Excess Credit Risk and Bank's Default Risk An Application of Default Prediction's Models to Banks from Emerging Market Economies

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Abstract

The purpose of this paper is to investigate the regulatory and institutional factors which may increase excessive risk taking in banks. Few studies deal with the impact of these external factors on bank's risk taking and probability of default, despite the fact that empirical investigation is crucial for understanding the relationship between the regulatory, legal and institutional environement and bank's health, especially in emerging market economies. We apply a two step logit model to a database of banks from emerging market economies. Our results confirm the role of the institutional and regulatory environment as a source of excess credit risk, which increases bank failure risk. The integration of these environmental variables significantly contributes to the explanatory and discriminatory power of our model of bank default prediction.

Keywords : excess credit risk, bank default, emerging market economies, institutional factors of default, two step logit model.

JEL classification : G21, G28, C35

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1 Introduction and literature survey

The last 20 years have witnessed several bank failures throughout the world, particularly in emerging market economies (EME) (Bell and Pain [2000]).

The interest for bank failures comes mainly from its costs : financial losses for the stakeholders (shareholders, clients, deposits insurance fund), loss of competitivity, and a potential destabilization of the financial system, through the contagion mechanisms, when several individual failures lead to a banking crisis. The resolution of these failures is a waste of resources, particularly scarce in EME (Honohan [1997])[1].

Excess credit risk and bad corporate governance in banks are the principal internal default factors.

An O.C.C. [1988] study lists the characteristics of failed banks during the 80's in the US. The main cause of failure was bad quality of the bank assets. This quality is under the responsability of bank's managers. Therefore, inefficient risk management was at the source of bank default. The four main factors in failed banks were :

1. inadequate credit policy,
2. inadequate system of control and monitoring,
3. inadequate system of non performing loans (NPL) identification,
4. excessive concentration of decision authority.

A recent review of principal banking crisis factors (Llewellyn [2002]) points out five common characteristics throughout the world :

- inefficient process of risk analysis, management and control,
- insufficient monitoring,
- perverse or weak incentives structure,
- insufficient information transfer,
- inadequate corporate governance.

[1]For example, the banking crisis in Indonesia (1997) and Thailand (1997-98) costed about 50-55% and 42.3% of the GDP respectively in term of restructurization (fiscal contribution).

Bad risk management and control generate excess risk in banks. This excess risk is the output of a credit decision which increases bank default risk to a level superior to other stakeholders' objective. The main cause for such credit risk taking behavior is the fact that the agent who is responsible for the credit decision doesn't support all the costs of his decision.

Different symptoms of excess credit risk can be found in the relevant literature (Keeton and Morris [1987], Clair [1992], and Honohan [1997]) :

- low quality of the loans portfolio (high ratio of NPL),
- high concentration of loans in the portfolio (by term, borrower, industrial and/or geographic sector, type of debt instrument),
- over optimistic evaluation of borrower's quality,
- insufficient risk pricing,
- high correlations between loans (different type of loans and NPL),
- excessive loans growth,
- absorption of risk above bank's technical capacity.

Concerning the relationship between the control of the agent and his risk taking behavior, Gorton and Rosen [1995] put forward an explanation of bank default in US based on inefficient corporate governance mechanisms, which favors excess risk.

Wage policy is one of the internal corporate governance mechanisms which is supposed to resolve agency costs problem[2](Jensen [1993]). The agent's salary (the manager responsible for the credit decision and risk taking) is indexed on his performance. He also gets shares in the bank's capital (stock-options for example)[3].

[2]Notice that banking industry has two main specificities concerning corporate governance (Prowse [1995], Caprio and Levine [2002], and Ciancanelli and Reyes Gonzalez [2000]), which are :

- the opacity of bank assets which exacerbates the information asymmetry between insiders and outsiders, and therefore increases agency costs problem,
- the regulation of the banking industry, which alters market discipline.

[3]Houston and James [1995] find a positive relationship between insider's capital shares and bank charter value, which loss limits excess risk (Charter value can be defined as an intangible asset which corresponds to expected future profits resulting from banking activity. It is often assimilated to the banking licence). Ang et al. [2001] and John et al. [2001] also find that this type of wage policy reduces excessive risk taking incentives.

Following Gorton and Rosen [1995], excessive risk taking incentives depend of the level of insider's shares. In a declining industry, where good investments opportunities become scarce[4], bad managers-insiders can preserve their jobs and increase their revenues allocating loans to risky borrowers. This relationship between risk taking and the level of managerial holdings is non linear and concave. For majority holdings, the device is efficient because it disciplines the manager (in case of excess risk and bank default, he loses his human capital investment and his shares), therefore reducing the incentives for excessive risk taking even in a declining banking industry. For minority holdings, the manager keeps his ability to resist to shareholder's control (entranchment), while still receiving the revenues of his shares, through excess risk, which is unobservable by the principal (shareholder).

This explanation of excess risk is particularly relevant in the case of banks in EME, where managers and executives often hold shares in banks.

The results of empirical studies on the impact of ownership structure on risk taking in banks provide mixed evidence. Saunders et al. [1990] find that banks controled by a majority of shareholders-outsiders are less risky. On the contrary, Knopf and Teall [1996] and Anderson and Fraser [2000] find that banks controled by a majority of managers-insiders are more risky. Demsetz et al. [1997] find that this is particularly significant in low charter value banks.

We can notice other bank default factors, which we can call external. These are macroeconomic and market structure factors. Other default factors are regulatory and institutional ones.

The main macroeconomic default factors are generally also those which cause banking crisis, particularly in EME. These factors are among other high inflation, interest rate fluctuations, foreign capital flows volatility, inadequate exchange rate regime, public debt, ...[5]. The structural and regulatory change in EME increase the probability of these macroeconomic default factors. The banks can't correctly evaluate the riskiness of their borrowers in a changing economic environment. A boom & bust cycle can emerge.

A hard competition on the credit market can push the bank to accept "bad risks", offering debt contract's conditions which don't reflect the riskiness of the

[4]When the traditional banking activities are declining, consequence of financial innovation and market deregulation, banks are loosing their intermediation advantage (decline of banking) (Kaufman and More [1994], Edwards and Mishkin [1995], Schmidt et al. [1999]). In order to keep their activity profitable, banks began either to finance new activities (off-balance sheet, derivatives), or to finance riskier activities, generating excess risk (Santomero and Trester [1998]).

[5]See the contributions of Caprio and Klingebiel [1996], Goldstein and Turner [1996], Gonzalez-Hermosillo [1999], and Demirgüç-Kunt and Detragiarche [2000].

counterparty (or which don't follow the bank's credit policy), particularly no risk adjusted pricing.

