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## CDS and the forecasting of bank default

Eric Thorez

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# THÈSE DE DOCTORAT

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PSL Research University

Préparée à l'Université Paris-Dauphine

CDS and the forecasting of bank default

École Doctorale de Dauphine — ED 543

Spécialité **Sciences de gestion**

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*L'Université n'entend donner aucune approbation ni improbation aux opinions émises dans les thèses : ces opinions doivent être considérées comme propres à leurs auteurs.*



*A Florence, Clément et Grégoire.*



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## List of Abbreviations and Acronyms

<b>AMF</b>	Autorité des Marchés Financiers
<b>BHCs</b>	Bank Holding Companies
<b>BCBS</b>	Basel Committee on Banking Supervision
<b>BIS</b>	Banque of International Settlements
<b>BRT</b>	Binary Recursive Trees
<b>BOPEC</b>	<b>B</b> ank subsidiaries, <b>O</b> ther (nonbank) subsidiaries, <b>P</b> arent company, <b>E</b> arnings and <b>C</b> apital adequacy
<b>Bps</b>	Basis points
<b>CAMEL(S)</b>	<b>C</b> apital protection or adequacy, <b>A</b> sset quality, <b>M</b> anagement competence, <b>E</b> arnings strengths, <b>L</b> iquidity risk exposure (And Sensitivity to market risks).
<b>CDS</b>	Credit Default Swap
<b>CFTC</b>	Commodities Futures Trading Commission
<b>COSO</b>	Committee of Sponsoring Organizations
<b>DD</b>	Distant to Default
<b>EBA</b>	European Banking Authority
<b>EC</b>	European Commission
<b>EDF</b>	Expected Default Frequency
<b>EFTA</b>	European Free Trade Association
<b>ESG</b>	Environmental, Social or Governance
<b>ESMA</b>	European Securities and Market Authority
<b>FDIC</b>	Federal Deposit Insurance Corporation
<b>FDICIA</b>	Federal Deposit Insurance Corporation Improvement Act
<b>FD</b>	Financial Distress
<b>Fed</b>	Federal Reserve
<b>FFIEC</b>	Federal Financial Institutions Examinations Council
<b>GAO</b>	Government Accountability Office
<b>GDP</b>	Gross Domestic Product
<b>IIA</b>	Internal Institute of Auditors
<b>IMF</b>	International Monetary Fund
<b>IRB</b>	Internal Ratings-Based approach
<b>ISDA</b>	International Swaps and Derivatives Association
<b>LFI</b>	Large Financial Institutions
<b>OCC</b>	Office of the Comptroller of the Currency
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>OLS</b>	Ordinary Least Squares
<b>OTC</b>	Over The Counter
<b>PD</b>	Probability of Default
<b>PIIGS</b>	Portugal, Ireland, Italy, Greece and Spain
<b>PV</b>	Present Value
<b>RMBS</b>	Residential Mortgage-Backed Security
<b>RWA</b>	Risk-Weighted Assets
<b>SD</b>	Standard Deviation
<b>SOX</b>	Sarbanes-Oxley Act
<b>SEC</b>	Securities and Exchange Commission
<b>SIFI</b>	Systematically Important Financial Institutions
<b>SEER</b>	System to Estimate Examination Ratings
<b>TARP</b>	Troubled Assets Relief Program

## Introduction Générale

- *A Moscou encore, on découvre une compagnie de faussaires qui contrefaisaient des billets de loterie et dont un des chefs était un professeur d'histoire universelle (...). Comment expliquerons-nous ce relâchement des mœurs dans la partie la plus civilisée de notre société ?*
- *Transformations dans les phénomènes économiques..., commença Zossimov.*
- *Comment l'expliquez ? Intervint Rasoumikhine. Et bien, justement par ce manque d'activité raisonnée...*
- *Que voulez-vous dire ?*
- *Et qu'a répondu votre professeur faussaire quand on l'interrogeait ?*
- *-« Tout le monde s'enrichit de différentes manières ; et bien, j'ai voulu, moi aussi, m'enrichir au plus vite ». Je ne me souviens plus de l'expression qu'il a employée, mais il voulait dire : gagner au plus vite, sans effort...*

*Dostoïevski (1866).*

*Berger et Bouwman (2013)* ont réalisé une chronologie claire et cohérente des crises bancaires et des crises de marchés qui ont été marquantes aux Etats-Unis de 1984:Q1 à 2010:Q4.

Il s'agit tout d'abord de deux crises bancaires à savoir :

- le crash du crédit (1990:Q1-1992:Q4) affectant surtout les petites banques et les petits prêts,
- la crise des subprimes (2007:Q3-2009:Q4) dont 140 faillites bancaires en 2009 *Berger et Bouwman (2013)*, et au total, plus de 500 petites banques auront failli aux Etats-Unis.

Viennent trois crises de marchés constituées par :

- le crash du marché boursier (1987:Q4) avec une chute brutale de 20% du S&P 500 le 19 Octobre 1987,
- la crise de la dette en Russie se soldant par un défaut le 17 août 1998 et celle du plus grand hedge fund mondial Long Term Capital Management (LTCM) de 1998:Q3 à 1998:Q4,
- l'explosion de la bulle High Tech ainsi que l'attaque terroriste de septembre 2001 (2000:Q2-2002:Q3), l'indice Nasdaq ayant chuté de 78% à la fin de 2002:Q3 entraînant la disparition de 5000 milliards de dollars en valeur de marché pour les sociétés High Tech, *Berger et Bouwman (2013)*.

Effectivement, nous pouvons constater l'augmentation forte (x 3) du secteur financier aux USA de 1947 à 2005, soit un passage de 2,3% à 7% du PIB.

Nous ne pouvons omettre également de mentionner la crise de la dette souveraine que l'Europe a subie de 2010 à 2014 avec une intensité maximale en 2011, ainsi que la crise financière asiatique de 1997 et le défaut de l'Argentine en 2002.

De manière plus large, le Fonds Monétaire International (FMI) estime qu'il y a eu 72 crises de la dette souveraine, 145 crises bancaires et 208 krachs monétaires de 1970 à 2010

De fait, à la fin des années 90, quelques chercheurs ont commencé à s'interroger sur la question de la prévision des crises bancaires et du défaut des banques qui ont commencé à sévir au début des années 1980, ces dernières n'arrivant plus dans ces conditions à assurer leur rôle d'intermédiaires financiers pour cause d'insolvabilité lorsque leur passif devient supérieur à leur actif.

De 1980 à 1996, trois quarts des pays membres du FMI ont été confrontés à des problèmes bancaires (Financial Distress) affirment *Davis and Karim (2008a)*. Ces deux décennies de libéralisation bancaire ont donc vu un accroissement des nouveaux produits financiers avec des effets décuplés par l'informatisation et l'internationalisation des marchés financiers.

Ainsi, des modifications majeures sous la forme d'une quasi abrogation du Glass-Steagall Act adoptée en 1999 sous le Gramm-Leach-Bliley Act ont permis aux banques d'affaires, d'investissements et aux sociétés d'assurance de se regrouper et alors de devenir universelles. Ces nouvelles entités ont pu diversifier totalement leurs investissements avec des effets à la fois positifs mais aussi négatifs quant à la prise de risques.

La crise financière qui a culminé entre 2008 et 2009 démarra aux Etats-Unis en 2007 avec l'effondrement des crédits hypothécaires (subprimes). *Demyanyk et Hasan (2011)* avancent que la titrisation des crédits hypothécaires liés aux subprimes constituait un encours de dette sur les marchés financiers américains de 1800 milliards de dollars en 2008 (pour des produits émis entre 2000 et 2007) en comparaison du total de la dette américaine pour la titrisation des crédits hypothécaires s'élevant à 6800 milliards de dollars.

Pour simple précision, la titrisation ou securitization en anglais permet à une banque de transformer des actifs de types créances bancaires ou instruments financiers en titres négociables.

Nous savons désormais que l'impact fort en résultant sur l'économie américaine l'a été d'autant plus que des regroupements de titres individuels ont été eux-mêmes repackagés ultérieurement en tranches (senior, subordonnée par exemple ...) en créant des titres toujours plus sophistiqués.

Cependant, il est difficile d'expliquer pourquoi cette crise prit une telle proportion et pourquoi les conséquences furent aussi grandes à l'extérieur des Etats-Unis (7500 banques existaient à cette période dans ce pays, dont 5000 mono-bâtiments).

*Levine (2010)* constate qu'en ce qui concerne les politiques financières en vigueur lors de la précédente décennie, des conflits d'intérêts majeurs sont apparus au sein des agences de notation et que les banques se sont ruées sur les Credit Defaults Swaps (CDS) qu'elles ont achetés en quantité importante dès 1996, grâce à une décision de la Fed autorisant la réduction de leur capital bancaire et encourageant de fait la prise de risque (pour ne pas mentionner le manque de transparence des marchés OTC).

Cette décision réglementaire eut un impact terrible sur les banques qui ont alors réalloué leur capital vers de plus grands risques avec une soif de rendements plus importants, *Stulz (2010)*. En effet, avant le début de la crise financière, l'encours des CDS augmenta considérablement pour atteindre une valeur notionnelle de 62000 milliards de dollars en 2007, *Levine (2010)*, alors qu'il atteignait 900 milliards en 2001, dans un marché de produits dérivés de l'ordre de 615000 milliards de dollars fin 2019 où plus de 80% des opérations sont réalisées en OTC, *les Echos (13/09/2010)*.

En particulier, selon l'International Swaps and Derivatives Association (ISDA), l'encours des dérivés de crédits a augmenté de 128% de juin 2004 à juin 2005. De manière concomitante, Fitch Ratings dans une étude parue en Novembre 2005 relate que vendeurs et acheteurs se seront échangés en 2004 pour 5300 milliards de dollars de contrats nominaux ou plus de 86% en un an, d'après *Issaoui (4/01/2006)* dans un article de La Tribune.

Pour référence, le PIB mondial de l'ordre de 50000 Milliards de dollars en 2008 fut égal à 73502 milliards de dollars en 2015 soit équivalent à l'ensemble des activités de financement non assurées par des banques de 75000 milliards de dollars en 2014, d'après le Conseil de Stabilité Financière, FSB (donc 50% des actifs valorisés laissés aux fonds de private equity, hedge funds et trusts i.e. ce que l'on dénomme également le « shadow banking »).

Compte tenu du PIB évoqué pour 2008, de l'ensemble des actions et obligations de 100000 milliards de dollars en valeur et d'un total des produits dérivés inscrits dans les livres des principales banques mondiales de l'ordre de 140000 Milliards de dollars en 2008, les marchés financiers ont pesé 4 à 5 fois plus que le PIB mondial en 2008.

En cohérence avec ce dernier point, *de la Rosière (16/02/2012)* fit référence à un coefficient du même ordre de grandeur à 4 pour l'année 2011, lors de la conférence organisée par le Cercle des Economistes et Nyse Euronext à Dauphine.

Bien évidemment, d'autres facteurs ou déterminants doivent être pris en compte et *Taylor (2008)* montre qu'en raison d'une politique monétaire laxiste, les taux d'intérêts chutèrent de 2002 à 2004. Il en résultat un trop plein monétaire qui en retour contribua au boom de l'immobilier, puis l'éclatement de la bulle afférente et enfin son effondrement (cf. la règle de Taylor). Lors des auditions aux Etats-Unis relativement à la commission d'enquête portant sur la crise financière, *Greenspan (2008)* a reconnu s'être trompé sur le bien-fondé de cette politique des taux bas, tout en reconnaissant que certains abus liés à l'utilisation excessive des CDS ont constitué une faille dans le système.

Instruments privilégiés de transfert du risque, les dérivés de crédits (les CDS étant les plus utilisés) comportent des zones d'ombre liées à l'opacité rémanente relative aux montants d'expositions de chaque acteur, comme le précise Fitch Ratings dans leur étude citée par *Issaoui (4/01/2006)* dans un article de La Tribune. Au-delà du risque systémique déjà envisagé à ce moment, Fitch Ratings fit remarquer également que les 10 banques le plus fortement positionnées sur le trading des dérivés de crédits se partagent 70% du marché.

Dans l'ordre, Deutsche Bank dont on connaît les difficultés depuis 2008, Morgan Stanley, Goldman Sachs et JP Morgan Chase.

Selon les auteurs de cette étude prémonitoire, « le marché serait dès lors vulnérable à une rupture de liquidité dans le cas où l'une ou plusieurs de ces institutions viendraient à rencontrer un problème ».

L'augmentation des prix de l'immobilier fut confirmée par *Reinhart et Rogoff (2008)* et ils décrivent une plus grande augmentation du taux d'accroissement des prix de l'immobilier aux Etats-Unis qu'en Suède (1991), Finlande (1991), Espagne (1977), Japon (1992) et Norvège (1987) au moment de leur propre crise financière. Un manque soudain de liquidité bancaire pour le marché du crédit bancaire doit être alors appréhendé, entraînant un mécanisme de contagion.

Comme trop souvent dans le cadre des crises de marchés ou des crises bancaires (ou les deux), les économistes et professionnels de la Finance minimisent dans un premier temps l'ampleur du phénomène en cours pour de multiples raisons provenant notamment du refus ou de la difficulté de reconnaître et d'accepter l'évidence d'une réalité qu'ils n'ont pas su eux-mêmes prévoir.

Ainsi *Cohen (Sept. 2008)* avança que « la bonne nouvelle, c'est que cela ne durera pas plus longtemps », *Artus (Oct. 2008)* que « la crise est finie » et *Minc (Oct. 2008)* que « c'est une crise grotesquement psychologique ».

Maintenant, s'il est commun de rechercher des coupables, il est tout aussi naturel et bien plus constructif de se demander comment nous aurions pu éviter cela.

En effet, des solutions simples visant à renforcer la régulation existent. Même si elles ne permettent pas nécessairement une allocation optimale des investissements, ces dernières limitent les excès d'une finance internationalisée et sophistiquée, sans contraintes sérieuses et donc risquée.

C'est pourquoi il conviendrait de coordonner efficacement la régulation bancaire au niveau international en mettant fin en particulier au jeu de la concurrence réglementaire et fiscale auquel excellent certains pays au sein même de l'Europe, à commencer par l'Irlande et le Luxembourg, même s'il est difficile de ne pas évoquer la Suisse.

Les 15 mesures de lutte contre l'évasion fiscales proposées par le G20 en 2015 vont dans ce sens puisqu'elles visent notamment les prix de transfert contribuant à l'optimisation fiscale pratiquée par certaines multinationales.



Pour ce faire, une redéfinition du rôle et de la mission des agences de notation paraît incontournable (et pas seulement pour les Etats-Unis), ainsi que premièrement l'encadrement stricte avec nettement plus de transparence et deuxièmement la réduction drastique voir la suppression des paradis fiscaux i.e. places financières abritant filiales de banques et sociétés offshore, y compris compagnies d'assurances et gestionnaires de fonds. Mais cela dépasse le cadre de ma Thèse et appelle des réflexions sur un autre plan.

Trop de règles peuvent néanmoins obérer les atouts d'une régulation optimale.

De fait, un attirail normatif complexe et prolifique n'est pas forcément la meilleure réponse à une finance sophistiquée et il est donc bien question de compromis entre lourdeur et célérité de façon à chasser le superflu pour ne garder que l'indispensable.

Ainsi, la gageure résiderait davantage dans la mise en œuvre d'un dispositif prudentiel de contrôle souple et sensible notamment pour les banques, rapidement évolutif et internationalisé, avec le pouvoir d'agir vite et bien tout en restaurant la Confiance.

C'est le prix à payer pour que l'économie mondiale puisse être financée correctement, sans dérivations chroniques de flux monétaires qui ne participent en aucun cas à l'intérêt commun et éloignent les banques de leur mission originelle d'allocation de crédits face à des dépôts, avec un horizon d'investissement à court terme tandis que les entreprises s'inscrivent dans le long terme.

Basés sur la problématique générale en page ci-après, figurent ensuite en quelques lignes le champ d'étude envisagé et l'approche retenue qui ont permis la rédaction de cette Thèse en Finance Bancaire à Dauphine.

## 1. Problématique générale et résumé

### Problématique générale

A partir d'une réflexion sur certains aspects de la régulation et de la gouvernance bancaire, une interrogation est portée sur les mécanismes visant à la prévision du défaut d'une banque qui légitiment l'intervention du régulateur.

### Résumé

*Fort d'un regard sur la régulation et la gouvernance, l'objet de cette thèse est d'étudier les mécanismes de prévision du défaut d'une banque qui légitiment l'intervention du régulateur. Nous analysons la pertinence de la classification CAMELS et de ses déterminants afférents en utilisant des banques non exclusivement américaines.*

*Les variables financières réagissant selon la zone observée, nous en déduisons la nécessité d'une supervision locale efficace, même si des institutions globales de régulation contribuent à davantage de sécurité et de transparence.*

*Puis, nous examinons si une gouvernance renforcée réduit nécessairement les problèmes financiers des banques européennes en montrant que certains déterminants améliorent la supervision et la régulation.*

*Enfin, pour l'intervention du régulateur nous proposons un mécanisme de prévision du défaut bancaire basé sur une différence temporelle minimum à ne pas franchir, à partir du spread de CDS de la banque suivie selon 2 seuils fixés.*

## 2. Comparaison entre déterminants financiers des banques et le défaut possible à travers des pays majeurs

La qualité des déterminants bancaires est une question épineuse depuis des décennies, notamment en matière de prévision du défaut d'une banque.

Certes, les Early-Warning Systems qui traitent de la prévision des crises bancaires ou les outils sophistiqués qui utilisent des modèles pour prévoir le défaut d'une banque sont nécessaires, mais ils empêchent parfois les analystes de se questionner véritablement sur la pertinence des variables qu'ils utilisent.

Par exemple, *Davis, Karim and Liadze (2011)* ont montré que comme des échantillons globaux de données ne sont pas adaptés, il est plus efficace d'utiliser deux modèles pour évaluer séparément des zones telles que l'Asie ou l'Amérique Latine afin de traiter des objectifs de politiques liés à la régulation.

C'est pourquoi dans le premier essai nous analysons la pertinence de la classification CAMELS et de ses déterminants afférents en utilisant des banques non exclusivement américaines, afin d'avoir une vision plus internationale.

A cette fin, j'ai retenu l'approche classique qui consiste à passer par le système américain de notation CAMEL i.e. l'Uniform Financial Rating System comme nous devrions le dire et dont l'acronyme signifie protection ou adéquation du **C**apital, qualité des **A**ctifs, compétence du **M**anagement, solidité des **E**ntrées en matière de gains et exposition au risque de **L**iquidité. En effet, c'est l'un des indicateurs les plus connus permettant l'évaluation de la santé des banques à titre individuel, introduit par les régulateurs américains en novembre 1979.

