

Outflow of corrupted asset, typical corruptions in banks with insured deposits, and banking crises *

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Abstract

The financial crises have been experiencing for last three decades mostly in developing countries where corruption is one of the unavoidable phenomena. Moreover most of these countries experienced crises in presence of deposit insurance scheme (DIS). Using a panel data for developing and industrialized countries for the period 1982 – 1997 and estimating a multivariate logit model this study has found that banking crisis is more likely in more corrupted countries using DIS. By a theoretical model this study then attempts to relate the influences of out-flows of corrupted assets and typical corruptions in banking sector in presence of DIS with banking crises. The study introducing a model argues that the asset price is collapsed partly because of outflow of corrupted liquid assets as the outflow amplifies the illiquidity of the market. The study also argues that the corruption in loan disbursement grips banking sector in to more problems due to higher non-performances of loans. The model describes at what situation the bank needs to sell the collateral and how the asset price fall may be aggravated by the illiquidity what is enhanced by liquid asset-outflow. In addition the model describes that the bank's chance of meeting the obligation to the depositors in the case of shock is lower because of lower gross return from collateral since part of the loan is disbursed not based on collateral but based on illegal private benefit. In all the chance of banking crisis is much higher in existence of corruption in asset and credit market.

Keywords: Corruption, asset price collapse, non-performing loan, and banking crises

JEL Classification: K4, G1, G21, O2

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1 Introduction

Many countries, both developing and industrialized, have been experiencing banking crises for couple of decades. The proliferation of large scale banking sector problems has raised widespread concern among the economists. Because banking crises disrupt the flow of credits to households and enterprises, reduce investments and consumptions, and may even jeopardize the functioning of the payments system. A number of studies analysed various episodes of banking crises in an effort to draw useful policy lessons. Different factors as the causes of banking crises have also been identified in those papers. Interestingly one can see that most of the crises experienced countries are from developing countries where high level corruption prevails and deposits are insured. Surprisingly, the consequences of corruption on banking crises have not been systematically examined. The main objective of this paper is to fill this void. The intention of this paper is first investigating empirically the impacts of countries overall corruptions and of using DIS by corrupted countries on banking crises. Then this study attempts developing a theoretical model to relate banking crises with outflow of corrupted assets and with typical corruption in banking sector using DIS.

The acts of corruption do not typically occur in broad daylight. Different author defines corruption from different angles.² Baker et al (2003) define different sources of dirty money³. All these sources⁴ in turn rely on *abuse of power both in public and private sector for illegal private benefits* and that is what this study defines as corruption.

² A more natural definition is that corruption is the intentional non-compliance with arm's length relationship aimed at deriving some advantage from this behaviour for oneself or for related individual (see Tanzi (1995a) and see Theobald (1990)). See also Dobel, P. J. (1978), and Bardhan (1997) for theoretical and political views of corruption.

³ Dirty money is the money that is illegally earned, illegally transferred or illegally utilized.

⁴ The sources are mainly 1) the abuse of public power for private benefit, 2) embezzlement of private funds, securities fraud, forgery, drug money, trafficking in counterfeit and contraband goods and so on, and 3) crime like evasion of taxes.

Banking crisis is a phenomenon what is related with functioning of the banking sector.⁵ On the other hand, the banking activity is generally affected by 1) the asset market, because the firmers/entrepreneurs depend on the asset prices whether they will take loan from bank, and because the bank's balance depends on the asset price while it sells its collateral in asset market, and by 2) credit market, because bank needs to collect funds/credits from depositors and then provide loan to the firmers/entrepreneur. Thus it is needed to examine the effect and nature of corruption on asset and credit market to analyse the impact of corruption on banking crises.

Patres (2002) and Baker et al (2003) both have found that a huge sum of corrupted money comes out of developing and transitional economies every year, and those monies grease the economic wheel of USA and many other industrialized countries. IMF estimates the global money laundering⁶ at \$600 billion to \$1.5 trillion a year.⁷ According to Baker et al (2003), about half of the laundered money comes out of developing and transitional economies, what is deposited in developed country's secret bank account (half of the amount is eventually lodged in U.S. accounts or dollar denominated assets elsewhere), and is largely a permanent outflow for developing countries. They added that perhaps less than ten percent of that out-flowed money returns as foreign direct investment to those developing countries.

Since 1982 ICRG (International Country Risk Guide) and since 1996 Transparency International (TI) have been surveying corruptions in different countries and reporting countries corruption perception indices. TI has also been trying for last few years finding out sector specific corruptions of the countries.⁸ TI finds

⁵ See, for example, Benston et al (1986) for details how to define banking problems.

⁶ Money laundering in brief is the processing of dirty monies to disguise their illegal origin.

⁷ FATF (Financial Action Task Force) is an inter-governmental body whose purpose is the development and promotion of politics, both at national and international levels, to combat money laundering and terrorist financing. And FATF finds from IMF stating that the aggregate size of money laundering in the world could be somewhere between two and five percent of the world's GDP. According to Patres (2002) the sum of dirty money is growing exponentially.

⁸ In 2001 TI launched an annual publication named Global Corruption Report (GCR). In the name of GCR the organization releases every year the news and analysis of corruption and the fight against corruption, addressing international and regional trends, highlighting noteworthy cases, and providing useful empirical evidence of corruption, including TI's own corruption perception index and bribe payers index.

Bangladesh as one of the very corrupted countries and its banking is nothing different. On the other hand this country experienced banking crises for 1986-1997 (Caprio and Klingbiel, 1996). Following TI the diversity of bank services and the numerous steps have been involved in loan processing, disbursement, and monitoring. And these provide corrupt bank officials with wide range of opportunities for extracting bribes.⁹ It has found one of the common practices of un-prudential banking policies of providing loans is over valuation of properties and assets of the borrower which are offered as collateral. TI has also found that one of the very usual ways of getting kickbacks from borrowers is taking some percent cut of the loan amount sanctioned.¹⁰ One of the reasons to take place the said kinds of un-prudential banking principles is that the banks are safe in the knowledge that the bank's lending risk would be covered by central bank credit guarantee. It could be easily seen that the picture is more or less same in banking sectors for many other corrupted countries as well.¹¹

Many studies have found corruption's link to economy from different angles. Nas et al (1986) find that the corruption, as a process, influences the optimal level of social welfare. Mauro (1995) finds that corruption lowers investment and there by economic growth. In a cross-sectional empirical study Sarkar and Hasan (2001) find the support to Mauro study. Shleifer and Robert (1993) find that a weak government experiences a very high corruption levels. DKD (Demirguc-kunt and Detragiach) (1997) finds from an empirical study that there is positive association of weak government, where the law-&-order condition is worse, and banking crisis.¹²

⁹ See TI's corruption report of 2003 about banking sector on Bangladesh.

¹⁰ There are other ways of getting kickbacks like outright bribes, valuable gifts, allotment of land, house construction, acquisition of apartments, and share in business, appointments in good jobs and so on.

¹¹ Though the specific type of corruption in banking sectors for many corrupted countries are not clearly reported by TI, but information can be gathered from many other online sources that the nature of corruptions in banking sector for many corrupted countries are more or less same. E.g. Nick Rosen's report on Venezuelan banking crisis in "Initiative or policy dialogue", Laura A. McQuade's report in USINDO on Indonesian Banking Sector, and so on.

¹² There are also other studies which find the nature of corruption link to economy. Among the many Mauro (2002), Huang and Shang-Jin (2003), Tanzi and Hamid (2000), Chand and Moene (1997), Damania et. al. (2003), Tanzi (1998), Sanjeev et. al. (1998). and Ehrlich and Lui (1999) are notable.

Different empirical studies,¹³ including the empirical part of this study in section 2, have found that existence of deposit insurance scheme (DIS) in a country increases the likelihood of banking crises. On the other hand many countries using DIS and whose average (1982-97) corruption indices following ICRG are about 3 or less than 3 (least corrupted country's index is 6) experienced banking crises for 1980s and 1990s (see I.3 in Appendix for the list of the countries).

The main intention of this paper is to develop a model from a theoretical point of view to show the relationship between corruption and banking crises from the angle of asset and credit market. However, lacking any empirical study in the past so far, a brief empirical analysis has also been done in the following section to draw the relationship between corruption and banking crises, and to justify the theoretical study. A multivariate logit estimation model is used. The panel data includes both developing and industrialized countries for the period 1981-1997. The estimation result finds significant association between corruption and banking crises. That is, higher a country is gripped with corruption the more likely is the country experiences a banking crisis. We have also tested whether the use of DIS by a corrupted country increases banking crises because of the more scope of misusing DIS in more corrupted countries. And we have found the affirmative answer.

By a theoretical model Allen and Gale (1998) analysed financial crises from the deposit side of the banking system. They argue financial crises as optimal if the return to the safe asset is the same inside and outside the banking system. They also argue that bank runs force the bank to liquidate their assets when prospects are bad, and simultaneous liquidation drives asset prices down. In an economy with credit limits what is endogenously determined, Kiyotaki and Moore (1995 and 1997) investigated how relatively small, temporary shocks to technology or income distribution might generate large, persistent fluctuations in output and asset prices. Vartia (Sept. 2003) studied falling of asset prices during banking crises and how

¹³ See Demirguc-kunt and Detragiach (1997) for example.

this falling affects the banking sector. She argues that part of the asset price collapse may be explained by the sales of assets and illiquidity in the market.