Keeley [1990] focus on the relationship between risk taking and charter value. This charter value is more important when the bank has monopoly power on the market. The threat of losing charter value disciplines the bank's risk taking behavior. Following the deregulation of banking activities in the US during the 80's, the market power of banks eroded, and their charter value decreased. Meanwhile, the banks had to increase their efforts in order to keep their profits at a certain level. This have generated excessive risk taking incentives.

Saunders and Wilson [2001] extended Keeley's work, studying the sensibility of the relationship between risk taking and charter value to economic cycles. They find that charter value is procyclical. It increases in periods of economic expansion, and decreases in periods of recession. Therefore, the disciplining effect of charter value is reduced when the economic environment becomes adverse.

Some theoretical models have also investigated this relationship between excess risk and competition. Hellmann et al. [2000] find that excessive risk taking can appear in a highly competitive market. Banking regulation can alter this effect, but generates own adverse incentives. Covitz and Heitfield [1999], Cordella and Levy Yeyati [2002], and Repullo [2002] find similar results.

Excess risk incentives can also have their sources in the characteristics of the banking regulation, like the deposits insurance system with fixed prime, or the regulator's behavior.

The existence of a guarantee fund which insures deposits reduces the depositors incentives to monitor the bank and therefore reduces market discipline. The fixe insurance prime incites the bank to use deposits to finance risky credits and can generate excess risk.

The regulator's behavior generates some regulatory discipline[6]. This discipline is imperfect because of specific problems like Too Big To Fail (TBTF) and forbearance (Kane [1989]).

Regulator's forbearance is a non intervention in a problem bank. This kind of behavior can lead to a more costly default of the bank, compared to an earlier intervention. It can also generate adverse incentives for the remaining banks, which can adopt excessive risk taking behavior. The TBTF problem is the result of conflict of interests between the bank and the regulator, and is also a consequence of the forbearance problem. Big banks, which default would generate important economic costs (losses for the stakeholders, financial system's destabilization, ...)[7] anticipate non intervention of the regulator in case of insolvability. These banks can engage themselves in excessive risk taking behavior.

[6]The regulation of the banking industry is mainly motivated by the negative effect of the externalities of potential bank failures (Berger et al. [1995], and Santos [2001]).

[7]Failures of National Bank of San Diego or Franklin National Bank of New York in US for example.

The intertemporal aspect of bank's capital regulation can incite to excess risk (Koehn and Santomero [1980], Kim and Santomero [1988], and Blum [1999]). The regulatory obligation to hold a minimum level of regulatory capital buffer in period $t+1$ puts a pressure on the bank's profits in period t. The regulation being costly and reducing the expected profits and charter value, the bank can be incited to generate the additional revenues by increasing risk taking.

Regulatory and institutional environment's characteristics can also generate excessive risk taking incentives.

The work of La Porta et al. (LLSV) [1997, 1998, 2000] puts forward the impact of the institutional environment's quality on the protection of stakeholders (protection of investors from insiders' expropriation), and on the nature and efficiency of capital markets and the performance of financial systems. The laws which govern the relationship between the stakeholder (principal) and the manager (agent) are affected by the country's institutional environment. This environment is a crucial determinant of the efficiency of corporate governance mechanisms which rules the principal-agent relationship. It can also favors excess risk or reduce the efficiency of its control by other mechanisms and institutions.

Klapper and Love [2002] study the relationship between corporate governance system and institutional environment in 14 EME. They use governance indicators from CLSA[8]. Their results confirm the presence of weak governance in weak institutional and regulatory environments. This relationship affects negatively firm's performance. Mitton [2002] finds that inefficient governance mechanisms[9] have weaken firms and contributed to amplify the Asian Flu. Hussain and Wihlborg [1999] also find that institutional factors have deapen the Asian Crisis, and the insolvency procedures have amplified its length.

Barth et al. [2001] study the relationship between bank regulation and supervision and banking industry performance. Their results put forward the role of market discipline as a crucial element of regulatory and supervision strategy. This form of discipline seems to be most efficient in monitoring bank's behavior. Barth et al. [2000] focus on the relationship between different systems of regulatory and types of ownership structure and performances and stability of banks. Their results show that regulatory restrictions of banking activities affect negatively the whole industry. The more a market is contestable the more market discipline is efficient, and can incite bank behavior to be more conservative. Calomiris and Powell [2000] find similar results in their study of regulatory evolution in Argentina during the 90's. This evolution was mainly based on enchancing market discipline, and incited banks to manage their risks more conservatively, which is a difficult task after a period of financial liberalization.

[8]Crédit Lyonnais Securities Asia. These indicators reflect discipline, transparency, independence, accountability and responsability. They're the result of interviews with bankers.

[9]Protection of minority shareholders from expropriation by managers-insiders and majority shareholders.

Barth et al. [2002] extend this analysis and compare the impact of different supervisory systems on bank profitability. This impact seems weak. A unique supervisory body increases bank's profitability.

As we have seen, several bank default factors emerge from the literature. However, the impact of institutional factors (regulation, rule of law, ...) on fundamental internal determinants of default - excess risk - remain neglected.

The purpose of our paper is to study the role of the institutional factors in driving excessive risk taking. Therefore, we adopt a two step approach (Maddala [1983]) inspired from Demirgüç-Kunt [1989b] and Thomson [1992], and we apply it to a database on EME's banks which contains accounting, regulatory and institutional informations (*Bankscope*, Barth et al. [2001], and La Porta et al. [1997, 1998]).

The rest of this article is organized as follows. We survey the literature on predicting bank default's modelisation in section 2, where we also present our approach. Our data and main results are presented in section 3. We conclude our work in section 4.

2 Models of bank default prediction

Several empirical studies on bank default prediction's modelisation (or early warning signal (EWS) models) using single equation appeared during the 70's, mainly in US[10].

At the end of the 80's, two equations models appeared. Their objective was to dissociate the internal and external factors of default, and especially to distinguish the insolvency factors from the regulatory failure factors.

The most frequent time horizon used in EWS models is one year. The definition of default concerns difficulties affecting bank's solvency. Default banks are called problem banks.

2.1 Single equation EWS models

The EWS models are supposed to translate different bank's performance and solvency indicators into a default risk estimation[11]. Using this estimation, the regulator can discriminate between more or less risky banks. The early identification of problem banks helps to initiate preventive and corrective actions. The majority of bank's default explanation and prediction models are based on

[10] See Demirgüç-Kunt [1989a] for a detailed survey.

[11] Reference models are from US : SEER and SCOR models for example.

CAMEL typology. This typology uses five risk factors[12] which form a bank's soundness rating[13].

Sinkey [1975] was the first to study problem banks, applying a multivariate discriminant analysis (MDA) to a sample of 220 small american commercial banks, of which 110 defaults, for the period 1969-1972. From 100 ratios, Sinkey chooses 10 of which 6 are significant. The quality of bank assets is the most significant one. Other most discriminant variables are assets' composition, loans' characteristics, capital adequacy, sources and use of income, efficiency and profitability.