En Janvier 1997, CAMEL évolua en CAMELS grâce à l'addition d'une sixième composantes (« **S** ») afin d'intégrer la **S**ensibilité aux risques de marchés.

Cet essai a la particularité de porter sur un échantillon de banques internationales, à la différence des deux suivants qui se spécialisent sur les banques européennes, permettant une analyse plus fine au-delà de variables financières exclusivement.

181 banques sont sélectionnées à travers le monde dans trois zones (Amérique du Nord-Océanie, Europe et principaux pays d'Asie) et classées par total de leurs actifs par pays (ou par zone pour l'Europe) sur lesquelles nous avons obtenu des données financières dans Bloomberg de 2006 à 2013. Nous avons retenu les banques avec le meilleur classement en 2008 et ainsi 50% des banques de notre sélection figurent dans le classement mondial des 100 premières par actifs.

Ensuite, nous avons effectué des régressions probit en panel par zones et à un niveau global pour toutes les banques sur un problème financier (Financial Distress) calculé comme une variable binaire dépendante en utilisant des variables explicatives de type CAMELS.

Etant donné que durant la crise financière la plupart des pays de notre échantillon ont été touchés, nous nous attendions à trouver des résultats cohérents à travers les 3 zones étudiées.

En fait, nos résultats soulèvent la question de la capacité de certaines variables de type CAMELS à intégrer la variété et les impacts des chocs subis par les banques à travers ces différentes zones et aussi suggèrent que des échantillons globaux pourraient être inappropriés. Ainsi, nous avons observé que les variables financières réagissent différemment selon les zones auxquelles les banques sont rattachées parce qu'il y a des cultures commerciales distinctes ou un cadre juridique qui influent sur l'organisation et le management des banques, leurs résultats et donc l'éventualité du défaut de l'une d'entre-elles.

Par conséquent, il y a du sens à ce que la surveillance et la supervision bancaire soient effectuées de manière efficace au niveau d'un pays ou d'une zone, même si des institutions globales de régulation supra nationales peuvent contribuer à davantage de sécurité et de transparence.

C'est précisément le rôle des Autorités Européennes de Supervision telles que L'Autorité Bancaire Européenne (EBA) ou l'Autorité des Marchés et des Titres Européens (ESMA), version supra nationale de l'Autorité des Marchés Financiers en France fondée en 2003 par Gérard Rameix et Michel Prada.

Maintenant, comme nous venons juste de le voir, la nécessité de solides et divers régulateurs au sein de chaque pays est également clé.

Pour une politique publique de régulation adaptée, ces résultats vont dans la même direction que les institutions globales de régulations supra nationales telles que le Fond Monétaire International (IMF), le Comité de Bâle, la Banque Mondiale et d'autres qui proposent de relever le niveau de publication obligatoire d'information financière (disclosure), tout en améliorant la transparence dans le domaine bancaire.

### **3. Est-ce qu'une gouvernance renforcée réduit nécessairement les problèmes financiers pour les banques européennes ?**

Une problématique connexe à celle développée précédemment consiste à examiner si une gouvernance renforcée réduit nécessairement les problèmes financiers pour les banques européennes. En effet, compte tenu des résultats que nous venons d'obtenir, il paraît raisonnable de s'en tenir à une seule zone pour réaliser ce deuxième essai également sur l'horizon retenu de 8 années de 2006 à 2013, sachant qu'il est plus difficile de se procurer des variables de gouvernance que des variables financières et économiques.

Pour exposer cette problématique, nous avons dû définir et expliquer dans un premier temps le mécanisme de gouvernance bancaire et quels sont les déterminants nécessaires pour décrire le mieux ce concept et qui devraient être en conformité avec des législations comme la 8<sup>ème</sup> Directive pour les sociétés ou groupes de grandes tailles en Europe, ainsi que les règles Bâloises.

Fondamentalement, « la gouvernance d'entreprise traite des moyens avec lesquels les investisseurs dans les entreprises s'assurent eux-mêmes d'obtenir un retour sur leurs investissements », *Shleifer and Vishny (1997)* dans leur enquête sur la gouvernance d'entreprise.

La gouvernance renvoie aux structures et process mis en œuvre dans le management des affaires d'une entreprise. Ceci doit améliorer la valeur actionnariale sur le long terme en optimisant la performance de l'entreprise et son niveau de responsabilité en tenant compte des différentes parties prenantes.

Par conséquent, la gouvernance peut varier d'une organisation à une autre en fonction de sa taille, la structure de l'actionnariat, son indépendance et sa complexité.

Aussi, selon le régime de propriété, la régulation bancaire agira différemment sur la prise de risque d'une banque à l'autre, *Laeven and Levine (2008)*.

De fait, « une société est un maillage de relations contractuelles entre elle et ses parties prenantes », *Jensen and Meckling (1976)*.

C'est pourquoi les règles des Conseils d'Administration doivent être claires, transparentes, en conformité avec la régulation et les lois. Dès lors, en cohérence avec la théorie du mandat (Agency Theory), *Jensen and Meckling (1976)*, la séparation de la propriété et du contrôle doit se dérouler sans à-coups de manière à permettre l'allocation la plus efficace des droits de contrôle résiduels, *Shleifer and Vishny (1997)*, ou pour éviter tout conflit d'intérêts en retenant la meilleure stratégie.

En effet, les intérêts des dirigeants et des actionnaires ne coïncident pas nécessairement (Agency problem) puisque les uns veulent optimiser l'ensemble de leurs rémunérations et avantages en nature, tandis que les autres cherchent à maximiser la valeur de la société.

Il en résulte des coûts supplémentaires de gestion (Agency costs) pour les actionnaires, liés à la délégation de pouvoir et l'asymétrie d'information qui en découlent.

Dans cet essai, nous avons étudié 49 banques parmi les 100 premières européennes de 2006 à 2013 et nous avons effectué des régressions probit en panel sur un problème financier en tant que variable binaire dépendante, en utilisant nos variables explicatives de gouvernance, financières et économiques. Ainsi, on peut évaluer si le niveau de gouvernance possède oui ou non une influence positive sur les risques bancaires majeurs et potentiellement éviter un problème financier ou un défaut de la banque.

A partir de notre sélection de variables de gouvernance parmi la structure et taille du Conseil d'Administration, son indépendance et celles qui relèvent des comités d'audit ou de Conseils d'Administration, nous avons d'abord montré que les variables de gouvernance ne sont pas aisément mesurables et nous avons mis en lumière quelques paradoxes à partir des articles que nous avons cités dans la revue de littérature de cet article.

Ceci explique en partie pourquoi certaines de nos variables de gouvernance ou économiques ont un pouvoir d'explication faible. En l'occurrence, 6 de nos 14 variables comptent réellement à savoir 3 variables financières, 2 de gouvernance et 1 économique.

En particulier, celles qui ont le plus de sens pour notre propos sont le ratio de directeurs indépendants et le ratio de Tier 1 capital.

De fait, si l'indépendance des directeurs appartenant au Conseil d'Administration est un sujet récurrent comme nous l'avons mentionné pour certains articles et avec des résultats parfois opposés, les nôtres montrent la significativité de cette variable d'où son intérêt expliquant sa prise en compte dans la Directive 8.

Au reste, le nombre de Conseils d'Administration organisés par an est un indicateur simple et également significatif qui induit notamment qu'une augmentation dans l'année en cours révèle l'existence de difficultés potentielles ayant certainement surgi l'année précédente en mobilisant ensuite anormalement le Conseil.

Le ratio de Tier 1 capital orienté risque est largement utilisé dans les départements ou les directions des risques dans la banque. En effet, c'est un ratio clé pour la protection ou l'adéquation du capital imposé par Bâle I et davantage par Bâle II sous la dénomination du ratio européen de solvabilité ou BIS ratio (Bank of International Settlements).

Il se rapproche donc du ratio Mc Donough mis en œuvre sous Bâle II dès 2007 et qui a pour numérateur un capital étendu au-delà du Tier 1 incluant le Tier 2 moins quelques déductions et un dénominateur identique constitué des actifs pondérés par risque. Des seuils minimum sont fixés pour ces deux ratios, ce qui en fait leur intérêt principal dans le cadre de politiques de régulation qui visent à imposer aux banques une gouvernance orientée vers la diminution de la prise de risques en particulier.

Nos résultats sont donc cohérents puisque cette variable explique parfaitement notre problème financier (variable dépendante) et ce n'est pas un hasard si son seuil a été récemment augmenté sous Bâle III en cours d'implémentation.

#### 4. CDS et la prévision du défaut des banques

Après avoir exploré les enjeux de régulation et de gouvernance en lien avec le défaut potentiel des banques, nous abordons dans ce troisième essai un mécanisme de prévision du défaut des banques. Il est basé sur une différence temporelle minimum à ne pas franchir, à partir du spread de CDS de la banque suivie selon 2 seuils fixés.

C'est pourquoi cette recherche empirique pourrait être utile au régulateur afin qu'il puisse intervenir le plus tôt possible avant qu'une banque ne fasse défaut pourvu que des procédures ad hoc soient conçues.

Les CDS ou Credit Default Swap font partie du groupe des dérivés de crédits dans les produits financiers. Ils fournissent une forme d'assurance contre le risque de crédit.

En 1994, ces CDS dérivés de crédits ont été développés par Blythe Masters de JP Morgan. Initialement, les banques les ont utilisés pour couvrir leur exposition au risque de crédit pour leur bilan. Cela leur permet donc de gérer le risque de contrepartie en dissociant du coût du risque de contrepartie le coût de financement de la créance afférente. Il est alors permis aux établissements de crédit la vente de leurs risques en conservant les créances à leur bilan, ainsi que l'achat de risques afin de diversifier leur exposition.

A partir d'une courte analyse du pouvoir de prévision de plusieurs types de produits financiers, nous trouvons que les caractéristiques des CDS sont les meilleures pour prévoir et donc idéalement parer à l'éventualité du défaut d'une banque.

Grâce aux propriétés financières des CDS et les résultats d'études empiriques, nous montrons que les spreads de CDS sont incontestablement un bon proxy (ou substitut) pour le risque bancaire, même s'ils sont plus sensibles aux changements liés à l'actualité et l'information financière que d'autres produits.

En effet, les CDS améliorent la fluidité économique en rendant plus efficace l'allocation du capital et du risque tout en étant suffisamment fiables pour guider les autres marchés en termes d'information et de découverte des prix.

Nous avons étudié 50 des 100 premières banques européennes de 2007 à 2013 et nous en avons examiné quelques-unes en détail en nous inspirant d'une idée provenant d'un article de *Hart et Zingales (2009)*.

La procédure qu'ils proposent consiste au déclenchement d'une intervention par le régulateur lorsque le prix du CDS (ou spread) franchit les 100 bps (points de base ou 1%) sur au moins 20 des 30 derniers jours de trading (1<sup>ère</sup> règle de décision).

La date correspondante est appelée T100.

Cependant, nous trouvons que ces premiers résultats sont insatisfaisants, y compris en ajoutant un deuxième indicateur tel que l'indice Financier Senior iTraxx à 5 ans de Markit (comprenant 25 CDS de même pondération sur 16 banques et 9 compagnies d'assurance) et en appliquant en parallèle la même procédure aux banques de notre échantillon (2<sup>ème</sup> règle de décision).

Envisageant alors une approche plus théorique et à l'aide de l'indice Européen iTraxx à 5 ans de Markit (comprenant 125 CDS de même pondération de sociétés dont les 25 précédentes), nous avons pu identifier un tunnel pour la courbe de spread de cet indice agrégé qui fluctue dans l'intervalle [0, 200] bps (points de base), de 20,16 à 216,87 bps exactement.

En outre, il est important de constater que la médiane et la moyenne sont très proches de 100 bps ce qui pourrait constituer une limite moyenne basse qui explique le niveau de déclenchement à 100 bps de *Hart et Zingales (2009)*.

Figure 1 => Les 3 Indices iTraxx à 5 ans de Markit (de Bloomberg)



Tab 01 => Statistiques descriptives des trois indices iTraxx du 01/01/07 au 12/03/13

	iTraxx Europe	iTraxx HIVOL	iTraxx Sr Financial
Moyenne	107,67	179,16	131,40
Médiane	105,61	169,42	125,88
Ecart type	45,29	90,87	76,37
Haut	216,87	552,52	355,31
Bas	20,16	38,78	6,95
Haut (date)	05/12/2008	05/12/2008	25/11/2011



De manière plus précise, les CDS de sociétés constituant cet indice Européen sont distribués selon quatre sous-indices : Financiers (Senior et Subordonnés), Non-Financiers et HIVOL pour Haute Volatilité.

L'indice HIVOL iTraxx à 5 ans de Markit comprend 30 CDS (de même pondération) des spreads des plus grands de sociétés européennes non-financières, incluses dans l'indice Européen précédent.

Notre période d'étude s'étend sur plus de 6 années du 01/01/07 au 12/03/13 et d'après nos résultats, nous comprenons désormais la nécessité d'un autre niveau de déclenchement, en l'occurrence à 200 bps.

Par conséquent, nous avons modifié légèrement notre approche parce que nous avons trouvé que si la capacité de prévention des spreads de banque compte, il est tout aussi approprié de superviser directement le spread de banque dans l'intervalle [0, 200] avec deux limites de déclenchement, l'une à 100 bps et l'autre à 200 bps.

En effet, les dates correspondantes du T100 à cette limite moyenne basse et du T200 à cette limite haute sont une réponse en adéquation avec la conclusion d'*Anderson (2009)* affirmant que les « spreads peuvent être des proxies (substituts) corrects pour les différences quant aux probabilités de défaut dans un échantillon représentatif de sociétés ».

Dès lors, il serait judicieux d'observer la vitesse à laquelle un spread passe de son T100 à son T200 correspondant. Dans ce cadre, il est beaucoup plus pratique et efficace de calculer le nombre de jours entre le T200 obtenu moins le T100 obtenu pour une banque donnée (convention 30/360) :

plus la durée est courte, plus le risque est grand.

Cela nous a conduits aussi à concevoir une méta-règle qui ajoute une solide troisième procédure ou règle de décision comme suit :

déclencher une « véritable intervention » lorsque le nombre de jours entre le T200 et le T100 est inférieur ou égale à 180 jours i.e.  $T200 - T100 \leq 180$  jours.

Notons que désormais la seconde règle de décision n'est plus prise en compte.

En cohérence avec nos résultats, il est d'autant plus intéressant d'observer que les événements importants de défauts (recapitalisation massive, nationalisation, sauvetage) arrivent le plus souvent au voisinage du T200 d'une banque en particulier et a fortiori au-delà.

Maintenant, il reste à comprendre davantage pourquoi l'utilisation des spreads de CDS pour la prévision du défaut des banques n'est pas plus efficace et dans le cas où cette dernière règle serait activée, que faire et quand exactement en ce qui concerne l'intervention du régulateur sachant que cela pourrait être d'un intérêt capital pour ce dernier.

### **Conditions permettant de déterminer la survenance d'un problème financier**

Il est important de préciser les conditions permettant de déterminer la survenance d'un problème financier (Financial Distress) comme explicité dans l'essai 2 et 3.

Le défaut d'une banque correspond à une faillite bancaire qui conduit le plus souvent au renflouement de la banque faillie, ce qui n'est pas si courant en Europe.

Voici pourquoi nous allons devoir examiner les facteurs qui conduisent à des problèmes financiers substantiels, même si parfois l'un d'entre-eux peut se transformer en faillite bancaire nécessitant éventuellement un renflouement bancaire important, voir à un sauvetage par l'état.

Par conséquent, il s'agit d'un problème financier lorsqu'au moins l'un des événements de crédits ci-après survient :

- Nationalisation partielle ou totale
- Rachat par une autre banque ou transfert dans un groupe de banques qui ont fusionné entre elles ou fusion forcée
- Echec aux stress tests entraînant le premier et deuxième point
- Garanties substantielles émises par l'état ou approuvées par la Commission Européenne entraînant le premier et deuxième point
- Run sur une banque
- Plan de restructuration approuvé par la Commission Européenne (plan de capitaux par l'EBA i.e. l'Autorité Bancaire Européenne).
- « Restructuration » : une modification dont les modalités constituant la dette qui ne sont pas favorables au créancier
- « Echec de paiement » : l'entité de référence n'arrive plus à effectuer les paiements dus après l'expiration de toute période gracieuse de report des délais
- « Banqueroute » : l'entité de référence est soit dissoute ou devient insolvable ou se retrouve incapable de payer ses dettes.

Notons que ces événements de crédits sont assez différents de ceux qui sont utilisés par l'ISDA (Association Internationale des Swaps et des Dérivés) pour les modifications effectuées dans le cadre du Big Bang et du Small Bang (*Suppléments ISDA, 2009 et voir aussi l'étude Markit, 2009*).

En effet, nos critères sont moins restrictifs et plus nombreux que ceux de l'ISDA puisque nous voulons être sûrs de pouvoir illustrer notre propos avec suffisamment de cas de problèmes financiers parce qu'il y a eu nettement moins de faillites bancaires en Europe qu'aux Etats-Unis.

# **Chapter I: A comparison of bank financial determinants and the related possible default across major countries**

## **Abstract**

In this study we consider the relevance of using the CAMELS classification and related determinants for banks that are not only American but also in other countries, to produce an international picture. The magnitude and characteristics of financial shocks on banks might differ considerably across countries and zones (or regions), hence it is worth testing CAMELS variables on a more global scale. Given that during the financial crisis most countries have been hit, we might expect to find quite consistent results across the 3 zones that are covered by North America-Oceania Anglo-Saxon countries, Europe and the major countries in Asia.

We have selected 181 banks in these 3 world zones ranked by total assets by country (or zone in Europe) for which we obtained detailed financial data on Bloomberg in the period from 2006 to 2013. We selected banks with the highest scores in 2008, thus half of our bank sample belong to the Top 100 worldwide banks by assets. Then, we performed panel probit regressions by zone and on a global scale for all 181 banks using a financial distress computed dummy as the dependent variable, and CAMELS explanatory variables.

Our results clearly raise questions about the capacity of some CAMELS variables to account for the variety and impact of crises affecting banks in these different zones and also suggest that global samples might be inappropriate. We observed that financial variables react differently depending on the country and zone banks belong to partly because there are business cultural distinctions or legal rules which impact on bank organization and management, their results, and hence the possibility of a bank default.

We conclude that efficient supervision of banks is essential at a zone or country level even if global regulatory institutions may help to ensure more security and transparency in the banking field.