The base of the model development is as follows. With a similar set up of Vartia (2003) the intention is to show the impacts of out-flowed corrupted assets and typical corruptions in banking sector in presence of DIS on banking crises. Let's consider a representative investor in an economy. Part of the total liquid assets held by the investor may be earned in corrupted way and that money could be referred as dirty money. The investor prefers to leave this corrupted asset out (referred as asset-out) of the illiquid-asset/investment market as it is safer to keep them hidden.¹⁴ One of the reasons to leave them out is that otherwise the corrupted liquid assets get revealed to the legal authority and to other deceived citizens who may claim the legal share, and thus he may lose this asset. Transferring the corrupted assets secretly in abroad is one of the safest policies.¹⁵ However, some liquid assets may get in (called asset-in) the country from foreigners as foreign direct investment. Thus the representative investor may have some additional liquid assets by dint of foreign direct investment. The investor may have then the net asset-out, i.e. asset-in subtracted from asset-out. The idea of this study is first to find the impact of this net liquid assets-out on asset prices. This paper argues that the asset price fall gets higher in a country where net liquid asset-out is more.

The model then focuses on the credit market, where the counter parties are the representative bank and firm. The bank has insured deposits (under DIS) to provide as loan to the firm investing in its projects. The prudential loan policy for the bank is to provide loan with collateral. But there is manager who is paid by the

¹⁴ Baker et al (2003) finds that the predominant motivation of this hiding is the hidden accumulation of wealth. A survey conducted in the 1990s of 550 business owners and managers in 11 countries produced this, among other startling conclusions. The essential drive is about getting rich secretly, hiding such money at a distance and avoiding pressures for distributions to employees and relatives locally.

¹⁵ Baker et al (2003) added that for wealthy citizens who illegally move their money abroad, the typical rationales offered have to do with evasion of taxes, circumvention of exchange controls and protection against inflation and confiscation. Patres (2002) finds that one of the major sources of impoverishment and crises in Africa, Asia, Latin America, and in many of the transitional economies is the pillage of the economy and the hundreds of billions of dollars transferred out of the country and depositing in U.S. and Europe's banks through money laundering.

bank and is in-charge to disburse loan.¹⁶ The manager could be corrupted and referred as CBM (corrupt bank manager). Provided that deposits are insured CBM has opportunity to provide loan in excess of collateral limits (referred as corrupted loan) depending on private illegal gain as found by TI. The scale of corruptions depends on the scale of relaxed law-and-order situation of the country. We have found positive association between corruption and worsening law-&-order situations (see I.2 in Appendix for details). However, this study argues that the overall bank's portfolio gets vulnerable to fail partly due to the CBM's dishonest will.

The representative firm collects the funds to invest in the project. The firm has choices to collect funds from either selling her illiquid assets in the asset market or getting loan from the bank. The efficient method to obtain the loan is to provide collateral. However, because of CBM the firm has opportunity to get loan in excess of collateral. To get this loan the firm needs to provide the CBM some illegal private benefit that is unofficial or hidden from the bank-portfolio or from the legal authority. The paper argues that in equilibrium the firm will be less interested in corrupted dealing with CBM if the illiquid asset price gets higher i.e. more liquidity available in investment market.

The paper is structured as follows. The following section serves an empirical analysis to investigate the impacts of corruption and use of DIS in corrupted countries on banking crises. Section 3 presents a simple model with impacts of corruption on asset prices and on the available liquidity after possible shocks in the credit market. Precisely this section solves out, by first looking at the model set-up, the no-arbitrage conditions of all three economic agents: the investor, the representative bank, and the firm. This section ends examining the equilibrium of the model and analysing the possible banking crises. The concluding remark is presented in the final section of this paper.

¹⁶ In reality in many countries the branch manager himself is responsible to disburse the loan. If not the manager himself, there could be some officer assigned in loan disbursement. Both the manager and officer in charge of loan disbursement are referred as manager in this study.

2. Empirical analysis: corruption and banking crises

Main hypotheses

The first hypothesis of this empirical study is the chance of banking crisis is higher in a higher corruption griped countries. Secondly, this study examines another hypothesis that presence of DIS in a country with higher corruptions increases crises probability. The background of second hypothesis is that different empirical studies¹⁷ have found that the use of explicit DIS in a country increases the chance of banking crises. The main reason has been defined as the chance of misusing the explicit DIS by bank management. Definitely the misusing scopes depend on the corruption scopes or the worsened law-and-order situations of the country and here is the logic to test above two hypotheses. To test the first hypothesis the variable used is “corruption” that takes the values 0 (most corrupted country) to 6 (least corrupted country). And to test the second one the variable used is “corrupt-DIS” that takes values “0” if there no explicit DIS, otherwise the variable takes the inversed values of corruption indices, i.e. the variable takes higher values for using explicit DIS with higher corruptions.

The data-set and defining banking crises

The period of the data set used is 1981-1997. Some countries are left out of the study because: 1) the banking systems in centrally planned economies like China are different than that of the market or decentralized economy, 2) the banking systems in transitional economies are also kind of different than that of the market economy because of their transforming form from the centrally planned economy to the market economy, and 3) finally some countries are left out because of the data of corruption is not available (crises experienced countries which are left out at the cause of lacking corruption indices are mostly developing countries and are likely be corrupted).

¹⁷ See for example DKD (1997) and Khan (2001).

The theoretical analysis of defining banking crises is depicted in my earlier two studies, Khan (2001 and 2003). Different studies,¹⁸ including this one, find that empirically because of information limitation banking crises are difficult to be identified. The potential for bank run is not directly observable. On the other hand, banking crises in recent years are not associated with only bank runs but with deterioration in asset quality and subsequent government intervention. Both bank run and large-scale government intervention could be preceded by deterioration in asset quality. But direct market indicators of asset values are usually lacking. Moreover, slow follow-up action once a crisis is recognized allows the situation to deteriorate to the point of a major bank crisis involving large-scale government intervention.

Given these information and conceptual limitations, most studies have employed a combination of events to identify and date the occurrence of a bank crisis. Banking sector distresses have been identified and dated following Caprio and Klingebiel (1996). However, in few cases the crises episodes are dated following DKD (1998). The criteria to specify crises spells are as follows,

- The starting date of the spell is the date when the central/financial authority/expert of the concerning country first recognizes that whole banking sector is at risk because of bank run, or because of banks with large portion of the total assets are insolvent or nonperforming.
- And the ending date is the date until when some reform/restructuring measures initiated usually by government or central authority took place in the banking sector, and after that date the concerning authority does not consider the whole banking sector at risk anymore. The spell is considered as crisis if at least one of the following criteria holds in between beginning and ending dates,
 - The ratio of non-performing assets 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

¹⁸ See for example Glick and Hutchison (1999)

- The cost of the rescue operation was at least 2 percent of the GDP
- Some of the episodes regarded as crises but lacks information of aforesaid 2 criteria. But those are considered as crises because either banking sector problems resulted in government/central-bank intervention with measures such as large-scale nationalization of banks or prolonged bank holidays or closing banks or merging large number of banks, or number of banks failed with possibly high proportion of total assets, or banks were severely affected that resulted in conversion of deposits in other forms like bonds.

The crises experienced countries for which corruption indices are available are presented in the Table 1.

Table 1: Banking crises in 1980s and 1990s for which the corruption indices are available

Country	Corrupt Index (Avg. 1982-97)	Period of Crisis	Country	Corrupt Index (Avg. 1982-97)	Period of Crisis
Algeria	3.375	1990-92	Liberia	0.68	1991-95
Argentina	3.5	1980-82, 89-90, 95-	Madagascar	4	1988
Bangladesh	0.775	1986-1997	Malaysia	4.37	1985-88, 97-
Bolivia	1.475	1986-88, 94-	Mali	1.83	1987-89
Brazil	3.675	1990, 94-	Mexico	2.77	1981-91, 95-
Burk. Faso	3.56	1988-94	Morocco	2.53	1980-85
Cameroon	2.59	1987-	Nicaragua	4.51	1985-96
Chile	3.25	1981-83	Nigeria	1.85	1990-
Colombia	2.9	1982-87	Norway	5.91	1987-93
Congo R	3	1992-	Panama	2.09	1988-89
Cote d'Ivoire	3.07	1988-91	Paraguay	1.41	1995-
Denmark	6	1990-92	Peru	2.85	1983-90
Ecuador	3.16	1980-85, 95-	Philippines	1.82	1981-87, 97-
Egypt	2.29	1980-85	Senegal	3	1983-91
El Salvador	2.35	1989	Sierra Leone	1.72	1990-
Finland	6	1991-94	Spain	4.42	1977-85
France	5.33	1994-95	Sri Lanka	3.1	1989-93
Ghana	2.57	1982-89, 97-	Sweden	6	1991-94
Guinea	3.51	1985, 93-94	Tanzania	3.17	1986-
India	2.79	1991-	Thailand	3.09	1983-87, 97-
Indonesia	1.51	1992-94, 97-	Togo	2	1993-95
Israel	4.98	1977-83	Tunisia	3	1991-95

Italy	3.70	1990-95	Turkey	2.94	1982-85
Jamaica	2.29	1994-	USA	5.08	1984-91
Japan	5.07	1990-	Uganda	2.27	1994-
Jordan	3.28	89-90	Uruguay	3	1981-84
Kenya	2.97	1985-89, 92-	Venezuela	2.84	1994-
Korea, R.	3.29	1997-	Vietnam	2.67	1997-
Kuwait	2.97	1980-89	Zambia	2.38	1995
Lebanon	2.51	1988-90	Zimbabwe	3.25	1995-

Banking crises info source: Caprio and Klingebiel (1996), and DKD (1997). Most of these crises dates are also supported by Lindgren et. al. (1996). Corruption Index Source: ICRG.

Estimation Model

A multivariate logit model is used. The logistic distribution is,

$$\text{Prob}(Y = 1) = \frac{e^{\beta'x}}{1 + e^{\beta'x}} = \Lambda(\beta'x)$$

The dependent variable is crisis dummy Y , and $Y = 1$ if there is a crisis otherwise $Y = 0$. Vector x is a set of explanatory factors. The parameter vector β reflects the impact of changes in x on the probability. The notation $\Lambda(\cdot)$ is used to indicate the logistic cumulative distribution function. The logic of using logit model is similar as it is in my earlier study on deposit insurance scheme, Khan (2001). See also Greene, William H. (1997) for details of the logit model.

