tasks become easier; and 3) more control over debtors resulted by consolidated claims, and severed perverse linkages between banks and corporations may ultimately facilitate better collection of loans.[44]

[44] Besides HK (2000) and Das and Quintyn (2002), Klingebiel (2000) and Scott (2002) have also found similar advantages and disadvantages of using a centralized AMC.

Main hypothesis

The empirical part of this paper will clarify the effect of using any CRP measures on durations of banking crises. Based on the above discussions about different CRP measures we assume that the use of any such measures increases the durations of banking crises. However, almost all of the banking crisis-episodes with the information of CRP measures used in our data set include some CRP measures. In this perspective, we are limited to test whether the uses of any CRP measure during crises causes the crises to last longer relative to the crises where the measure is not used. Specifically, the hypothesis we are going to work with is as follows,

- Given other factors remaining the same, the use of any CRP measure cause a banking crisis to last longer than the crisis lasts if the measure not used.

Testing the hypothesis for all the mentioned CRP measures will reveal a CRP measure's effectiveness in terms of crises' durations relative to the other CRP measures in use.

Other explanatory variables

Explanatory variables other than the CRP measures may also affect the lengths of crises. We attempt to determine these explanatory variables as well. Another purpose to determine these variables is to use them as the control variables when we test the relationship between the CRP measures and the durations of crises. We choose these variables from a set of explanatory variables applied in different studies as the determinants of the occurrences and the costs of banking crises.

DKD (1999, 2002 and 2005) use different macroeconomic, financial, and institutional variables to test their relationship with the occurrences and the costs of crises. The macroeconomic variables are the GDP growth rate, the terms-of-trade change, the depreciation rate, the real interest rate, the inflation rate, and the ratio of the government budget surplus to GDP. The financial variables are the ratio of liquid reserves to total assets of banks, the ratio of M2 to foreign exchange reserves, the ratio of domestic credit in the private sector to GDP, and the rate of growth of real domestic credit in the private sector. The institutional variable is the use of deposit

insurance scheme (DIS) which is explicitly formed. To represent a country's institutional environment, the indicator is the per capita GDP. The detailed theoretical views of using these variables are given in DKD (1999).

However, Table-1 summarizes the signs of the explanatory variables we expect to be related with the dependent variable, the durations of banking crises. We derive the expected signs following different theoretical and empirical studies shedding light on the relationship between the variables and the vulnerability of banking sector. In the table, we also report the key findings of the studies regarding the variables.

Table 1. Expected signs of the explanatory variables other than the CRP measures with reference to different studies

Explanatory variable	Expected sign	Reference and short explanation
GDP growth rate	-	Kaminsky and Reinhart (1999), Gorton (1988): cyclical output downturns increase banking sector problems; DKD (1999, 2002, 2005): -ve relation with occurrence and costs of BC
Terms of trade change	-	Kaminsky and Reinhart (1999), Gorton (1988): terms of trade deterioration increase banking sector problems; DKD (1999): -ve relation with occurrence and costs of BC
Inflation rate	+	Obstfeld (1986): 2. generation theory; Komulainen and Lukkarila (2003): +ve relation with CC; DKD (1999, 2005): +ve relation with BC occurrence and its cost.
Depreciation rate	+	Kaminsky and Reinhart (1999), Valesco (1987): defend exchange rate against speculative attack; DKD (1999, 2002): +ve relation with occurrence and costs of BC.
Real interest rate	+	DKD (1999, 2002, 2005): +ve relation with occurrence and costs of BC.
Govt. budget / GDP	-	Krugman (1979): 1. generation theory; Abderrezak (2000): -ve relation with BC-length, Komulainen and Lukkarila (2003): -ve relation with CC
Broad money / foreign exchange reserves	+	Calvo (1998): creates vulnerability to sudden stop; DKD (1999, 2002, 2005): +ve relation with occurrence and costs of BC; Komulainen and Lukkarila (2003): + ve relation with CC
Banks' cash reserve / total asset	-	Wyplosz (2002): indicate soundness of banking sector;
Claims on private sector / GDP	+	Corsetti et al (1999): measures lending boom; Komulainen and Lukkarila (2003): +ve relation with CC; DKD (1999, 2005): +ve relation with occurrence and costs of BC
Domestic credit growth	+	Krugman (1979): 1. generation theory; Komulainen and Lukkarila (2003): +ve relation with CC; DKD (1999): +ve relation with occurrence and costs of BC
Private domestic credit growth	+	DKD (2002, 2005): +ve relation with occurrence of BC
The use of explicitly formed DIS	+	Kane (1989): creates incentives for taking excessive risks (moral hazard) by banks; DKD (1999, 2002, 2005): +ve relation with occurrence and costs of BC
GDP per capita	-	DKD (1999, 2005): +ve relation with occurrence of BC

NB: BC = banking crises; CC = currency crises; Otherwise mentioned, all the variables in the table measured in the year BC begin.

Note that the proxy variables used to estimate the effect of financial liberalization are different in different studies. For example, the growth of real total domestic credit is used by DKD (1999) and by Komulainen and Lukkarila (2003); the growth of real private domestic credit by DKD (2005 and 2002); and Abderrezak (2000) considers

the period between the date of reform for the liberalized financial system and the dates of the occurrences of crises[45].

Similar to DKD (2005 and 2002), we use the growth of real private domestic credit as the proxy variable of liberalized financial system. In a sense, using this growth is more sensible than the growth of real total domestic credit. The reason is that in the capitalist economic world the liberalization of a financial system has a stronger impact on liberalizing the channel for domestic credits in the private sector than in the whole sector. We use the lagged growth (by two years the beginning of crises) to see whether the variable has the similar effect on the durations of crises as it has on the occurrences or the costs of crises. The growth of real private domestic credit averaged over the period of crises last is also used to determine whether the variation in this credit growth during the ongoing crises has any relation with the durations of crises.

3. The data

One of the major problems to study the explaining factors of the durations of banking crises is to find a specific standard or decisive factor to determine the durations of banking crises. Some studies have attempted to solve this problem. For instance, Lindgren et al (1996) and Caprio and Klingebiel (1996, 2000, and 2003; *CK stands for Caprio and Klingebiel* henceforth) report the durations of crises on the basis of the data from financial experts of the crises experienced countries. The dataset we use come from CK (2003). The time period of the data is 1977-2003.[46] The initial year is 1977 because the crises have been experienced more frequently since then. Our sample includes both the developing and the industrialized countries.

Centrally planned economies and economies in transition are excluded from the sample; because the interrelation between the banking system and the rest of the

[45] The reform date is defined when one or more measures are taken to free a repressed financial system. The characteristics of a repressed system corrected or freed are as follows: 1) interest rates become free-market determined; 2) government control on capital flows and exchange rates is cancelled; 3) barriers to exit for financial institutions and their major clients are eliminated; 4) government sponsored programs to guarantee minimum business activities are removed.

[46] It should be mentioned that we began this paper with the dataset of CK (2000); therefore the dataset of all the explanatory variables collected was for the period of 1977 – 1999. However, we updated the dataset on the durations of crises from CK (2003) and found 3 additional new crises episodes, i.e. Argentina (2001), Turkey (2000) and Uruguay (2002), which started since 2000. These episodes were dropped due to the extensive time and effort needed to collect the data on each of the explanatory variables.

economy in these countries is distinctive from the market economies. Sierra Leone, Congo Republic and El Salvador are also omitted, because these countries were affected by civil war for most of our study period. Some crises episodes are dropped because of non-availability of the data about the ending dates of the crises. Otherwise, we take all the crisis-episodes characterized by the so called "*systemic banking crises*" reported in CK (2003).

From the detailed crises information reported in CK (2003), we find that at least one of the two following conditions holds for most of the systemic crises to take place: 1) the ratio of non-performing loans to total assets is 10 percent or more, 2) the costs of the rescue operations is at least 2 percent of GDP.[47] In addition to the systemic crises, we also include some non-systemic (sometimes referred as the borderline or small scale) crises, as reported by CK (2003). To include these non-systemic crises, at least one of the two just mentioned conditions needs to hold. All together, we obtain 78 crisis-episodes in 64 countries which are reported in Table-2.

Table 2. Countries with banking crises

Country	Crisis starts	Dura-tion	Country	Crisis starts	Dura-tion	Country	Crisis starts	Dura-tion	Country	Crisis starts	Dura-tion
Algeria	1990	3	Djibouti	1991	3	Kuwait	1980	10	Senegal	1988	4
Argentina-1	1980	3	Ecuador-1	1980	6	Lebanon	1988	3	Spain	1977	9
Argentina-2	1989	2	Ecuador-2	1996	7c	Madagascar	1988	1	Sri Lanka	1989	5
Argentina-3	1995	3	Egypt	1980	6	Malaysia-1	1985	4	Swaziland	1995	1
Australia	1989	4	Equ. Guinea	1983	3	Malaysia-2	1997	6c	Sweden	1991	4
Bangladesh	1986	11	Finland	1991	4	Mali	1987	3	Tanzania	1986	14
Benin	1988	3	Ghana-1	1982	8	Mauritania	1984	10	Thailand-1	1983	5
Bolivia	1986	3	Ghana-2	1997	6c	Mexico-1	1981	11	Thailand-2	1997	6c
Brazil-1	1990	1	Guinea-1	1985	1	Mexico-2	1994	4	Togo	1993	3
Brazil-2	1994	6	Guinea-2	1993	2	Morocco	1980	6	Tunisia	1991	5
Burkina Faso	1988	7	India	1993	10c	Nepal	1988	1	Turkey	1982	4
Cameroon-1	1987	7	Indonesia-1	1992	3	Nicaragua	1985	12	Uganda	1994	9c
Cameroon-2	1995	4	Indonesia-2	1997	6c	Nigeria	1990	10	USA	1984	8
Central Afr.	1988	12	Israel	1977	7	Norway	1987	7	Uruguay	1981	4
Chad	1980	12	Jamaica	1996	7c	Panama	1988	2	Venezuela	1994	2
Chile	1981	3	Japan	1992	11c	Paraguay	1995	5	Vietnam	1997	6c
Columbia	1982	6	Jordan	1989	2	Peru	1983	8	Zambia	1995	1
CongoD. R.-1	1980	13	Kenya-1	1985	5	Philippines-1	1981	7	Zimbabwe	1995	8c
Congo D. R.-2	1994	9c	Kenya-2	1992	11c	Philippines-2	1998	5c			
Cote d'lvoir	1988	4	Korea, Rep.	1997	6c	Sao Tome P.	1980	20			

Note: 'c' refers to the continuation of crisis (e.g. 6c = duration observed for 6yrs and still continuing). The data source is Caprio and Klingebiel (2003).