## 1. Introduction and related literature

### 1.1 CAMELS and BOPEC ratings

The quality of bank determinants has been an issue for decades, especially in order to predict bank default. Early-Warning Systems that deal with the prediction of banking crises and simple or sophisticated tools that use models in order to forecast bank default are necessary, but they sometimes prevent analysts from really questioning the relevance of the variables they use.

In addition studies in the field of banking finance are often focused on a specific country such as the US or a zone without the possibility of producing a more global picture that could permit comparisons between countries or zones as well as a more relevant use of bank financial determinants for better identifying key variables.

For instance, *Davis, Karim and Liadze (2011)* showed that because global samples are irrelevant when they pool data, it was more efficient to use their two models to assess zones separately (such as Asia, or Latin America) in order to deal with policy objectives.

So, our research here focuses on the relevance of the CAMELS classification and related determinants using not only American banks to give a more international picture.

To address the problem we started by considering the classical approach of using the US CAMEL ratings system, which is formally referred to as the Uniform Financial Rating System. This is one of the most well established indicators of assessing the health of individual banks and probably one of the oldest methods, being introduced by US regulators in November 1979. CAMEL stands for **C**apital protection or adequacy, **A**sset quality, **M**anagement competence, **E**arnings strengths and **L**iquidity risk exposure.

Following an onsite examination, notified in advance, by the supervisory authorities (the Federal Reserve, the Federal Deposit Insurance Corporation i.e. FDIC and the Office of the Comptroller of the Currency i.e. OCC) bank examiners assign a score on a scale of one (best) to five (worst) for each of the five CAMEL components. They also assign a single summary measure taken from the analysis of the CAMEL components, known as the “composite” rating which is strictly confidential. This score is expressed on a one-through-five scale. Banks with composite ratings of one or two are regarded as safe and sound and banks with weaker ratings of three, four or five are unsatisfactory as explained in the figure below (*Gilbert, Meyer and Vaughan 2002*).

Bank supervision requires regular on-site examination. In the USA the Federal Deposit Insurance Corporation Improvement Act (FDICIA) set rules in 1991 requiring that most banks submit a full-scope federal or state examination every 12 months and small, well-capitalized banks must be examined every 18 months, *Gilbert, Meyer and Vaughan (2002)*.

In January 1997, CAMEL evolved into CAMELS, with the addition of a sixth component (“S”) to summarize Sensitivity to market risk. As the CAMELS rating system is mainly built on accounting numbers from regulatory filings, a reliable financial reporting system depends on the effective functioning of this rating system, *Jin, Kanagaretnam, Lobo and Mathieu (2013)*. Supervisory authorities tend to avoid using the M component as Management variables are often qualitative and difficult to measure, whereas other components can be clearly proxied by accounting ratios, *Capelle-Blancard and Chauveau (2002)*.

Figure 2 => What are CAMELS ratings?

<b>WHAT ARE CAMELS RATINGS?</b>	
<b>CAMELS composite rating</b>	<b>Description</b>
<b>Safe and sound</b>	
1	Financial institutions with a composite one rating are sound in every respect and generally have individual component ratings of one or two.
2	Financial institutions with a composite two rating are fundamentally sound. In general, a two-rated institution will have no individual component ratings weaker than three.
<b>Unsatisfactory</b>	
3	Financial institutions with a composite three rating exhibit some degree of supervisory concern in one or more of the component areas.
4	Financial institutions with a composite four rating generally exhibit unsafe and unsound practices or conditions. They have serious financial or managerial deficiencies that result in unsatisfactory performance.
5	Financial institutions with a composite five rating generally exhibit extremely unsafe and unsound practices or conditions. Institutions in this group pose a significant risk to the deposit insurance fund and their failure is highly probable.
<p>NOTE: CAMELS is an acronym for six components of bank safety and soundness: capital protection (C), asset quality (A), management competence (M), earnings strength (E), liquidity risk exposure (L), and market risk sensitivity (S). Examiners assign a grade of one (best) through five (worst) to each component. They also use these six scores to award a composite rating, also expressed on a one-through-five scale. As a rule, banks with composite ratings of one or two are considered safe and sound while banks with ratings of three, four, or five are considered unsatisfactory.</p> <p>SOURCE: <i>Federal Reserve Commercial Bank Examination Manual</i>.</p>	

CAMELS ratings, based on on-site examinations, cover a bank’s financial condition, the quality of its management and systems of internal control, its regulatory policies and compliance with laws, *Cole and Gunther (1998)*. The role of regulators consists principally in concentrating on early intervention and providing banks with adapted responses to permit any troubled ones to recover as soon as possible.

Because of the multiple dimensions of CAMELS ratings we observe that its primary purpose was not to predict bank failure. To this end *Cole and Gunther (1998)* made comparisons between supervisory ratings and Call Report information for predicting future bank failures during the second quarter of 1988 and the first quarter of 1992 and concluded that if CAMEL ratings improved forecast accuracy (and contained useful information) it was only if the examination had happened during the previous half-year. This could explain why they found that a probit statistical model using publicly available financial data gives better results with respect to bank failure.

Similarly, *Berger, Davies and Flannery (2000)* showed that only recently-assigned BOPEC ratings out-performed market-based measures for predicting future performances of BHCs (Bank Holding Companies). Supervisory assessments tend to be less accurate than market indicators such as stocks or bonds for predicting future changes in performance. (A probable explanation could be that supervisors and rating agencies pay more attention to default probabilities and an organization's current condition than the stock market which rather concentrates on future revenues and profitability i.e. future conditions).

They compared BOPEC ratings of BHCs quality with stocks or bond market assessment for 184 banks over the period 1989:Q4 – 1992:Q2, having also access to the frequency of on-site inspections. They collected 4 indicators of market assessment: the proportion of common equity owned by insiders, abnormal stock return, Moody's rating on outstanding debentures and the proportion of common equity shares owned by institutional investors.

They found that bond market ratings (market information) and BOPEC ratings (supervisory data) "Granger-cause" one another indicating that both financial markets and supervisors contain some unique prediction information or in other words, discover information which is only included later in the other group's assessments. (Granger-causality is a statistical method which attempts to predict whether one variable or set of data is likely to influence change in the other). Conversely, the "Granger-causality" effects between supervisory assessment and equity markets give a very weak to null result which is consistent with our previous suggestion that both these data sets show differences in incentives about the future.

A "BOPEC" rating is assigned by the Federal Reserve reflecting the conditions of the BHC's **B**ank subsidiaries, **O**ther (nonbank) subsidiaries, **P**arent company, **E**arnings and **C**apital adequacy. Like CAMELS ratings, BOPEC ratings range from 1 (strongest) to 5 (weakest) and supervisors assign numerical ratings to each of the individual components and rate BHC management as satisfactory, fair, or unsatisfactory. Significantly, in addition to on-site examinations, US bank supervisors regularly resort to off-site surveillance to both reduce on-site costs and to complement the on-site examinations. At the end of the 90's, an interagency body of bank and thrift supervisors i.e. the Federal Financial Institutions Examinations Council (FFIEC) required banks to issue quarterly Reports of Condition and Income known as the Call Reports. Hence the development of various tools based on CAMELS variables by US supervisors using Call Report data to schedule and plan examinations, including econometric models. For instance, to obtain balance sheet data for an American bank study, one tends to use Call Report's tapes for individual banks and Federal Reserve Y-9 data tapes for BHCs.

Several researchers show that the added value of supervisory assessments deteriorates over time. For example *Hirtle and Lopez (1999)* suggest that information deteriorates within 18 to 36 months after examination. Interestingly they find that information quality significantly decays when the US banking industry suffers from financial troubles or a given bank shows

signs of deteriorating finances. They used CAMEL ratings (based upon entire on-site examination) assigned to banks from 1989 to 1995 by the FDIC, the Federal Reserve, the OCC and state banking supervisors.

As a consequence of the cited works above we decided that we needed to focus in this study on data that describes banks from the financial and accounting (bank's book) aspect but also from the regulatory discipline side assuming that some quantitative data is available for the latter.

The usefulness of CAMELS ratings is confirmed by several researchers e.g. *De Young, Flannery, Lang and Sorescu (1998)* who found from their empirical results that government examinations (with on-site examinations) result in valuable information concerning bank safety several quarters before this information is internalised by markets into debentures prices. Based on a three-step research methodology, they used quarterly data for national banks subsidiaries of BHCs with traded debentures between 1989 and 1995 and their CAMELS ratings that are regressed on these financial data. Their findings showed that information in CAMEL ratings added some value which had not yet been integrated by the market regarding the safety of large banks that are publicly traded. Later *De Young, Flannery, Lang and Sorescu (2001)* state that their results bring no clear proof that CAMEL information adds some value beyond what the market already knows. However they used a relatively small number (67) of large banks with traded debentures in their study. They also comment on the informational advantage that a government monitor could add to small banks that are not followed so much by financial markets.

*Dahl, O'Keefe and Hanwek (1998)* showed that examiners and auditors influence differently the provisioning for loan losses and the timing of loan-loss recognition (charge-offs). They studied the effect of audit (by private firms) and examinations (by government agencies) on loan-loss recognition (for two categories of loans) and on total provision for loan losses (nearly all US commercial and savings banks between 1987 and 1997). The two categories of loans were commercial and industrial loans and loans secured by real estate. They found that bank examiners influence the timing of loan-loss recognition, but not auditors. Indeed, if the impact of examinations on commercial and industrial loan-loss recognition is important, there is no effect on real-estate loan-loss recognition. This is based on their findings which showed that auditors had a real positive effect on provisions for loan losses between 1992 and 1997, but examinations gave no significant effect on provisioning most of the time.

*Berger and Davies (1998)* came to a similar conclusion, but they initially found that the effects on private information due to CAMEL downgrades are important when it is a question of uncovering unfavorable information. It could be that loan quality data transmitted to market within quarterly financial statements reveals a rapid increase of

provisions for loan losses, thereby indicating that a negative examination happened because of a bad financial situation in a particular bank. Their sample consisted of bank Call Report data, Federal bank examination data, BHC data, and stock return data from 390 bank examinations conducted on lead banks of large publicly traded banking organizations from January 1985 to June 1989. They state that multiple examinations occurred for many banks in their sample i.e. the 390 bank examinations were for 164 banks (162 lead banks of BHCs and 2 independent banks). They also suggest that banks which have unsatisfactory ratings when examined could logically benefit more from auditing conclusions because it may then reveal their poor financial conditions.

*Billet, Garfinkel and O'Neal (1998)* show that insured deposit financing helps banks protect themselves from the full cost of market discipline suggesting that bankers consider regulatory supervision (discipline) is less costly than market supervision. Thus, in times of increasing risks, banks tend to raise their consumption of insured deposits because then their associated regulatory costs are perceived as being relatively cheaper than uninsured deposits (or uninsured liabilities) that banks reduce in parallel. In their study, Uninsured deposits are defined by Total Deposits less Insured Deposits and Total Deposits by all deposits including foreign deposits which are uninsured. Their initial sample consists of published credit ratings changes for BHCs for the period January 1990 to December 1995. They conclude that regulation may undermine the effectiveness of market discipline in mitigating against bank risk taking. Indeed, bank managers and equity markets definitely observe a difference between the costs of market discipline and regulatory discipline, hence the reduction of market discipline effectiveness when banks become more risky as they are prone to use more insured deposits.

Conversely, *Jordan, Peek and Rosengren (1999)* found that market discipline was more effective when the disclosure of the supervisory information was eased for distressed US banks during the banking crisis (and so regulation is essential). They conceived a file for all formal actions imposed on large banks which detained at least \$300 million in assets i.e. banks that are publicly traded from 1989 to 1994 in order to scrutinize the effects of announcements of formal enforcement actions on the share prices of banks. This file was based on information they gathered from the Federal Reserve System, the Office of the Comptroller of the Currency (OCC) and the Federal Deposit Insurance Corporation (FDIC). For a relevant public regulatory policy, these findings concur with global regulatory institutions such as the International Monetary fund, the Basel Committee, the World Bank and others which propose to raise disclosure as well as to ameliorate transparency in the banking field.

Nevertheless, it is important to note the findings of *Jordan, Peek and Rosengren (1999)* that for banks which have not yet fully revealed financial troubles, there is a potential impact on their capital position, earnings and loan loss provisioning. These banks could suffer from a larger stock price reaction than those which have already revealed difficulties. Hence, the



need to examine these related variables as shown later in the data section. This is also why banks which are under the conditions specified in “cease and desist orders” must take special actions to modify provisions for loan loss reserves, earnings and planned loan charge-offs, and supplying markets investors with new information. In such cases recommendations to management may also consist of setting clear quantitative targets such as nonperforming loans and capital ratios to turn around a troubled bank.

Furthermore, disclosure certainly strengthens transparency because investors use that information in order to better guess another bank’s financial condition. Bank stocks will then be repriced with similar exposures which encourage management to take steps to avoid examiner intervention. This is precisely what we could expect from market discipline that may result from greater transparency aimed at resolving banking difficulties, *Flannery and Sorescu (1996)*. Indeed, *Flannery (1998)* pointed out that it is a question of how to process market information to complement procedures in order to control and monitor BHCs. For on-site examinations there is always a normal lag time for the recognition of an increased probability of failure. If supervisory and market information could be combined then this could reduce the recognition lag. However, any corrective action may take some time as supervisors cannot enforce a corrective intervention or action without having sufficient time to produce evidence that a bank is having trouble, *O’Keefe and Reidhill (1997)*. Consequently, supervisors may use market information in order to justify their intervention hence reducing the time between the date of recognition and the beginning of their intervention, as they can sometimes be hesitant to admit and deal with problems that occurred under their supervision.

## **1.2 Bank defaults and sophisticated Early Warning Systems**

By the end of the 90’s a few researchers had addressed the question of the prediction of bank default and banking crisis. Indeed, the two last decades of the past century ended with a substantial amount of different types of banking crises everywhere in the world i.e. situations where banks can no longer perform their role as intermediates because they become insolvent i.e. their liability value is larger than their asset value.

Three-quarters of IMF countries experienced banking distresses in the period 1980-1996 state *Davis and Karim (2008 a)*. These two decades of financial liberalization have also been accompanied by an increase of new financial products with enhanced effects because of computerization and internationalization of financial markets. The major changes to the American Glass-Steagall Act, adopted in 1999 under the Gramm-Leach-Bliley Act, allowed commercial banks, investments banks and insurance companies to consolidate and then to become universal which permits these new whole entities to fully diversify their investments with negative and positive effects on risk-taking as a result.

Obviously, other factors or determinants must be considered as *Taylor (2008)* shows that due to lenient monetary policy, interest rates fell from 2002 to 2004 and this resulted in a monetary excess that in turn contributed to the housing boom and then the subsequent burst and collapse (cf. Taylor rule). The rise of housing prices was confirmed in *Reinhart and Rogoff (2008)* and they also show a far larger growth rate for the house prices in the US than in Sweden (1991), Finland (1991), Spain (1977), Japan (1992) and Norway (1987) at the time of their financial crises. A sudden lack of banking liquidity for bank credit markets must also be considered, hence leading to contagion.

*Demirgüç-Kunt and Detragiache (1998)* show that a banking crisis tends to arise more often in countries that have experienced financial liberalization and that the related effects are reduced by a strong institutional environment. Their study during 1980 to 1994 is based on a multivariate logit model linking the likelihood of a crisis to a vector of explanatory variables. They find that if the macroeconomic context is not strong enough then low GDP growth, high real interest rates and high inflation and an explicit deposit insurance system can lead to banking crisis.

However, in theory, an explicit deposit insurance system should mitigate against the fragility of banks as a self-fulfilling panic as described by *Diamond and Dybvig (1983)*, but this implies some more risk-taking by bank decision makers (i.e. a moral hazard), all the more as we are considering the years after 1999 i.e. post the Gramm-Leach-Bliley Act. They focus mainly on macroeconomic determinants and assert that this is partly because of a lack of data among the potential choice microeconomic variables of banking and regulation, hence the need to investigate further bank level information. This was confirmed by *Demirgüç-Kunt and Detragiache (2005)* for an extended period from 1980 to 2002 for this study with 94 countries and up to 77 crisis occurrences in their enriched sample.

Another methodology was used by Kaminsky and Reinhart (1999) who found that financial liberalization often results in a banking crisis and subsequently a currency crisis, which in turn fuels the banking crisis, creating a vicious circle. Their sample consisted of 20 countries and included 76 currency crises and 26 banking crises from 1970 to 1995. They find 26 currency crises and 3 banking crises for the period from 1970 to 1979 and 50 currency crises and 23 banking crises between 1980 and 1995. This major increase of banking crises is linked to the post-liberalization era, whereas that of the 70's may be attributed to a very regulated decade. They use a non-parametric approach based on a signal extraction model to reach their conclusions (\*). With the help of a minimization of their Noise To Signal Ratio given by a Probability of Type II error / (1 – Probability of Type I error), they construct a country specific threshold and then obtain a benchmark for an Early Warning System with univariate indicator signals.

(\*) Defining a specific interval of time between signals and crisis, they establish specific thresholds for each of their fifteen variables in order to compute their related time series of 1 (signal of crisis) or 0 (no-signal of crisis) measures any time their determinants go over their given threshold during the selected elapse of time. Then, they operate a reconciliation between those series and actual events (crisis or no-crisis) in order to design their measure of predictive accuracy.

Their most valid variables are among the group of capital account (reserves for instance) and financial liberalization (such as real interest rate that predicts 50% of banking crises and domestic credit / GDP that produces 100% of banking crises).

For crisis prediction, *Demirgüç-Kunt and Detragiache (2000)* went further revealing that this type of model produces less in-sample Type I and Type II errors regarding probability estimations than in the signal extraction model of *Kaminsky and Reinhart (1999)*. Using their model, the monitor selects the probability threshold that would minimize a loss function characterizing the likelihood of either the costs of taking an action should no crisis happen or the costs of no action when problems arise. Two frameworks are contemplated: the first attempts to assess how deep the fragility is in order to intervene or not, and the second involves the rating of the fragility of the banking system. They consider six banking crises that span the years 1996 and 1997 i.e. the Jamaican crisis of 1996 and the five East Asian crises of 1997, building related out-of-sample forecasted probabilities. For three of these six crises the results are too optimistic and the authors explain this by the novelty of their econometric evaluation of systemic banking crises, in particular the use of their forecasting and monitoring tools. Furthermore, as a crisis is often triggered by new phenomena, coefficients that were used inside in-sample models might be pointless out-of-sample. In addition, it is important to consider the inherent following bias for this type of study: banking crises do not occur often and so consist of rare events (36 crisis episodes only compared to 766 observations used for in-sample estimation), not to mention extreme events regulators incorporated since the previous financial crisis.