Estimation Result

The model estimates a reduced form relationship without deriving it from a specific structural model of the economy. A number of explanatory variables are used (see the list of explanatory variables in Appendix). Dependent variable is banking crisis dummy. Main interest is to see the impact of corruption and the impact of using explicit DIS in countries with varied level of corruptions (the variable named "corrupt-DIS") on banking crises. The estimation result is as follows.

Table 2: Estimation of corruption's and corrupt-DIS's impact on banking crises

Dep. Variable = Banking Crisis Dummy							Dep. Var. = Corrup.	Dep. Va., Corr-DIS	
	(1)	(2)	(3)	(4)	(5)	(6)		(7)	(8)
Indep. Var.	Coeffic. (Std Er.)	Coeffic. (Std Er.)	Coeffic. (Std Er.)	Coeffic. (Std Er.)	Coeffic. (Std Er.)	Coeffic. (Std Er.)	Indep. Var	Coeffic. (Std Er.)	Coeffic. (Std Er.)
constant	-1.99*** (.311)	-2.22*** (.629)	-1.95*** (.294)	-2.21*** (.593)	-3.30*** (.339)	-3.82*** (.749)	constant	4.26*** (.279)	-0.009 (.109)
corruption	-0.212*** (.088)	-0.278** (.143)	-0.225*** (.084)	-0.304** (.133)			bank-crisis	-0.859 (.771)	0.401 (.429)
gdp growth		-0.069* (.040)		-0.064* (.0387)	-0.074* (.041)	-0.081 (.069)			-0.014 (.017)
tot change		-0.046** (.023)		-0.0484** (.0222)	-0.057** (.024)	-0.077* (.043)			0.010 (.011)
dis		0.97** (.477)		1.07** (.462)					
corrupt-DIS					3.36** (1.54)	5.10** (2.67)			
log likeli.	-229.2	-87.9	-243.5	-93.8	-88.9	-49.33	log likeli.	-77.3	-334.3
observ. no.	996	484	1061	519	484	238	observ. no.	996	484
LR chi ²	5.91	15.09	7.37	18.66	13.11	7.82	LR chi ²	1.02	2.26
prob > chi ²	0.0150	0.0045	0.0067	0.0009	0.0044	0.0500	prob > chi ²	0.3132	0.5194
pseudo R ²	0.0127	0.0790	0.0149	0.0904	0.0686	0.0734	pseudo R ²	0.0065	0.0034

***, **, and * represents 1%, 5%, and 10% significant level respectively.

The variable corruption is used both as lone independent variable and with other independent variables. First, all possible explanatory variables¹⁹ are used in the model (result is not reported). But the model specification is best if GDP-growth-rate, terms-of-trade-change, and deposit-insurance-scheme are used with corruption²⁰.

The results in first two specifications, (1) and (2) in Table-2, are derived using the data set for 1982-1997. The corruption indices are in fact available from 1982. However, the results in the following two specifications, (3) and (4) in the Table, are derived using the data set for 1981-1997, and relatively better results are obtained. Corruption index of 1982 could be used in 1981 because the corruption indices for a country do not change widely/rapidly with year changes, and high degree of correlation exists between current and lagged value of corruption²¹. In specification (5) the variable "corrupt-DIS" is used with other two control variables. In Specification (6) the variable "corrupt-DIS" is used dropping out the countries

¹⁹ See the list of explanatory variables in Empirical Analysis Appendix. These are the most possible explanatory variables associated with banking crises found in earlier studies, e.g. in DKD (1997).

²⁰ The same explanatory factors along with per-capita-GDP have had the best specification model in my early study Khan (2001).

²¹ The correlation between current and lagged values of corruption, taking the correlation matrix, is 0.9729.

with no-DIS, i.e. corrupt-DIS = 0 is dropped out. Specifications (7) and (8) are for causality check.

The variable “Corruption” is strongly significant and with expected negative sign in all of the specification models. Note that the higher corruption-index value implies the lower corruption. That is, lower is the corruption the less likely is the banking crisis given that other factors remain same. The result is intuitive because lower corruption implies lessened illegal activities, lessened misuse of wealth and resources in every sector of the economy, and thus lessened misuse of prudential banking policy what ultimately helps keeping the banking sector more sound and safe.

The variable “corrupt-DIS” is significant at 3% level with expected positive sign. That is the uses of explicit DIS in higher corruption stricken countries increases the likelihood of banking crises. The result is intuitive in the sense that the use of explicit DIS in a higher corrupted country implies that the scope of misusing the scheme (using the un-prudential banking policy at a higher scale) by bank management is higher which ultimately lead the banking sector into crisis. We have found same evidence even if we test “corrupt-DIS” dropping the countries with no-DIS, i.e. testing the variable only for the countries using DIS (Specification (6)).

The other control variables are also more or less strongly significant with expected sign which have been found in other studies as well²². The negative association of GDP-growth rate and of tot-change implies that the higher is the gdp-growth rate or tot-change the less likely is the banking crisis. On the other hand the positive association of explicit DIS scheme implies that the use of explicit DI scheme makes the country more likely to have banking crisis.

In Specification (7) corruption is dependent and banking-crisis is independent variable. The variable “bank-crisis” is far from being significant at the least 10% level. The model fits very poorly as the pseudo-R² value is much less than pseudo-R² value of model-1. The model is even rejected as the model chi² value is about 1

²² These variables are significant with similar signs e.g. in DKD (1997) and in my earlier study on DIS.

and the model's significance level is about 31% (much higher than the least significant level 10%). Thus it can be argued that the causality runs in the direction of corruption impacts the banking crisis.

Similarly in Specification (8) "corrupt-DIS" is dependent and banking-crisis is independent with other control variables. Not any of the variables are significant. In addition model quality is much worse than that in Specification (5) comparing log-likelihood values, likelihood-ratio values, and model's non-rejecting probabilities ($\text{prob} > \chi^2$). Thus the causality runs in the direction of "corrupt-DIS" affects banking crises.

3 A simple model of asset prices and liquidity in existence of corruption

3.1 The model set-up

The model has 3 types of agents and three periods. The agents in the economy are: 1) a continuum of risk neutral investors who may have net liquid asset-out due to corruption, 2) risk neutral bank which has fund from depositors as surrendered and the fund is insured under DIS, and this fund is allocated to safe reserves and loans, and 3) risk neutral firm which may collect funds either selling illiquid assets in the investment market or taking loans from bank providing collateral. So there are depositors in the economy, but their behaviour is not modelled because of model's complication, and this paper mainly focuses on the impact of corruption on banking crises through the existence of corruption in asset and credit market. On the other hand any corrupted negotiation between bank officials and the depositors in the corrupted country has not been found (e.g. TI has not reported such a negotiation). It is assumed that the depositor just surrenders his funds to the bank under DIS for what the gross return is r_D .

There are three periods in the economy, the planning period, intermediate period, and the final period i.e. $t = 0, 1, \text{ and } 2$ respectively. The assets could be preserved in two ways, in the liquid form what is safe, and in the illiquid form what is risky but profitable. Initially, only the investors hold the liquid assets. There is no profit if investor keeps assets only in the liquid form for whole period (storage technology), i.e. one unit of liquid assets at period t produces just one unit in period $t + 1$. The asset in the illiquid form is then regarded as production technology and profitable for investor; one unit of illiquid assets transforms Q_G in the good time and Q_B in the bad time ($Q_G > Q_B$). The return is realized only in the final period and the early liquidation makes loss to the investor. In order to make the holding of illiquid asset attractive the model assumes that the expected return from illiquid asset is higher than that from liquid asset.

There are also projects to invest what is initiated by the representative firm. The projects are more risky in the sense that the return is R in case of success otherwise it is zero (failure). The firm holds only the illiquid assets. The firm finances the project selling the illiquid asset to the investor and/or obtaining loan from the bank. To procure loan from bank the firm provides collateral. But in a corrupted country, as TI finds, the firm has opportunity to get loan in excess of collateral limits. It provides illegal private benefit to the CBM for this excess loan. The initial endowment of the firm is A . The model assumes that the technology for productive investment project is not available to all agents. The model also assumes that, in order to make the project attractive, the expected return for the firm from project is higher than that from the illiquid asset.

The function of the bank is just as intermediaries. The bank does not hold any assets, but it has the fund D deposited by depositors and it is insured under DIS. The paid manager is in-charge of loan disbursement. The prudential loan policy of the manager is to provide loan in exchange of collateral and valuing the collateral with a given parameter $0 \leq \beta_0 \leq 1$. But the CBM has opportunity to provide excess loan in exchange of illegal private benefit. The scale/limit of this corrupted dealing

depends on the law-&-order situation of the country. Finally, the bank sells the collateral in case the firm fails to repay the loan.

The time frame of the model is as follows. All the investment and financing decisions are made in the planning period $t = 0$. That is the firm first decides whether to carry out the project. It also decides how much to collect loans both in collateralized and/or in corrupted dealings and how much from the asset market selling the illiquid assets to the investors. The bank first signs a contract with the depositors and then uses the deposited fund as safe reserves and loans. The bank's amount of safe reserves and then amount of loans are decided. And finally, given the net liquid asset-out, the investor decides the amount of liquid assets to buy the illiquid assets in the planning period, and hold rest of the amount as liquid assets to use in the following periods.

In intermediate period $t = 1$, the economy faces a shock (the so called "bad state") with chance λ . All investment projects fail as a result of shock and then a lower gross return Q_B is produced to the illiquid asset. In the case of no-shock the firm's expected return is ensured, and the banks expected return is finalized. In the case of no-shock, the gross return to the illiquid asset is Q_G . The bank's obligation to depositor is also finalized in this period, but the depositor waits till final period to realize and consume the return. The firm is always defaulted in the case of shock. In this case the bank takes over the collaterals and sells those in the asset market. The price of the collateral is determined by the available liquidity in the market. All sorts of uncertainties like the returns on illiquid assets and on investment projects are resolved in this period. Finally, in this period it is possible to analyze the solvency position of the bank, and whether the banking crisis takes place or not. The banking crisis depends on selling price of the collaterals after shock. In the case of no-shock there is no banking crisis.