[47] For the rest of the systemic crises, the conditions that apply include banking sector problems resulting in government intervention with measures such as large-scale nationalization of banks, or prolonged bank holidays, or closing banks, or merging large number of bank, or that banks with at least 10% of the total assets insolvent.

Table 3. Banking crises along with CRP measures enforced

			Containment phase		Rehabilitation and restructuring phase				
Country	Crisis starts	Dura-tion	Blanket guaranty	Open ended, extensive liquidity supply	Forbearance-A	Forbearance-B	Recapitalization	Asset Management Company centralized	Public debt relief program
Argentina-1	1980	3	**1**	0	0	**1**	0	0	**1**
Argentina-2	1995	3	0	0	0	0	0	0	0
Australia	1989	4	0	0	0	**1**	0	0	0
Brazil	1994	6	0	0	**1**	**1**	0	0	**1**
Chile	1981	3	0	**1**	0	**1**	0	0	**1**
Columbia	1982	6	**1**	**1**	0	0	0	0	0
Cote d'lvoir	1988	4	0	**1**	**1**	**1**	0	**1**	0
Ecuador-2	1996	7c	0	0	**1**	**1**	0	0	**1**
Egypt	1991	5	**1**	**1**	0	**1**	0	**1**	0
Finland	1991	4	**1**	**1**	0	**1**	0	**1**	0
France	1994	2	0	0	0	**1**	0	**1**	0
Ghana	1982	8	**1**	**1**	**1**	**1**	0	0	**1**
Indonesia-1	1992	3	0	0	0	**1**	0	0	0
Indonesia-2	1997	6c	**1**	**1**	0	**1**	**1**	**1**	0
Japan	1992	11c	**1**	**1**	0	**1**	**1**	0	0
Korea, Rep.	1997	6c	**1**	**1**	**1**	**1**	**1**	**1**	0
Malaysia-1	1985	4	0	**1**	0	**1**	0	0	0
Malaysia-2	1997	6c	**1**	0	0	**1**	**1**	**1**	0
Mexico	1994	4	**1**	**1**	0	**1**	**1**	**1**	**1**
NewZealand	1987	4	0	**1**	0	0	0	0	0
Norway	1987	7	**1**	**1**	0	**1**	0	0	0
Paraguay	1995	5	**1**	**1**	0	**1**	0	0	0
Philippines-1	1981	5	0	**1**	**1**	**1**	0	**1**	**1**
Philippines-2	1998	5c	0	0	0	0	0	0	0
Senegal	1988	4	**1**	**1**	0	**1**	0	**1**	**1**
Spain	1977	9	0	**1**	0	**1**	0	0	0
Sri Lanka	1989	5	**1**	0	0	**1**	**1**	**1**	0
Sweden	1991	4	**1**	0	0	0	0	**1**	0
Thailand-1	1983	5	0	0	0	**1**	0	0	0
Thailand-2	1997	6c	**1**	**1**	0	**1**	0	0	0
Turkey-1	1982	4	0	0	0	0	0	0	0
Turkey-2	1994	1	**1**	0	0	**1**	0	0	0
USA	1984	8	0	0	**1**	**1**	0	0	0
Uruguay	1981	4	**1**	**1**	0	**1**	**1**	**1**	**1**
Venezuela	1994	2	0	**1**	0	**1**	0	0	0

Note: 'c' in column 3 refers to the continuation of crisis (e.g. 6c = duration observed for 6yrs and still continuing).

The data on CRP measures are lacking for many of the crisis-episodes reported in Table 2. The data with CRP measures are available for 40 crisis-episodes and it comes from HK (2000). As the centrally planned and transitional economies are excluded,

we obtain the data for 35 crisis-episodes and it is reported in Table 3. All of the episodes, except 3, are found to use some CRP measures.

Durations of 31 episodes in the table match with the durations of the episodes reported in Table 2,[48] but the remaining four (Egypt-1991, France-1994, New Zealand-1987, and Turkey-1994) do not. Nevertheless, these 4 episodes belong to the group of "non-systemic banking crises", as reported by CK (2003).[49] In Table 3 the value "1" implies that the respective CRP measure is in force and "0" implies that it is not.

We plot a histogram graph (Figure 1) of the crisis-episodes for which the durations are complete (28 crisis-episodes). We find that most of the crisis-episodes last for 4 years. More than 64% of the episodes are within the range of 3-5 years in duration. The shortest duration is 1 year and occurred only once. The longest duration is 8 years and occurred 3 times.

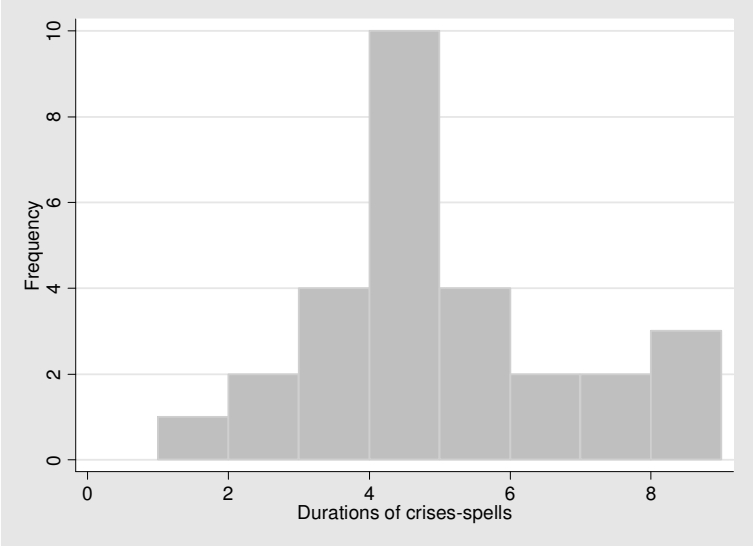


Figure 1. Crisis-episodes with CRP measures for which the durations are complete

[48] The beginning and ending years for some of the crises spells are slightly different between CK (2003) and HK (2000). In that case, we follow the length reported in CK (2003) because their data are more reliable and richer.

[49] In the regression we use both of the samples with all 35 crises spells and with 31 crises spells.

3.2 Measuring the explanatory variables

CRP measures

All the CRP measures mentioned in section two relax the existing policy regulations of a banking system. We use a dummy variable for each of the CRP measures. The dummy variable takes the value '0' when the CRP measure to test is absent and it takes '1' if the CRP measure is used.

The variable "*Blanket guaranty*" takes the value '1' if in a measure the government either issues an explicit guarantee to all depositors, or the market participants are implicitly protected from losses through the stipulation that public banks' market share exceeds 75 percent.

The variable "*Open ended, extensive liquidity supply*" takes the value '1' if in a measure the government extends liquidity support (often at below-market rate) for more than 12 months and the overall support are greater than the total banking capital.

The variable "*Forbearance-A*" takes the value '1' if in a measure the banks are permitted to continue operation despite being insolvent.

The variable "*Forbearance-B*" takes the value '1' if in a measure either the variable "Forbearance-A" is applied or other bank prudential regulations are suspended, or not fully applied.

The variable "*Recapitalization*" takes the value '1' if in a measure the banks are recapitalized or repeatedly recapitalized.

The variable "*Public debt relief program*" takes the value '1' if in a measure the government implements a broad public debt relief program. This program is for corporations or other types of borrowers to facilitate their debt repayments, and it includes an exchange rate guarantee program or the rescue of corporations.

Finally, the variable "*Asset management company*" takes the value '1' if in a measure the government sets up a centralized asset management company.

Formulation of the explanatory variables other than the CRP measures and their data sources are reported in Table-4.

Table 4. Formulation and data sources of the variables other than the CRP measures

Variables	Definition	Sources
GDP growth rate	= $\{(G_t - G_{t-1})/G_{t-1}\}$*100, G_t = (*yearly GDP at current price*) / (*consumer price index*) at time t[50]	International Financial Statistics (IFS)
Terms of trade change	=$\{(T_t - T_{t-1})/T_{t-1}\}$*100, T_t = (the unit value of export) / (the unit value of imports), at time t	IFS
Inflation rate	= $\{(p_t - p_{t-1})/p_{t-1}\}$*100, where p = consumer price index	IFS
Depreciation rate	= $\{(D_t - D_{t-1})/D_{t-1}\}$*100, D_t = exchange rate (national currency per USD) at time t.	IFS
Real interest rate	= $d - i$, where d = nominal deposit rate (or central bank discount rate if deposit rate is absent) and i = contemporaneous rate of inflation	IFS
M2 / Foreign exchange reserves	= (*M2/F*), where *M2* = the broad money and is drawn from line 34 + the quasi-money in line 35 in IFS and F = foreign exchange reserves, (both converted into national currency)	IFS
Govt. budget surplus / GDP	= (*government budget surplus / GDP*)*100	IFS
Private domestic credit / GDP	= (*Domestic credits to private-sector / GDP*)*100; both are computed at current price	IFS
Banks' cash reserve / Total assets	= (*BLR / BTA*)*100, where *BLR* = banks' liquid reserves; drawn from line 20 of IFS and *BTA* = banks' total assets; drawn from line-21 + line-22a + line-22d	IFS
Private domestic credit growth$_{t-2}$	= $(C_t - C_{t-1})/C_{t-1}$; C_t = (*total domestic-credits used by the private sectors*) / (*consumer price index*), at time t	IFS
Average private domestic credit growth	Private domestic credit growth averaged over the crises episodes last, for which the values are available.	IFS
GDP / Capita	Ratio of GDP (in US Dollar) to total population	IFS
DIS (Deposit insurance scheme)	A dummy takes 1 if there used an explicitly formed DIS, otherwise 0	Garcia (1999), McCarthy (1980), Talley and Mas (1990), De Lange (1992), and Kyei (1995)

Note that the observed values for all the variables, except the private domestic credit growth, are taken at the time the crises begin. As mentioned in the table, the observed values for one of the variables of private domestic credit growth are lagged by 2 years the crises begin and for another the values averaged over the durations of crises.