By comparison between the multivariate Logit models in *Demirgüç-Kunt and Detragiache (2005)* and the signal extraction method in *Kaminsky and Reinhart (1999)*, *Davis and Karim (2008 a)* we conclude that, as far as the in-sample predictive ability is concerned, the multivariate logit model gives more acceptable results than those from signal extraction. Also, their results show that the multinomial logit model is more likely to agree with global Early Warning Systems whilst the signal extraction methodology is better for country specific Early Warning Systems. They find that changes in terms of trade and real GDP growth are the best predictors for banking crises for their sample.

Binary Recursive Trees (BRT) or decision tree techniques are used in research on machine learning and often feature in medical research. Based on a recursive partitioning algorithm using "If-Then" rules to undertake solving prediction questions implemented in Early Warning Systems, these rules can classify banks as in *Davis and Karim (2008 b)* or later, in *Davis, Karim and Liadze (2011)*, using a proprietary software package ("CART", Salford Systems Inc.). Instead of addressing the question of the likelihood of a banking crisis in n years as in a multivariate logit model, BRT partitioning tries to guess what non-linear variable interactions are more likely to weaken an economy with regards to banking crises. Moreover, the BRT non-parametric approach requires no specific statistical distribution which is a substantial advantage, especially as there is no need that all variables follow the same distribution as each variable takes the same distribution across cross-sections.

However, the results for OECD countries (including emerging market countries) in *Davis and Karim (2008 b)* with both BRT and logit models give no robust results regarding a potential increase of crisis probability before the subprime crisis (i.e. for the preceding two years). Specifically, the Logit model gives better performances for the UK and the US. This is probably why *Davis, Karim and Liadze (2011)* showed that global samples are irrelevant when they pool data so it was more efficient to use both models to assess zones separately (such as Asia, or Latin America) in order to deal with policy objectives.

*Wilson (1998)* and the McKinsey company proposed a model, CreditPortfolioView, which is based on a discrete time multi-period model and only measures default risk. In this multi-factor model, default probabilities which are generated by a Logit model depend on macroeconomic variables (such as growth rate, level of interest rates, unemployment, etc.). These variables are specified for each country and they relate to the state of their economy. Furthermore, each of these independent variable is assumed to follow an autoregressive model of order 2 (AR(2)). Then, the main idea of CreditPortfolioView consists of connecting those macroeconomic factors to the default and migration probabilities. However, in order to calibrate the model, reliable default data for each country and their related industrial sector are needed as mentioned by *Crouhy et al. (2000)*, and another limitation also exists because the model requires a specified procedure to adjust the migration matrix. Indeed, because of the brevity of historical past records, it is really difficult to cover several credit cycles and test the inherent model robustness in case of a crisis.

Other very technical and sophisticated tools have been developed in the empirical literature using operational research models such as Case-based reasoning, Neural Networks, Trait Recognition, Multicriteria decision aid, etc. as described in *Demyanyk and Hasan (2011)*. Interestingly, none of these methods appear to be substantially better than another, if we compare their results. This is why it may be more efficient to combine at least two of them e.g. *Davis and Karim (2008 a)* or *Davis, Karim and Liadze (2011)*, depending on either the global or country / zone specific Early Warning Systems we want to focus on.

## 2. Data

### 2.1 Sample analysis and data collection

We have selected 181 banks in the world ranked by total assets by country (or zone for Europe) for which we obtained detailed financial data on Bloomberg in the period 2006 to 2013. Specifically, we have focused on the Top 150 banks by total assets by country (or zone for Europe) in 3 main zones i.e. 62 banks for North America-Oceania Anglo-Saxon countries (USA, Canada and Australia), 57 banks for Europe and 62 banks for major countries in Asia (India, China, Japan), thereby trying to reach an equilibrium in the number of banks by zone. We have not used Russian banks for historical, political and economic reasons.

We selected banks with the highest scores in 2008 using the Relbanks website that gives classifications of top banks by assets by country and also by assets in the world, plus data from queries in Bloomberg and Fitch Connect databases. Consequently half of our bank sample belonged to the Top 100 banks by assets in the world for the year 2008 according to Relbanks website. At year end 2008, we found that our 12 Chinese banks belong to the Top 20 in China and our 20 Indian banks belong to the Top 50 in India. Because Australian banks have not been really impacted by the financial crisis, we note no real shifts for asset ranking after 2008 (even until 2016) hence our 7 Australian banks remain in the 14 first in Australia.

In our total ranking, the smallest banks were The South Indian Bank Ltd with total assets at €2.35bn in 2006 and Signature Bank in USA at €4bn in 2007. They were still the smallest in 2008 by total assets. The biggest banks in 2008 were European i.e. Royal Bank of Scotland Group PLC at €2508bn and Deutsche Bank at €2202bn from our Bloomberg sample. However, using the Relbanks ranking of Top banks in the world by assets in 2008 Barclays appears in second position and Deutsche Bank in third. None of our European banks had total assets under €10bn between 2006 and 2013. It is interesting to note that in 2008 all Top five banks in the world by assets were European, but only 2 out of 5 in 2013 (the last year for our period of study) the others being 2 Chinese and 1 Japanese. More recently in 2016, there are 4 Chinese and 1 Japanese banks in the world Top five.

We have been able to select our 57 European banks using the ranking of the Top 100 European banks by their total assets in 2008 (Fitch Ratings companies' data-base) that included 31 countries (EU and European Free Trade Association i.e. EFTA including Iceland, Norway, Switzerland and Liechtenstein). It is necessary to use consolidated accounts and this explains why the data are not always those communicated by the financial department of the related banks, because analysts had often to reprocess internal accounting data.

A reason why we were not able to use all the 100 European banks for our regression analysis is because many of them disappeared during this period. Hence, "caja" banks from Spain do not figure in our sample because many of them went bankrupt or were taken over (e.g. with the creation of Bankia on 3/12/10). Sometimes we could not obtain relevant data about

banks, because they are just too small or not listed because of their “caja” status as for example “caisses d’épargne” and “mutual banks” in France (Savings-Banks). In addition, Northern Rock had already been nationalized on 17/02/2008 in the UK as it was too dependent on market refinancing after a bank run during the summer 2007, Nationwide was partially nationalised, Bradford & Bingley was nationalised in the UK on 29/09/08. Alliance & Leicester was definitely acquired by Santander UK on 13/10/08, Anglo Irish Bank was also nationalized on 21/01/09 (and would merge later on 1/07/11 with Irish Nationwide Building society i.e. INBS under a new name, Irish Bank Resolution Corporation) and HBOS was bought by Lloyds on 19/09/08 (deal on the 19/01/09).

Outside the UK, ABN Amro was taken over by Fortis, RBS and BNPPARIBAS (offer on 8/10/07), Kaupthing bank was nationalized on 9/10/08 but we kept it in our study, Sachsen LB was taken over by Landesbank Baden-Württemberg (LBBW), IKB was saved by its shareholders, Dresdner merged with Commerzbank on 11/05/09 after this last bank announced this future acquisition on 31/08/2008 and WestLB incurred embezzlement with its prop-trading department. Although the Banques Populaires Group and Caisses d’Epargne Group appear in the ranking of the Top 100 European banks, we have not been able to integrate them into our sample as they later merged creating the BPCE Group. Nor was using Natixis a possibility as their Corporate and Investment Banking branch depends a lot on this new BPCE Group and its business is quite specialized in comparison to most of the banks in our sample.

## **2.2 Financial Distress (our dependent variable)**

In this study, our approach to qualify a financial distress for a given year is based on a dummy variable which has a value of 1 or 0. This financial distress will be taken in our regression analysis as the dependent variable which is based on a trigger resulting from a double condition.

In *Wheelock and Wilson (2000)*, interesting and clear definitions about bank failure in USA are given. Firstly, they consider a bank failure is when a bank has been closed by the FDIC as failed. Secondly, they increase their sample by taking into account banks with total equity capital less goodwill divided by total assets of less than 2%, because of regulatory action (the precise timing of failure may be arbitrary). For these banks, they define a failure date as the earlier of the reported date of closure or the day before the Call Report provided that the related equity ratio is under 2%. With the SEER risk rank probit model (System to Estimate Examination Ratings), *Gilbert, Meyer and Vaughan (2002)* use financial data to assess the probability that a bank supervised by the Fed will either fail or see its tangible capital fall below 2% of total assets (in the next 24 months) which is exactly the same condition as tangible capital equals total equity capital less goodwill. Because this condition is not as obvious forward as the closure of a bank which failed, we also consider financial distress in this study. To define financial distress we are going to use 2 financial variables that are more generally used rather than the conditions reported in the 2 previous articles.

The first is TIER1\_CAP\_RATIO variable (Tier 1 Capital Ratio), defined as the ratio of Tier 1 capital to risk-weighted assets. *Jin, Kanagaretnam and Lobo (2011)* use this ratio as a measure of balance sheet strength for US banks, as in *Aebi, Sabato and Schmid (2011)* from banks taken from the Compustat bank North America database. According to the *Berltratti and Stulz (2012)* study on large banks across the world, banks which possess more capital should have more flexibility to respond to adverse shocks. They conclude that large banks with more deposits, more Tier 1 Capital, less funding fragility and less exposure to US real estate performed better (in terms of stock prices). *Minton, Taillard and Williamson (2012)* even use it in one of their regressions (US banks) as the dependent variable (OLS regression). In conclusion, the smaller it is, the riskier is the bank. We set this first partial trigger so that if Tier 1 Capital Ratio < 6%, then the related dummy equals one, otherwise it is 0. Indeed, the Basel Committee on Banking Supervision has opted for an increase of the minimum Tier 1 Capital Ratio at 6% in the aftermath of the financial crisis.

Secondly we have used the RETURN\_ON\_ASSET ratio (ROA), because this is largely used in such contexts, though banks are quite special companies. For instance, *Jin, Kanagaretnam and Lobo (2011)* use it, as one of the three conditions ("ROA is less than -5%", added to a Tier one capital under 4% and a ratio of Loan Loss Provision divided by total loan over 1%) they require to classify a given bank as a troubled one, when *Jin, Kanagaretnam, Lobo and Mathieu (2013)* refer to a large loss. Based on this and *Krishnan (2005)* who proposes to measure a financial distress in particular by a dummy variable indicating a loss (if net income < 0) during the current year, we claim that ROA proxies for a loss and provides substantial information on the financial health of the bank. *Berger, Imbierowicz and Rauch (2013)* also use the ROA in their multivariate logistic regressions and *Ellul and Yerramilli (2013)* in their panel regressions. We set this second partial trigger so that if ROA < 0, then the related dummy equals 1 or 0 otherwise. Under these two conditions, our resulting trigger for our financial distress is going to be equal to 1 if at least one of both partial triggers is equal to 1.

In summary,

FD=1 if (Tier 1 Capital Ratio < 6%) or (ROA < 0),

where FD is a Financial Distress equal to 0 if the above condition is not met.

## 2.3 Explanatory variables

From the Bloomberg group of financial and accounting variables we select our related explanatory variables so that they proxy the 6 CAMELS dimensions as much as possible. We also identify a dummy variable (1 for a European bank, 0 otherwise).

For our different regressions, our “default” dependent variable is going to be a dummy for a financial distress of a given bank.

### Tab 02 => Selected Bloomberg variables

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SELECTED BLOOMBERG VARIABLES
<b>CAPITAL PROTECTION</b>
TOT_EQ_TO_TOT_ASSET (%) (*)
<b>ASSET QUALITY</b>
LOG(TOT_ASSET)
TOT_LOAN_TO_TOT_ASSET (%)
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET (%) (*)
<b>MANAGEMENT COMPETENCE</b>
OPER_MARGIN (%)
RETURN_COM_EQY (%)
<b>EARNINGS STRENGTHS</b>
RETURN_TOT_EQY (%)
NET_REV_TO_TOT_CAP (*)
<b>LIQUIDITY RISK EXPOSURE</b>
CUSTOMER_DEPOSIT_TO_TOT_ASSET (%) (*)
CASH_TO_TOT_ASSET
ST_BORROW_TO_TOT_ASSET (%) (*)
<b>SENSITIVITY TO MARKET RISKS</b>
BOOK_VAL_PER_SH

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Source: Bloomberg. We compute the Log of TOT\_ASSET with TOT\_ASSET in Euro thousands (knowing that they are given in Euro million in Bloomberg).

(\*) stand for Bloomberg variables that we scaled by assets (or by capital for the Net Revenue).

Cf. description of each variable in detail in table 0 in appendix.

### Capital protection

Capital is a key factor as *Wheelock and Wilson (2000)* showed, because less capitalized US banks tend to be easily acquired (often just before becoming insolvent) and Total Equity has a buffer role against losses by protecting a bank’s solvency whilst reducing the possibility of a financial distress, as in *Cole and Gunther (1998)* US bank study. We also chose the TOT\_EQ\_TO\_TOT\_ASSET variable (Total Equity divided by Total Assets), as *Arena (2008)* in his Latin America and East Asia bank study, claiming that this ratio is used in analysis of solvency, or *Demirgüç-Kunt, Detragiache and Gupta (2000)* with a reduced basis (Equity divided by Total Assets) in an analysis of banking systems in distress for several countries. We expect that this coefficient should have a negative sign. Indeed, banks with a higher



capitalisation scaled by Total Assets should be more robust and less likely to find that their financial distress dependent variable crosses the red line.

### **Asset quality**

Regarding our financial and accounting variables, TOT\_ASSET variable (Total Assets) is a classical proxy that equates to the size of a bank and which, because of the “too big to fail” concept, should theoretically be negative. Most of our variables are scaled by Total Assets. CUSTOMER\_DEPOSIT\_TO\_TOT\_ASSET and TOT\_LOAN\_TO\_TOT\_ASSET qualify indirectly for retail banking i.e. a financial activity that grants loans to companies or individuals from the collection of deposits. We expect to find a negative sign for the first variable in our regressions. However, we should also remember that shareholders take more risks when deposit insurance is implemented, *Merton (1977)*. Using Total Assets, *Jin, Kanagaretnam, Lobo and Mathieu (2013)* even consider bank size as a driver of risk taking, differentiating large and smaller banks by adding the square and cube of size to a size determinant in their model. They quote prior literature that suggested that the size impact on different dependent variables is non-linear. In order to construct their Risk Management Index, *Ellul and Yerramilli (2013)* use, in their regressions on US Bank Holding companies, determinants such as the size e.g. the Log (Total Assets) and the square of the size i.e. Log [(Total Assets)squared].

Similarly *Minton, Taillard and Williamson (2012)* compute regressions of stock performance of US Banks and board determinants and risk monitoring functions. *Bhattacharyya and Purnanandam (2011)* use the same approach in their regressions relating US banks’ systematic risk and idiosyncratic risk to mortgage lending activities. According to them, very large banks tend to cover themselves by hedging their risks in the derivatives markets and should a crisis arise they expect to be saved by their state (too-big-too-fail facilities). However, in most papers, the Log (Total Assets) is used e.g. in *Aebi, Sabato and Schmid (2011)*, *Adams and Mehran (2011)*, *Bertratti and Stulz (2012)* or *Berger, Imbierowicz and Rauch (2013)*, *Cole and White (2012)*. The last two authors suggest that young small banks should probably fail more easily than larger ones, but because the larger ones have invested in toxic RMBS they find difficult to conclude on a particular effect for this variable. *Aebi, Sabato and Schmid (2011)* use the ratio Loans / Total Assets because it indicates the asset side of a bank. However, even though higher values of this ratio characterize banks detaining smaller portfolio of securities, hence performing better should a crisis happen, an interpretation is not easy according to them. *Bertratti and Stulz (2012)* found that banks which possess government securities instead of loans would have performed better. Other authors use this determinant e.g. *Ellul and Yerramilli (2013)*. In order to measure loan quality as *Betz, Oprica, Peltonen and Sarlin (2013)* for European banks, or *Jin, Kanagaretnam and Lobo (2011)* for US banks, we decided to use PROV\_FOR\_LOAN\_LOSS\_TO\_TOT\_ASSET (Provision for Loan Losses divided by Total Assets). *O’Keefe and Wilcox (2009)* also used this with 11 others to account for individual banks’ composite CAMELS rating in USA (mimicking SCOR i.e. Statistical CAMELS Off-site Rating which indicates an anticipated deterioration of

CAMELS rating). The Bloomberg definition for this “periodic expense for possible future loan losses”, which could be negative when there is a recovery of loan losses, indicates when increasing abnormally, an expectation of a probable failure. As loans form an important part of a bank’s assets, a banks’ reporting for loans potentially reveals the state of health a bank is in.

### **Management competence**

This variable dimension used in CAMELS is sometimes omitted in financial papers, as mentioned previously. RETURN\_COM\_EQY variable i.e. T12 Net Income Available for Common Shareholders divided by Average Total Common Equity is a measure of a corporation's profitability, revealing how much profit a company generates with the money shareholders have invested (from the Bloomberg definition). Total Common Equity could be seen as a fraction or part of Total Equity. OPER\_MARGIN variable i.e. Operating Income (Losses) divided by Net Income is a ratio used to measure a company's pricing strategy and operating efficiency (from the Bloomberg definition). *Betz, Oprica, Peltonen and Sarlin (2013)* only took the nominator but they computed it differently i.e. Operating Costs divided by Operating Income.

### **Earnings strengths**

NET\_REV\_TO\_TOT\_CAP variable i.e. Net Revenue divided by Total Capital is conceptually close to the Return On Equity (see table 0 in appendix for a detailed definition of these variables). So, it makes sense to include it inside this section as, *Cole and Gunther (1998)* explained that substantial net income implies a lack of financial difficulties. *Berger and Bouwman (2013)* computed the variable Profitability (Return On Equity) they measured this as Net Income divided by Equity Capital. The RETURN\_TOT\_EQY variable equals Net Income divided by the sums of average Total Common Equity and average Preferred Equity. This is quite similar to the previous variable because Net Income signifies Net Revenue from Bloomberg data description.

### **Liquidity risk exposure**

*Berltratti and Stulz (2012)* and *Aebi, Sabato and Schmid (2011)* mention that the Deposit To Asset ratio reveals the composition of liabilities and that deposit financing is safer than money market funding as far as bank runs are concerned (more stable funding than the interbank market). Other authors use this determinant such as *Ellul and Yerramilli (2013)* or *Bhattacharyya and Purnanandam (2011)* and we expect this ratio to be negatively associated with financial distress. Note that we only use a fraction or a part of Deposit as we have chosen the Customer Deposit variable from Bloomberg scaled by Total Assets:

CUSTOMER\_DEPOSIT\_TO\_TOT\_ASSET.