All agents realize their respective returns in the final period, $t = 2$. The depositor realizes his obligations from the bank.²³

3.2 Optimal Behaviour of the Agents

3.2.1 Behaviour of the Investor

The model assumes that all the initial wealth, W , of the representative²⁴ investor is in liquid form. Of W , γ_c is the proportion that is dirty money and flows out (asset-out) of the economy. However, this shortage of liquid asset is partly recovered by the foreigner's direct investment. Let's say this is γ_f in proportion with W and following Patres (2002) and Baker et al (2003), $0 \leq \gamma_f \leq \gamma_c$ for developing countries. So the proportion of the net asset-out is $\gamma_i = \gamma_c - \gamma_f$. Eventually the representative investor is left with $1 - \gamma_i$ proportion of total liquid assets to buy the illiquid assets. The investor can gain revenues basically in two possible strategies: i) the investor holds liquid assets from the first period to the intermediate period and then buys the illiquid asset sold by the bank in the case of shock²⁵. In the case of no shock, the investor is assumed to hold the liquid asset until the final period implying no possibility of profits. And (ii) the investor buys illiquid assets from the firm in the first period and holds it until the final period. Note that selling the illiquid assets by the investor what he bought in the planning period makes a loss to her and that is why he will hold it until the final period.

The price of illiquid assets in both the planning and intermediate period is affected by the net asset-out as it reduces the liquidity. It is assumed that the expected return

²³ The model could be explained in two periods, but to make the investor conditional of losing an asset if she liquidates the illiquid asset, what she buys in the planning period, in the intermediate period the model needs three periods.

²⁴ The model can be analysed by representative agents whose useable resources are subject to be affected by corruptions in different proportions.

²⁵ It is assumed that the investor holds the safe assets outside the banking system. However, they don't compete with the bank's system lending to the firms directly since only the banks can distinguish the genuine risky investments.

to the illiquid asset is higher than that to the safe asset in order to make the buying of illiquid assets attractive, i.e.

$$V_1 = (1-\lambda)Q_G + \lambda Q_B > 1.$$

Thus the investor holds the liquid asset only if they can make a profit from buying the collateral at a low price in the intermediate period. If there is no liquid asset in the intermediate period then the price would fall to zero when the bank tries to sell the collateral in the case of shock and thus there is a possibility of infinite profits for liquid asset holders.

The maximization problem of the representative investor is

$$\text{Max}_{\tau, l_0, l_1} \Delta = (1-\lambda)\{(\tau L + Q_G l_0)\} + \lambda\{Q_B l_1 + Q_B l_0\} \quad (1)$$

$$\text{s.t. } L = (1 - \gamma_i)W \quad (2)$$

$$P_0 l_0 = (1-\tau)L \quad (3)$$

$$P_1 l_1 = \tau L \quad (4)$$

Where, the given parameters and exogenous variables of model are:

λ , is shocking probability.

Q_G is good time's return on illiquid asset.

Q_B is bad time's return on illiquid assets.

$L = (1 - \gamma_i)W$ is the total available liquid assets hold by the investor to buy illiquid assets.

P_0 is the price of illiquid assets in period 0.

P_1 is the price of illiquid assets in period 1.

Decision variables of the investor are:

τ is the share of liquid assets hold by investor either to buy illiquid asset in intermediate period in the case of shock otherwise hold it just as liquid asset till final period in case of no-shock.

I_0 is the amount of illiquid assets the investor buys at price P_0 in period $t = 0$.

I_1 is the amount of illiquid assets the investor buys in period $t = 1$ at price P_1 .

The model assumes that there is no way for the investor other than buying the illiquid asset or holding liquidity. The price P_1 has to be weakly lower than the present value of the return to the illiquid asset in the bad state, i.e. $P_1 \leq Q_B$, otherwise the investor will not buy the asset.

From conditions (3) and (4) it can be easily shown that both I_0 and I_1 can be derived in terms of decision variable τ and other given/exogenous parameters, i.e.

$$I_0 = \frac{(1-\tau)(1-\gamma_i)W}{P_0} \text{ and } I_1 = \frac{\tau(1-\gamma_i)W}{P_1} \quad (5)$$

Then the only decision variable is τ and the maximization problem may be rewritten using the condition (5):

$$\text{Max}_{\tau} \Delta = (1-\lambda)\left\{\tau(1-\gamma_i)W + Q_G \frac{(1-\tau)(1-\gamma_i)W}{P_0}\right\} + \lambda\left\{Q_B \frac{\tau(1-\gamma_i)W}{P_1} + Q_B \frac{(1-\gamma_i)(1-\tau)W}{P_0}\right\} \quad (6)$$

The no-arbitrage condition can be found taking the F.O.C. with respect to τ ,

$$(1-\lambda)\left\{(1-\gamma_i)W - Q_G \frac{(1-\gamma_i)W}{P_0}\right\} + \lambda\left\{Q_B \frac{(1-\gamma_i)W}{P_1} - Q_B \frac{(1-\gamma_i)W}{P_0}\right\} = 0$$

After a little algebraic manipulation it can be written as

$$\frac{(1-\lambda)Q_G + \lambda Q_B}{P_0} = (1-\lambda) + \lambda \frac{Q_B}{P_1} \quad (7)$$

The investor chooses the optimal amount of illiquid asset at period $t = 0$ and hold liquid assets from planning to intermediate or to final period with this condition. This condition implies that the expected return to the strategy of buying the illiquid asset at $t = 0$ and holding it until final period must equal the expected return to the strategy of holding liquid asset until $t = 1$ and then buying the illiquid asset in the case of the shock. Note from Eq. (4) that the intermediate period's price is defined by the liquidity left in planning period and the liquidity is affected by the net asset-out due to corruption. The higher is the net asset-out the lower will be the liquidity in intermediate period. And thus the intermediate period price will fall.

3.2.2 Behaviour of the Bank

The bank is the representative of intermediary to provide credit to the firm. The bank has D amount of total credit what is surrendered by depositors. The fund is insured under DIS. The bank manager is in-charge to allocate the fund between safe reserves and loans. Of D the bank keeps the amount S as its safe reserves and rest of the amount, X_s , is provided as loan to the firm. CBM may provide loan illegally for private benefit due to the corruption opportunity in corrupted countries and knowing the bank is safe in the knowledge that the bank's lending risk would be covered by DIS. Illegal private benefit is unofficial to the bank and secret from the legal authority. The model assumes that the limit/scale of corruption in loan disbursement could be up to the limit/scale of relaxed law-and-order situation of the country (see I.2 in Appendix that corruption is very strongly influenced by law-&-order situation of the country). CBM knows the current law-and-order situation but not of the following periods, thus always there is chance for the CBM to be caught and be punished in following periods.

The budget constraint for the bank is $S + X_s \leq D$, where S is bank's safe reserves, X_s is bank's total loan to firm, and D is the total deposited fund at bank. The bank's maximization problem is then,

$$\text{Max}_{S, X_S, C_b} \Pi = S + (1 - \lambda)rX_S + \lambda P_1 C_b - r_D D \quad (8)$$

$$\text{s.t. } S + X_S = D \quad (9)$$

Where exogenous and given variables are:

r is the expected return rate²⁶ the bank receives from investment project.

r_D is the return rate to pay the depositor.

D is the amount of total deposit surrendered by depositors.

The decision variables are:

S is the safe reserve of the bank.

X_S is the total credit provided as loan to the firm.

C_b is the amount of collateral for the bank.

The first term in R.H.S. of condition (9) is just the yield of reserves with return rate $r = 1$. The second term is the yield from loan. The third term indicates the yield in the case of shock, where the bank sells its collateral in intermediate period at price P_1 . And the final term is the total claims of the depositors.

After illegal negotiation between CBM and firm the collateral requirement is set which is regarded as the debt contract between the bank and the firm. Thus the debt contract between the bank and the firm is,

$$X_S = \beta P_0 C_b \quad (10)$$

The collateral requirement parameter β , what is exogenous, may be interpreted as a percentage of the collateral value up to which the credit is lent. The bank uses the collateral only in the case of shock. Both the prudential loan policy and the corruption will of the CBM lie in β . Lets say β_b is some given parameter ($0 \leq \beta_b \leq 1$)

²⁶ The return rate refers to the gross return rate i.e. for 10% interest the gross return is 110.

represents the collateral valuation on the basis of prudential loan regulation. But because of corruption opportunity the CBM would provide higher credit based on an exogenous parameter β_p . Thus the CBM manages the bank to have the debt contract between the bank and the firm as,

$$X_S = (\beta_b + \beta_p)P_0C_b \quad (11)$$

Granting β_p proportion of the loans involves private benefit to the CBM and $0 \leq \beta_p \leq \beta_L$. The upper boundary β_L is defined by the relaxed law-and-order condition of the country. The worse is the law-and-order condition of the country the higher will be β_L and then the higher will be the upper boundary of β_p . This is logical as we have found positive association between higher corruption and worsening law-&-order situation (Appendix I.2).

The loan manager may be honest and the subjective value of personal illegal benefit to him is zero then. Future possible legal consequences, moral responsibility, humanity or pious-ness, and so on could make him to be honest. Thus the manager may follow completely the prudential banking loan policy ($\beta_p=0$). The use of corruption opportunity will depend on the manager's given subjective value to the private illegal benefit; the most corrupt manager may provide loan even for very negligible amount of collateral but depending completely on the parameter β_p .