4 Empirical analyses

4.1 Descriptive statistics: durations of crises and the CRP measures

We can analyze the relative effectiveness of the CRP measures by using descriptive statistics. In the statistics, we can compare the average duration of crises when a CRP is used with the average duration of whole crises. Table-5 below reports the descriptive statistics of the durations of crises (i.e. the mean, the minimum, and the maximum durations of crises) in conjunction with the CRP measures present or

[50] In order to obtain the real GDP value, GDP deflator can be used. However, in our data source, deflator values are missing for many of the sample countries.

absent. The numbers reported in the table are derived from the sample of crisis-episodes with durations complete (28 episodes), while the numbers in the parentheses are from the sample with durations both complete and incomplete (35 episodes).

The statistics might be different for the sample of crises with durations complete from the sample of crises with durations both complete and incomplete. In our case, however, they are much the same. Here we mainly focus on analysing the descriptive statistics derived from the sample of crises with only the durations complete. The average duration of total crises in the sample is 4.57. The measure "*Blanket guarantee*" was enforced (i.e. the variable takes the value '1') in about 46% of the cases (from the data of Table-3). The average duration of the crises in this case, 4.62, is about the same as the average duration of the total sample crises.

The measure "*Open ended, extensive liquidity supply*" was implemented in about 57% of the cases. The average duration of crises with this measure present, 5.00, is higher than the average duration of the total crises, indicating that the use of liquidity support is likely to be associated with longer crises.

The measure "*Forbearance-A*" was applied in about 18% of the cases. The average duration of crises with this forbearance present, 6.6, is much higher than the average of the total crises. This indicates that the presence of this measure could be associated with long-lasting crises.

Table 5. Lengths of crises in conjunction with the CRP measures present or absent

	No. of crises	Mean duration of crises	Min	Max.
Total Crises	28 (35)	4.57 (5)	1 (1)	9 (11)
Blanket guaranty present	13 (18)	4.62 (5.28)	1 (1)	8 (11)
Blanket guaranty absent	15 (17)	4.53 (4.70)	2 (2)	9 (9)
Open ended, extensive liquidity supply present	16 (20)	5.00 (5.45)	2 (2)	9 (11)
Open ended, extensive liquidity supply absent	12 (15)	4.00 (4.40)	1 (1)	8 (8)
Forbearance-A present	5 (7)	6.60 (6.57)	4 (4)	8 (8)
Forbearance-A absent	23 (28)	4.13 (4.60)	1 (1)	9 (11)
Forbearance-B present	23 (29)	4.65 (5.13)	1 (1)	9 (11)
Forbearance-B absent	5 (6)	4.2 (4.33)	3 (3)	6 (6)
Recapitalization present	3 (7)	4.33 (6.00)	4 (4)	5 (11)
Recapitalization absent	25 (28)	4.60 (4.75)	1 (1)	9 (9)
Public debt relief program present	8 (9)	4.87 (5.11)	3 (3)	8 (8)
Public debt relief program absent	20 (26)	4.45 (4.96)	1 (1)	9 (11)
Asset Management Company centralized	10 (13)	4.30 (4.69)	2 (2)	7 (7)
Asset Management Company decentralized	18 (22)	4.72 (5.18)	1 (1)	9 (11)

The measure "*Forbearance-B*" was used in about 82% of the cases. The average duration of crises with this forbearance present, 4.65, is not much different from the average of the total crises. That is, initiating this forbearance may not make a significant change to the duration of a crisis.

The measure "*Recapitalization*" was used in about 10% of the cases only, which is a very low or insignificant use. The average duration of crises with this measure present, 4.33, is little lower than the average of the total crises. It is unlikely that this measure will produce any significant change on the durations of crises because of the very limited use of this measure and the fact that the average duration of crises does not differ much from the total's average. However, there is an exception to this measure. When we consider the sample of crises with durations both complete and incomplete (given in parenthesis), the statistics is different. The average duration of crises in the presence of this measure is then higher than the average of the total.

The measure "*Public debt relief program*" was initiated in about 29% of the cases. In its presence the average duration of crises, 4.87, is higher than the average of the total. This indicates that the presence of this program could be associated with long-lasting crises.

Finally, the use of centralized "*Asset Management Company*" is found in about 36% of the cases. With this measure present the average duration of crises, 4.3, is lower than the average of the total, indicating that a centralized AMC could produce a negative association with the durations of crises.

4.2 Estimation model

Empirical analysts very often begin estimation with the ordinary least square (OLS) model. However, there is a problem in using the OLS model in this study. A part of the crises in our sample are incomplete and the OLS model does not differentiate between the complete and the incomplete crises. In this case estimating the explanatory variables associated with the durations of crises using the OLS model will not give us the robust results. One way to circumvent this problem is to use OLS model taking the sample of crises with durations only complete, but this reduces the sample size. Another option is to use a *duration estimation model*, in which the crises with durations incomplete do not need to be dropped out.

A duration model confirms the robustness of the results by taking into account the censoring problems resulted from crises with ongoing durations. We have the right, but no left, censoring problems, because the durations of some crises in our sample did not end within the study period.[51] Still the question of using the duration model could arise since we use annual data. Duration models using annual data, however, have been estimated by e.g. Miranda (2006) and Mata and Portugal (1994).[52] A brief analysis of a duration model, much of which is developed from Kiefer (1988), is as follows.

Hazard function, $\lambda(t)$, describes the probability that a switch will occur conditional on the spell surviving through time *t*. When $\lambda(t)$ increases in *t*, the hazard function is said to exhibit positive duration dependence and the opposite occurs when $\lambda(t)$ decreases in *t*. Hazard function is defined as follows,

$$\lambda(t) = \lim_{\Delta t \to 0} \frac{P(t \le T < t + \Delta t | T \ge t)}{\Delta t} = \frac{-d \log S(t)}{dt} = \frac{f(t)}{S(t)}$$

Where *T* refers to the duration of a spell, *t* to the realization of *T* of the spell, *S*(*t*) the survival function[53] and *f(t)* the density function of the spell.

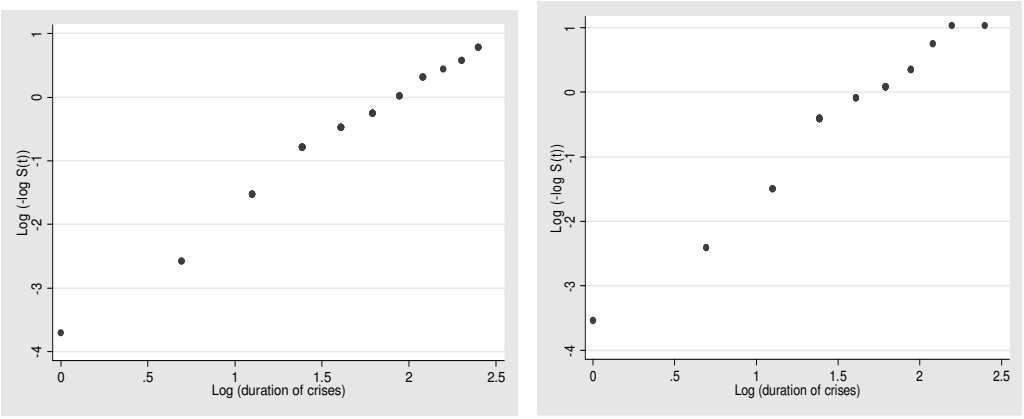
The frequently used model for adjusting survival functions for the effects of covariates is the proportional hazard model. In the proportional hazard model, the concomitant covariates have a multiplicative effect on the hazard function

$$\lambda(t, x, \beta, \alpha) = \varphi(x'\beta)\, \lambda_0(t,\alpha).$$

$\lambda_0(t, \alpha)$ is called the baseline hazard corresponding to $\varphi(.) = 1$. A popular choice is to let $\varphi(x'\beta) = \exp(x'\beta)$. The hazard, when all covariates are zero, is actually equal to $\lambda_0(t, \alpha)\exp(\beta_0)$. That is, the intercept term serves to scale the baseline hazard. The function $\lambda_0(t, \alpha)$ may be left unspecified in which case Cox proportional hazard model is used. It may take a specific parametric form as well. There are two well-known distributions, exponential and Weibull, for the specific parametric form. If we let $\lambda_0(t,$

[51] The problem is left censoring if the ending date of a spell is within the sample period but not the starting date, while it is right censoring if the starting date is within but not the ending date.
[52] Duration model is mostly used in microeconomics with micro data, where time units usually constitute an hour, a day, and a month.
[53] $S(t) = \Pr(T \ge t)$, which yields the probability that the spell duration T lasts at least to time t.