CASH\_TO\_TOT\_ASSET (Cash divided by Total Assets) is a computed ratio by Bloomberg which provides an extensive and complete basis for Cash in banks. For Latin American and East Asia banks, *Arena (2008)* used the ratio of Liquid Assets (Cash and Reserves, Bonds and

other marketable securities) divided by Total Assets to proxy for liquidity risks while *Cole and White (2012)* in USA focused mainly on Cash (Cash and Items due from other banks) divided by Total Assets as well as *Demirgüç-Kunt, Detragiache and Gupta (2000)* in their analysis of banking system in distress from data for several countries. Although cash contributes to liquidity by allowing banks to fend off unexpected deposit withdrawals, a too large amount may hint at possible hardship especially if the flow is important, hence we should consider this ratio to be positively connected with financial distress. Indeed, under some circumstances a bank may have to sell specific activities, financial products or subsidiaries and too many cash holdings could be linked to agency problems.

Another explanation can be found in *Bennet, Hwa, Kwast (2011)* citing the paper of *Acharya and Mora (2011)*, who observed during the first quarter of 2009, that banks which were about to fail needed to mitigate against their deposit outflows and raised deposit rates to stop the loss. In order to prevent this, under Basel III, the Liquidity Coverage Ratio for short-term exposure must verify that Stock of high quality Assets divided by Total Net Cash outflows over the next 30 calendar days is over 100%. In their European bank study, *Betz, Oprica, Peltonen and Sarlin (2013)* included Short-Term Borrowing divided by total liabilities in their CAMELS indicators for Liquidity which is expected to be positively associated with financial distress. Nevertheless, in order to be consistent with other variables in our normalization approach, we keep on scaling variables by Totals Assets and therefore we have devised a ST\_BORROW\_TO\_TOT\_ASSET variable.

### **Sensitivity to market risks**

In January 1997, CAMEL evolved into CAMELS, with the addition of a sixth component (“S”) to summarize Sensitivity to market risk which explains why this variable dimension is not taken into account in some papers. BOOK\_VAL\_PER\_SH i.e. book value per share (book value of equity) may be combined with another value in banking articles related to governance or risk management. For example, the price to book ratio (or market to book ratio) is completely market oriented being equal to the last price divided by the BOOK\_VAL\_PER\_SH i.e. book value per share (book value of equity). This variable proxies for the market’s growth expectations, *Aebi, Sabato and Schmid (2011)*. *Campbell, Hilscher and Szilagyi (2008)* also use it in their logit model of bankruptcy and failure on US firms. However, the share price value variable in our initial sample was often missing especially for Asian banks and this is why we have kept BOOK\_VAL\_PER\_SH.

Interestingly, *Berger and Bouwman (2013)* found for US banks that “capital helps small banks to increase their probability of survival and market share at all times” hence, the connection between capital and sensitivity to market risk, even if it was not their intention from the hypotheses they had to test. Furthermore, they showed that “capital enhances the performance of medium and large banks primarily during banking crisis”. This is the reason why the Capital protection dimension in CAMELS is so important.

### **European dummy variable**

As in our study analyzing whether better governance necessarily reduces financial distress for European banks, it appeared logical to include a European dummy variable (1 for a European bank, 0 otherwise). Our sample includes banks in Norway, Iceland and Switzerland even though some European countries are not included. This variable is likely to be country / zone sensitive. Firstly, *Shleifer and Vishny (1997)* conclude that good Governance originates from legal protection of investors as well as concentrated ownerships. Supporting this *La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998)* suggest that legal rules in a given country (and the distinction between common law and civil law) have an impact on the concentration of ownership. Secondly *Laeven and Levine (2008)* and *Beltratti and Stulz (2012)* show that banks which have more powerful owners are at greater risk (more important specific risks), but turn out to be safer should a country enforce stronger protections laws. Similarly *Beltratti and Stulz (2012)* agree that, during the financial crisis, large banks belonging to countries with stricter legal protection on bank activities performed better and decreased loans less, even though differences across countries on banking regulations are not correlated to bank performance. Thirdly, *Aggarwal, Erel, Stulz and Williamson (2008)* claim that countries where the protection level is low for investors foreign firms are not inclined to invest in governance as much as firms have to do in the US.

## **2.4 Summary statistics**

### **Table A of summary statistics: all banks**

*Tab 03 => Table A of summary statistics: all banks*

This table shows the main summary statistics for our variables for the 181 banks from which we get detailed financial data from 2006 to 2013. We obtained 1242 complete sets of observations.

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
TOT_LOAN_TO_TOT_ASSET	1242	56,660	15,753	1,519	88,728
RETURN_TOT_EQY	1242	8,459	12,374	-141,453	64,367
CASH_TO_TOT_ASSET	1242	4,042	4,203	0,002	29,590
OPER_MARGIN	1242	17,698	192,039	-6632,044	94,830
TOT_EQ_TO_TOT_ASSET	1242	7,138	3,921	0,863	45,770
ST_BORROW_TO_TOT_ASSET	1242	9,606	9,353	0,000	67,174
NET_REV_TO_TOT_CAP	1242	14,628	9,670	0,148	81,247
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	1242	0,416	0,597	-0,366	5,770
CUSTOMER_DEPOSIT_TO_TOT_ASSET	1242	61,572	22,014	1,245	94,137
Log_TOT_ASSET	1242	8,053	0,642	6,371	9,399
RETURN_COM_EQY	1242	8,452	13,055	-141,453	64,367
BOOK_VAL_PER_SH	1242	19,664	44,776	0,020	617,840

**Table B of summary statistics: European banks**

*Tab 04 => Table B of summary statistics: European banks*

This table shows the main summary statistics for our variables for the 57 banks from which we get detailed financial data from 2006 to 2013. We obtained 387 complete sets of observations.

Variable	Obs	Mean	SD	Min	Max
TOT_LOAN_TO_TOT_ASSET	387	55,016	17,037	9,929	84,585
RETURN_TOT_EQY	387	5,531	16,644	-141,453	64,367
CASH_TO_TOT_ASSET	387	2,686	2,470	0,013	15,319
OPER_MARGIN	387	12,789	52,198	-663,830	94,830
TOT_EQ_TO_TOT_ASSET	387	5,355	2,227	0,863	14,504
ST_BORROW_TO_TOT_ASSET	387	15,482	10,399	0,478	57,130
NET_REV_TO_TOT_CAP	387	6,669	4,953	0,228	40,134
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	387	0,451	0,554	-0,136	5,770
CUSTOMER_DEPOSIT_TO_TOT_ASSET	387	38,825	14,359	2,316	87,492
Log_TOT_ASSET	387	8,429	0,496	6,995	9,399
RETURN_COM_EQY	387	5,367	16,947	-141,453	64,367
BOOK_VAL_PER_SH	387	33,361	73,701	0,020	617,840

**Table C of summary statistics: US, Canadian and Australian banks**

*Tab 05 => Table C of summary statistics: US, Canadian and Australian banks*

This table shows the main summary statistics for our variables for the 62 banks from which we get detailed financial data from 2006 to 2013. We obtained 415 complete sets of observations.

Variable	Obs	Mean	SD	Min	Max
TOT_LOAN_TO_TOT_ASSET	415	57,426	18,402	5,147	88,728
RETURN_TOT_EQY	415	9,099	10,788	-49,258	55,080
CASH_TO_TOT_ASSET	415	2,922	4,020	0,002	29,590
OPER_MARGIN	415	8,584	327,820	-6632,044	73,610
TOT_EQ_TO_TOT_ASSET	415	9,269	3,328	3,130	32,796
ST_BORROW_TO_TOT_ASSET	415	7,780	7,919	0,000	67,174
NET_REV_TO_TOT_CAP	415	18,055	10,146	0,148	81,247
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	415	0,555	0,800	-0,366	5,667
CUSTOMER_DEPOSIT_TO_TOT_ASSET	415	65,255	15,077	8,822	89,576
Log_TOT_ASSET	415	7,894	0,647	6,603	9,252
RETURN_COM_EQY	415	8,969	12,310	-72,660	55,080
BOOK_VAL_PER_SH	415	22,351	22,025	2,205	183,352

**Table D of summary statistics: Asian banks**

*Tab 06 => Table D of summary statistics: Asian banks*

This table shows the main summary statistics for our variables for the 62 banks from which we get detailed financial data from 2006 to 2013. We obtained 440 complete sets of observations.

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>SD</b>	<b>Min</b>	<b>Max</b>
TOT_LOAN_TO_TOT_ASSET	440	57,383	11,112	1,519	79,010
RETURN_TOT_EQY	440	10,431	8,224	-27,476	35,772
CASH_TO_TOT_ASSET	440	6,292	4,632	0,059	22,068
OPER_MARGIN	440	30,611	15,619	-65,704	71,724
TOT_EQ_TO_TOT_ASSET	440	6,697	4,622	2,530	45,770
ST_BORROW_TO_TOT_ASSET	440	6,160	6,898	0,064	34,084
NET_REV_TO_TOT_CAP	440	18,396	8,031	1,032	48,171
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	440	0,253	0,294	-0,358	1,449
CUSTOMER_DEPOSIT_TO_TOT_ASSET	440	78,105	15,210	1,245	94,137
Log_TOT_ASSET	440	7,873	0,610	6,371	9,355
RETURN_COM_EQY	440	10,679	8,531	-29,608	35,772
BOOK_VAL_PER_SH	440	5,083	6,981	0,099	46,793

### 3. Methodology (empirical analysis)

#### 3.1 Models

The dependent variable has a value of 0 or 1 for financial distress and our explanatory variables consist of our accounting and financial variables on a yearly basis.

Then, the marginal probability of a financial distress may be given by the following equation (Logit model):

$$P_{i,t} = P(Y_{i,t+1} = 1) = \frac{1}{1 + \exp(-\alpha - \beta x_{i,t})}$$

where  $Y_{i,t+1} = 1$  if the bank gets a financial distress in year  $t+1$  i.e. with a lag of  $+1$ , and  $x_{i,t}$  is equal to the vector of explanatory variables that arose the year before,  $\alpha$  is the constant coefficient (intercept) and  $\beta$  is the vector of the coefficients related to the explanatory variables.

With a probit model, the previous equation would be written as follows:

$$P_{i,t} = P(Y_{i,t+1} = 1) = F(\alpha + \beta x_{i,t})$$

where  $F$  is the standardized normal cumulative distributive function.

We made panel probit regressions as described above for  $t$  for the period 2006-2013 (+2014 for Financial Distress in regressions with the lag). See the related regressions in tables 1 to 5 in the appendix.

We selected the probit model which is more adapted and easier for calculations with random effects than the Logit model, as suggested by some econometricians like *Pirotte (2011)*, all the more as the Random Effects' estimator here give more detailed results. Indeed, the probit model with Random Effects simplifies calculations for integrations using marginal non-conditional likelihood after the computation of the conditional likelihood.

#### 3.2 Main results

The following sections contain comments on the probit regressions in our appended tables.

##### **Lag regressions with all 181 banks (see Table 1 in appendix)**

With regards to the regressions with all of our chosen 13 or 11 variables in the probit table 1 (from 2006 to 2013), our full columns (1) and (3) contain the lag regression results. When we examine the results for this probit model with Random Effects with a lag of  $+1$  year for the financial distress, we see in column (1) that only one variable is strongly significant at the 1% level i.e. the `PROV_FOR_LOAN_LOSS_TO_TOT_ASSET` (Asset quality type) with a positive sign. Particularly for US Banks, we noted in the introduction that it could be possible that loan quality data transmitted to the market by quarterly financial statements would show a rapid increase of provision for loan losses, i.e. a negative examination because of a bad

financial situation in a certain bank. Furthermore, it appears that auditors tend to focus on different aspect of bank accounting such as the provision for loan losses. Hence, it appears consistent that this variable shows this strong result at the 1% level with a lag (and at the 5% level with no-lag) but later, only significant in the North America-Oceania zone at the same level for the lag regression certainly because the weight of US banks is substantial even if Canadian and Australian Corporate banking culture are not that different.

Regarding the `ST_BORROW_TO_TOT_ASSET` variable (Liquidity risk exposure type), we expect to find a positive sign for the related coefficient revealing potential difficulties, as suggested earlier. We find significance at the 5% level with a positive sign and no significance at all for the column with no-lag. Indeed, banks anticipating possible hardships which could occur in the coming months could resort to Short-Term Borrowing.

The `CUSTOMER_DEPOSIT_TO_TOT_ASSET` variable (Liquidity risk exposure type) is weakly significant at the 10% level with a negative sign as expected because deposit financing is safer than money market funding as explained in the explanatory variable section.

In column (3) where two variables have been omitted for this regression with lag, we have no change except the `RETURN_COM_EQY` variable (Management competence type) which is now significant at the 5% level with a negative sign. It makes sense as we have suppressed the `RETURN_TOT_EQY` variable (Earnings strengths), which was really correlated to `RETURN_COM_EQY` with a correlation coefficient of 0.989 (see table 6 in appendix) and we have eventually removed the `TOT_LOAN_TO_TOT_ASSET` variable (Asset quality type) because this is difficult to interpret as mentioned in the explanatory variable section. Then, all of our following regressions in our different zones have been made without these two variables i.e. with 10 variables in total as we no longer need the EUROPE dummy variable. We noted that the coefficient of the EUROPE dummy variable was not significant at all.

The p-values linked to the Wald test result for these lag regression with columns (1) and (3) are very low (0.000) indicating that our model is robust.

#### **No-lag regressions with all 181 banks (see Table 1 in appendix)**

If we focus on the no-lag regression in column (2), we find that three variables are strongly significant at the 1% level. Firstly, the `TOT_EQ_TO_TOT_ASSET` variable (Capital protection type) with an expected negative sign is strongly significant which is important as Total Equity has a buffer role against losses by protecting a bank's solvency as stated in the explanatory variable section. Secondly, the `OPER_MARGIN` variable (Management competence type) with an expected negative sign is also really significant, hence indicating that this measure of a company's pricing strategy and operating efficiency is relevant, but later only significant in the Asian zone with its related regressions. Thirdly, the `CASH_TO_TOT_ASSET` variable (Liquidity risk exposure type) is absolutely significant with a positive sign which indicates that



a possible too large amount of cash may hint at potential hardships especially if the flow is important as we observed in the explanatory variable section.

The PROV\_FOR\_LOAN\_LOSS\_TO\_TOT\_ASSET variable remains significant for the no-lag regression, but at the 5% level and is even stronger at the 1% level in column (4) where two variables were omitted.

The Log\_TOT\_ASSET (Asset quality type) is weakly significant at the 10 % level with a negative sign and even at the 5% level in the column (4) where two variables were omitted. We showed in the explanatory variable section that it was uneasy to conclude with this variable. However, only the lag regression of the Asian zone gives significant results at the 5% level showing that a bigger size is more beneficial to banks in this area.

The p-values linked to the Wald test result for these lag regressions with columns (2) and (4) are very low (0.000) indicating that our model is robust. Considering this and our preceding comments, all of the following regressions in our different zones have been made with 10 variables. Because of their poor significance levels, the remaining variables have no power of explanation either for these lag or no-lag regressions.

#### **Regressions with all 181 banks and a modified Europe dummy (see Table 2 in appendix)**

With regards to the regressions with all of our chosen 13 or 11 variables in the probit table 2 (from 2006 to 2013), our full column (1) contains the lag regression results and the column (2) the no-lag regressions. When we examine the results for this probit model with Random Effects, we observe no significant change with the regressions in the table 1 except for the Log\_TOT\_ASSET in column (2) which appears now to be more significant at the 5% level with a negative sign. Nevertheless, we can at least conclude that if the normal Europe dummy has no power of explanation as shown in the table 1 regressions at a global stage with all the banks, cutting the period in two intervals where the Europe dummy is forced at 0 for the period 2011 to 2013 in columns (1) and (2) does not contribute to more significance. The p-values linked to the Wald test result for all these regressions with columns (1) and (2) are very low (0.000) indicating that our model remains robust.

#### **Lag regression with 62 US, Canadian and Australian banks (see Table 3 in appendix)**

With regards to the regressions with all of our chosen 10 variables in the probit table 3 (from 2006 to 2013), our full column (1) contains the lag regression results. When we examine the results for this probit model with Random Effects with a lag of +1 year for the financial distress, we see in column (1) that only one variable is strongly significant at the 1% level i.e. the PROV\_FOR\_LOAN\_LOSS\_TO\_TOT\_ASSET (Asset quality type) with a positive sign as in column (3) of the table (1) which is not so surprising considering our previous comment on US banks.

Regarding the ST\_BORROW\_TO\_TOT\_ASSET variable (Liquidity risk exposure type), we find significance at the 5% level again with a positive sign and no significance at all for the column with no-lag.

The RETURN\_COM\_EQY variable (Management competence type) is no longer significant. Now, we observe that the NET\_REV\_TO\_TOT\_CAP variable (Earnings strengths type) is significant at the 5% level with a negative sign which signifies a lack of financial difficulties as mentioned in the explanatory variable section.

The BOOK\_VAL\_PER\_SH variable (Sensitivity to market risk type) is also significant at the 5% level but with a positive sign. The result for this variable is difficult to interpret as it is not combined with another one such as the share price for instance.

The p-value linked to the Wald test result for this lag regression with column (1) is very low (0.000) indicating that our model is robust.

#### **No-lag regression with 62 US, Canadian and Australian banks (see Table 3 in appendix)**

If we now focus on the no-lag regression in columns (2), we see that only the RETURN\_COM\_EQY variable (Earnings strengths) is significant and at the 1% level, as it was in column (4) of the table 1. All the nine other variables have no power of explanation, but we must consider that we are dealing with a subset of our global sample and what is more the p-value linked to the Wald test result for this no-lag regression with column (2) is important (0.1909) indicating that our model is not robust enough.

#### **Lag regression with 57 European banks (see Table 4 in appendix)**

With regards to the regressions with all of our chosen 10 variables in the probit table 4 (from 2006 to 2013), our full column (1) contains the lag regression results.

When we examine the results for this probit model with Random Effects with a lag of +1 year for the financial distress, we see with column (1) that the RETURN\_COM\_EQY variable (Management competence type) is significant at the 5% level as for the table 1 with all the banks.

The TOT\_EQ\_TO\_TOT\_ASSET variable (Capital protection type) with a non-expected negative sign is significant at the 5% level. This result is surprising because Total Equity is supposed to behave as a buffer role against losses by protecting a bank's solvency as stated in the explanatory variable section. In order to clarify this, we could assume that for some small European banks, the ratio could characterize this particularity i.e. small banks are riskier. As the Log\_TOT\_ASSET variable (Asset quality type) has no power of explanation, this hypothesis must be rejected. Another explanation could be that as European banks resorted to equity issues far less than US banks did during the financial crisis, then, when there is an increase of the ratio one year before a financial distress, it may be a real sign of forthcoming

difficulties. Nevertheless, we note that the sign is negative as expected with the column (2) for the regression with no-lag, but with a coefficient which is not significant.