The illegal negotiation between CBM and the firm could be written in terms of CBM's private benefit asking:

$$\Psi_p = \alpha P_0 \beta_p C_b \quad (12)$$

Where,

Ψ_p indicates private illegal benefit of the CBM. In direct term condition (12) explains the percent cut of the loan amount. However any other kind of kickbacks can easily

be explained by (12) because in reality the borrower will always recover his kickback payments from illegal loans sanctioned.

α , $0 \leq \alpha < 1$, is exogenous parameter that defines illegal benefits in percentage of sanctioned illegal loan $P_0 \beta_p C_b$. α depends on the behavior of firm; how desperate the firm is for this extra illegal loan. The model assumes that no β_p is sanctioned for no α , i.e. $\beta_p \geq 0$ for $\alpha \geq 0$.

After a successful illegal negotiation between CBM and firm, the CBM manage the bank to provide loan with the contract,

$$\begin{aligned} X_s &= (\beta_b + \beta_p) P_0 C_b \\ \Rightarrow C_b &= \frac{X_s}{(\beta_b + \beta_p) P_0} \end{aligned} \quad (13)$$

So C_b is now written in terms of decision variable X_s and other exogenous/given parameters as in condition (13). Similarly, S may be written in terms of X_s and given variable D . The bank's objective function is then maximized with respect to single decision variable X_s and is re-written as follows,

$$\text{Max}_{X_s} \Pi = D - X_s + (1 - \lambda) r X_s + \lambda P_1 \frac{X_s}{(\beta_b + \beta_p) P_0} - r_D D \quad (14)$$

The no arbitrage condition of the bank may be defined as,

$$\begin{aligned} -1 + (1 - \lambda) r + \frac{\lambda P_1}{(\beta_b + \beta_p) P_0} &= 0 \\ \Rightarrow r &= \frac{1}{(1 - \lambda)} - \frac{\lambda P_1}{(1 - \lambda)(\beta_b + \beta_p) P_0} \end{aligned} \quad (15)$$

So the bank has to decide X_s in such a way that the condition (15) holds. The bank would not be willing to lend if the gross return rate of the loan is lower than r . If the return rate is higher, the bank would be willing to lend, but the firm would not be

willing to borrow. Thus there could be corner solutions if not the above no-arbitrage condition holds.

The return rate r needs to be increased if the amount of loan based on illegal private benefit (β_p) gets increased while the efficient valuation (β_b) is given. The result is intuitive: the increase of amount of loans based on illegal private benefit of CBM implies that the total loan gets riskier and then to recover this risk bank's interest rate gets increased. In reality the interest rate on loans in higher corrupted countries are higher than in less-corrupted/industrialized countries.

The condition (15) expresses that the lower is the expected price P_1 in intermediate period, in the case of shock, the higher is the required return rate on loans. Since the lower expected P_1 implies lower return from selling collateral at period $t=1$ in the case of shock, bank has to take into account this value-loss when setting the required return rate r .

3.2.3 Behaviour of the firm

The representative firm needs liquid funds for investing in project. The liquid fund sources for the firm are loan from the bank and/or from selling its illiquid assets to the investor. Because of the opportunity of corrupted dealing between the CBM and the firm, the firm may obtain funds from the bank without providing enough collateral but providing some illegal private benefits to the CBM.

Taking into account total loans it can obtain with its collateral and the price of the illiquid asset selling the firm decides whether to carry out the risky investment project or not. It may instead hold only the illiquid asset and obtain the return from it in the final period. Then there will be no trade of illiquid assets. The decision making of the firm can be examined by studying the profits the firm would gain from the investment project. If the expected return from illiquid asset is higher than the profits from project, the firm never undertakes the project. The return from the

investments has to be at least as large as the expected return of the illiquid asset in order to the investments be attractive, i.e. in the per unit form,

$$[(1-\lambda)R]P_0 \geq (1-\lambda)Q_G + \lambda Q_B \quad (16)$$

R is the return from investment project. R.H.S. is the expected return to the illiquid asset if the asset is not used in investment project.

The requirement of the planning period illiquid asset's price P_0 is,

$$P_0 \geq \frac{(1-\lambda)Q_G + \lambda Q_B}{(1-\lambda)R}. \quad (17)$$

P_0 needs to satisfy the above inequality to undertake the investment project by the firm. P_0 turns to equal $(1-\lambda)Q_G + \lambda Q_B$ if there is no liquidity problem and no possibility of trading illiquid asset at a deflated price. No one would be interested to buy asset at a higher price, nor the firm be attractive to sell at a lower price. The firm requires the denominator of inequality (17) greater than 1 (the safe return) to under take a project. Thus the inequality (17) needs to hold in equality for no arbitrage condition. The equal condition could be justified in a way that the investors are not willing to buy assets at price $P_0 = (1-\lambda)Q_G + \lambda Q_B$ for the reasons: i) because of the corrupted net asset-out, the overall liquidity of the investor could be lower than enough, and ii) the investor may have feeling that there is chance of buying illiquid assets at lower price in the intermediate period.

The model assumes that the technology for productive investment project is not available to all agents. Otherwise every one would intend to invest in the project for extra profit and no one would be willing to buy the illiquid assets, and the price P_0 would have been equal to $(1-\lambda)Q_G + \lambda Q_B$. Thus the representative firm would initially undertake the project when the condition (17) holds.

The firm's optimal behaviour may be described by the maximization problem written as,

$$\text{Max}_{A_C, A_F, X_{1D}, X_{2D}} \Omega = (1-\lambda)[X_{1D}R - X_{2D}r + Q_G A_C] + (1-\lambda)R P_0 A_F \quad (18)$$

$$\text{S.t. } A = A_C + A_F$$

Where the given and exogenous variables are:

λ , Q_G , r , and P_0 are the same as they are in investor's objective function.

R is the return on entrepreneur's invested project.

Decision variables are:

X_{2D} is the loan the firm demands through CBM from the bank.

X_{1D} is the loan the firm can use in the project after paying the illegal benefit to CBM.

A_C is the amount of illiquid assets the firm decides to sell to investor at price P_0 .

A_F is the amount of illiquid assets the firm decides to offer as collateral for the bank loan.

The first term in Eq. (18) indicates the total return on part of the project financed by loan and the last term indicates the total return on part of the project financed by selling the illiquid asset. In the case of shock the return for the firm is zero.

After a successful negotiation between CBM and firm, the firm agrees to provide the CBM illegal benefit that is written as,

$$\Psi_p = \alpha P_0 \beta_p A_C \quad (19)$$

Then,

$$X_{2D} = X_D = (\beta_b + \beta_p) P_0 A_C \Rightarrow A_C = \frac{X_D}{(\beta_b + \beta_p) P_0} \quad (20)$$

$$X_{1D} = X_D - \alpha P_0 \beta_p A_C = X_D - \alpha \beta_p \frac{X_D}{(\beta_b + \beta_p)} \quad (21)$$

As in constraint (20) the decision variable A_C could be defined in terms of X_D and other exogenous/given variables. Plugging the value of A_C in budget constraint of (18), A_F could also be defined in terms of X_D and other exogenous and given variables. The firm's objective function may then be maximized with respect to single variable X_D and is written in the following way,

$$\text{Max}_{X_D} \Omega = (1-\lambda) \left[\left\{ X_D - \frac{\alpha \beta_p X_D}{(\beta_b + \beta_p)} \right\} R - X_D r + \frac{Q_G X_D}{(\beta_b + \beta_p) P_0} + R P_0 \left\{ A - \frac{X_D}{(\beta_b + \beta_p) P_0} \right\} \right] \quad (22)$$

The no-arbitrage condition of the firm is,

$$R - r + \frac{Q_G}{P_0(\beta_b + \beta_p)} - \frac{R}{(\beta_b + \beta_p)} = \frac{\alpha R \beta_p}{(\beta_b + \beta_p)} \quad (23)$$

The firm will decide on X_D in such a way that the condition (20) holds. Plugging the value of r from the condition (15) the above condition can be reorganized as follows:

$$R - \frac{1}{(1-\lambda)} + \frac{\lambda P_1}{(1-\lambda)(\beta_b + \beta_p) P_0} + \frac{Q_G}{P_0(\beta_b + \beta_p)} - \frac{R}{(\beta_b + \beta_p)} = \frac{\alpha R \beta_p}{(\beta_b + \beta_p)} \quad (24)$$

So the firm will decide on X_D in such a way that the net return from its invested project equals the return loss due to illegal payment to the CBM. In addition, we find from the no arbitrage condition that the firm would be less interested for illegal excess loan if the planning period's illegal asset's price, P_0 , gets increased and then the illegal private benefit rate, α , would decrease.

3.3 The Equilibrium

The earlier sections analyze each agent's optimization problem. These analyses mainly focus the behavior of the agents inducing no-arbitrage conditions under

which the agents choose an interior solution for the optimization problem. The intention of this section is to analyze optimal choices in the equilibrium frame work given the market clearing conditions, and budget and feasibility constraints.

The price of the illiquid asset in the planning, P_0^* , and in intermediate period, P_1^* , the rate of return for bank on collateralized loans r , and the private illegal benefit parameter α defines the equilibrium of the model. The equilibrium also consists the optimal investment decisions and portfolio choices of agents that is $(X^*_D, A^*_C, (A - A^*_C))$, (S^*, X^*_S, C^*) , and $(\tau(1 - \gamma_i)W^*, I^*_0, I^*_1)$ for the firm, the bank, and the investor respectively.²⁷ This paper is interested in impact of corruption on asset price fall and impact of illegal private benefit during the banking crisis. The detailed analysis of equilibrium is presented in Appendix.

The equilibrium price of illiquid asset in intermediate period P_1 is necessary to consider two cases, shock and no-shock. In the case of no-shock the firms are successful in their projects and can pay the required payments to the bank managers. And the manager can meet the obligations of depositors without selling the collateral or without liquidating the illiquid assets. Then the asset price is determined by the present value of the safe return²⁸, that is $P_1 = Q_G$. The price greater or lower than Q_G makes no one to buy or sell the illiquid assets respectively.