$\alpha) = \alpha t^{\alpha-1}$, in exponential distribution $\alpha = 1$ and $\lambda_0(t, \alpha) = 1$, and in Weibull distribution α is greater or less than '1' which is estimated from the sample. $\alpha>1$ implies that the hazard is positive duration dependent and the opposite holds for $\alpha<1$.



a) The sample of crisis-spells without CRP measures used in the final regression (presented in column 1 of Table-6)

b) The sample of crisis-spells with CRP measures

Figure 2. The plot of *log*(*-logS*(*t*)) vs. *log*(*duration-of-spells*)

Having a non-parametric estimation analysis, we find that the survival values for our data are not linearly related with the durations of crisis-spells (i.e. $\alpha \neq 1$). The details of our non-parametric estimation are reported in the appendix. A graphical plot of *log*(*-logS*(*t*)) vs. *log*(*durations-of-spells*) helps us to identify the proper distribution of a duration model fit. The plot looking like linear hints the distribution to fit the Weibull model.

In Figure-2 (a), the plot represents a sample of 41 crisis-spells without the data of CRP measures. The sample is used in estimating the explanatory factors, other than the CRP measures, of the durations of crises (results reported in Table 6 later). The plot of Figure-2 (b) represents the sample of 35 crisis-spells with the data of CRP measures (as reported in Table-3). Both of the plots hint that using a Weibull distribution is better than the Exponential one. However, we can still reconfirm that the distribution is Weibull by looking at the estimated value of α, which should be greater than '1' and statistically significant.

The estimation of β and of the ancillary parameter α is done via a maximum likelihood method. A subject known to fail at time t_j contributes $f_j(t_j)/S_j(t_{0j})$ – the value of the density at time t_j conditional on the entry time t_{0j} – to the likelihood function. On the other hand, a censored observation only known to survive up to time t_j

contributes $S_j(t_j)/S_j(t_{0j})$ – the probability of surviving beyond time t_j conditional on the entry time t_{0j}. The log-likelihood is thus given by

$$\ln L = \sum_{j=1}^{n} \left\{ d_j \ln f_j(t_j) + (1-d_j) \ln S_j(t_j) - \ln S_j(t_{0j}) \right\}.$$

Where $d_i = 1$ if the ith spell is uncensored and = 0 if censored, t_j is the analysis time when spell record ends, and t_{0j} is the analysis time when spell record begins (which is always '0' in our case). Note that we use the single record data – a single observation for each of the explanatory variables we use is taken as oppose to each of the crisis-spells[54]. Otherwise mentioned, the observations are taken for the years when the crisis-spells begin. The regression parameters β and the ancillary parameter α are implicit in the above log-likelihood expression. They both are components of the chosen $S_j(t)$ and its corresponding $f_j(t)$.

We take the *robust* standard errors (see e.g. Huber, 1967 and White, 1980), according to which the standard errors are adjusted for countries' clustering. The robust method is used for the weak assumption that ($\mathbf{x}_i$, $\boldsymbol{\epsilon}_i$) are independently but not necessarily identically distributed, where $\mathbf{x}_i$ and $\boldsymbol{\epsilon}_i$ are the regressors and the error terms respectively. Note that a point estimate b (the estimated coefficient of $\mathbf{x}_i$) is the same for both the conventional (where $\mathbf{x}_i$ and $\boldsymbol{\epsilon}_i$ are independently and identically distributed) and the robust standard errors.

4.3 Regression results

4.3.1 Explanatory variables other than the CRP measures

First we estimate the factors, other than the CRP measures, that are associated with the durations of crises so that these can be used as the control variables when we estimate the effects of CRP measures. All the variables listed in Table 4 of Section 3 are included in the test.

[54] The reason of not using the multiple record data is that complete observations of many explanatory variables we use in the regression are not available for years the crises spells last. Thus we get a high number of missing values for different explanatory variables and the estimation result becomes spurious or misleading.

All 78 crisis-episodes reported in Table 2 could be used if there were no missing data for the explanatory variables we include. However, there are many missing data (see the summary statistics in Table-A2 of appendix). In addition to the missing data, the sample size decreases as we drop out some observed values of the variables. These values are outliers as the estimation results of the variables are markedly changed if we run the regressions with these values. The outlying observations and the corresponding variables are reported in Table A3 of the appendix.

In our estimation technique, we first use the explanatory variables all together and then each independently. This type of estimation technique is followed in many empirical studies (see for instance Klein 1996). There are also other reasons for choosing this technique. Error because of omitted variables is reduced if we estimate an equation by taking all the variables together. On the other hand, since there are missing values, the highest number of observations can be used only when we estimate each of the explanatory variables independently.

Table-6 reports the estimation results obtained with the duration model. The first column shows the result of all the explanatory variables together. In the column, the variable for terms of trade change is not included. This variable is not statistically significant either it is tested independently or jointly with others (results not reported). However, taking this variable in conjunction with others simply reduces the number of observations, since it has the lowest number of observations (see the summary statistics in Table A2 of the appendix). The next two columns show the results of each variable tested independently (the parameters found statistically significant are only reported).

In the duration model the sign of a coefficient indirectly indicates the covariate's relation with the durations of spells - because it estimates the hazard of ending the spells, not the durations of the spells directly. The hazard sign goes in the opposite direction to the duration of a spell. A unit change in a covariate x corresponds to (exp(coefficient of x) – 1)*100) percentage change in the hazard function. The number of failures (i.e. the number of spells with durations complete) and the *time at risk* (i.e. the sum of the durations of all completed spells or censored spells) are reported in addition to the number of observations.

We find that the *real interest rate* is negatively associated with the hazard of crisis-spell. That is, the duration of a crisis is longer if it begins during a period of high real interest rate. This finding is in line with other studies on banking crises. For instance,

DKD (1999 and 2005) find that a crisis is more likely to occur when the real interest rate increases. High real interest also makes a banking crisis more costly, as DKD (1999) find.

Table 6. Estimating the hazard function of crisis-spells taking the explanatory factors other than the CRP measures

Dep. Var. = hazard of crisis-spells	(1)	(2)	(3)
GDP growth rate	.0441 (.032)		
Inflation rate	-.0106 (.0165)		
Depreciation rate	.0005 (.0146)		
Real interest rate	-.032** (.015)		
Govt. budget surplus / GDP	.0713 (.075)		
M2 / Foreign exchange reserves	-.0002 (.0012)		
Private domestic credit / GDP	-.0331** (.0156)		
Private domestic credit $growth_{t-2}$	.0373** (.0175)	.0140*** (.0047)	
Average private domestic credit growth	.0435 (.0268)		-.015* (.0082)
Banks' cash reserve / Total assets	-.0465*** (.0160)		
DIS	-.9938** (.4796)		
GDP / Capita	.0503 (.0333)		
α	3.018*** (.7234)	2.066*** (.2096)	1.96*** (.177)
Constant	-3.96*** (1.24)	-4.198*** (.4809)	-3.90*** (.404)
No. of Obs.	41	62	62
No. of Failures	31	50	50
Time at Risk	237	374	374
Log-likelihood	-27.27	-57.37	-58.64
Wald Chi^2	46.32	8.69	3.34
Prob > Chi^2	0.0000	0.0032	0.0674

We have reported the estimated coefficients of the variables and the standard errors (in the parentheses). *, **, and *** refer to 10%, 5%, and 1% significance level respectively.

The duration of a crisis is longer when it begins during a term of higher *ratio of domestic credit in the private sector to GDP*, which implies a larger exposure of the banking sector to the private sector borrowers. Similarly to the finding on real interest rate, the finding of this variable is in line with other studies on banking crises. DKD (1999 and 2005) find the variable to be positively related with the likelihood of crises

and also with the costs of crises. Komulainen and Lukkarila (2003) find that this variable is positively related with the likelihood of currency crises as well. In all, it implies that although the expansion of the private sector is the fundamental basis of a capitalist and market economy, a higher ratio of domestic credit increases the probability of crisis, its costs, and makes the crisis-spell last longer. Of course, a major cause could be the inefficient management of the domestic private sector.

The *growth of real private domestic credit lagged by two years* is significant having a negative relation with the durations of crises. This implies that the crisis-spells which are preceded by the liberalized financial systems, implying the increases of the real private domestic credits, do not in fact last long. Those crises are recovered rapidly. However, our finding on this variable is different from others on the issue of banking crises. For instance, DKD (1999, 2002 and 2005) find a similar variable to be positively related with the likelihood of crises and the costs of crises.[55] Komulainen and Lukkarila (2003) also find that a similar variable is positively related with the likelihood of currency crises.

The estimation results show that the durations of crises do not last long if the beginning of crises coincides with the liquidity shortage of banks. Although the shortage of *banks' cash reserve* is found by DKD (1999) to be one of the causes (at weak significance level) of banking crises,[56] we find that a crisis-spell developing from the liquidity shortage is in fact recovered relatively faster. Evidently, the crises spells of Sweden (1991-94), Australia (1989-92), Indonesia (1992-94), Thailand (1983-87), and Finland (1991-94) began with the shortage of banks' cash reserve and lasted relatively shorter than those in Ecuador (1980-85), Nicaragua (1985-96), Burkina Faso (1988-94), Columbia (1982-87), Israel (1977-83), Peru (1983-90), Ghana (1982-89), and of Mexico (1981-91), which began with relatively high banks' cash reserve.

Another significant explanatory variable is the implementation of explicitly formed deposit insurance scheme (DIS). The sign implies that the crises spells developing with the existence of explicitly formed DIS last long, perhaps because the scheme is not supported by a well-designed and effective system. It is also possible that the

[55] DKD (1999) have used the growth of total, instead of private, domestic credits. However, the aim of using this factor – as the proxy of financial liberalization – is the same in DKD's two other papers, as it is in our study.