Altman et al. [1977] also apply a MDA model to a sample of 212 american savings & deposits banks for the period 1966-1973. They divide their sample into three sub-samples : problem banks (56), fragile banks (having temporary problems) (49), and healthy banks (107). From 32 tested ratios, 7 are significant. The most discriminant variable is the operational profit, and its evolution.

Martin [1977] is the first to use a logit model. He studies a sample of 5642 healthy banks and 58 failed banks for the period 1970-1976. After testing 25 ratios, 4 are significant, mainly the capital asset ratio, and the loans portfolio's composition to total assets ratio.

Avery and Hanweck [1984], Barth et al. [1985] and Benston [1985] have also contributed to the EWS models literature, applying logit models to different samples of banks (respectively 1290 of which 100 defaults, 906 of which 318 defaults, and 890 of which 178 defaults) for various periods during the beginning of the 80's, exclusively in US. Generally less than 10 ratios are significant, mainly proxies of the loans portfolio composition and quality, capital ratio, and the sources of income.

Pantalone and Platt [1987] have proposed a model including most of CAMEL proxies : profitability, management's efficiency, leverage, diversification and economic environment. They used a sample of 113 default and 226 healthy banks for the beginning of the 80's. Their results confirm that the main cause of default was bad credit risk management, which occurred as excess risk and/or inefficient risk taking control and monitoring.

Barr and Siems [1994] propose two new EWS models, with a two years time horizon. Their model include CAMEL proxies and efficiency scores[14] as management's quality proxies (the M is the most difficult CAMEL type risk factors to estimate objectively), and a proxy of the economic conditions. Following Barr

[12]Since january 1997, a sixth factor has been added - S - for the bank's sensibility to market risk.

[13]See figure 1 in appendix for a brief summary of the five risk factors.

[14]The evaluation of efficiency using production frontier methods permit to calculate efficiency scores. These scores measure the distance between each observation and the efficient frontier. Observations which lie on this frontier are considered as efficient (Färe et al. [1994] and Coelli et al. [1999]).

et al. [1993], efficiency scores decrease three years before bank's default[15]. This sensibility is very useful for management's quality estimation in EWS models.

Barr and Siems apply a probit model integrating efficiency scores obtained from a Data Envelopment Analysis methodology as management's quality proxies, with four other CAMEL proxies variables. Their model is more robust and precise than Martin's [1977] and Pantalone and Platt's [1987] models.

2.2 Two equations models with institutional factors

Two equations models allow to dissociate risk factors which affect bank solvency from external factors (particularly regulatory ones) which drive the regulator's behavior, especially his propensity to intervene in problem banks.

Gajewski [1988] was the first to incorporate such a distinction between insolvency and failure in his model, studying a sample of 2447 healthy and 134 default banks. Gajewski uses two equations : the first models economic insolvency, the second administrative failure. After testing 25 ratios, 10 are significant.

Demirgüç-Kunt [1989b] also propose to treat economic insolvency as one of the factors influencing regulator's decision to intervene and declare a bank failed, next to other economic, political and bureaucratic factors[16], following the work of Kane [1989]. In the same spirit, Thomson [1992] propose to model the failure decision of the regulator as a call option. He supposes a distinction between insolvency and failure, the latter being a regulatory and administrative decision. His model is build from two equations : the first models net value of the bank (solvency), the second models the bank's failure (allowing to model the regulator's behavior). Demirgüç-Kunt's approach is very similar[17]. Both studies apply a two step method following Maddala [1983], estimating the first equation with OLS and the second one with a logit model.

2.3 The two step model : a proposition

Our main objective is to study the impact of regulatory and institutional factors of an EME on excessive risk taking incentives.

A two step approach allows a distinction between regulatory and institutional factors and excess risk, from the relationship between this internal default factor and other default factors.

[15]More efficient banks monitor better their expenses, manage better their risks, and anticipate better the evolution of the economic environment, in order to adapt their strategy.

[16]These are information (monitoring costs), legal, political (agency costs), financial and administrative constraints.

[17]She introduces a third equation which models bank's net value of the deposits insurance contribution.

In our study, the indicator of excess risk is the *ratio of non performing loans* - $\frac{NPL}{GL}$, which we discretize in order to obtain our first dependent polytomic variable of three classes - $CNPL$.

It is build as follows :

$$CNPL = \begin{array}{ll} 1 & \text{if } \frac{NPL}{GL} < 5\% \text{ (low excess risk)} \\ 2 & \text{if } \frac{NPL}{GL} \in [5\%,\ 20\%] \text{ (medium excess risk)} \\ 3 & \text{if } \frac{NPL}{GL} > 20\% \text{ (high excess risk).} \end{array}$$

Our second dependent variable is a dummy - $DEFAULT$ - which is equal to 1 if the bank was in default at time t[18].

The two steps of our approach are :

1. estimation of the relation between an indicator of excess risk $CPNP$ and regulatory and institutional factors using an ordered logit model,
2. estimation of a bank default function integrating the estimated value $\widehat{CNPL}$ and other risk factors using a binary logit model.

The two equations to be estimated are[19] :

$$CNPL = \alpha(\text{X environmental factors}) \tag{1}$$

$$DEFAULT_t = \beta(\widehat{CNPL}_{t-1}) + \gamma(X_{t-1}\, \text{risk factors}) \tag{2}$$

The variables used to estimate equation 1 are defined in the table 1. The first seven regulatory variables come from Barth et al. [2001] database, the last institutional variables from La Porta et al. [1997, 1998]. We have selected the most representatives variables of different dimensions of the regulatory and institutional environment in studied EME.

The variables in equation 2 are respectively $\widehat{CNPL}$ which is the estimated value of the excess risk indicator form equation 1, and six proxies variables of risk factors (see table 2).

[18] We explain bank default probability with a one year time horizon.

[19] See Maddala [1983] and Thomas [2000] for a description and discussion of logit models.