In the case of shock all projects of entrepreneurs fail and banks are unable to get its loan back. Then the only option for the bank is to sell the collateral C inelastically. In this case the selling price of collateral depends completely on the available liquidity from the investor where the investor's liquidity is affected by net liquid asset-out. Thus if the liquidity $\tau(1 - \gamma_i)W$ is greater or equal the bad time fundamental value, i.e. $\tau(1 - \gamma_i)W \geq Q_B C$, the equilibrium collateral price would equal the bad time safe return Q_B . This means that the liquidity is enough to absorb the collateral sold by the bank at the fundamental value. However the price can not be higher than fundamental value because the investor would not be willing to buy then.

²⁷ In equilibrium the market clearing conditions imply that $X^*_D = X^*_S$, $A^*_C = C^* = I^*_1$, and $A - A^*_C = I^*_0$.

²⁸ The return is realized in the final period as we assumed.

In the case of shock if there is not enough liquidity in the asset market the collateral price may fall under the fundamental value. Then $\tau(1-\gamma_i)W \leq Q_B C$ and the price will be determined as a ratio of available liquidity and the collateral supplied by the bank, i.e. $P_1 = \tau(1-\gamma_i)W/C$. It is worth noting now that the asset price is increasing function of the liquidity provided by the investors as τ is positively associated with P_1 , but it is decreasing function of the corruption as P_1 is negatively associated with γ_i . That is, the higher is net asset-out due to corruption, the lower is then the total liquidity the investor can use in the illiquid asset market, and thus the lower is the price of collateral after shock. The price of collateral sold by the bank in intermediate period can be summarized in the following way,

$$P_1^* = \begin{cases} P_1 = Q_G, & \text{if there is no shock} \\ P_1 = Q_B, & \text{if shock occurs, but } Q_B \leq \frac{\tau(1-\gamma_i)W}{C} \\ P_1 = \frac{\tau(1-\gamma_i)W}{C}, & \text{if shock occurs, but } Q_B > \frac{\tau(1-\gamma_i)W}{C} \end{cases} \quad (25)$$

Now the bad state's equilibrium price needs to be solved explicitly in terms of exogenous variables. Note that in the case of good state the equilibrium price always equals the present value of the safe return to the illiquid asset. The no-arbitrage condition of the investor (7) may be rewritten in the following way to derive the price P_1 in the case of shock,

$$P_1 = \frac{\lambda Q_B P_0}{(1-\lambda)Q_G + \lambda Q_B - (1-\lambda)P_0} \quad (26)$$

The equation finds that if for some reasons $P_0 = (1-\lambda)Q_G + \lambda Q_B$ the price of the illiquid asset will just equal the present value of the bad state return, i.e. $P_1 = Q_B$. On the other hand, if $P_0 < (1-\lambda)Q_G + \lambda Q_B$ then $P_1 < Q_B$. This implies that knowing that he may be able to buy illiquid asset at deflated price in the following period the investor is not willing to buy illiquid asset at price $P_0 = (1-\lambda)Q_G + \lambda Q_B$ in the planning period. That is why he leaves part of the liquid assets for the intermediate

period²⁹. Using the condition (17) and the above explanation the planning period equilibrium price can be written in the following way,

$$(1-\lambda)Q_G + \lambda Q_B \geq P_0 \geq \frac{(1-\lambda)Q_G + \lambda Q_B}{(1-\lambda)R} \quad (27)$$

The right hand side term of the condition refers the lower boundary and the left hand side term refers the upper boundary of the planning period price. If the condition (17) holds as a no-arbitrage condition the lower boundary dominates and the right hand side term of condition (27) holds as equality. Note that the price is defined by the liquidity available i.e. by $(1-\gamma_i)W$. So if the price was P_w for full liquidity (i.e. $\gamma_i=0$), the price would be $(1-\gamma_i)P_w$ for shortage of liquidity (i.e. $\gamma_i>0$). In fact $P_0 = (1-\gamma_i)P_w$.

Condition (27) expresses that the higher is the gross return Q_G and Q_B of illiquid assets in good and bad state respectively, the higher the initial price initial price requires. The intuition behind this is that the higher is the illiquid asset return the less attractive is the investment project to carry out, and thus the firm requires the higher price from selling illiquid assets in order to finance the project.

In order to analyse the effect of corruption it is necessary to examine the relation between corrupted loan portion γ_b and gross return R of the firm's project. Condition (24) can be rewritten in the following expression to derive the project's gross return for the firm,

$$R = \frac{\frac{1}{1-\lambda}P_0(\beta_b + \beta_p) - \frac{\lambda}{1-\lambda}P_1 - Q_G}{P_0(\beta_b + \beta_p - \alpha\beta_p) - P_0} \quad (28)$$

Corrupted loan amount, β_p , has two routs through which it affects gross return. The term in the numerator suggests that the gross return R needs to be increased for increment in corrupted loan, while the denominator suggests the opposite. However, it can be argued that the effect of numerator dominates the effect of

²⁹ She does not leave the whole liquid asset for the intermediate period because if there is no sale of illiquid assets then holding liquid assets is less valuable than holding illiquid assets.

denominator for any $\lambda > 0$ and for any non-negative value of α . Thus the higher the corrupted loan the higher is the required gross project's return, and the lower is the initial price (from (27)). This is rather intuitive in the sense: the bank needs to increase the gross return r to recover the loss from corrupted loan for what R of firm needs to be increased.

R needs to be increased for higher α as well, i.e. if private illegal benefit to CBM is increased, to recover this illegal benefit payment the gross return R needs to be increased. With respect to this higher expected R , for what the project becomes more attractive, the firm is ready to sell illiquid asset at lower price in the initial period.

The probability of shock λ in lower boundary of (27) may affect the initial price in two ways. The term in the denominator suggests the positive association between the price and shock probability. However the numerator suggests the negative association. But it could be argued that the denominator's effect dominates the numerator's one. Thus the initial price gets increased for increment of shocking probability. On the other hand the price gets decreased for higher shocking probability in upper boundary in L.H.S because $Q_G \geq Q_B$.

Finally the intermediate price P_1 is examined. In intermediate period the illiquid asset i.e. the collateral is needed to sell only in the case of bad time. The intermediate price P_1 can be derived inserting the value of P_0 from the no-arbitrage condition (7) and then the condition (27) turns as follows,

$$Q_B \geq P_1 \geq \frac{\lambda Q_B}{(1-\lambda)(R-1)} \quad (29)$$

Condition (29) shows that the lower boundary of the price depends on expected gross return R of the project, the bad time illiquid asset return, and the shocking probability. Like the planning period price the intermediate price is also negatively associated with the corrupted loan as the required gross return from the project increases due to higher corrupted loan. The higher is bad time's return Q_B the higher is the price. Finally the intermediate price gets increased for increases of

shocking probability. Note that like initial price the intermediate price is also affected by total available liquidity of investor i.e. by $(1-\gamma_i)W$ and similarly $P_1 = (1-\gamma_i)P_{1w}$.

3.4 Banking crisis

In the case of no shock the banks total obtaining is from both the honest and corrupted loans, and it is rX_S . The banking crisis will not occur in the case of no shock because then $S + rX_S \geq D$ as the model assumes.

The firm will default and the bank will have to take over the collateral in the case of shock. The bank will start selling the collateral to recover the obligations to depositor. Now the banking crisis will depend on the selling price of the collateral. The collateral price will depend on the liquidity available. If there is sufficient liquidity in the market the collateral price will equal its fundamental value Q_B . In this case the bank will fail if,

$$S + Q_B C_b < D \Rightarrow S + Q_B \frac{X_S}{(\beta_b + \beta_p)P_0} < (X_S + S) \Rightarrow \frac{Q_B}{(\beta_b + \beta_p)P_0} < 1 \quad (30)$$

The case is more interesting if there is no sufficient liquidity. Then the price is determined by $P_1 = \frac{\tau(1-\gamma_i)W}{C_b}$ and the bank will fail if,

$$S + \frac{\tau(1-\gamma_i)W}{C_b} C_b < D \Rightarrow S + \tau(1-\gamma_i)W < (S + X_S) \Rightarrow \tau(1-\gamma_i)W < X_S \quad (31)$$

Thus expression (30) shows that in an economy where higher corruption exists in banking sector to provide loan the economy is more prone to banking crisis. Similarly from (31), the economy is more prone to banking crisis if the liquidity gets lower due to higher net liquid asset-out as a result of corruption.

4. Conclusion

The objective of this paper has been first to show by an empirical study that banking crisis is more likely in corruption gripped countries generally, and especially in corrupted countries which uses DIS. Then the objective has been to develop a theoretical model to relate banking crisis with the influences of corrupted asset outflow and typical corruptions in banking sector using DIS.

Using a panel data for industrialized and developing countries for the period 1982-1997 a multivariate logit model is estimated. The empirical finding is that more corrupted country is more prone to banking crisis. Even though the bank crisis is a terminology that specifically means the bank failure, but in fact bank crisis is the consequence of multi-sector's failure as both the banking performances and performances of production firms, who obtain loans from banks, relates many other sectors as well. Countries general corruption perception indices reflect the overall dysfunctional of the sectors and thus corruption's association with banking crisis is logical. Especially, the positive association of corrupted countries using DIS with banking crises is more logical because the use of DIS by more corrupted countries is just opening the door to the corrupt bank syndicate to allocate the fund in loan disbursement for illegal private fund.