[56] However, the result is different in the case of currency crises, as Komulainen and Lukkarila (2003) find that banks' cash reserve is positively related (not statistically significant) with the likelihood of currency crisis in the emerging economies.

prudential regulation and the efficient supervision of banks are lacking. Consequently excessive risk-taking on the part of bank management is possible. For similar reasons DKD (1999, 2002 and 2005) find that the use of explicitly formed DIS to be positively related with the probability of banking crises and with the costs of crises.

When each of the variables is tested independently, most of the variables still hold the similar signs. However, none of the variables are statistically significant, except the growth of real private domestic credits lagged by two years and this growth with its average over the period of crisis-spells last. The results with the variables found significant are only reported in Table-6. Average growth of real private domestic credits is found to be positively related (at weak significance level) with the length of crisis-spells, which is different from the relationship of the growth of real private domestic credits lagged by two years. That is, the financial sector reform with an aim of lowering the private domestic credit growth is essential immediately after the onset of a crisis in order to shorten the crisis-spell.

Like the growth of real private domestic credits, we also estimate all other variables reported in Table 4 by taking their average over the periods the crisis-spells last. We estimate each independently and also taking all of them together, but none of those variables are significant (the results are not reported).

4.3.2 CRP measures and the durations of crises

This subsection focuses on examining the effects of CRP measures on the durations of crises, where the duration estimation model is used. Table 7 reports the estimation results. All the CRP variables reported in Section 3 are included. The variables found significant in Column 1 of Table 6 are used as the control variables. The number of observations, the number of failures and the time at risk in Table 7 are respectively 34, 27 and 169. As mentioned early, only 3 of the crisis-episodes in our dataset with CRP measures found without using any kinds of CRP measures. Thus we focus on the relative effectiveness of the CRP measures in terms of the durations of crises.

Amongst the measures, the most unfavorable one is "*Forbearance-A*", i.e., the most accommodating forbearance of bank regulations as it allows the insolvent banks to remain operative. This measure is found to be strongly significant (at 1% level) and negatively related with the hazard function. The hazard value is reduced by about 78% for switching from no application to the application of this forbearance. The

result implies that permitting the regulation forbearance in order to keep the insolvent banks operating not only increases the costs of crises as HK (2003) find, it also increases the durations of crises. The reason could be that this forbearance allows the bank managements of the insolvent banks to play undue role for the personal benefit on their own, i.e. the moral hazard problem. The managements of the solvent banks may also take the advantage of the forbearance by signifying themselves as insolvent. Thus the destabilization of the already distressed banking system rather enlarges.

Table 7. Estimating the hazard function of crisis-spells: the effects of CRP measures

Dep. var. = hazard of crises spells	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Real interest rate	-.048* (.025)	-.052** (.025)	-.0249 (.026)	-.047* (.025)	-.044## (.030)	-.044* (.026)	-.048* (.026)
Private domestic credit / GDP	-.04*** (.013)	.037*** (.013)	-.047*** (.014)	-.039*** (.013)	-.038*** (.015)	-.047*** (.016)	-.039*** (.0147)
Private domestic credit growth$_{t-2}$	.008 (.015)	.009 (.015)	.002 (.013)	.007 (.016)	.0089 (.015)	.0125 (.0143)	.0099 (.0141)
Banks' cash reserve / Total assets	-.065*** (.018)	-.057*** (.015)	-.057*** (.019)	-.06*** (.016)	-.058*** (.017)	-.06*** (.017)	-.059*** (.017)
DIS	-.572 (.443)	-.59 (.434)	-.285 (.462)	-.532 (.461)	-.502 (.504)	-.431 (.429)	-.575 (.444)
Blanket guaranty	.220 (.423)						
Open ended, extensive liquidity supply		-.234 (.411)					
Forbearance-A			-1.51*** (.520)				
Forbearance-B				-.246 (.441)			
Recapitalization					-.288 (.588)		
Public debt relief program						-.692## (.478)	
Asset Management Company							.0845 (.401)
α	3.01*** (.551)	2.9*** (.512)	3.46*** (.647)	2.99*** (.527)	2.91*** (.524)	3.10*** (.529)	2.96*** (.505)
Constant	-2.68*** (.736)	-2.5*** (.657)	-2.88*** (.86)	-2.44*** (.672)	-2.58*** (.658)	-2.4*** (.765)	-2.65*** (.825)
Log-likelihood	-19.37	-19.36	-15.64	-19.39	-19.40	-18.53	-19.47
Wald Chi^2	17.54	15.76	24.58	15.75	18.81	16.18	20.08
Prob > Chi^2	0.0075	0.0151	0.0004	0.0152	0.0045	0.0128	0.0027

***, **, * and ## refer to 1%, 5%, 10% and 15% significance level.

CRP variable with "*Public debt relief program*" is significant at weak level (15% level) of significance. The hazard value is reduced by about 50% if this program is adopted. As said earlier, government implements this debt relief program with an aim to help credit borrowers by relieving them from repaying their obligations. The

program probably worsens the distressed banking situation by attracting borrowers who would not be able to pay debts even in good times. Like the most accommodating forbearance, this debt relief program is also found to increase the costs of crises in HK (2003).

Rests of the CRP measures are found to be statistically insignificant to have any relation with the durations of crises. Two of the measures "Blanket guarantee" and "Asset Management Company" are even found to have positive relation with hazard function. That is, the blanket guarantee during the panicking stage of crisis and also the use of a centralized Asset Management Company reduce the durations of crises.[57]

In order to estimate the CRP variables with all 35 observations, as reported in Table 3, we drop the variable "Real interest rate" from the regression as it contains one missing value (results reported in Table A4 of the appendix). Estimation results remain much the same as those above. However, the level of significance with the CRP variable "*Public debt relief program*" improves (significant at 10% level). An alternative procedure to use all 35 observations is to replace a predicted value of the real interest rate in its missing value. Doing also such a procedure, we find much the similar results with the CRP variables, where the significance level with the public debt relief program is improved (at 11% level) as well.[58] The result is not reported.

Thus our overall arguments are as follows. Once a country is in trap of banking crisis, the government might feel less confident to have any alternatives other than taking some CRP measures. The reason is otherwise the government does not know how long the crisis would last. If so, we propose the government to avoid using the CRP measures like the most accommodating forbearance of bank regulations that keep insolvent banks in operation and also the measure of public debt relief program. The government can choose some CRP measures with possibly the least adverse effect in terms of durations of banking crises. In this regard the CRP measures having the least possible adverse effect are the blanket guarantee and the use of centralized Asset Management Company. The next set of CRP measures to choose is the liquidity

[57] Klingebiel (2000) and Calomiris et al (2004), through case studies, find a mixed success record of using the centralized Asset Management Company in achieving the goal of hastening the recovery of crisis-spells. In addition, HK (2000) find its relation with the recovery costs of crises to be insignificant.

[58] In this procedure, "Real interest rate" is estimated first using the OLS model and then find its predicted values. The explanatory variables used are *the ratio of private domestic credit to GDP*, *private domestic credit growth lagged by two years*, *the ratio of banks' cash reserve to total assets*, *deposit insurance scheme*, and *GDP per capita*.

support, recapitalization of banks and the regulation forbearance allowing the lesser degree of lenience towards banks.[59]

The time parameter of hazard function

The time parameter of hazard function is given by "α." It can be seen from all of the regressions in Tables 6 and 7 that α is strongly significant and its coefficient is greater than one. This implies that the Weibull distribution model performs better than the Exponential one. In addition, $\alpha > 1$ implies that the hazard function exhibits positive duration dependence, i.e., the probability of ending a crisis-spell increases by itself as the spell grows older. This observation of the time parameter on a crisis-spell is supported by Abderrezak (2000).

The quality of regression model

The quality of a regression model in the duration model is evaluated by the log-likelihood value, the Wald-chi-squared value, and the joint significant level (Prob > chi^2) of the estimated parameters. The higher Wald-chi-squared value, lower Prob>chi^2 value, and the higher log-likelihood value imply the better quality of a regression model.

4.3.3 Robustness of the estimation results

There could be a potential problem of simultaneity bias here. That is, a severe crisis, which is likely to last long, may have triggered the adoption of CRP measures. If this is so, the effects of the CRP measures estimated above are contaminated. We need to verify that our results are not contaminated by the reverse causality. To do so we use an instrumental variable estimation, where we try to purge the endogenous components of the CRP measures in the first step of a two-step estimation approach. In a nutshell, in the first step, CRP measures are the dependent variables and are estimated from a number of explanatory variables where there is at least one variable that is uncorrelated with the durations of crises. In the second step, we estimate the

[59] The regulation forbearance allowing the lesser degree of lenience towards banks could be e.g. over looking violations of laws, standards and regulations by individual banks, business deregulation on banking designing to introduce new profit opportunities to weak banks and so on.

benchmark columns (the columns of Table 7) with the predicted values of adopting CRP measures estimated in the first step.