Table 1: Explicative variables used in the estimation of equation 1

Variables	Definition
regulatory proxies	
PHOLDEM	equals 1 if the first holding of the bank comes from an EME (38.14% of our sample)
MCAR	Minimum regulatory capital ratio, (mean 9.31, standard deviation 1.34, minimum and maximum 8 and 11.5)
DEPOSITINS	equals 1 if a deposits insurance system exists (78.13% of our sample)
FREQEXAM	equals 1 (2) if large banks are examined on-site once (twice) a year (86.93% and 13.07% of our sample)
MISCMGTREP	equals 1 if the auditor has the legal obligation to report management / executive miscmanagement (45.8% of our sample)
LEGALACT	equals 1 if the regulator can use legal actions against the auditors for neglected work (88.03% of our sample)
PROHIBABL	equals 1 if abroad loan making is prohibited by banking regulation (13.89% of our sample)
institutional proxies	
RULEOFLAW	rule of law quality's indicator (from 2.08 to 6.78 in our sample, mean 4.95, standard deviation 1.65)
LEGSYSFR	equals 1 if the legal system is based on the french system (81.1% of our sample)

3 Data and results

3.1 Data

We have build a bank defaults database in most of EME from three geographic zones : Asia, Latin America and CEE[20]. Three arguments motivate our choice of these countries :

- the important number of bank defaults in these countries during the 90's,
- heavier consequences of bank failure in these countries,
- interconnection and globalization of financial and banking systems expose developed economies to heavier difficulties in case of defaults in EME.

[20]Central and Eastern Europe.

Table 2: Risk factors (CAMEL type) used to estimate equation 2

Variables	Definition	CAMEL category
$EQTA$	Equity / Total Assets	C
$EQTL$	Equity / Total Loans	C
TA	Total Assets	A
$NPLGL$	Non Performing Loans / Gross Loans	A
$NLTA$	Net Loans / Total Assets	A
$LLRGL$	Loan Losses Reserves / Gross Loans	A
$PEXP$	Personal Expenses / Total Operating Expenses	M
NI	Net Income	E
NIM	Net Interest Margin	E
ROA	Net Income / Total Assets	E
$TDTA$	Total Deposits / Total Assets	L
$LIQATA$	Liquid Assets / Total Assets	L
$TLTD$	Total Loans / Total Deposits	L

In order to build our database, we have contacted local regulatory institutions[21]. We have also used informations from the on-line database *Banker's Almanac*[22]. It helps us to identify the name and the time of default.

We consider as default a bank which can't operate whitout external support, or which is already engaged into a procedure which leads to its exit from the market. Therefore, a bank is in default when it's under one of the following procedure :

- external administration (regulatory and restructuring agency support[23]),
- banking licence suspension or revocation,
- liquidation,
- failure.

[21]Central banks, prudential regulatory and supervisory commissions, deposits insurance funds, banking associations and federations, regulatory commissions associations, and restructuring agencies.

[22]www.bankersalmanac.com

[23]NPL buyout, recapitalization, ...

Following this typology, we have 297 defaults for the period 1990 to 2002 for 34 EME. Keeping only commercial, savings and investment banks, and dropping years where residual defaults occurred, we finally get a database of 270 default banks for which we have accounting data from *BankScope*[24]. We have respectively 24 defaults in 1997, 80 in 1998, 75 in 1999, 37 in 2000, 36 in 2001, and 18 in 2002.

We have then completed our database with accounting (balance sheet) and governance (ownership structure) data from *BankScope*. Accounting data concern details of balance sheet and profit & loss positions. These data are annual and denominated in thousands USD. They allow us to build CAMEL ratios proxies - the risk factors of equation 2. The governance data give us information concerning first holding's nationality, the holdings percent and their names.

We also included regulatory and institutional variables from Barth et al. [2001] database[25], which is the result of interviews with local regulatory institutions, and institutional informations from La Porta et al. (LLSV) [1997, 1998] database. These data are mainly qualitative and are grouped by country. LLSV's dataset contains various indicators and dummies reflecting institutional and governance environment's quality. The focus is put on stakeholders rights protection mechanisms.

We have first studied descriptive statistics of different balance sheet ratios, particularly their means for the state default versus non default. These statistics were aberrant for small default banks, indicating that other factors lied at the source of their problems (probably macroeconomic ones). We have therefore bounded the variable *Total Assets* TA in order to eliminate small banks ($TA > Q_1$, first quartile equals to 105.11 millions of USD). A first size criterion determines our sample. We have then focus on banks which main activity is credit allocation, and therefore the main source of risk is credit risk, and we have bounded the variables *Net Loans in Total Assets* $NLTA$ (elimination of the first percentile $p10$, equals 25.32% of total assets) and *Total Deposits to Total Assets* $TDTA$ (elimination of the first $p5$, equals 26.81% of total assets). A second bank's activity criterion determines our sample.

We finally get a pooled sample of 894 banks for the period $1996 - 2002$, of which 61 defaults. Commercial banks compose the main part of our sample (more than 95% of our sample). The main part of the defaults occur in 1997 and 1998, respectively 23 and 17, and then 4, 9 and 7 in the following years - 1999, 2000 and 2001.

Table 3 shows the frequencies of defaults by country. Table 4 shows descriptive statistics for the main balance sheet variables and ratios (in millions USD, the ratios are in %).

[24]Frequencies of default and available banks are shown in table 8 in appendix.

[25]Available on-line on www.worldbank.org.

Table 3: Defaults frequencies by country

Country	Defaults	Banks	Def. freq.
Argentina	7	151	4.64
Bolivia	7	23	30.43
Colombia	3	104	2.88
Ecuador	2	63	3.17
Indonesia	1	68	1.47
Korea (South)	12	33	36.36
Mexico	2	95	2.11
Malaysia	19	82	23.17
Peru	4	100	4
Thailand	3	54	5.56
Venezuela	1	121	0.8
	61	894	6.82

3.2 Results

We ran two regressions corresponding to two different specifications in order to estimate equation 1 :

1. regression (1.1) with proxies variables of the regulatory environment (Barth et al. [2001]),
2. regression (1.2) with proxies variables of the regulatory environment (Barth et al. [2001]) and proxies variables of the institutional environment (La Porta et al. [1997, 1998].

Our results are shown in table 5 hereafter. The repartition of the banks by excess risk classes is the following (dependent variable $CNPL$ from equation 1) [26] :

	(1.1)		(1.2)
1	234 (32.19%)	1	233 (33.1%)
2	362 (49.79%)	2	343 (48.73%)
3	233 (18.02%)	3	128 (18.17%)

We have then ran two regressions of the CAMEL type logit model (equation 2) including the estimated values of $\widehat{CNPL}$ (from (1.1) and (1.2)) as dependent variables to explain default (regressions (2.1) et (2.2)). Table 6 presents

[26]The difference of frequencies comes from a higher number of missing observations when we include La Porta et al. [1997, 1998] variables.