To develop a theoretical model we have focused on asset and credit (loan) market because bank's activity is most affected by these two markets. To avoid much complicity the influence of overall corruptions in asset market in a straight forward way while the influence of typical corruptions in banks in loan disbursement in a bid more specified way have been investigated. The model shows that the bank plunges into problems first because of non-performances of loans and the non-performances is amplified by corruption in loan provision. Then the bank finds deflated price in selling its collateral due to shortage of liquidity what is partly affected by the outflow of the corrupted liquid assets. Because of illiquidity the asset price may even fall short of the fundamental value.

The main role of this study is the liquidity after net-asset out and non-performance of loans due to corrupted loan disbursement in credit market. The firm holds only illiquid assets and it needs to exchange this asset to liquid fund. Due to the presence of corrupted loan the firm may have more total liquid funds relative to the illiquid assets it has. On the other hand the liquidity gets lower to buy the illiquid assets because of net asset-out as the outflow of dirty money is higher than the asset-in as foreign direct investment in developing (mostly corrupted) countries. The bank has depositor's surrendered liquid fund what is insured under DIS and this fund is provided as loan to the firm based on not only the prudential policy, but also on CBM's illegal private benefit.

The model defines a process what is just a part of the complex process of the deepness of banking crises experienced mostly in developing countries in last three decades. The banking sector in the crises experienced developing countries drowned into problems due to first non-performing loans and then credit losses. Both non-performing loans and credit losses were partly affected by corruption. Due to corruption opportunity CBM exaggerates the valuation of collateral, given by firm for loan, for its illegal private benefit and manage the bank to sanction loan accordingly. In the case of a shock the bank needs to sell this collateral because of liquidity needs to meet the claim of depositor. The two fold effects of corruptions, i) bank's less collateral than enough, and ii) lower selling price from less liquidity due to net asset-out hastens the banking crises.

There may raise questions of policy implications of this study and the answers are as follows. Many aiding nations or organisations like World Bank are concerned about the corruption in developing countries as corruption restrains the economic development of the country. Necessary measures need to be taken to check corruption especially in banking sector, because bank is the best possible intermediary for industrialization, income redistribution, and in all for the economic growth. Banking sector needs to be free from any political pressure or patronage. Central bank authority should be independent and empowered enough to take stringent and punitive actions against corrupt bank managements. Different

measures instructed by Transparency International, World Bank, and so on could be followed to eliminate corruption from the country and from the banking sector. At the same time the developed nations, where the corrupted liquid assets flows in or deposited in, should be sincere and take necessary measures to preclude the inflow of corrupted/dirty money from the developing nations. The study could be extended why the developed nations should preclude this inflow for their own and global interests.

The study has several limitations what could be improved. Some of the assumptions could be relaxed to make the study more realistic. The study lacks the behaviour of the depositors. Concerning corruption, depositor's behaviour does not matter in that extent lacking enough evidence of illegal negotiation between bank managements and depositors. That is the depositor might have corrupted fund but in practice to deposit that fund the depositor can not negotiate with the bank on rate or return, she just abide the given bank's regulation. However, banking crisis severity could be lessened if the assumption that all depositors withdraw their funds in the intermediate period is relaxed. Depositors could be of two types (Diamond and Dybvig (1983)), impatient and patient.

Another limitation of this study is that the model investigates the influence of outflow of corrupted liquid assets as given. However, there could be some factors that make the outflow of corrupted liquid assets i.e. indigenize this outflow. To avoid further complicacies this has not investigated this exogenous factors. But this would be more realistic had those factors been investigated.

The model assumes that all projects of the entrepreneurs fail after shock. But in fact projects are not homogeneous rather heterogeneous that some projects could be less exposed to the shock. Thus fraction of the projects would fail what would ultimately reduce the crisis probability but basic idea of the model would remain same. Finally, the model could be improved introducing some non-linearity to the framework of the model rather using the linearity of the maximization problems of the representative agents.

Appendix

I. Empirical analysis

I.1 Corruption and Banking Crises

Explanatory Factors

Different explanatory factors used to test the relationship between banking crisis and corruption is given in the Table as follows,

Table A1: Different explanatory variables, definition, and source of collection

Variables	Definition	Source
GDP Growth	Rate of growth of real GDP (GDP at current value/Consumer price index)	IFS (International Financial Statistics)
Tot change	Change in the terms-of-trade (ratio of unit values of export and import)	IFS
Inflation	Percent change in consumer price index	IFS
Depreciation	The rate of change of exchange rate (national currency per USD – year average value)	IFS
Real interest rate	Nominal interest rate minus the contemporaneous rate of inflation	IFS: Nominal Interest Rate: a rate charged by the Central Bank to Domestic banks such as the discount rate; otherwise, the commercial bank deposit interest rate.
M2/reserves	Ratio of M2 to foreign exchange reserves of the Central Bank	M2 is money plus quasi-money (lines 34+35 from the IFS). Reserves also from IFS.
Surplus/GDP	Ratio of Central Government budget surplus to GDP	IFS
Private/GDP	Ratio of domestic credit to the private sector to GDP	Domestic credit to the private sector is line 32d from the IFS.
Cash/bank	Ratio of bank liquid reserves to bank assets	Bank reserves are line 20 of the IFS. Bank assets are lines 21 + lines 22a to 22f of the IFS.
Credit growth ₂	Rate of growth of real domestic credit (ratio of dom. credit to private-sector to GDP)	IFS
DIS	Using deposit insurance scheme with different regulations explicitly formed. In the case of no scheme with explicitly formed regulations, then it is implicit insurance scheme	Garcia (1999) and is also checked through the articles by McCarthy (1980), Talley and Ignacio (1990), Carisano (1992), De Lange (1992), Vittas (1992), House of Commons (1992), Kyei (1995),

	as the government usually come forward to rescue the banking sector after banking crisis.	and BASLE Committee Report (March 1997)
Corruption	Yearly corruption indices	ICRG
Corruption -DIS	The variable takes values "0" if there no explicit DIS otherwise the variable takes inversed values of corruption indices.	

Estimation Result

After the onset of a banking crisis, the behaviour of some of the explanatory variables is likely to be affected by the crisis itself.³⁰ These feed-back effects would harm the relationship I try to identify. So the observations after the onset of banking crises to the end of banking crisis are excluded from the panel data. Country and yearly fixed effects are often included in the empirical model to allow for the possibility that the dependent variable may change cross-country and cross-year independently of the explanatory variables included in the regression. In logit estimation, including country or yearly fixed effects would require omitting from the panel all countries or years that did not experience a banking crisis during the period under consideration (Greene, 1997, chapter 19) and this would imply disregarding a large amount of available information.

The main focus of the regression is to draw the relationship between banking crisis and corruption. I used a reduced form relationship, i.e. the relationship of different explanatory factors with banking crisis is not derived from a specific structural model of the economy. For this reason it always raises the question which regressors best specify the model and which regressors do have direct causal links to the dependent variable. I follow the similar model specification as I did in earlier paper on DIS, i.e. first I used all possible explanatory variables found in the earlier studies and then selected the explanatory variables which best specify the model.

The number of observations in model (2) and (4) in Table-1 are much less because of many missing observations of the explanatory factors other than Corruption. In the logit model while the sign of the coefficient does indicate the direction of the

³⁰ See DKD (2000) for details.

change, the magnitude depends on the slope of the cumulative distribution function (see Green 1997 ch. 19 for details).

The countries used in estimation models of Table-1

Specification Model (1): Algeria, Argentina, Australia, Austria, Bangladesh, Belgium, Bahrain, Bolivia, Brazil, Burkina Faso, Cameroon, Canada, Chili, Columbia, Republic of Congo, Cot Devoir, Denmark, Dominican Republic, Ecuador, Egypt, El Salvador, Finland, France, Great Britain, Germany, Ghana, Greece, Guatemala, Guinea, Honduras, Iceland, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kenya, Korea, Kuwait, Lebanon, Liberia, Madagascar, Malaysia, Mali, Mexico, Morocco, Nicaragua, Nigeria, Netherlands, Norway, New Zealand, Panama, Paraguay, Peru, Philippines, Portugal, Senegal, Sierra Leon, Spain, Sri Lanka, Sweden, Switzerland, Syria, Tanzania, Thailand, Togo, Tunisia, Turkey, Uganda, U.S.A., Uruguay, Venezuela, Vietnam, South Africa, Zambia, Zimbabwe.

Specification Model (2): Argentina, Australia, Bangladesh, Belgium, Brazil, Burkina Faso, Canada, Chili, Columbia, Cot Devoir, Denmark, Finland, France, Great Britain, Germany, Greece, Guatemala, Iceland, India, Ireland, Israel, Italy, Japan, Jordan, Kenya, Korea, Malaysia, Morocco, Netherlands, Norway, New Zealand, Philippines, Portugal, Senegal, Spain, Sri Lanka, Sweden, Switzerland, Syria, Thailand, Togo, Tunisia, Turkey, USA, South Africa.

The countries used in Specification Model (3) and Specification Model (4) are the same as in Model (1) and Model (2) respectively.

Summary statistics of the variables used in Specification Model (2)

Variable	Obs	Mean	Std. Dev.	Min	Max
multicri	484	.0495868	.2173143	0	1
gdpgr_con	484	3.360216	5.687534	-19.87	58.81197
tot_chng	484	.5689463	8.39175	-39.5	37.86
depositi	484	.4979339	.5005131	0	1
corruptio	484	4.43843	1.43039	0	6

I.2 Corruption and Law-&-order Situation

Both the corruption indices and law-&-order indices have been collected from International Country Risk Guide for the period of 1982-1997. All countries available in the guide for that or sub-period have been taken. And we found the following results.