Table 8. Durations of crises and the CRP measures: two-step estimation

a) OLS estimation model: CRP-measures as the dependent variables

	Blanket guaranty	Open ended, extensive liquidity supply	Forbearance-A	Forbearance-B	Recapitalization	Public debt relief program	Asset Management Company
Private domestic credit / GDP	.0026 (.0027)	.0028 (.003)	.0005 (.0018)	.005** (.002)	.0048 (.003)	-.001 (.001)	.003 (.003)
Corruption	-.049 (.074)	-.064 (.068)	-.085* (.047)	-.081## (.053)	-.058 (.050)	-.106*** (.03)	-.052 (.07)
Crises-around	.092 (.072)	.031 (.072)	-.014 (.057)	.017 (.045)	.068 (.048)	.0127 (.058)	.117* (.05)
Constant	.321 (.360)	.586* (.317)	.529** (.255)	.832*** (.23)	-.001 (.20)	.704*** (.25)	.091 (.279)
F-values	1.30	0.53	1.15	2.05	1.29	5.01	1.95
Prob > F	0.2914	0.6672	0.3451	0.1276	0.2962	0.0060	0.1416
R-squared	0.0930	0.0440	0.0840	0.1458	0.1681	0.1967	0.1530
Root MSE	.50576	.51414	.40679	.37012	.38765	.41623	.4725

***, **, * and ## refer to 1%, 5%, 10% and 15% significance level.

b) Estimating the hazard function of crisis-spells: the effects of predicted CRP-measures

Dep. Var. = hazard of crises-spells	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Real interest rate	-0.056** (0.028)	-0.048* (0.026)	-0.039 (0.026)	-0.045* (0.026)	-0.053** (0.027)	-0.043* (0.026)	-0.057** (0.028)
Private domestic credit / GDP	-0.041*** (0.013)	-0.039*** (0.014)	-0.048*** (0.016)	-0.037*** (0.014)	-0.043*** (0.014)	-0.046*** (0.016)	-0.042*** (0.013)
Private domestic credit $growth_{t-2}$	0.010 (0.015)	0.009 (0.015)	0.007 (0.015)	0.008 (0.015)	0.010 (0.015)	0.008 (0.015)	0.009 (0.015)
Banks' cash reserve / Total assets	-0.071*** (0.015)	-0.060*** (0.016)	-0.051*** (0.019)	-0.056*** (0.016)	-0.067*** (0.015)	-0.055*** (0.017)	-0.073*** (0.015)
DIS	-0.771* (0.473)	-0.553 (0.428)	-0.307 (0.457)	-0.459 (0.430)	-0.702 (0.451)	-0.420 (0.435)	-0.790* (0.480)
Blanket guaranty - Predicted	1.829 (1.430)						
Open ended, extensive liquidity supply- Predicted		-0.130 (1.580)					
Forbearance-A- Predicted			-2.776** (1.294)				
Forbearance-B- Predicted				-1.001 (1.215)			
Recapitalization- Predicted					1.243 (1.519)		
Public debt relief program- Predicted						-1.098 (0.920)	
Asset management company- Predicted							1.734## (1.200)
α	3.061*** (0.491)	2.951*** (0.506)	2.977*** (0.518)	2.941*** (0.513)	3.006*** (0.496)	2.943*** (0.516)	3.086*** (0.489)
Constant	-3.338*** (0.768)	-2.516*** (0.980)	-1.915** (0.863)	-1.934* (1.083)	-2.585*** (0.684)	-2.107** (0.837)	-2.998*** (0.675)
Log-likelihood	-18.69	-19.49	-18.45	-19.33	-19.19	-19.19	-18.46
Wald Chi^2	24.57	16.34	17.5	14.37	20.88	14.02	26.31
Prob > Chi^2	0.0004	0.012	0.0076	0.0258	0.0019	0.0294	0.0002

We use corruption (the higher the value, the lower the corruption) as an instrument of CRP measures, which is positively related with the adoption of CRP measures, but has no link with the durations of crises. This instrument is technically supported by HK (2003), who argues that corruption has no link with the costs of crises, but is positively linked with the adoption of CRP measures. The number of crises simultaneously occurring around the globe, i.e., "*Crises around*", is also used as an instrument of CRP measures. The assumption is that the greater the number of crises occurring simultaneously around the globe, the greater the panic of the central authority, which triggers the adoption of a CRP measure. The ratio of private domestic credit to GDP, i.e., the degree of the banking sector's exposure to the private sector borrowers, is also used as an explanatory variable of CRP measures; the assumption is that the greater the exposure of the banking sector to private sector borrowers, the stronger the incentive of the government to adopt a CRP measure to protect the private sector.

Tables 8(a) and (b) report the results of the two-step estimation approach. The results of the first step estimation using an OLS model are reported in Table 8(a). Robust standard errors are taken. Both of the variables "corruption" and "crises-around" have the expected signs in almost all of the regressions in the table. However, not all are statistically significant. The ratio of private domestic credit to GDP has also the expected sign in almost all regression columns, but the parameter is insignificant in most of the cases.

As can be seen from Table 8(b), CRP measures with their predicted values still have much the similar signs and the significance levels as those in Table 7. Forbearance-A with its predicted values is still the significant CRP measure having positive relation with the durations of crises. Thus the effects of the CRP measures on the durations of crises derived in Table 7 should not be of suspicion because of the reverse causality.

Estimation by OLS model

We also estimate OLS model using the sample of crisis-spells with only the durations complete; thus many crisis-spell observations are dropped out because of their incomplete durations. The result with the explanatory variables other than the CRP measures is reported in Table A5 of the appendix. The results show that some of the explanatory variables, which were found significant in the duration model, are still

significant with the similar signs. For example, the ratio of banks' cash reserve to total assets, private domestic credit growth lagged by two years, and the average private domestic credit growth are significant with the similar signs (the latter two variables are significant only when each is tested as the sole independent variable). Although not statistically significant, the ratio of private domestic credit to GDP and the deposit insurance scheme still exhibit the similar signs (real interest rate has a similar sign only when tested as the sole independent variable).

Results with the OLS model show that the variable for the government's fiscal position, i.e., the ratio of government budget surplus to GDP, is significant and has a negative relationship with the duration of crisis. This implies that the greater the government's budget surplus, the shorter the duration of crisis. This variable has the same sign in the duration model (Table 6) as well, but is not statistically significant. Abderrezak (2000) in his duration model finds that the government's fiscal position is negatively associated with the length of banking crisis.

OLS estimation results with the CRP measures are reported in Table A6 of the appendix. The sample takes the crisis-spells for which the durations are complete. The effects of the CRP measures on the durations of crises remain much the same as that depicted in the duration model of Table 7. Forbearance-A is still the only strongly significant CRP measure.

Further robustness

A duration model is estimated by using the sample of 31 crisis-spells with CRP measures, i.e. dropping 4 crisis-spells encompassing Egypt (1991), France (1994), New Zealand (1987) and Turkey (1994), because the crises are non-systemic (see Section 3). The estimation results with the CRP measures are reported in Table-A7 of the appendix and they are much the same as in Table 7. Forbearance-A is strongly and the "Public debt relief program" is weakly significant with signs similar to those in Table 7.

We estimate different columns of Table 7 using the Cox proportional hazard model as well, because we find the Cox model also fit our sample. To fit this model, the plot of the log(-log(survival)) versus the plot of log(survival time) of the uncensored crises-spells need to be parallel with each other. The estimation results are nonetheless the same as our results with the Weibull distribution model (results not reported here due to limited space, but are available from the author on request).

4.3.5 The precise findings of this study relative to others

Table 9. The findings of this study relative to other studies

Explanatory variable	Sign found by others	Dependent variable	Studies	The sign with duration of crisis in our study
Forbearance-A (i.e. regulation forbearance to keep insolvent banks operative)	+ve	Costs of BC	HK (2003)	+ve
Public debt relief program	+ve	Costs of BC	HK (2003)	+ve (weakly significant)
Asset Management Company	Insignificant	Costs of BC	HK (2000 & 2003)	Insignificant
Real interest rate	+ve	Costs & occurrence of BC	DKD (1999 & 2005)	+ve
Government budget surplus / GDP	-ve	Lengths of BC	Abderrezak (2002)	-ve (Insignificant)
		Occurrence of CC	Komulainen and Lukkarila (2003)	
Private domestic credit / GDP	+ve	Costs & occurrence of BC	DKD (1999 & 2005)	+ve
		Occurrence of CC	Komulainen & Lukkarila (2003)	
Private domestic credit growth$_{t-2}$	+ve	Occurrence of BC	DKD (2005 & 2002)	-ve
		Costs of BC	DKD (1999)	
Banks' cash reserve / Total asset	-ve	Costs of BC	DKD (1999)	+ve
	+ve (Insignificant)	Occurrence of CC	Komulainen & Lukkarila (2003)	
DIS	+ve	Costs of BC	DKD (1999)	+ve
		Occurrence of BC	DKD (2002)	

Note: BC and CC refer to "banking crises" and "currency crises" respectively.

5. Conclusion

The costs of long-lasting crises can be high and difficult to measure. The entire credit system can become disrupted by the worsened aftermath of the real economy. Domestic creditors and investors may transfer their funds abroad. To tackle this vulnerable situation, the government can borrow money from international source like the IMF, or attempt to increase the inflow of foreign private capital. However, credit from foreign sources can become rather costly, because the more distressed a country's banking system is, the tougher the terms-and-conditions imposed by the foreign sources. It is thus extremely important to defend the economy from having to pay such a high price caused by a long crisis-spell, and to identify the factors associated with long-lasting spells.

Aiming at identifying the factors associated with the durations of crises, this study uses the data on crises with different durations for the period of 1977-2003. Both the developing and the industrialized countries are used. A duration model is used to obtain robust estimation results by taking into account the censoring problems caused by the incomplete crisis-spells.

To recover a crisis experienced economy early, the government can be strict by sticking to its existing banking regulations. However, it is found that in most of the crisis-episodes governments come up with using some CRP measures. The possible reason is that otherwise the governments do not know how long the crises would last. The usual CRP measures are blanket guarantee, open-ended and extended liquidity support, regulation forbearance, recapitalization, public debt relief program for bank borrowers, and setting up a centralized Asset Management Company. These measures might rather extend the crisis period, because the measures relax the existing bank regulations and the bank management can use this relaxed regulations to their advantage. In most of the cases, these measures are not even fully market-oriented.