Table 4: Descriptive statistics for the main balance sheet variables and ratios

Defaults					
Variables	*N*	*mean*	*std.dev.*	*min.*	*max.*
TA	61	5053.76	8211.61	108.3	35254.67
NI	61	-144.2	490.74	-3203.08	164.66
ROA	61	-4.62	17.52	-112.21	2.06
NLTA	61	60.36	12.65	26.78	90.79
TDTA	61	79.79	11.74	38.4	99.34
EQTA	61	4.77	18.62	-120.92	28.26
EQTL	61	8.05	35.5	-221.93	59.3
LLRGL	61	7.88	11.05	1.19	60.24
NPLGL	61	16.66	13.64	1.83	65.72
PEXP	61	27.29	12.54	1.12	54.75
NIM	61	2.76	7.71	-52.99	13.15
LIQATA	61	18	8.82	4.88	42.87
TLTD	61	76.77	16.02	29.11	124.1
Non defaults					
Variables	*N*	*mean*	*std.dev.*	*min.*	*max.*
TA	833	3366.76	7110	106.7	56740.29
NI	833	-13.45	209.54	-2461.5	880.32
ROA	833	0.62	3.56	-35.15	23.66
NLTA	833	56.8	13.74	25.38	92.35
TDTA	833	75.92	12.66	18.51	95.19
EQTA	833	11.25	6.65	-15.25	53.45
EQTL	833	21.28	13.76	-31.93	100.98
LLRGL	833	6.63	5.65	0	50.56
NPLGL	833	10.68	11.23	0	89.59
PEXP	833	33.44	12.44	0.29	76.96
NIM	833	8.2	7.67	-8.06	55.8
LIQATA	833	23.24	13.35	0.34	69.08
TLTD	833	77.36	27.02	27.68	362.93

Table 5: Estimation results of equation 1 from our model

Variables	(1.1)	(1.2)
PHOLDEM	0.506***	0.701***
	(0.16)	(0.16)
MCAR	0.091***	0.359***
	(0.03)	(0.08)
DEPOSITINS	−0.668***	
	(0.22)	
FREQEXAM	−1.157***	−1.16***
	(0.23)	(0.24)
MISCMGTREP	0.527***	−0.579**
	(0.19)	(0.24)
LEGALACT	−1.652***	
	(0.29)	
PROHIBABL	1.661***	1.035***
	(0.25)	(0.24)
RULEOFLAW		−0.448***
		(0.1)
LEGSYSFR		−2.051***
		(0.35)
N	727	704
Khi-2	510.31***	475.56***
Log L	−648.03	−638.88
% concordant	71.3%	70.1%

*** : significant at 1%

** : significant at 5%

our results[27]. Table 7 presents the results of a binary CAMEL logit model, for comparison[28].

[27]Selected CAMEL proxies ratios come from a previous study which objective was to build an EWS type model for EME banks, which allowed us to validate the applicability of the CAMEL typology to these banks (Godlewski [2003]). We have also ran two other binary logit regressions with significant variables form the CAMEL model and environmental variables used to explain the excess risk indicator in equation 1 for comparison. The results are shown in table 9 in appendix.

[28]We only present the results of the logistic regression made on the sample corresponding to regression (2.1).

Table 6: Estimation results of equation 2 from our model

Variables	(2.1)	marginal effect	ε	(2.2)	marginal effect	ε
$\widehat{CNPL}$	2.266**	0.161	0.174	1.969*	0.142	0.155
	(0.93)			(1.01)		
EQTL	−0.025**	-0.00178	-0.168	−0.025**	-0.0018	-0.169
	(0.01)			(0.01)		
NPLGL						
PEXP						
NIM	−0.215***	-0.0153	-0.407	−0.2***	-0.0144	-0.383
	(0.05)			(0.05)		
LIQATA	−0.048***	-0.00341	-0.38	−0.048***	-0.00346	-0.4
	(0.01)			(0.01)		
TLTD	−0.007*	-0.0005	-0.219	−0.006*	-0.00043	-0.203
	(0.004)			(0.004)		
N. def.	56			55		
N	727			704		
Khi-2	676.98***			648.94***		
Log L	−165.43			−163.51		
McFadden R^2	67.17%			67.1%		
Def. reclass. rate	83.9%			87.3%		

*** : significant at 1%
** : significant at 5%
* : significant at 10%
ε : elasticity

We get the following estimated probabilities $\widehat{CNPL}$[29] : for equation (1.1) we have $p(CNPL = 1) = 0.345$, $p(CNPL = 2) = 0.441$ and $p(CNPL = 3) = 0.214$, and for equation (1.2) $p(CNPL = 1) = 0.347$, $p(CNPL = 2) = 0.439$ and $p(CNPL = 3) = 0.214$.

3.3 Discussion

First holding from an EME ($PHOLDEM$) has a positive impact on excess risk. We can explain this result by the fact that the state often remains the first holding in EME. It doesn't discipline and monitor correctly and efficiently bank risk taking behavior (forbearance, anticipation of intervention in case of difficulites,

[29]Calculated on samples containing 727 and 704 banks respectively.

Table 7: Estimation results of a CAMEL binary logit model

Variables	CAMEL(2.1)	marginal effect	ε
EQTL	-0.022^{*}	-0.00156	-0.157
	(0.01)		
NPLGL	0.002	0.00014	0.011
	(0.01)		
PEXP	0.002	0.00014	0.023
	(0.01)		
NIM	-0.172^{***}	-0.0122	-0.346
	(0.05)		
LIQATA	-0.048^{***}	-0.00341	-0.377
	(0.02)		
TLTD	-0.005^{***}	-0.00036	-0.154
	(0.01)		
N. def.	56		
N	727		
Khi-2	671.50^{***}		
Log L	−168.17		
McFadden R^2	66.63%		
Def. reclass. rate	78.6%		

*** : significant at 1%
** : significant at 5%
* : significant at 10%
ε : elasticity

...). The knowledge transfer, particularly the art of risk management, is also less important as with a first holding from a developed country.

A higher minimal regulatory capital ratio ($MCAR$) increases excess risk. Generally this ratio is higher in EME (closer to 12% than to 8%), in order to limit excess risk and to force banks to recapitalize, and become more solvent and sound. However, as we have seen, a higher regulatory capital can incite to excess risk, as additional capital imply additional effort in term of profitability, which can be achieved by increasing risk taking.

The existence of a deposits insurance system ($DEPOSITINS$) reduces excess risk. This result seems counter-intuitive concerning the moral hazard problem which is a consequence of such system. However, such guarantee fund protect depositors, and can therefore reduce excess risk needed to generate more profits, in order to signal good performances and avoid liquidity problems.

The frequency of on-site exams ($FREQEXAM$) reduces excess risk, therefore producing some regulatory discipline. The threat of frequent exam which can result in licence suspension or revocation (and charter value elimination) in case of non conformity to regulatory standards can incite the bank to adopt a more conservative risk taking behavior.

Auditor's reports on miscmanagement ($MISCMGTREP$) have a positive effect on excess risk in the first regression (1.1) and a negative effect in the second one (1.2). We were expecting a negative sign of this coefficient, because such report can be the basis for an ulterior regulatory intervention. Without the institutional variables ($RULEOFLAW$ and $LEGSYSFR$), the sign is positive, signaling either that this type of threat is not credible (auditor's negligeancy for example), or that such report have an adverse effect, inciting bank managers to a "maximum" level of excess risk before a probable regulator's intervention after a negative report on miscmanagement. In the second regression (1.2) the sign is negative, indicating a discipline effect of the auditor's report, controlling for country's rule of law quality.