When we examine the NET\_REV\_TO\_TOT\_CAP variable (Earnings strengths type) we find that this is only significant at the 10% level with a negative sign.

The p-value linked to the Wald test result for this lag regression with column (1) is very low (0.0057) indicating that our model is robust.

#### **No-lag regression with 57 European banks (see Table 4 in appendix)**

If we now focus on the no-lag regression in columns (2), we see that only the RETURN\_COM\_EQY variable (Earnings strengths) is significant and at the 1% level, as it was for all the banks in column (4) of the table 1 or for US, Canadian and Australian banks in column (2) of the table 3.

All the nine other variables have no power of explanation, but we must consider that we are dealing with a subset of our global sample. However, contrary to US, Canadian and Australian banks, the p-value linked to the Wald test result for this no-lag regression with column (2) is very low (0.0000) indicating that our model is robust.

#### **Lag regression with 62 Asian banks (see Table 5 in appendix)**

With regards to the regressions with all of our chosen 10 variables in the probit table 5 (from 2006 to 2013), our full column (1) contains the lag regression results.

When we examine the results for this probit model with Random Effects with a lag of +1 year for the financial distress, we see with column (1) that the OPER\_MARGIN variable (Management competence type) is significant at the 5% level with a negative sign.

It shows that this measure of a company's pricing strategy and operating efficiency is only adequate for the Asian zone (except the global level for all banks) with its related regressions that include the no-lag one with an even better significance at the 1% level.

Regarding the ST\_BORROW\_TO\_TOT\_ASSET variable (Liquidity risk exposure type), we expect to find a positive sign for the related coefficient revealing potential difficulties, as suggested in the explanatory variable section. We find significance at the 5% level with a positive sign and a weak significance at the 10% for column (2) with no-lag.

The p-value linked to the Wald test result for this lag regression with column (1) is low (0.0241) indicating that our model is robust.

#### **No-Lag regression with 62 Asian banks (see Table 5 in appendix)**

If we now focus on the no-lag regression with column (2), the Log\_TOT\_ASSET (Asset quality type) is significant at the 5 % level with a negative sign.

So, only the lag regression of the Asian zone give significant results (except the global level for all banks) showing that a bigger size benefits more to banks from this area.

The TOT\_EQ\_TO\_TOT\_ASSET variable (Capital protection type) with an expected negative sign is significant at the 5% level.

We observe that the OPER\_MARGIN variable (Management competence type) is strongly significant at the 1% level with a negative sign.

As with all the banks in the table 1, the CASH\_TO\_TOT\_ASSET variable (Liquidity risk exposure type) is absolutely significant at the 1% level with a positive sign which indicates that a possible too large amount of cash may hint at potential hardship especially if the flow is important as we observed in the explanatory variable section.

Regarding the ST\_BORROW\_TO\_TOT\_ASSET variable (Liquidity risk exposure type), we find a weak significance at the 10% level with a positive sign.

The p-value linked to the Wald test result for this no-lag regression with the column (2) is very low (0.0045) indicating that our model is robust.

## 4. Conclusion

In this study we have compared effects on bank financial determinants depending on zones or on a more global level relating to possible bank default across major countries. In order to do this, we considered the relevance of using the CAMELS classification and related determinants for banks that are not only American but also in other countries, to produce an international picture. As the magnitude and characteristics of financial shocks on banks might differ significantly across zones, hence it was worth testing CAMELS variables on a more global scale.

We have selected 181 banks in the world (North America-Oceania Anglo-Saxon countries, Europe and major countries in Asia) ranked by total assets by country (or zone for Europe) for which we obtained detailed financial data on Bloomberg in the period 2006 to 2013. We selected banks with the highest score in 2008, thus half of our bank sample belong to the Top 100 worldwide banks by assets. Then, we performed panel probit regressions by zone and on a global scale for all 181 banks using a financial distress computed dummy as the dependent variable, and CAMELS explanatory variables.

We observed that financial variables react differently depending on the zone banks belong to partly because there are business cultural distinctions or legal rules which impact on bank organization and management, their results, and hence the possibility of a bank default. We found that of our 13 initial variables 5 are strongly significant at the 1% level and 4 at the 5% level. We obtained more significant variables in the regressions with all the banks as regressions for banks in a particular zone use subsamples. The five strongly significant variables are Total Equity To Total Asset, Provision For Loan Losses To Total Assets, Operating Margin, Return on Common Equity and Cash To Total Assets.

For instance, when we examine the results for all 181 banks with a lag of +1 year for the financial distress in column (1) table 1, we find that only one variable was strongly significant at the 1% level i.e. the Provision For Loan Losses To Total Assets (Asset quality type) with a positive sign. Particularly for US Banks, we noted in the introduction that loan quality data transmitted to the market by quarterly financial statements could reveal a rapid increase of provisions for loan losses, thereby indicating a bad financial situation in a certain bank. It may be directly connected to the fact that loans are simply growing rapidly, hence inducing specific risks. As we observed that the variable Total Loans To Total Assets was never significant we can conclude that this is mainly a question of loan quality which is fully consistent with the previous point. All this explained probably why Provision For Loan Losses To Total Assets is also only strongly significant at the 1% level with the lag regression for the North America-Oceania Anglo-Saxon zone.

If we now focus on the no-lag regression in column (2) table 1, we find that three variables are strongly significant at the 1% level i.e. Total Equity To Total Assets (Capital protection type), Operating Margin (Management competence type) and Cash To To Total Assets (Liquidity risk exposure type). We find later that the reflection of this into regressions for our 3 zones is unequal and not always aligned with these results, especially for the two last variables.

For the banks which belong to the European zone and the North America-Oceania Anglo-Saxon zone, when we focus on the no-lag regression in column (2) we find that only the Return on Common Equity variable (Earnings strengths) is significant at the 1% level, as it was in column (4) of the table 1 for all the banks. This last result is interesting because this variable has also no power of explanation at all for Asian banks, as well as the Net Revenue To Total Capital variable (Earnings strengths type). Conversely, the Cash To To Total Assets variable (Liquidity risk exposure type) and the Operating Margin variable (Management competence type) are only strongly significant for Asia in the no-lag regression, but not at all significant for the two other zones.

Given that during the financial crisis most countries have been hit, we initially expected to find quite consistent results across our 3 zones that are covered by North America-Oceania Anglo-Saxon countries, Europe and major countries in Asia. So, our results clearly raise questions about the capacity of some CAMELS variables to account for the variety and impact of financial shocks affecting banks in these different zones and also suggest that global samples might be inappropriate.

Consequently, it makes sense that Bank oversight and supervision are efficiently undertaken at a zone or country level even if global regulatory institutions may help to ensure more security and transparency in the banking field. This is precisely the role of the European Supervisory Authorities such as the European Banking Authority (EBA) or European Securities and Market Authority (ESMA). Now, as we have just shown, the role of diverse and robust country supervisors is also a key factor.

As far as the USA is concerned, we have already mentioned the Federal Reserve, the FDIC and the OCC, we should not omit the Securities and Exchange Commission (SEC) and the Commodities Futures Trading Commission (CFTC). For a relevant public regulatory policy, these findings lead in the same direction as global regulatory institutions such as the International Monetary fund, the Basel Committee, the World Bank and others propose to raise disclosure as well as to promote transparency.

## 5. Appendix

**Table 0: variable definitions**

Tab 07 => Table 0: Variable definitions

BLOOMBERG VARIABLES	VARIABLES DEFINITION
TOTAL_EQUITY_TO_TOT_ASSET	<p>Total Equity: firm's total assets minus its total liabilities.</p> <p>INDUSTRIALS, BANKS, FINANCIALS, UTILITIES, &amp; REITS</p> <p>Common Equity + Minority Interest + Preferred Equity</p> <p>Where:                      Common Equity is RR010, TOT_COMMON_EQY                      Minority Interest is BS062, MINORITY_NONCONTROLLING_INTEREST                      Preferred Equity is BS061, BS_PFD_EQY. TOT_ASSET: cf. below.</p>
TOT_COMMON_EQY	<p>The amount that all common shareholders have invested in a company. Calculated as:</p> <p>Share Capital &amp; APIC + Retained Earnings and Other Equity</p> <p>Where:                      Share Capital &amp; APIC is BS064, BS_SH_CAP_AND_APIC                      Retained Earnings and Other Equity is BS065, BS_RETAIN_EARN</p> <p>Figure is reported in millions; the Scaling Format Override (DY339, SCALING_FORMAT) can be used to change the display units for the field.</p>
TOT_ASSET	<p>BANKS</p> <p>Total Assets:                      This is the sum of Cash &amp; bank balances, Fed funds sold &amp; resale agreements, Investments for Trade and Sale, Net loans, Investments held to maturity, Net fixed assets,                      Other assets, Customers' Acceptances and Liabilities.</p> <p>Canada:                      This is the sum of Cash &amp; Bank Balances, Short Term Investments, Interbank Assets, Securities Purchased with Resale Agreements, Net loans, Investments Held to Maturity, Net fixed assets, Other assets, Customers' Acceptances and Liabilities.</p>
RETURN_TOT_EQY	<p>Calculated as Net Income (IS050) divided by the sum of average Total Common Equity (RR010) and average Preferred Equity (BS061).                      Available for all industry types.</p>
RETURN_COM_EQY	<p>Measure of a corporation's profitability by revealing how much profit a company generates with the money shareholders have invested, in percentage.</p> <p>Calculated as:  <math>(T12 \text{ Net Income Available for Common Shareholders} / \text{Average Total Common Equity}) * 100</math></p> <p>Where:                      T12 Net Income Available for Common Shareholders is T0089, TRAIL_12M_NET_INC_AVAI_COM_SHARE                      Average Total Common Equity is the average of the beginning balance and ending balance of RR010, TOT_COMMON_EQY                      If either the beginning or ending total common equity is negative, Return on Equity will not be calculated.                      Please reference Return on Common Equity Adjusted (F1169, RETURN_ON_COMMON_EQUITY_ADJUSTED) for the adjusted value that excludes the impact of abnormal items.</p>

A comparison of bank financial determinants and the related possible default across major countries

CUSTOMER_DEPOSIT_TO_TOT_ASSET	<p>BANKS</p> <p>Customer Deposits: Total deposits received from customers Amounts due to banks are shown in borrowings. TOT_ASSET: cf. above.</p>
TOT_LOAN_TO_TOT_ASSET	<p>BANKS</p> <p>Total Loans: Includes Commercial loans, Consumer loans and Other loans.</p> <p>France: Loans are not separated into commercial and consumer. Some banks break out mortgage loans and lease financing.</p> <p>China: Includes financial lease receivables. TOT_ASSET: cf. above.</p>
BOOK_VAL_PER_SH	<p>Measure used by owners of common shares in a firm to determine the level of safety associated with each individual share after all debts are paid accordingly. Units: Actual Calculated as:</p> <p>Total Common Equity / Number of Shares Outstanding</p> <p>Where: Total Common Equity is RR010, TOT_COMMON_EQY Shares Outstanding is BS081, BS_SH_OUT</p>
CASH_NEAR_CASH_ITEM	<p>BANKS</p> <p>Cash &amp; Near Cash: Includes cash in vaults and non-interest earning deposits in banks. Includes receivables from the central bank and postal accounts. Includes cash items in the process of collection and unposted debits. Interest bearing deposits in other banks are included in interbank assets. Includes statutory deposits with the central bank.</p> <p>Japan: Excludes collateral. Semi-annual and consolidated reports include deposits to central bank and other institutions.</p> <p>Netherlands: Includes cash, checks and short-term investments.</p>
CASH_TO_TOT_ASSET	<p>Ratio to measure the percentage of cash and near cash over total assets. Calculated as:</p> <p>Cash and Near Cash * 100 / Total Assets Cash and Near Cash is BS010, BS_CASH_NEAR_CASH_ITEM Total Assets is BS035, BS_TOT_ASSET i.e. TOT_ASSET here, cf. above.</p>



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<p>OPER_MARGIN</p>	<p>Ratio used to measure a company's pricing strategy and operating efficiency, in percentage.</p> <p>BANKS &amp; FINANCIALS</p> <p>Calculated as:</p> <p>Operating Income (Losses) / Net Income * 100</p> <p>Where:</p> <p>Operating Income is IS033, IS_OPER_INC Net Revenue is RR209, NET_REV.</p>
<p>ST_BORROW_TO_TOT_ASSET</p>	<p>ST_BORROW includes bank overdrafts, short-term debts and borrowings, repurchase agreements (repos) and reverse repos, short-term portion of long-term borrowings, current obligations under capital (finance)leases, current portion of hire purchase creditors, trust receipts, bills payable, bills of exchange, bankers acceptances, interest bearing loans, and short term mandatory redeemable preferred stock. Net with unamortized premium or discount on debt and may include fair value adjustments of embedded derivatives.</p> <p>For banks and financials, includes call money, bills discounted, federal funds purchased, and due to other banks or financial institutions.</p> <p>For Real Estate Investment Trusts (REITs), includes all unsecured borrowings regardless of length of term. This field is used either for unsecured debt or short term borrowing. Unsecured debt refers to mortgage and other secured debt which is not collateralized by property or assets of the company.</p> <p>Available for all formats. TOT_ASSET: cf. above.</p>
<p>NET_REV_TO_TOT_CAP</p>	<p>BANKS &amp; FINANCIALS</p> <p>Sum of interest income, trading account profits (losses), investment income (losses), commissions and fees earned, and other operating income, minus interest expense.</p> <p>Calculated as:</p> <p>Net Interest Income + Trading Acct. Profits + Commissions &amp; Fees Earned + Other Operating Income (Losses)</p> <p>Where:</p> <p>Net Interest Income is RR016, NET_INT_INC Trading Acct. Profits is IS017, IS_TRADING_ACCT_PROF Commissions &amp; Fees Earned is IS019, IS_COMM_AND_FEE_EARN_INC_REO Other Operating Income (Losses) is IS020, IS_OTHER_OPER_INC_LOSSES</p> <p>Please reference Net Revenue Adjusted (IM392, IS_ADJUSTED_NET_REVENUE) for the adjusted value that excludes the impact of abnormal items.</p>

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TOT_CAP	<p>Total investment that shareholders and debtholders have made in a company. Figure is reported in millions.</p> <p>BANKS &amp; FINANCIALS Calculated as:</p> <p>Short Term Borrowings + Securities Sold with Repo Agreements + Long Term Borrowings + Preferred Equity + Minority Interest + Total Common Equity</p> <p>Where: Short Term Borrowing is BS047, BS_ST_BORROW Securities Sold with Repo Agreements is BS049, BS_SEC_SOLD_REPO_AGRMNT Long Term Borrowings is BS051, BS_LT_BORROW Preferred Equity is BS061, BS_PFD_EQY Minority Interest is BS062, MINORITY_NONCONTROLLING_INTEREST Total Common Equity is RR010, TOT_COMMON_EQY</p>
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	<p>BANKS Provision for loan losses: The periodic expense for possible future loan losses. Could be negative when there is a recovery of loan losses. May include other provisions if they are not disclosed separately.</p> <p>FINANCIALS Provision for loan losses: Provision allocated for uncollectible interest income and principal on loans granted to customers. Could be negative when there is a recovery of loan losses. May include other provisions if they are not disclosed separately.</p> <p>TOT_ASSET: cf. above.</p>
RETURN_ON_ASSET	<p>Indicator of how profitable a company is relative to its total assets, in percentage. Return on assets gives an idea as to how efficient management is at using its assets to generate earnings.</p> <p>INDUSTRIALS, BANKS, FINANCIALS, UTILITIES, &amp; REITS Calculated as:</p> <p><math>(\text{Trailing 12M Net Income} / \text{Average Total Assets}) * 100</math></p> <p>Where: Trailing 12M Net Income is RR813, TRAIL_12M_NET_INC Average Total Assets is the average of the beginning balance and ending balance of BS035. TOT_ASSET (Cf. above).</p>

TIER1_CAP_RATIO	<p>BANKS</p> <p>Tier 1 Capital Ratio: Tier 1 or Core capital ratio. Tier 1 is used for commercial banks and core capital is used for savings and loans in the United States (U.S.).</p> <p>The ratio of Tier 1 capital to risk-weighted assets.</p> <p>For Core Tier 1 Capital Ratio see Core Tier 1 Capital Ratio (BS895, BS_CORE_TIER1_CAPITAL_RATIO).</p> <p>Common stockholders' equity: Qualifying perpetual preferred stock. Minority Interest in consolidated subsidiaries less Goodwill and other disallowed intangibles.</p> <p>Core capital for savings and loans: Common stockholders' equity. Noncumulative perpetual preferred and surplus. Minority interests less intangible assets (other than PMSR). The ratios are discussed in the Cooke Committee and adopted by each country. The information is provided in terms of absolute numbers and percentages. If the absolute amounts are disclosed, the percentages should be computed for this account. Slightly different ratios are defined for commercial banks and savings and loans. The minimum ratios set by the U.S. Federal Reserve and OTC are 4% for commercial banks and 3% for savings and loans, respectively.</p> <p>Canada: Computed in accordance with the Office of Superintendent of Financial Institutions (OSFI) based on standards issued by the Bank for International Settlements. Since 1992, Canadian deposit-taking institutions are required to maintain a minimum Tier 1 capital ratio of 4%.</p> <p>Europe: The Bank of International Settlements in Basel requires a Tier I ratio of 4.4% (and now 6%). In Europe it is referred to as the BIS ratio, the European Solvency ratio, or the Cooke ratio as the Cooke committee established it.</p> <p>Japan: Discloses only international standard.</p>
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*EUROPE: dummy variable which is equal to 1 (0 otherwise) if a bank belongs to geographical Europe.*

**Table 1: PROBIT (All 181 banks with 13 or 11 variables)**

Tab 08 => Table 1: PROBIT (All 181 banks with 13 or 11 variables)