Correlation:

	Corruption	Law-&-order
Corruption	1.0000	
Law-&-order	0.7157	1.0000

Logit estimation:

Dep. Variable = Corruption		Dep. Variable = Law-&-order	
	(1)		(2)
	Coefficient (Std Err.), z-value		Coefficient (Std Err.), z-value
constant	1.136*** (.293)	constant	3.263*** (.569)
law-&-order	1.08*** (.157), 6.88	Corruption	0.840*** (.260), 3.23
log likeli.	-189.391	log likeli.	-51.705
no. of observ.	1985	no. of observ.	1985
LR chi ²	80.75	LR chi ²	11.68
prob > chi ²	0.0000	prob > chi ²	0.0006
pseudo R ²	0.1757	pseudo R ²	0.1015

***, **, and * represents 1%, 5%, and 10% significant level respectively.

The logit model is estimated where corruption is dependent variable and law-&-order index is independent variable. Higher corruption index indicates lower corruption, whereas higher law-&-order index indicates better law-&-order situation of the country. Thus the positive coefficient in Specification (1) implies that better is law-&-order situation in a country the lower will be the corruption.

Specification (2) is estimated with law-&-order as dependent and corruption as independent variable. Corruptions significantly affect law-&-orders. But comparing likelihood-ratio (LR χ^2), model's significance level (prob > χ^2), and goodness of the fit of the model (pseudo R^2) between two specification models (1) and (2) model (1) is much better. Thus the causality runs in the way that corruption is affected by law-&-order situation of a country.

I.3 List of the highly corrupted countries which experienced banking crises in the presence explicit deposit insurance scheme:

Countries	Crises period	Avg. corrup. index (82-97)	Countries	Crises period	Avg. corrup. index (82-97)
Argentina	80-82, 89-90, 95	3.5	Mexico	95-97	2.77
Bangladesh	86-97	0.775	Nigeria	90-97	1.85
India	91-97	2.79	Philippines	81-87, 97-	1.82
Indonesia	97-	1.51	Sri Lanka	89-93	3.1
Kenya	85-89, 93-95	2.97	Thailand	97-	3.1
Kuwait	81-90	2.97	Uganda	94-97	2.27
Lebanon	88-90	2.51	Venezuela	94-97	2.84

Caprio and Klingebiel (1996) for bank crises and ICRG for corruption indices

II. The general equilibrium analysis

II.1 The price in intermediate period

One of the main interests of this paper is to find the asset price in intermediate period in different conditions. By definition the price equals the fundamental value in the case of no shock. So the focus is in the case of shock.

$$P_1 = Q_B \text{ if } P_1 = \frac{\lambda Q_B P_0}{(1-\lambda)Q_G + \lambda Q_B - (1-\lambda)P_0} = Q_B$$

Then the condition requires $P_0 = (1-\lambda)Q_G + \lambda Q_B$.

However, if the condition is $P_0 < (1-\lambda)Q_G + \lambda Q_B$, then $P_1 < Q_B$.

II.2 Optimal choices in equilibrium

The maximization problems discussed in Section 3 described the behaviour of the economic agents what induces the no-arbitrage conditions. Market clearing conditions, the budget constraints, and the feasibility constraints are also required for the optimum solutions of different agents to be derived.

The market clearing conditions of the model are,

$$A - A_C^* = I_0$$

$$C_b^* = I_1$$

$$A_C^* = C_b^*$$

$$X_D^* = X_S^*$$

$$P_1 C_b^* = \tau L^* = \tau(1 - \gamma_i)W^*$$

The budget and the feasibility constraints are,

$$A = A_C^* + (A - A_C^*), \text{ for the firm,}$$

$$D = S + X_S, \text{ for the bank,}$$

and

$$(1 - \gamma_i)W^* = \tau(1 - \gamma_i)W^* + P_0 I_0, \text{ for the investor.}$$

Optimal choices of the economic agents:

Optimal choices of the agents in the equilibrium can be given in terms of equilibrium prices and different exogenous parameters.

$$\tau(1-\gamma_i)W^* = P_1^* C^* = P_1^* I_1^* \quad (\text{because } C^* = I_1^*)$$

$$\Rightarrow \tau(1-\gamma_i)W^* = P_1^* (A - I_0^*) \quad \text{and} \quad (1-\gamma_i)W^* = \frac{P_1^* (A - I_0^*)}{\tau}$$

Then,

$$(1-\gamma_i)W = \tau(1-\gamma_i)W^* + P_0^* I_0^* = P_1^* (A - I_0^*) + P_0^* I_0^*$$

$$\Rightarrow I_0^* = \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*}$$

$$\tau(1-\gamma_i)W^* = (1-\gamma_i)W^* - P_0^* I_0^* = (1-\gamma_i)W^* - P_0^* \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*}$$

$$I_1^* = C_b^* = A_C^* = A - I_0^* = A - \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*}$$

$$X_S^* = \beta^* P_0^* C_b^* = (\beta_b + \beta_p^*) P_0^* \left[A - \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right]$$

$$S^* = D - X_S^* = D - (\beta_b + \beta_p^*) P_0^* \left[A - \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right]$$

$$X_D^* = \beta^* P_0^* A_C^* = (\beta_b + \beta_p^*) P_0^* \left[A - \frac{(1-\gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right]$$

II.3 Absence of no-arbitrage conditions:

The no-arbitrage condition is the interior solution of the agent's maximization problem what is described in Section 3. But if the no-arbitrage conditions are not

satisfied with respect to equilibrium prices, the agent can choose the corner solution depending on the initial endowments of the agents. The choices of corner solutions for different agents are given as follows:

The bank's choice

Given the opportunity of corruption, the corrupt bank manager may provide loans to the firm if the no-arbitrage condition holds. However, the official would be unable to lend the firm if for some reasons the present price, P_0^* , or the collateral valuation parameter β_b and β_p^* get to zero. This means that then $X_D^* = 0$ and also $X_S^* = 0$. Given that $P_0^* > 0$, $\beta_b > 0$, $\beta_p^* > 0$, the equilibrium criterion for $X_S^* = 0$ can be expressed in the following way,

$$X_S^* = (\beta_b + \beta_p^*)P_0 \left[A - \frac{(1 - \gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right] = 0 \Rightarrow \left[A - \frac{(1 - \gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right] = 0$$

$$\Rightarrow (1 - \gamma_i)W^* = P_0^* A.$$

Provided that the bank manager's subjective value to the private illegal benefit is zero, $\beta_p^* = 0$ for $\alpha = 0$. Then the bank's loan disbursement is completely based on prudential policy and the amount of loan supplied is,

$$X_S^* = \beta_b P_0^* \left[A - \frac{(1 - \gamma_i)W^* - P_1^* A}{P_0^* - P_1^*} \right].$$

The amount of safe reserve of the bank depends on the fund and loan provided in both corrupted and non-corrupted way. If $D^* = X_S^*$, the safe reserve, S^* , is equal to zero. If $D^* > X_S^*$, then $S^* = D^* - X_S^*$. The management may restrict credit supply depending on the amount of credits the bank holds, i.e. the corrupt manager can only provide loan for illegal private benefit if there is enough credit from depositors.

The firm's choice

Given the asset prices and the collateral valuation parameters the firm chooses to finance the investment project both by bank loan and selling the illiquid asset under the no-arbitrage condition. The firm's fund collection policy depends on P^*_0 and β_p while β_b is given. If the subjective value of corrupted loan to the bank manager is zero i.e. $\beta_p = 0$, the firm would not have any opportunity to obtain excess loan paying illegal private benefit. She would completely abide bank's prudential loan policy and would decide the amount of loan for a given β_b . Provided the corrupt bank manager the portion of the sectioned loan the firm would agree to pay as illegal private benefit can be found from the bank's and firm's no-arbitrage conditions. Condition (24) can be reorganised as follows,

$$\alpha^* = \frac{(\beta_b + \beta_p^*)}{\beta_p^*} - \frac{(\beta_b + \beta_p^*)}{(1-\lambda)R^*\beta_p^*} + \frac{\lambda P^*_1}{(1-\lambda)P^*_0 R^*\beta_p^*} + \frac{Q^*_G}{P^*_0 R^*\beta_p^*} - \frac{1}{\beta_p^*}$$

Let's define right hands side tem as M^* . If $\alpha^* < M^*$ the firmer would willing borrow more amount corrupted loan. But if $\alpha^* > M^*$ the firm would not willing to borrow corrupted loan.

The initial positions of the funds of the investors and of the bank are also required to define the firm's financing strategy in equilibrium. For example, if the amount of investor's liquid wealth is so small and he decides leaving all wealth in the liquid form for the second period, i.e. $(1-\gamma_i)W^* = \tau(1-\gamma_i)W^* \Rightarrow \tau = 1$, the firm has then only alternative to borrow fund from the bank and thus for the firm $A-A^*_C = 0$.

The investor's choice

There could be such a planning period price P_0 and the total wealth of the investor $(1-\gamma_i)W$ that the investor leaves no liquid assets for intermediate/final period, i.e. $\tau(1-\gamma_i)W = 0$. To take place this condition the investor needs to be attracted much

to buy all the illiquid assets from the firm. The investor will be attracted if and only if the planning price is low enough. The criterion is then,

$$\tau(1-\gamma_i)W^* = (1-\gamma_i)W - P_0^* \frac{(1-\gamma_i)W - P_1^* A}{P_0^* - P_1^*} = 0 \Rightarrow (1-\gamma_i)W^* = P_0^* A$$

The investor may also leave all her assets for the next/final period what implies that $l_0 = 0$ and $\tau(1-\gamma_i)W = (1-\gamma_i)W$. The investor will leave all her assets for the later periods usually when her wealth is so low. That is the criterion for investor to leave all her assets for the later period is,

$$\tau(1-\gamma_i)W = (1-\gamma_i)W - P_0^* \frac{(1-\gamma_i)W - P_1^* A}{P_0^* - P_1^*} = (1-\gamma_i)W$$

$$\Rightarrow (1-\gamma_i)W = P_1 A.$$

$(1-\gamma_i)W > P_1 A$ implies that the investor has enough assets to buy illiquid assets in the planning period leaving liquidity for the later periods, that is then $\tau(1-\gamma_i)W < (1-\gamma_i)W$.

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