Legal action against neglecting auditors ($LEGALACT$) have a negative impact on excess risk. Through disciplining auditors, the regulator can affect bank's incentives, because its excessive risk taking will be found out easier if audits are done more efficiently.

Abroad loans making prohibition ($PROHIBABL$) have a positive impact on excess risk, because such regulation reduces loans portfolio diversification opportunities (Allen and Gale [2000])[30].

These results put forward existing complementarity of these factors to the market discipline which is considered as a corporate governance mechanism (Jensen [1993]). These factors have also a positive effect on regulatory discipline. Our results show the importance of institutional environment in enchancing other corporate governance mechanisms efficiency, and therefore in reducing excessive risk taking incentives.

Referring to our results, bank regulation have a significant impact on excess risk in EME's banks. This impact can be adverse, as with minimum regulatory capital ($MCAR$). Regulatory discipline seems efficient, curbing excessive risk taking incentives.

Taking into account the correlations, we have dropped variables $DEPOSITINS$ and $LEGALACT$ in regression (1.2) in order to include variables $RULEOFLAW$ and $LEGSYSFR$. $RULEOFLAW$ is the most significant variable and the least correlated with other explicative variables of our model (comparing to other indicators of stakeholders and debtholders rights protection). It allows us also to include a proxy of rule of law quality and test its impact on excess risk. Variable $LEGSYSFR$ has been introduced to control legal system's origin (dummies

[30] A potential positive impact of such regulation, and therefore a negative sign, concerns the restriction of bank activities to local credit markets, on which local banks have better information and can better assess its riskiness.

variables of british and german legal systems were correlated with other explicative variables of our model). The signs of these two institutional variables are negative, indicating that excess risk is reduced in a state of law. The french legal origin have a significant impact.

The impact of institutional factors on excess risk is significant. An institutional environment of quality reduces excessive risk taking incentives.

When we introduce the variable $\widehat{CNPL}$ in our model of bank default prediction (equation 2), and after controlling other CAMEL risk factors variables, we find that only proxies of risk factors C, E and L are significant with coherent signs. The marginal effect of $\widehat{CNPL}$ is the most important, indicating that the default probability is highly sensitive to $\widehat{CNPL}$, and therefore to institutional factors which affect excess risk. This variable contributes the most to default probability. In term of elasticity, a one percent increase of variables NIM or $LIQUIDASSET$ reduces more default probability (respectively 40.7% and 38.3% in equation (2.1), and 38% and 40% in equation (2.2)). The elasticity of $\widehat{CNPL}$ is the lowest (17.4% and 15.5% respectively). It seems that banks in EME of our sample should concentrate more on margin and asset's liquidity to reduce their default probability.

We remark that default reclassification rates are better when we use our two step approach, with the integration of the estimated excess risk indicator $\widehat{CNPL}$ from equation 1 (83.9% and 87.3% respectively)[31], compared to those from a CAMEL binary logit model (78.64%). The default reclassification rate derived from our specification including institutional variables (regression (1.2)) is the highest.

The default reclassification rates derived from CAMEL binary logit models including the same regulatory and institutional (table 9 in appendix, regressions (CAMEL 1) and (CAMEL 2)) remains lower (82.1% and 81.6% respectively).

4 Conclusion

Risk taking behavior in banks can be affected by the regulatory and institutional characteristics, and can degenerate into excess risk. This excess risk increases bank's default probability.

In this article we applied a two step logit model to study the impact of the regulatory and institutional environment on excess risk, and the relationship between this factor and bank default. Applying our methodology to a micro and macro economic database (balance sheet data from *BankScope*, and regulatory and institutional data from Barth et al. [2001] and La Porta et al. [1997, 1998]) of EME banks, we find evidence which validate our hypothesis.

[31] At the default rate of our sample, approximatively 7%.

This type of environment have a significant impact on excess risk, particularly bank regulation, regulatory discipline, and rule of law quality. The estimation of an excess risk indicator depending on this environmental factors allows, after controlling for capitalization, earnings and liquidity factors, better explanation and discrimination of one year horizon default probability with higher default reclassification rates comparing to an alternative specification with a CAMEL binary logit model. This result holds even when we introduce these same environmental factors into CAMEL binary logit models.

The integration of an excess risk indicator, which is a function of the regulatory and institutional environment, increases the explanatory and discriminatory power of an EME's bank default prediction model. Our approach proves also the importance and relevance of regulatory and institutional factors in driving excessive risk taking behavior.

References

[1] Allen F. and Gale D. [2000], *Comparing Financial Systems*, MIT Press.

[2] Altman E. I., Haldeman R.G. and Narayanan P. [1977], "Zeta Analysis A New Model to Identify Bankruptcy Risk of Corporations", *Journal of Banking and Finance* 1, pp. 29-54.

[3] Anderson R.C. and Fraser D.R. [2000], "Corporate Control, Bank Risk Taking and the Health of the Banking Industry", *Journal of Banking and Finance* 24, pp. 1383-1398.

[4] Ang J.S., Lauterbach B. and Schreiber B.Z. [2001], "Internal Monitoring, Regulation, and Compensation of Top Executives in Banks", *International Review of Economics & Finance* 10, pp. 325-335.

[5] Avery R.B. and Hanweck G.A. [1984], "A Dynamic Analysis of Bank Failures", *Bank Structure and Competition, Conference Proceedings*, Federal Reserve Bank of Chicago, pp 380-395.

[6] Barr R.S. and Siems T.F. [1994], "Predicting Bank Failure Using DEA to Quantify Management Quality", *Financial Industry Studies Working Paper*, Federal Reserve Bank of Dallas.

[7] Barr R.S., Seiford L.M. and Siems T.F.[1993], An Envelopment Analysis Approach to Measuring the Management Quality of Banks", *Annals of Operations Research* 45, pp. 1-19.

[8] Barth J.R., Nolle D.E., Phumiwasana T. and Yago G. [2002], "A Cross-Country Analysis of the Bank Supervisory Framework and Bank Perfor-

mance", *Economic and Policy Analysis Working Paper* 2, Office of the Comptroller of the Currency (O.C.C.).

[9] Barth J.R., Caprio Jr G. and Levine R. [2001], "The Regulation and Supervision of Banks Around the World A New Database", *Working Paper*, World Bank.

[10] Barth J.R., Caprio Jr G. and Levine R. [2000], "Banking Systems Around the Globe : Do Regulation and Ownership affect Performance and Stability ?", *Working Paper*, World Bank.