This table shows the panel regressions for our 181 banks with variables taken from Bloomberg data from 2006 to 2013. Columns (1) (3) contain a lag of +1 for a Financial Distress (FD\_lag\_1) and columns (2) (4) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Europe is a dummy variable which is equal to 1 if a bank belongs to geographical Europe. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD	(3) FD lag 1	(4) FD
Log_TOT_ASSET	-0.105 (0.141)	-0.535* (0.300)	-0.165 (0.130)	-0.631** (0.280)
TOT_EQ_TO_TOT_ASSET	0.000643 (0.0187)	-0.140*** (0.0417)	-0.000491 (0.0185)	-0.142*** (0.0423)
TOT_LOAN_TO_TOT_ASSET	0.00513 (0.00512)	0.00831 (0.0106)		
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	0.328*** (0.106)	0.469** (0.220)	0.357*** (0.101)	0.538*** (0.208)
CUSTOMER_DEPOSIT_TO_TOT_ASSET	-0.0106* (0.00610)	-0.0144 (0.0122)	-0.00839 (0.00565)	-0.0112 (0.0115)
OPER_MARGIN	-0.00192 (0.00202)	-0.0379*** (0.00867)	-0.00183 (0.00197)	-0.0375*** (0.00871)
RETURN_COM_EQY	-0.00122 (0.0235)	-0.129** (0.0594)	-0.0114** (0.00544)	-0.118*** (0.0207)
RETURN_TOT_EQY	-0.0115 (0.0250)	0.0118 (0.0614)		
NET_REV_TO_TOT_CAP	-0.0162 (0.0133)	-0.0247 (0.0242)	-0.0200 (0.0129)	-0.0296 (0.0237)
BOOK_VAL_PER_SH	0.000493 (0.00117)	-0.00176 (0.00221)	0.000662 (0.00115)	-0.00134 (0.00215)
CASH_TO_TOT_ASSET	0.000464 (0.0169)	0.116*** (0.0272)	-0.00239 (0.0166)	0.110*** (0.0264)
ST_BORROW_TO_TOT_ASSET	0.0179** (0.00720)	0.0131 (0.0150)	0.0165** (0.00704)	0.0109 (0.0149)
EUROPE	-0.115 (0.204)	-0.692 (0.438)	-0.0540 (0.194)	-0.588 (0.418)
Constant	-0.237 (1.408)	4.888 (3.040)	0.440 (1.255)	5.967** (2.793)
Wald chi2	94.62	87.80	93.84	86.18
p-value	<u>0.0000</u>	<u>0.0000</u>	<u>0.0000</u>	<u>0.0000</u>
Observations	1,242	1,242	1,242	1,242
Number of ident	181	181	181	181

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 2: PROBIT (All 181 banks with 13 variables and a modified Europe dummy)**

Tab 09 => Table 2: PROBIT (All 181 banks with 13 variables and a modified Europe dummy)

This table shows the panel regressions for our 181 banks with variables taken from Blomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Europe dummy is forced at 0 for the period 2011 to 2013 in columns (1) (2). Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
Log_TOT_ASSET	-0.113 (0.141)	-0.607** (0.308)
TOT_EQ_TO_TOT_ASSET	0.00392 (0.0177)	-0.124*** (0.0390)
TOT_LOAN_TO_TOT_ASSET	0.00444 (0.00495)	0.00516 (0.0101)
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	0.329*** (0.106)	0.480** (0.222)
CUSTOMER_DEPOSIT_TO_TOT_ASSET	-0.00909* (0.00549)	-0.00773 (0.0102)
OPER_MARGIN	-0.00192 (0.00204)	-0.0400*** (0.00899)
RETURN_COM_EQY	-0.00159 (0.0235)	-0.125** (0.0591)
RETURN_TOT_EQY	-0.0107 (0.0251)	0.0171 (0.0611)
NET_REV_TO_TOT_CAP	-0.0160 (0.0133)	-0.0239 (0.0244)
BOOK_VAL_PER_SH	0.000542 (0.00117)	-0.000958 (0.00216)
CASH_TO_TOT_ASSET	0.000515 (0.0170)	0.112*** (0.0276)
ST_BORROW_TO_TOT_ASSET	0.0182** (0.00719)	0.0172 (0.0153)
EUROPE (0 for 2011-2013)	-0.0264 (0.164)	-0.512 (0.317)
Constant	-0.288 (1.411)	4.886 (3.110)
Wald chi2	94.56	83.7
p-value	<u>0.0000</u>	<u>0.0000</u>
Observations	1,242	1,242
Number of ident	181	181

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3: PROBIT (US, Canadian and Australian banks: 10 variables)**

Tab 10 => Table 3: PROBIT (US, Canadian and Australian banks: 10 variables)

This table shows the panel regressions for our 62 banks with variables taken from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
Log_TOT_ASSET	-0.359 (0.230)	-0.625 (1.058)
TOT_EQ_TO_TOT_ASSET	0.0216 (0.0395)	-0.0279 (0.193)
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	0.497*** (0.163)	0.389 (0.596)
CUSTOMER_DEPOSIT_TO_TOT_ASSET	0.00758 (0.0121)	0.0285 (0.0798)
OPER_MARGIN	-0.000232 (0.000618)	-0.0443 (0.0324)
RETURN_COM_EQY	-0.0102 (0.0108)	-0.488*** (0.158)
NET_REV_TO_TOT_CAP	-0.0583** (0.0258)	-0.00382 (0.111)
BOOK_VAL_PER_SH	0.0108** (0.00504)	0.00140 (0.0145)
CASH_TO_TOT_ASSET	0.0253 (0.0260)	0.0252 (0.0774)
ST_BORROW_TO_TOT_ASSET	0.0386** (0.0154)	0.0776 (0.0999)
Constant	0.716 (2.253)	1.886 (11.82)
Wald chi2	45.49	13.62
p-value	<u>0.0000</u>	<u>0.1909</u>
Observations	415	415
Number of ident	62	62

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4: PROBIT (European banks: 10 variables)**

*Tab 11 => Table 4: PROBIT (European banks: 10 variables)*

This table shows the panel regressions for our 57 banks with variables taken from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
Log_TOT_ASSET	0.337 (0.257)	-0.198 (0.422)
TOT_EQ_TO_TOT_ASSET	0.118** (0.0583)	-0.0183 (0.0815)
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	0.181 (0.211)	-0.348 (0.534)
CUSTOMER_DEPOSIT_TO_TOT_ASSET	0.00378 (0.0132)	0.00866 (0.0179)
OPER_MARGIN	-0.000357 (0.00223)	-0.0167 (0.0140)
RETURN_COM_EQY	-0.0146** (0.00687)	-0.189*** (0.0357)
NET_REV_TO_TOT_CAP	-0.0959* (0.0543)	-0.0536 (0.0800)
BOOK_VAL_PER_SH	-2.97e-05 (0.00135)	9.38e-05 (0.00169)
CASH_TO_TOT_ASSET	-0.0418 (0.0455)	0.0596 (0.0740)
ST_BORROW_TO_TOT_ASSET	0.00653 (0.00961)	0.00196 (0.0155)
Constant	-4.140* (2.411)	1.279 (4.002)
Wald chi2	24.82	53.58
p-value	<u>0.0057</u>	<u>0.0000</u>
Observations	387	387
Number of ident	57	57

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5: PROBIT (Asian banks: 10 variables)**

*Tab 12 => Table 5: PROBIT (Asian banks: 10 variables)*

This table shows the panel regressions for our 62 banks with variables taken from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
Log_TOT_ASSET	-0.529 (0.323)	-1.139** (0.577)
TOT_EQ_TO_TOT_ASSET	-0.0164 (0.0449)	-0.174** (0.0838)
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	-0.338 (0.463)	-0.372 (0.620)
CUSTOMER_DEPOSIT_TO_TOT_ASSET	-0.00933 (0.0156)	-0.0288 (0.0267)
OPER_MARGIN	-0.0244** (0.0111)	-0.0767*** (0.0196)
RETURN_COM_EQY	0.0101 (0.0229)	-0.0158 (0.0311)
NET_REV_TO_TOT_CAP	0.0222 (0.0234)	0.0283 (0.0355)
BOOK_VAL_PER_SH	0.0169 (0.0159)	0.00924 (0.0270)
CASH_TO_TOT_ASSET	0.0171 (0.0397)	0.226*** (0.0586)
ST_BORROW_TO_TOT_ASSET	0.0713** (0.0281)	0.0737* (0.0415)
Constant	2.742 (3.202)	9.650* (5.702)
Wald chi2	20.59	25.48
p-value	<u>0.0241</u>	<u>0.0045</u>
Observations	440	440
Number of ident	62	62

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1



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**Table 6: Pearson matrix of correlations**

Tab 13 => Table 6: Pearson matrix of correlations

Variables	TOT_LOAN _TO_TOT_ ASSET	RETURN_ TOT_EQY	CASH_TO TOT_ASSE T	OPER_ MARGIN	TOT_EQ_T O_TOT_ ASSET	ST_BORRO W_TO_TOT _ ASSET	NET_REV_ TO_TOT_ CAP	PROV_FOR _LOAN_LO SS_TO_TO T_ ASSET	CUSTOMER _DEPOSIT _TO_TOT_ ASSET	Log_TOT_ ASSET	RETURN_ COM_EQY	BOOK_ VAL_ PE R_SH
TOT_LOAN_TO_TOT_ASSET	1,000											
RETURN_TOT_EQY	-0,058	1,000										
CASH_TO_TOT_ASSET	-0,138	0,209	1,000									
OPER_MARGIN	-0,017	0,238	0,032	1,000								
TOT_EQ_TO_TOT_ASSET	0,051	-0,017	0,007	0,027	1,000							
ST_BORROW_TO_TOT_ASSET	-0,284	-0,017	-0,050	-0,017	-0,231	1,000						
NET_REV_TO_TOT_CAP	0,110	0,191	0,165	0,067	0,184	-0,561	1,000					
PROV_FOR_LOAN_LOSS_TO_TOT_ASSET	0,243	-0,425	-0,026	-0,121	0,166	-0,045	0,071	1,000				
CUSTOMER_DEPOSIT_TO_TOT_ASSET	0,271	0,085	0,218	0,032	0,012	-0,574	0,716	-0,027	1,000			
Log_TOT_ASSET	-0,417	0,023	0,084	0,012	-0,376	0,417	-0,471	-0,081	-0,453	1,000		
RETURN_COM_EQY	-0,056	0,989	0,201	0,231	-0,027	-0,017	0,182	-0,448	0,087	0,023	1,000	
BOOK_VAL_PER_SH	-0,051	-0,028	-0,156	-0,021	-0,059	0,145	-0,077	-0,023	-0,199	0,089	-0,031	1,000



## **Chapter II: Does better governance necessarily reduce financial distress for European banks?**

### **Abstract**

This paper empirically examines whether better governance necessarily reduces financial distress or default for banks.

We first had to define and explain the mechanism of banking governance and the determinants that best describe that concept and comply with legislation such as the 8<sup>th</sup> Directive used for big Corporates in Europe or Basel rules.

We have studied 49 banks among the TOP 100 European banks during the period 2006 to 2013 and performed a panel probit regression analysis on the financial distress dummy as our dependent variable using our selected governance, financial and economic explanatory variables in order to assess whether or not the level of governance has a positive impact on major banking risks thus potentially avoiding financial distress or a bank's default.

First, we found that governance determinants such as the independent Directors' ratio or the number of board meetings per year do matter to explain bank distress, giving credence to the extent of increasing supervision and regulation, as far as the independence of Boards is concerned.

Second, we show that the Tier 1 capital ratio, the return on asset and the price to book ratio, that we initially identified to use as financial control variables for our regressions, give significant results.

Hence, we highlight the use of the Tier 1 capital ratio as a key regulatory capital adequacy ratio in the Risk Management departments of European banks, especially since the Basel II implementation in 2007 and the recent and partial introduction of Basel III.

## 1. Introduction and related literature

### 1.1 What does governance mean for the banking field?

To address this issue, we first had to define and explain the mechanism of banking governance and importantly, what determinants are necessary to describe this concept.

In this paper, we will attempt to show whether better governance necessarily reduce financial distress (or defaults) for European banks.

Basically, “Corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment” state *Shleiffer and Vishny (1997)* in their survey of corporate governance.

Governance refers to the structures and processes by which affairs and business of a company are managed. It must improve long-term shareholder value by enhancing corporate performance and accountability by taking into account the interest of other stakeholders.

So, governance can vary from one organization to another depending on its size, the structure of the stakeholder base, its independence and its complexity. Also, depending on its ownership structure bank regulation will impact differently on the extent of risk taking from one bank to another, *Laeven and Levine (2008)*.

But when problems arise, we cannot only consider the role of the board of directors because governance reforms may lead to regressive behaviour among the market participants asserts *Adams (2012)*. Similarly, *Berger et al. (2013)* suggest that weak governance brings about inappropriate management (with poor monitoring by the board’s compartmentalized approach) and also state that “all relevant studies show that governance structures have a tremendous influence on bank risk”.

Thus we conclude that a good management governance framework should include:

- Relevant objectives
- Comprehensive delegated authorities
- Clear policies and procedures imposing boundaries on decision-making
- Appropriate internal controls and assurance mechanisms

Lots of repositories and legislation for companies exist both in Europe and in the USA. For instance, the Sarbanes-Oxley Act (SOX) of 2002 that applies to all companies listed on the NYSE in order to strengthen their level of governance. This was introduced following to the crisis of big Corporates in 2000 and 2001 such as Worldcom or Enron.

If the USA reaction to financial scandals (2000-2001) was comprehensive and resulted in stricter laws, Europe also added new principles later in the 8<sup>th</sup> Directive choosing substance over form, as a strategic approach, because a governance framework is pointless when integrity and a true corporate culture has not been established.

As a result in Europe the Directive 2006/43/EC basically modified the 4<sup>th</sup> Directive and 7<sup>th</sup> Directive on May 17, 2005 producing later the revised 8<sup>th</sup> Directive. This was adopted into the French law under the “Ordonnance” of December 8, 2008.

The Article 14 (text N° 2008-1278 of 8<sup>th</sup> December 2008), which is an adaptation of the requirement for legal yearly accounts and consolidated account controls in France, states the two following rules:

- Creation of a “special committee” i.e. the former audit committee under the responsibility of the Board.
- At least, one of the members of the special committee (which are chosen by the Board members from its team) must be proficient in Finance and accountancy (and also independent of the executive function).

This special committee is responsible for the supervision of four main tasks in the light of specific principles which are proficiency and independence. These are the:

1. Follow-up of the financial reporting process
2. Follow-up of the efficiency of the internal control system and the efficiency of risk management
3. Legal yearly account control and at least, controlling the consolidated accounts monitored by auditors
4. Independence of auditors

Not all types of companies are governed by article 14, mainly the public companies. These rules do apply for the governance of the banking field but it is of paramount importance to remember that banking governance is definitely special. In fact, many national or international regulators impose particular repositories or legislation to banks because their activities have nothing to do with classic Corporates. For instance, the systemic banks or Large Financial Institutions (LFI) should be carefully handled because the whole international economy would incur tremendous risks if one of them went bankrupt (not to mention the possibility of contagion effects).

“The financial crisis can be to an important extent attributed to failures and weaknesses in corporate governance arrangement” suggests *Kirkpatrick (2009)* in the conclusion of his report.

Moreover, *Adams (2012)* reminds us that OECD had launched an action plan in order to reshape corporate governance and that later OECD adopted recommendations on risk management, shareholder rights, board rules and remuneration.

This is consistent with *Aggarwal, Erel, Stulz, and Williamson (2008)* who maintain that a company’s governance policy is dependent on the legal origin of each country. *La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998)* first came to the slightly refined conclusion that countries (such the USA or UK), in which legislation is funded upon common-law, better

protect investors than countries in which legislation is based upon civil-law (as in many European countries).

In addition to the ownership concentration *Aggarwal, Erel, Stulz and Williamson (2008)* suggested that to make investors interests safer (as well as *Shleifer and Vishny (1997)*), they have also to draw attention to statutory procedures that are important in civil-law countries. Thus, it is logical to consider that in Europe, Risk Management committees or Audit committees are more essential than the same committees in common-law countries, hence the importance of the new by-law such as the 8<sup>th</sup> Directive.

However, some repositories are more banking oriented such as the Basel rules. Indeed, because of the recent financial crisis, the supervision of banks has become a matter of concerns.

Solvent banks may be weak to bank runs, *Diamond and Dybvig (1983)*. This is why we did implement deposit guarantee schemes decades ago. Basically, the art of war tricks used by regulators in order to prevent banks from a potential failure has been supervision and minimum capital requirement. A higher level of quality of capital is currently expected for the Tier 1 and we will see the importance of this data later, when choosing the Tier 1 Capital Ratio as a financial variable.

Capital stands for the portion of a bank's asset which gets no related contractual commitments for repayment. Should the bank's asset value decrease, it will be available as a cushion. And a classical example in Europe consisted in the creation of the Basle Committee in 1974, by the Governors of the central banks of the Group of ten. Their objectives were to increase the quality and efficiency of the banking supervision while improving the stability of the international financial system.

So, the Cook ratio was designed by the Committee in 1988 and first adopted in 1992 by the Banks. It was then cancelled in 2007 in favor of the Mc Donough ratio (Pillar 1 in Basel II) which was a kind of optimization, because it took into account the specificities of the related risks (credit, market and also operational risks). Indeed, capital adequacy is a ratio of capital to "risk-weighted assets" (RWA).

## 1.2 Basel II or when more governance rules lead to more risks

*Adams (2012)* showed that 171 governance policies were introduced or significantly updated between 1993 and 2010 in 195 countries including Taiwan and Hong Kong. Moreover, between 2007 and 2010, 49 countries updated governance codes or regulations.

In their article about the manipulation of Basel risk-weights, *Mariathasan and Merrouche (2012)* show that regressions appeared when Basel I rules evolved to Basel II and that the replacement of the Cook ratio adopted in 1988 in the McDonough ratio implemented in 2005 in order to boost efficiency accurately increased complexity and sophistication then "unfortunately" reduced transparency.

As Basel rules from the Basel Committee on Banking Supervision (BCBS) deal with the level of bank capital that provides a robust tool to maintain bank stability for many researchers or policymakers, we definitely have identified an issue. As a matter of fact, the Basle Accords were initially much more designed to protect deposits rather than preventing bank bankruptcies. An explanation for that resides in the long term debts belonging to tier 2 capital ratios and as we know, they do matter for deposits by supplying them with a safety cushion, but no insurance against bankruptcy.

In addition the study of *Mariathasan and Merrouche (2012)* concludes that some banks played with the rules by manipulating risk-weights (under the advanced approaches in Basel II) when the financial crisis was approaching. According to their findings, this strategic use was also confirmed in other empirical findings.

Under these circumstances unweighted leverage ratios which are more basic than risk-weighted asset ratios appear to be better predictors when a crisis is about to occur, even though the latter appear to be more efficient when the risk of a potential crisis is low. Thus a higher level of banking supervision, i.e. Basel II in comparison to Basel I, does not necessarily provide a better indicator of banking risk and thus does not give the expected guarantee against potential bank distress.

The Basel III implementation among banks, which is being introduced, is of concern to banks, particularly regarding the leverage ratio. Indeed, banks do not want to limit their leverage ratio and this matter is being actively discussed.