This study finds that the regulation forbearance to keep insolvent banks functioning strongly and the government's public debt relief program is weakly significant, having the positive relation with the durations of crises. The rests of the measures do not have significant relation with the durations of crises. The measure of blanket guarantee and the use of centralized Asset Management Company are even having negative signs with the durations of crises, i.e. these measures reduce the durations of crises. We thus propose governments avoid using the measure of regulation forbearance keeping the insolvent banks in operation and also the public debt relief program. Instead the governments can choose, if they feel less confident to be strict by sticking to the existing banking regulations, a measure which has no significant relation with durations of crises; especially it can choose the measure of blanket guarantee or the use of a centralized Asset Management Company.

In testing a set of explanatory variables other than the CRP measures, this study finds that some of the variables not only increase the probability of crises to occur or the costs of crises, they also increase the durations of crises. Evidently, crisis-spells last long when they begin during a period of high real interest rates, or begin when the banking sectors have greater exposure to private sector borrowers, or begin in the presence of deposit insurance scheme. DKD (1999, 2002 and 2005) find all these

variables to be positively correlated not only with the probability of crises to occur, but also with the costs of crises.

Some of the explanatory variables are however differently related. For instance, crises spells do not last long if they begin during a term of higher credit growth lagged by two years. Nor do they last long if the onset of crises coincides with the shortage of bank liquidity. DKD (1999 and 2005), however, find that high lagged credit growth, which may capture a credit boom, is positively correlated with the probability of crises occurrence and the costs of crises. DKD (1999) also observe that the shortage of bank liquidity is positively correlated with the probability of crises occurrence. Finally, similar to the result of Abderrezak (2000), this study finds that the probability of ending crisis-spell increases as the spell grows older.

This study has some limitations, however. Defining the crisis-spells of the sample used in this study is not based on a unique criterion or a decisive factor. Rather it is based on the evaluations of specific financial experts of each country. The study would have been more robust, had the crisis-spells been defined based on a single decisive factor. We intend to do this in the near future. Finally, the estimation results should be viewed with caution, as the sample size used is not large enough.

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Appendix

Non-parametric methods of estimation in duration model

The aim of the method is to summarize and graphically view the sample distribution of the duration of crisis-spells. The methodology employed is intuitive and robust to the censored observations. Much of the following development is taken from Kiefer (1988).

We have the simple survivor function:

$$\hat{S}(t) = n^{-1}(\text{no. of sample points} \geq t)$$

where n is the number of observations. We need a modification to allow censoring. Let us consider that the completed durations in the sample of size n are ordered from the smallest to the largest as $t_1 < t_2 < \ldots < t_K$. The number of the completed durations K is less than n because some of the observations are censored (i.e. their spells have not ended within our survey period 1977-2003) or because of "ties". Ties usually occur when two or more observations have the same duration.

Now consider the sample of crisis-spells, the time unit of which is by year. Table-A1 below is created using a sample with 41 observations, which we use in regression-column 1 of Table-6. There are 10 spells that did not end within our study period and thus considered as the censored spells. Furthermore, there are a number of ties in the data; 2 episodes lasting 2 years, 5 episodes 3 years, 7 episodes 3 years and so on. In all, K the number of distinct crisis-spells equals 11.

Let h_j be the number of crisis-spells with completed duration t_j, for j = 1, 2, . . ., K. In the absence of any ties, h_j are all equal to one. The values of h_j for the sample are given in Table A1. Let m_j be the number of observations censored between t_j and t_{j+1}. Thus m_K is the number of censored observations, which continue at least till the time t_K, the longest completed duration. m_j for the data of crisis-spells are also given in the table. Then n_j be the number of spells neither completed nor censored before duration t_j. Thus we have,

$$n_j = \sum_{i \geq j}^{K} (m_i + h_i) .$$

The values of n_j are given in the table. Then the hazard $\lambda(t_j)$ can be formulated as follows,

$$\hat{\lambda}(t_j) = \frac{h_j}{n_j} .$$

Table A1: Nonparametric hazard and survival estimates of the crisis-spells

Duration in years, t_j	h_j (Completed Spells)	m_j (Censored Spells)	n_j	Hazard Function, $\lambda(t_j)$	$1-\lambda(t_j)$	Survival Function, $S(t_j)$	Integrated Hazard, $\hat{\Lambda}(t_j)$
1	1	0	41	0.02439	0.97561	0.97561	0.02439
2	2	0	40	0.05	0.95	0.926829	0.07439
3	5	0	38	0.131579	0.868421	0.804878	0.205969
4	7	0	33	0.212121	0.787879	0.634146	0.41809
5	4	1	26	0.153846	0.846154	0.536585	0.571937
6	3	4	21	0.142857	0.857143	0.45993	0.714794
7	3	1	14	0.214286	0.785714	0.361374	0.929079
8	3	1	10	0.3	0.7	0.252962	1.229079
9	1	0	6	0.166667	0.833333	0.210801	1.395746
10	1	1	5	0.2	0.8	0.168641	1.595746
11	1	2	3	0.333333	0.666667	0.112427	1.929079

The hazard value implies the probability of completing a spell with duration t_j conditional upon the spell reaching duration t_j. The *Kaplan-Meier* or *product-limit* estimator for the survivor function is,

$$\hat{S}(t_j) = \prod_{i=1}^{j} (n_i - h_i)/n_i = \prod_{i=1}^{j} (1 - \hat{\lambda}_i) .$$

This estimator is in fact obtained by setting the estimated conditional probability of completing a spell at t_j equal to the observed relative frequency of completion at t_j. Both the values for $\hat{\lambda}(t_j)$ and $\hat{S}(t_j)$ are reported in the table.

We know that for the exponential distribution the hazard is constant and the integrated hazard is linear in duration *t*.[60] The integrated hazard can be estimated by

$$\hat{\Lambda}(t_j) = \sum_{i \le j} \hat{\lambda}(t_j) .$$

The values of the integrated hazard, $\hat{\Lambda}(t_j)$, are also reported in the table.

Graphical presentation helps to describe the distribution of duration of spells. We have plotted in Figure-A1 the estimated survivor function and the integrated-hazard function[61] for the sample of 41 crisis-spells. Both the survival and the integrated hazard values for our testing sample seem non-linearly related with the duration of spells. That is, the survival or hazard values are not the same for all crisis-spells. The hazard increases as the spells grow older.

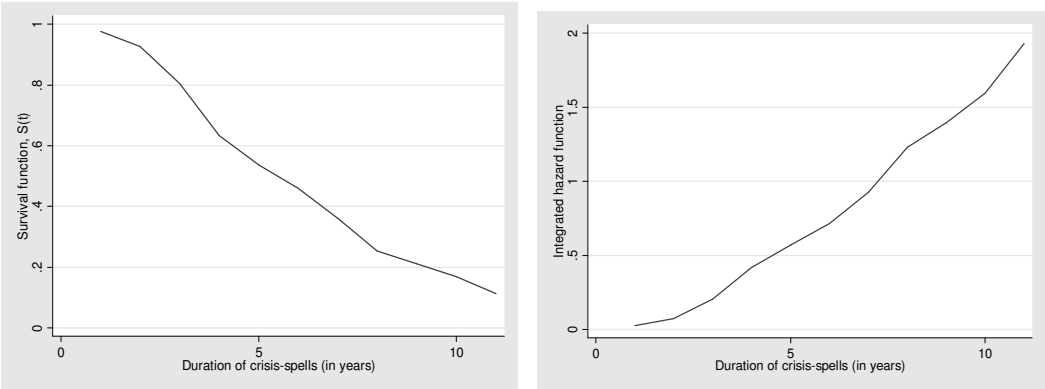

Figure-A1: Survival and the integrated-hazard functions of crisis-spells

Two well-known distribution models in the survival estimation are the *Exponential* and the *Weibull* distribution. Let's set the integrated-hazard $\Lambda(t) = \gamma t^{\alpha}$, where *t* is the durations of spells. Using exponential distribution is appropriate when $\alpha = 1$, i.e., the integrated hazard is linearly related with the durations of spells. However, the integrated hazard function in the above graphical presentation seems to have $\alpha > 1$, i.e., a non-linear relation between the integrated hazard and the durations of spells. Thus, in our case, using Weibull distribution is more appropriate than using the Exponential one.

[60] For the exponential distribution with parameter $\gamma > 0$: cumulative distribution, $F(t) = 1 - \exp(-\gamma t)$; survivor function, $S(t) = \exp(-\gamma t)$; density function, $f(t) = \gamma \exp(-\gamma t)$; hazard function, $\lambda(t) = \gamma$; integrated hazard function, $\Lambda(t) = \gamma t$.

[61] As the estimate of the hazard function exhibits an implausible variation over time, very often economists plot integrated hazard in order to smoothen the variation over time.

Another way of choosing the distribution is to see the graph of the log(-logS(t)) vs. log (durations of spells). In the case of Weibull distribution, the graph will show a linear relationship. The appropriateness of using Weibull distribution can also be proven by viewing the estimated value of α, which should be significantly greater than one. The value of α can be estimated by running regression with the Weibull distribution.