[11] Barth J.R., Caprio Jr G., and Levine R. [1999], "Financial Regulation and Performance: Cross-Country Evidence", *Working Paper*, World Bank.

[12] Barth J.R, Brumbaugh D. Jr., Sauerhaft D. and Wang G.K. [1985], "Thrift Institutions Failures : Causes and Policy Issues", *Bank Structure and Competition, Conference Proceedings*, Federal Reserve Bank of Chicago, pp. 184-216.

[13] Bell J. and Pain D. [2000], "Leading Indicator Models of Banking Crises - A Critical Review", *Financial Stability Review* December, Bank of England.

[14] Benston G.J. [1985], "An Analysis of the Causes of Savings and Loan Associations Failures", *Monograph Series in Finance and Economics*, New York University.

[15] Berger A.N., Herring R.J. and Szegö G.P. [1995], "The Role of Capital in Financial Institutions", *Journal of Banking & Finance* 19, pp. 393-430.

[16] Blum J. [1999], "Do capital adequacy requirements reduce risks in banking ?", *Journal of Banking & Finance* 23, pp. 755-771.

[17] Calomiris C.W. and Powell A. [2000], "Can Emerging Market Bank Regulators Establish Credible Discipline ? The Case of Argentina, 1992-1999", *Working Paper*, World Bank.

[18] Caprio Jr G. and Levine R. [2002], "Corporate Governance in Finance : Concepts and International Comparison", *Working Paper*, World Bank.

[19] Caprio G. and Klingebiel D. [1996], "Bank Insolvencies : Cross-Country Experience", *Working Paper*, World Bank.

[20] Ciancanelli P. and Reyes Gonzalez J.A. [2000], "Corporate Governance in Banking : A Conceptual Framework", *Working Paper*.

[21] Clair R.T. [1992], "Loan Growth and Loan Quality : Some Preliminary Evidence from Texas Banks", *Economic Review*, Federal Reserve Bank of Dallas.

[22] Coelli T., Prasada Rao D.S., and Battese G.E. [1999], *An Introduction to Efficiency and Productivity Analysis*, Kluwer Academic Publishers.

[23] Cordella T. and Levy Yeyati E. [2002], "Financial Opening, Deposit Insurance, and Risk in a Model of Banking Competition", *European Economic Review* 46, pp. 471-485.

[24] Covitz D. and Heitfield E. [1999], "Monitoring, Moral Hazard, and Market Power : A Model of Bank Lending", *Finance and Economics Discussion Series* 37, Federal Reserve Board.

[25] Demirgüc-Kunt A. and Detragiarche E. [2000], "Monitoring Banking Sector Fragility : A Multivariate Logit Approach", *The World Bank Economic Review* 14 (2), pp. 287-307.

[26] Demirgüç-Kunt A. [1989a], "Deposit-Institution Failures : A Review of Empirical Literature", *Economic Review* 25, Federal Reserve Bank of Cleveland.

[27] Demirgüç-Kunt A. [1989b], "Modeling Large Commercial-Bank Failures : A Simultaneous-Equation Analysis", *Working Paper*, Federal Reserve Bank of Cleveland.

[28] Demsetz R.S., Saidenberg M.R. and Strahan P.E. [1997], "Agency Problems and Risk Taking", *Staff Reports* 29, Federal Reserve Bank of New York.

[29] Edwards F.R. and Mishkin F.S. [1995], "The Decline of Traditional Banking : Implications for Financial Stability and Regulatory Policy", *Economic Policy Review*, Federal Reserve Bank of New York.

[30] Färe R., Grosskopf S., and Lovell C.A.K. [1994], *Production Frontiers*, Cambridge University Press.

[31] Gajewski G.R. [1988], "Bank Risk, Regulator Behavior, and Bank Closure in the Mid 1980's : A Two Step Logit Model", *PhD Dissertation*, The George Washington University.

[32] Godlewski C.J. [2003], "Modélisation de la Prévision de la Défaillance Bancaire Une Application aux Banques des Pays Emergents", *mimeo*, LaRGE, Université Robert Schuman.

[33] Goldstein M. and Turner P. [1996], "Banking Crises in Emerging Economies : Origins and Policy Options", *BIS Economic Papers* 46, Bank for International Settlements.

[34] Gonzalez-Hermosillo B. [1999], "Determinants of Ex-Ante Banking System Distress : A Macro-Micro Empirical Exploration of Some Recent Episodes", *Working Paper* 33, International Monetary Fund.

[35] Gorton G. and Rosen R. [1995], "Corporate Control, Portfolio Choice and the Decline of Banking", *Journal of Finance* 50 (5), pp. 1377-1420.

[36] Hellmann T.F., Murdock K.C. and Stiglitz J.E. [2000], "Liberalization, Moral Hazard in Banking, and Prudential Regulation : Are Capital Requirements Enough ?",*American Economic Review* 90(1), pp. 147-165.

[37] Honohan P. [1997], "Banking system failures in developing and transition countries: Diagnosis and predictions", *BIS Working Papers* 39.

[38] Houston J.F. and James C. [1995], "CEO Compensation and Bank Risk Is Compensation in Banking Structured to Promote Risk Taking ?", *Journal of Monetary Economics* 36, pp. 405-431.

[39] Hussain Q. and Wihlborg c. [1999], "Corporate Insolvency Procedures and Bank Behavior: A Study of Selected Asian Economies", *Working Paper* 135, International Monetary Fund.

[40] Jensen M.C. [1993], "Presidential Address : The Modern Industrial Revolution, Exit and Failure of Internal Control Systems", *Journal of Finance* 48, pp. 831-880.

[41] John K., Saunders A. and Senbet L.W. [2001], "A Theory of Bank Regulation and Management Compensation", *The Review of Financial Studies* 13, pp. 95-125.

[42] Kane E.J. [1989], *The S&L Insurance Mess : How Did It Happen ?*, Washington D.C., The Urban Institute.

[43] Kaufman G.G. and More L.R. [1994], "Is Banking a Declining Industry ? A Historical Perspective", *Economic Perspectives*, Federal Reserve Bank of Chicago.

[44] Keeley M.C. [1990], "Deposit Insurance, Risk, and Market Power in Banking", *American Economic Review* 80, pp. 1183-1200.

[45] Keeton W.R. and Morris C.S. [1987], "Why Do Banks' Loan Losses Differ ?", *Economic Review* 72, Federal Reserve Bank of Kansas City.

[46] Kim D. and Santomero A.M. [1988], "Risk in Banking and Capital Regulation", *Journal of Finance* 43, pp. 1219-1233.

[47] Klapper L.F. and Love I. [2002], "Corporate Governance, Investor Protection, and Performance in Emerging Markets", *Policy Research Working Paper*, World Bank.

[48] Koehn M. and Santomero A.M. [1980], "Regulation of Bank Capital and Portfolio Risk", *Journal of Finance* 35, pp. 1235-1250.

[49] Knopf J.D. and Teall J.L. [1996], "Risk Taking Behavior in the US Thrift Industry : Ownership Structure and Regulatory Changes", *Journal of Banking and Finance* 20, pp. 1329-1350.

[50] La Porta R., Lopez-de-Silanes F., Shleifer A., and Vishny R.W. [2000], "Investor Protection and Corporate Governance", *Journal of Financial Economics* 58, pp. 3-27.

[51] La Porta R., Lopez-de-Silanes F., and Shleifer A. [1998], "Law and Finance", *Journal of Political Economy* 106, pp. 1113-1155.

[52] La Porta R., Lopez-de-Silanes F., Shleifer A., and Vishny R.W. [1997], "Legal Determinants of External Finance", *Journal of Finance* 52, pp. 1130-1150.

[53] Llewellyn D. [2002], "An Analysis of the Causes of Recent Banking Crises", *The European Journal of Finance* 8, pp. 152-175.

[54] Maddala G.S. [1983], *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge University Press.

[55] Martin D. [1977], "Early Warning of Bank Failure", *Journal of Banking and Finance* 1, pp. 249-276.

[56] Mitton T. [2002], "A Cross-Firm Analysis of the Impact of Corporate Governance of the East Asian Financial Crisis", *Journal of Financial Economics* 64, pp. 215-241.

[57] O.C.C. [1988], "Bank Failure An Evaluation of the Factors Contributing to the Failure of National Banks", Office of the Comptroller of the Currency.

[58] Pantalone C.C. and Platt M.B. [1987], "Predicting Commercial Bank Failures Since Deregulation", *New England Economic Review*, pp. 37-47.

[59] Prowse S.D. [1995], "Alternative Methods of Corporate Control in Commercial Banks", *Economic Review*, Federal Reserve Bank of Dallas.

[60] Repullo R. [2002], "Capital Requirements, Market Power, and Risk Taking in Banking", *Working Paper*.

[61] Santomero A.M. and Trester J. [1998], ”Financial Innovation and Bank Risk Taking”, *Journal of Economic Behavior and Organization* 35, pp. 25-37.

[62] Santos J.A. [2001], ”Bank Capital Regulation in Contemporary Banking Theory : A Review of the Literature”, *Financial Markets, Institutions and Instruments* vol. 10, pp. 41-84.

[63] Saunders A. and Wilson B.K. [2001], ”An Analysis of Bank Charter Value and Its Risk Constraining Incentives”, *Journal of Financial Services Research* 19, pp. 185-195.

[64] Saunders A., Strock S. and Travlos N.G. [1990], ”Ownership Structure, Deregulation, and Bank Risk Taking”, *Journal of Finance* 45, pp. 643-654.

[65] Schmidt R.H., Hackerthal A. and Tyrell M. [1999], ”Disintermediation and the Role of Banks in Europe : An International Comparison”, *Journal of Financial Intermediation* 8, pp. 36-67.

[66] Sinkey J.F. Jr [1975], ”A Multivariate Statistical Analysis of the Characteristics of Problem Banks”, *Journal of Finance* 30, pp. 21-36.

[67] Thomas A. [2000] *Économétrie des Variables Qualitatives*, Dunod.

[68] Thomson J.B. [1992], ”Modeling the Bank Regulator’s Closure Option : A Two Step Logit Regression Approach”, *Journal of Financial Services Research* 6, pp. 5-23.

APPENDIX

Figure 1: CAMEL rating elements

- **C** Capital Adequacy measures capital buffer against unexpected losses,
- **A** Asset Quality (particularly loans portfolio quality),
- **M** Management Quality,
- **E** Earnings measures historical stability and composition of earnings,
- **L** Liquidity measures bank's exposition to liquidity risk.

Table 8: Bank defaults frequencies by country

Country	Country code	Available banks	Default banks	Default rate
Argentina	AR	135	28	20.74%
Bosnia-Herzegovina	BA	22	1	4.55%
Bulgaria	BG	28	2	7.14%
Bolivia	BO	16	7	43.75%
Brazil	BR	188	19	10.11%
Colombia	CO	56	9	16.07%
Costa Rica	CR	35	3	8.57%
Czech republic	CZ	32	2	6.25%
Ecuador	EC	43	2	4.65%
Estonia	EE	12	4	33.33%
Hong Kong	HK	105	1	0.95%
Croatia	HR	48	8	16.67%
Indonesia	ID	93	34	36.56%
Korea (South)	KR	55	33	60.00%
Lithuania	LT	13	2	15.38%
Latvia	LV	28	4	14.29%
Mexico	MX	46	4	8.70%
Malaysia	MY	65	32	49.23%
Nicaragua	NI	12	6	50.00%
Panama	PA	86	8	9.30%
Peru	PE	34	5	14.71%
Poland	PL	58	1	1.72%
Paraguay	PY	45	3	6.67%
Romania	RO	36	2	5.56%
Russia	RU	166	6	3.61%
Singapore	SG	59	7	11.86%
Slovenia	SI	27	1	3.70%
Slovakia	SK	27	4	14.81%
Thailand	TH	40	17	42.50%
Taiwan	TW	48	3	6.25%
Ukraine	UA	44	2	4.55%
Uruguay	UY	57	6	10.53%
Venezuela	VE	71	1	1.41%
Yugoslavia	YU	23	4	17.39%

Defaults are cumulated over 6 years.

Table 9: Estimation results of alternative CAMEL binary logit models

Variables	(CAMEL 1)	(CAMEL 2)
NIM	-0.123^{**}	-0.154^{**}
	(0.05)	(0.07)
LIQATA	-0.0951^{***}	-0.087^{***}
	(0.02)	(0.02)
PHOLDEM	-0.982^{***}	-1.176^{***}
	(0.33)	(0.36)
MCAR	0.096	0.003
	(0.1)	(0.17)
DEPOSITINS	-1.562^{***}	
	(0.43)	
FREQEXAM	-0.433	-0.249
	(0.71)	(0.89)
MISCMGTREP	1.863^{***}	2.09^{***}
	(0.5)	(0.53)
LEGALACT	-0.373	
	(0.5)	
PROHIBABL	2.25^{***}	1.535^{***}
	(0.58)	(0.55)
RULEOFLAW		0.013
		(0.24)
LEGSYSFR		-1.529^{*}
		(0.89)
N. def.	56	49
N	727	704
Khi-2	703.64^{***}	718.08^{***}
Log L	-152.1	-128.94
McFadden R^2	69.82%	73.58%
Def. reclass. rate	82.1%	81.6%

*** : significant at 1%

** : significant at 5%

* : significant at 10%