Other Tables

Tabe-A2: Summary statistics of different variables without CRP variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Crisis-spell duration	78	5.935897	3.630104	1	20
GDP growth rate	63	1.567029	10.66896	-29.46377	34.21468
Terms of trade change	26	-2.610769	8.476297	-17.08	14.38
Inflation rate	64	26.68312	47.23188	-3.96	276.34
Depreciation rate	74	20.79864	47.84037	-18.03945	336.4302
Real interest rate	61	-5.258056	32.39425	-210.556	21.2114
Govt. budget surplus / GDP	54	-3.83037	4.509938	-21.79	2.59
M2 / Foreign exchange reserves	72	31.33956	80.49275	1.18	411.25
Private domestic credit / GDP	67	34.63521	26.65081	.1787805	120.87
Private domestic credit $growth_{t-2}$	62	6.701025	20.7429	-55.11988	65.7771
Average private domestic credit growth	70	2.917606	17.72366	-61.40312	80.28796
Banks' cash reserve / Total assets	74	12.35027	13.61766	.0731742	61.14
DIS	78	.3076923	.4645258	0	1
GDP / Capita	68	3.885	6.887869	.01	30.5

Table-A3: The outlying observations and the variables for which they are outliers

Outlying observations	The variables
Congo D. R. (1980)	GDP growth rate
Argentina (1989), Brazil (1990 and 1994) and Congo D. R. (1994)	Inflation rate, Depreciation rate, and Real interest rate
Kuwait (1980)	Govt. budget surplus / GDP
Chad (1980)	M2 / Foreign exchange reserves
Guinea (1993)	Private domestic credit / GDP
Brazil (1990), Nepal (1988)	Private domestic credit $growth_{t-2}$
Nepal (1988)	Average private domestic credit growth

Table A4. Estimating the hazard function crisis-spells: the effects of CRP measures (The variable "Real interest rate" is dropped from the set of control variables used in Table 7 so that we can use all 35 observations with CRP measures)

Dep. Var. = hazard of crisis-spells	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Private domestic credit / GDP	-.036*** (.012)	-.0349*** (.012)	-.044*** (.0123)	-.034*** (.0123)	-.0323** (.013)	-.042*** (.012)	-.034*** (.013)
Private domestic credit growth$_{t-2}$	-.003 (.008)	-.003 (.0076)	.0023 (.010)	-.0031 (.0079)	-.0026 (.007)	.004 (.008)	-.0027 (.007)
Banks' cash reserve / Total assets	-.051*** (.018)	-.046*** (.015)	-.049*** (.019)	-.046*** (.016)	-.044*** (.016)	-.046*** (.016)	-.045*** (.017)
DIS	-.167 (.491)	-.146 (.492)	-.1278 (.456)	-.127 (.492)	-.078 (.539)	-.121 (.473)	-.158 (.503)
Blanket guaranty	.234 (.387)						
Open ended, extensive liquidity supply		.0509 (.398)					
Forbearance-A			-1.51*** (.483)				
Forbearance-B				-.306 (.387)			
Recapitalization					-.590 (.524)		
Public debt relief program						-.763* (.473)	
Asset Management Company							.0861 (.426)
α	2.96*** (.567)	2.91*** (.534)	3.5*** (.666)	2.96*** (.558)	2.85*** (.520)	3.1*** (.558)	2.9*** (.53)
Constant	-3.10*** (.728)	-3.04*** (.699)	-3.3*** (.819)	-2.89*** (.596)	-2.98*** (.655)	-2.9*** (.71)	-3.1*** (.875)
Log-likelihood	-20.94	-21.08	-16.29	-20.92	-20.59	-19.87	-21.07
Wald Chi^2	12.88	12.91	24.63	14.56	13.48	19.42	14.03
Prob > Chi^2	0.0245	0.0242	0.0002	0.0124	0.0192	0.0016	0.0154

***, **, * and ## refer to 1%, 5%, 10% and 15% significance level. The number of observations, the number of failures and the time at risk are respectively 35, 28 and 175.

Table-A5. OLS estimation: explanatory variables other than the CRP measures and the durations of crises (the sample of spells with durations complete)

Dep. V. = durations of crises	(1)	(2)	(3)	(4)	(5)
GDP growth rate	.022 (.055)				
Inflation rate	-.023 (.045)				
Depreciation rate	-.025 (.060)				
Real interest rate	-.067 (.077)				
Govt. budget surplus / GDP	-.317** (.117)	-.29*** (.069)			
M2 / Foreign exchange reserves	.003 (.002)				
Private domestic credit / GDP	.011 (.035)				
Private domestic credit growth$_{t-2}$	.035 (.05)		-.058*** (.02)		
Average private domestic credit growth	.046 (.051)			.088*** (.03)	
Banks' cash reserve / Total assets	.076*** (.025)				.05*** (.027)
DIS	1.18 (.995)				
GDP / Capita	.004 (.088)				
Constant	2.2 (1.4)	3.5*** (.43)	5.9*** (.45)	5.4*** (.42)	4.8*** (.57)
No. of Obs.	31	41	50	50	60
F-values	4.27	17.91	7.70	7.45	3.42
Prob > F	0.0029	0.0001	0.0079	0.0088	0.0695
R-squared	0.4663	0.2431	0.1654	0.1285	0.0493
Root MSE	2.3027	2.4859	2.9047	2.9682	3.3015

We have reported the estimated coefficients of the variables and the standard errors (in the parentheses). *, **, and *** refer to 10%, 5%, and 1% significant level respectively

Table-A6. OLS model: CRP measures and durations of crises (the sample includes only the crises-spells with durations complete)

Dep. Var. = dur. of cr.-spell	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Private domestic credit / GDP	.035 (.026)	.032 (.026)	.030 (.024)	.035 (.028)	.038 (.028)	.038 (.027)	.036 (.026)
Private domestic credit growth$_{t-2}$	-.004 (.014)	-.005 (.016)	-.004 (.012)	-.005 (.014)	-.007 (.016)	-.01 (.014)	-.006 (.014)
Banks' cash reserve / Total assets	.07** (.03)	.064**(.029)	.05* (.029)	.07*** (.02)	.077*** (.025)	.07*** (.02)	.07** (.026)
DIS	.12 (.83)	.14 (.77)	.064 (.70)	.091 (.77)	.024 (.83)	.07 (.76)	.10 (.79)
Blanket guaranty	-.17 (.81)						
Open ended, extensive liquidity supply		.64 (.78)					
Forbearance-A			2.1*** (.80)				
Forbearance-B				.029 (.42)			
Recapitalization					.52 (.74)		
Public debt relief program						.63 (.69)	
Asset Management Company							-.34 (.77)
Constant	2.4** (1.1)	2.2* (1.1)	2.4** (1.0)	2.4** (1.0)	2.2* (1.1)	2.2* (1.1)	2.5*** (1.1)
F-values	2.01	1.87	10.52	2.12	2.17	3.34	2.05
Prob > F	0.1162	0.1398	0.0000	0.1015	0.0948	0.0214	0.1109
R-squared	0.1780	0.2016	0.3514	0.1762	0.1825	0.1961	0.1832
Root MSE	1.9219	1.8941	1.7072	1.924	1.9166	1.9006	1.9158

We have reported the estimated coefficients of the variables and the standard errors (in the parentheses). *, **, and *** refer to 10%, 5%, and 1% significant level respectively. All of the above results are derived by using 28 observations.

Table-A7. Estimating the hazard function of crisis-spells: the effects of CRP measures (the sample contains 31 spells with CRP measures; 4 spells are dropped because they are not accompanied by systemic crises)

Dep. Var. = hazard of crises-spells	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Private domestic credit / GDP	-.04*** (.013)	-.04*** (.013)	-.054*** (.013)	-.036*** (.013)	-.035*** (.014)	-.047*** (.013)	-.036*** (.014)
Private domestic credit growth$_{t-2}$	-.003 (.009)	-.002 (.008)	.003 (.0119)	-.003 (.008)	-.002 (.008)	.0043 (.009)	-.0019 (.007)
Banks' cash reserve / Total assets	-.06*** (.02)	-.059*** (.018)	-.063*** (.023)	-.054*** (.020)	-.05*** (.020)	-.055*** (.020)	-.049** (.022)
DIS	-.431 (.562)	-.488 (.577)	-.492 (.50)	-.385 (.564)	-.340 (.602)	-.416 (.533)	-.419 (.582)
Blanket guaranty	.405 (.437)						
Open ended, extensive liquidity supply		.432 (.421)					
Forbearance-A			-1.81*** (.566)				
Forbearance-B				-.568 (.437)			
Recapitalization					-.384 (.543)		
Public debt relief program						-.905* (.523)	
Asset Management Company							.187 (.51)
α	3.4*** (.62)	3.37*** (.548)	4.3*** (.63)	3.44*** (.58)	3.27*** (.547)	3.63*** (.579)	3.36*** (.559)
Constant	-3.7*** (.78)	-3.6*** (.71)	-3.9*** (.815)	-3.3*** (.58)	-3.55*** (.663)	-3.39*** (.713)	-3.78*** (1.00)
Log-likelihood	-13.89	-13.85	-8.50	-13.82	-14.04	-12.81	-14.16
Wald Chi^2	10.44	13.51	27.88	11.96	8.92	15.93	12.36
Prob > Chi^2	0.0638	0.0191	0.0000	0.0353	0.1123	0.0070	0.0301

NB: No. of obs. = 31, No. of failure = 24, Time at risk =163.

Table-A8. Sample compositions

Row-1	Column 1 of Table 6	All countries of Table-2 except Algeria, Argentina-2, Bangladesh, Benin, Brazil-1 and -2, Cameroon-1, Central African R., Chad, Congo D. R. -1 and -2, Cote d'lVoir, Djibouti, Egypt, Equ. Guinea., Ghana-2, Guinea-1 and -2, Israel, Jamaica, Kuwait, Lebanon, Madagascar, Mali, Mauritania, Nepal, Nicaragua, Panama, Paraguay, Sao T. P., Senegal, Tanzania, Togo, Turkey, Uganda, Vietnam, Zambia
Row-2	Column 2 and 3 of Table 6	All countries of Table-2 except Bangladesh, Benin, Brazil-1, Chad, Djibouti, Equatorial Guinea, Guinea-1 and -2, Lebanon, Mali, Mauritania, Nepal, Sao T. P., Uganda, Vietnam and Zambia
Row-3	Columns 1-7 of Table 7	All countries of Table-3
Row-4	Columns 1-7 of Table A4 of Appendix	All countries of Table-3 except Brazil-2