Interestingly, *Laeven and Levine (2008)* had already showed that capital regulation raised the risk-taking incentive for bank owners who would ideally compensate for the utility loss especially when there is one predominant bank owner for a given bank. This is consistent with what we have just shown because in such a case a large shareholder could put pressure on the board in order that management implemented the advanced approaches in Basel II (Internal Ratings-Based approach i.e. IRB). Thus, stricter rules on capital could lead to more risks when a given bank has a sufficiently powerful owner, but the results are the opposite in banks with a larger diversified owner base. However, the importance of one predominant owner diminishes in economies where stronger shareholder protection laws exist.

### 1.3 Capital structure and deposit insurance

In accordance with the points developed in the previous sub-section, *Beltratti and Stulz (2012)* show that better capitalized banks and banks from countries which put into practice a tighter supervision performed better during the crisis. They also note in agreement with empirical research that shareholders take more risk when deposit insurance is implemented, e.g. *Merton (1977)*.

Basically, banks are quite special companies in that they use 90 percent of debt or even more e.g. 95 percent as *Admati (2014)* asserted whereas non-financial firms only use 40

percent on average. Also their stakeholders include depositors as well as subordinated debt holders, *Mehran, Morrison, and Shapiro (2011)*. Of course, ways that require banks to decrease the value deposit insurance protection could be explored in the literature of capital contingent, capital insurance or bail-in, but that exceeds the scope of this paper.

Consistent with *Laeven and Levine (2008)*, a tradeoff between high capital entrenchment and less restriction for the deposit taking banks has to be definitely dictated by market discipline in order to avoid unconsidered risk taking and the rise of shadow-banking. Astonishingly, the largest banks are even bigger today than they were prior to the financial crisis.

#### 1.4 Board design, size of Boards, Board members and meeting attendance

Board and Audit committee characteristics certainly play a major role in the selected variables for our regressions. So now we will examine these characteristics in detail.

“The firm is a nexus of contracting relationships between the firm and its shareholders”, *Jensen and Meckling (1976)*.

Ideally, Board rules need to be clear, transparent and compliant with regulations and laws in order that, consistent with the classical agency perspective, *Jensen and Meckling (1976)*, the separation of ownership and control can be as smooth as possible in order to permit an efficient allocation of residual control rights, *Shleifer and Vishny (1997)*, or to avoid conflict of interests and hence retain the best designed strategy.

This means that board members with the appropriate role ensures that talented directors take necessary and timely decisions. But the number of members does matter as well. A simple and important characteristic of board structure may be the size of the board of directors. Related determinants could also comprise the number of board meetings and the percentage of board meeting attendance.

If too large Boards appear to be inefficient *Adams (2012 bis)*, a heuristic or good practice could produce a number of 8 to 12 members for an “ideal” board size. Unfortunately, this suggestion is not based on data from the banking field and in *Adams and Mehran (2011)*, they find a mean of 18 members for board size in US banks.

Similarly, *Coles, Daniel and Naveen (2008)* find from observations between 1992 and 2001 that the median board amounts to ten people including eight outside directors, and quote similar figures from other sources.

They also find that complex firms tend to have larger boards than simple firms and have more outside directors. Furthermore, their empirical results also show that the connection between Tobin’s Q and board size has an amazingly U-shaped form.

Tobin’s Q is equal to  $(\text{total assets} + \text{mkt value of equity} - \text{total common equity} - \text{deferred taxes}) / \text{total assets}$ .

Nevertheless, Tobin’s Q increases with the size of board for complex firms and decreases with the size of the board for simple firms. The number of outside directors is an important factor in this relationship.



Furthermore, other studies (for US banks) tend to confirm that a range of between 8 and 12 members in their sample of financial institutions, *Minton, Taillard and Williamson (2012)* also give a number (as a mean) which is regularly decreasing from 13.3 to 12.4 between 2003 and 2008. According to them, decision making is less costly in smaller boards. Their figures are also consistent with the banks' sample of *Mehran, Morrison, and Shapiro (2011)* where the board mean size steadily declines from 20 to 15 between 1987 and 2007 and stabilises to 15 between 2003 and 2007.

All these studies empirically tend to imply that a board of directors, even for large banks, should not comprise more than twenty people i.e. should not be too big, otherwise we could get an inverted parabola with regards to the relationship between performance and board size. Indeed, *Lorsch (2005)* insists that "design choices begin with the size of the board, the proportion of management and independent directors, and the mix of talent and experience the board needs". Hence, this confirms our choice for some related variables (size of the board and percentage of the number of independent directors).

The length and number of meetings per year must be decided as well as the number of independent directors when executives are away. Of course, this rational could be extended to any others types of committees the board needs (e.g. risk committee, audit committee, compensation committee, etc.).

Interestingly, the governance standards implemented by the Enron board were supposed to be sound as, for instance, only two company executives belonged to the 13 directors of the board and there was a large independence among the non-executive directors; a strong code of conduct was also in place, *Useem (2005)*.

So, how was it possible that the board suspended the code of conduct and let the first wrongdoing happen? Another determinant for either the board or audit committee concerns the number of independent directors. And, precisely, inside the audit committee of Enron, two directors were not entirely independent members, which is in breach with the post Enron SOX and 8<sup>th</sup> Directive we introduced previously (and the size of audit committees are definitely smaller than that of the Board).

However, it should be clearly specified in the code of conduct when there is one, that any infringement by a company must be revealed publicly which is potentially challenging. The Management implementation of the code of conduct often consists of a decision protocol or delegation authority which contains the strategic and operating plan, the capital structure and budget as well as investment policies, the accounting, audit and risk management policies and the Directors' compensation for the coming year.

Surprisingly, *Aggarwal, Erel, Stulz and Williamson (2008)*, in their paper on differences between governance practices in the U.S. and foreign firms found that board size was not value relevant and neither was the separation of chairman and CEO. But, it could be easily suggested that this study was not financial institution oriented and, what is more, their

sample applies to the years before 2007 (2005 in particular) which have no connection with the financial crisis.

That makes sense because bank governance is definitely different from that of non-financial companies. In fact, more stakeholders are involved with banking companies which are then, “logically” larger, more complex and opaque, and with greater financial flows at stake.

We have just illustrated the connection between the size of the board and success of a company and *Boone, Casares Field, Karpoff and Raheja (2007)* find that the more firms grow the more board size and independence increase, as if it adapts in an endogenous manner to ease the path to success for firms.

A few empirical papers go further e.g. *Aebi, Sabato and Schmid (2011)* who discover in their regressions on US banks that the coefficient of the natural logarithm of board size is relevant and positive regarding its relationship with performance (considering buy and hold returns in particular).

In accordance with those findings, regarding Bank Holding Companies, *Adams and Mehran (2011)* find no negative correlation between performance and board size (Tobin’s Q proxy) with a sample encompassing 34 years, when others try to prove that large board of directors could reduce firm values because of the free-rider problem due partly to costly monitoring. Yet, US banks who received TARP funds had larger boards, hence denoting weaker governance.

In order to clarify the positive relationship between board size and the Tobin’s Q, they suggest that larger boards could contain more directors who are also in charge of subsidiary directorships. This situation often happens in the US because of the organizational widespread form of Bank Holding Companies and may plausibly result in a greater capacity to cope with complexity as well as supporting the management of the Bank Holding Company (BHC).

In addition to the number of board participants and in order to try to give a rational explanation to some contradictory results, we are going to explore the quality of their work using a new characteristic which is related to a quantitative measure: the effective time spent on governance by a board, especially as some of the board members may have several directorships. In such a case, *Adams and Mehran (2011)* conclude that there is a drop in the performance when directors hold several directorships.

This is consistent with *Adams (2012)* who states that if directors hold several directorships, they are less focused on each of them. So, the effectiveness of the time spent by board members has to be taken into account as well as their efficiency in terms of expertise. She also refers to the fraction attendance problem which is “the fraction of directors who attended fewer than 75% of the meetings they were supposed to attend during the previous fiscal year”. If the number of board meetings per year matters then their quality and efficiency are equally important. Indeed, the “board access to information is key” says *Kirkpatrick (2009)*. So, in order to get adequate and correct information, board members

should attend their meetings as often as they can, provided that there are a sufficient number of board meetings per year.

Other type of committees may be concerned by this approach. For instance, audit committees, and the question in the first place could be why do we need audit committees? We have started to answer this question in the beginning of this paper by introducing the SOX (USA) and the Directive 8 (Europe) repositories that are quite similar. *Krishnan (2005)* reminds us that the SOX Act and the SEC rules were designed to promote internal control. He also shows that there is a positive association between the quality of an audit committee and the quality of internal controls. Those policy initiatives make sense because the better internal control is, the better is the quality of financial reporting.

So, we could apply our previous suggestions concerning the number of board committees per year to the number of audit committees per year. In other words, the attendance of audit committee members is important as well as there being a sufficient number of audit committee meetings during the year.

*Jin, Kanagaretnam, Lobo and Mathieu (2013)* quote a report of GAO (Government Accountability Office) from 1991 which states that breaches in internal control substantially led to bank failures in the late 80's and a lack of internal control contributed to serious weaknesses in corporate governance quality. They also show that banks that were in compliance with the Federal Deposit Insurance Corporation Improvement Act (FDICIA) designed in 1991, especially regarding the internal controls part, had reduced risk-taking during the pre-crisis period (2000-2006) and had a lower probability to get financial difficulties or failure in the crisis period (2007-2010).

Note that this act in the US (with new auditing rules requiring auditors to certify and report on the effectiveness of internal control of financial reporting and governance reforms) concerns banks with \$500 million or more in assets increasing in 2005 to \$1 billion. *Jin, Kanagaretnam and Lobo (2011)* showed that banks that are audited by the Big 4 auditors have a lower probability of failure, because there is a positive relationship between the Big 4 auditors and audit quality. This is in agreement with the assertion by *Krishnan (2005)* about the importance of quality controls.

Indeed the Big 4 are more qualified, powerful and less prone to any incentives that could increase their risk of litigation or damage their reputation. However, we did not use the related dummy auditor type determinant because all the big banks i.e. the listed ones normally use one Big 4 auditor or even two (listed companies in France must have 2 auditing companies) and we want to avoid any potential association with the size variable.

So, these elements are definitely in line with the definition of Corporate Governance we gave in the introduction of this paper quoting *Shleiffer and Vishny (1997)* as it can provide assurance that suppliers of finance to corporations will get a return on their investment.

## 1.5 Gender diversity in the boardroom

*Adams and Ferreira (2009)*, show that for US firms not only women attend board meetings more frequently than men, but the larger their percentage on the board the better is the attendance of men. She has also asserted that attendance behavior is key to governance because this is the main way directors get their information in order to carry out their tasks. What is more, there is no other measure that is publicly available for individual director behavior.

Women tend also to be more frequently assigned to nominating, audit and corporate governance committees whilst men are more likely to be part of compensation committees. And we could expect a board member to pay more attention to governance when sitting on true committees (hence importance of attending meetings).

However, they find that gender diversity has a negative impact on firms with strong governance and explain this by a potential over monitoring for such firms. Conversely, they obtain a positive impact on performance for firms with weaker governance.

*Sing, Terjesen and Vinnicombe (2008)* also show that for the 100 firms in the UK FTSE index women have both a more international profile than men in boards and more frequently possess MBA qualifications complemented by really diverse experiences on more different types of boards than men. Human Capital Theory may certainly explain why they have been appointed based on their knowledge, skills and experience. So, it is important to consider the fact that assigning women more than men to key committees will allow their influence for governance to be really effective among boards.

Gender diversity in the boardroom can foster a better behavior such as the attendance of directors to board meeting. Consequently, it may be of interest to select a variable such as the percentage of women on board among our future determinants.

## 1.6 Independence of the board members in financial institutions

In opposition to the total number of directors for board size in financial institutions, *Minton, Taillard and Williamson (2012)* report that the percentage of outside directors (hence, independent) regularly increased from a mean of 73% to 78% between the year 2003 and 2008 (in US Banks). This is also consistent with the sample of US banks used by *Mehran, Morrison, and Shapiro (2011)* where the percentage of outside directors was shown to rise steadily from a mean of 76% to 84% between 1990 and 2006. Interestingly, a slight drop of 84% to 82% appears from mid-2006 to mid-2007, but they make no comment on this change.

As far as banks are concerned, the independent nature of the board may be irrelevant because it is harder to find relevant and available experts with the ability to cope with banking complexity for board membership. *Guerrera and Thal-Larsen (2008)* cite that 66 percent of bank directors had no banking expertise at all in eight important financial

institutions in the US and also that the SOX rules prevented them from getting highly qualified professionals in the relevant fields among their board.

Similarly in Europe many potential new board members already work for a competitor as the banking market in each European country is not as developed in comparison to the US (for instance, there are only five main banks in France, hence, they are concentrated and endogenous).

*Adams and Mehran (2011)* maintain that bank performance does not depend on the percentage of outside directors. Similarly, *Minton, Taillard and Williamson (2012)* show that during the financial crisis, the percentage of independent directors was negatively connected to the Bank Holding Companies stock performance.

In conclusion the previous studies suggest that the size of the board and its performance are not necessarily correlated and counterintuitively, perhaps, the independence of the board members is not related to a bank's performance.

Fundamentally, independence should be definitely an asset for a company.

Independence could lodge itself in unexpected areas as *Aebi, Sabato and Schmid (2011)* show that during the crisis CROs who reported directly to the board of directors increased the performance of banks. On the contrary, the banks where the CRO did report to the CEO resulted in a decrease of the ROE and stock returns.

Also, *Ellul and Yerramilli (2013)* confirmed these results finding that a strong and also independent risk management practice (such as *Kashyap, Rajan and Stein, 2008*) can definitely reduce banking risks and thus, enhance operating performance and annual returns during 2007 and 2008 i.e. the crisis years. This is also consistent with *Dermine (2011)* in the section "lessons from 20-year experience with a banking simulation" of this paper.

As such, this positive effect of the reporting of the CRO directly to the board of directors characterizes an underlying independence aspect for the board of directors in that the CRO is not necessarily a board member. It also explains why it cannot unfortunately be correlated with the percentage of outside directors.

As a conclusion of all this *Mongiardino (2010)* proposes the following good practices for banking governance: "a) Dedicated risk committee at board level, covering all aspects of risk and meeting on a frequent basis (at least bi-monthly), b) Independence of board members (no former executives); at least some members with risk expertise, c) CRO should report jointly to the CEO and the board".

Despite this assertion we do not think that we can firmly assert that independence, time and knowledge remain at the root of board risk observation. We accept that the effective time spent by the board members as well as an appropriate independence of the board members

and the CRO in particular is important, but knowledge (or proficiency) is still an issue to be addressed.

It is logically consistent with the 8<sup>th</sup> Directive in Europe and the SOX in the USA, although the 8<sup>th</sup> Directive deals more with Audit committees than risk management committees. Yet their positive impacts on risk may be the same as *Ellul and Yerramilli (2013)* had to resort to using audit committees in place of risk committees when they did not find one.

This is consistent with *Minton, Taillard and Williamson (2012)* who confirm that in most commercial banks risk management is carried out by the asset and liability management committee or the audit committee, even if there are CROs in some banks who are not members of one or both of these committees.

### 1.7 The importance of Board members expertise

The empirical paper of *Minton, Taillard and Williamson (2012)* clearly shows that a greater financial expertise of the board members led to more risk taking. This had a positive impact on investors' wealth before the financial crisis but became negative during the crisis. Therefore having more financial experts among the independent board members tends to raise performance in normal times but fails to maintain it when a crisis arises.

We could connect the determinants of governance that are financial expertise or proficiency with outside directors' independence.

The following table summarises the degree of risk taking during the financial crisis:

*Tab 14 => Degree of risk taking during the financial crisis*

DIRECTOR STATUS	DIRECTOR SKILL OR COMPETENCY	
	<u>Not proficient</u>	<u>Proficient</u>
<u>Independent</u>	"Quite strong"	"Strong"
<u>Not independent</u>	"Undetermined"	"Quite strong or undetermined"

To explain the terms used in the table the previous paragraphs indicate that the evidence reviewed suggests that there is a relationship between Independent and Proficient that is "Strong".

In the previous section, we showed that independence of the outside directors weakened performance during the crisis, hence probably enhancing risks. This is why we have used a "Quite strong" term for the relationship between Independent and Not proficient concerning the risk taking propensity.

We could consider that the relationship between Not independent and Proficient requires a “Quite strong” term, as *Minton, Taillard and Williamson (2012)* insist more on the proficiency in finance than on independence. However, we could also argue that proficient directors would try to reduce risk taking in order to keep their position in line with what *Shleifer and Vishny (1997)* named reputation-building. Consequently, we have decided to use the term “Quite strong or undetermined”.

Based on the different sources mentioned before, there is no other choice but use the term “Undetermined” to the relationship between Not independent and Not proficient. We normally might expect a “Weak” term for this relationship, as opposite to the relationship between Independent and Proficient. However, it is not common sense to conceive that a board with less independent and less proficient members would be inclined to be less risk taking (or produce a better performance for a given bank).

Having considered the relationship between director’s independence and their skills or competency it is essential to remember that banks are subjected to local legislation. As previously mentioned, *Shleifer and Vihsny (1997)* came to the conclusion when considering corporate governance in Germany, the US and Japan that if we combine concentrated ownerships (or large investors) with the legal protection of investors, then it leads to more effective governance.

In their conclusion, *Laeven and Levine (2008)* show that banks which have higher controlling ownership are inclined to be riskier, hence, indicating also that depending on their ownership structure, the same regulation on their risk taking would produce very different results. However, they also find that in an economy with a stronger legal protection of shareholders the relationship between risks and ownership is reduced. *Beltratti and Stulz (2012)* find quite similar results and show that for large banks, pro-shareholder boards generated more value for shareholders prior to the crisis, but during the crisis produced poor performance. Thus, decisions that were relevant before the crisis in order to maximize the shareholder value may have been inadequate during the crisis.

It is essential to note that European banks tend to have more concentrated ownerships than US banks and hence making a connection with our comments about civil-law and common-law countries previously in the introduction of this paper (see also *Aggarwal, Erel, Stulz and Williamson, 2008*). Indeed, as the civil-law countries should protect companies less than common-law countries do, it is consistent that European banks that are more concentrated rely more on Risk Management committees or Audit committees. Hence this influenced our choice of governance characteristics.

*Shleifer and Vihsny (1997)* noted that large investors that are equity holders could have an interest in pushing firms to take too many risks, because they have a short-term view in comparison to creditors who pursue a more long term perspective. *Mehran, Morrison and Shapiro (2011)* emphasize this claiming that regulators or debtholders look for low volatility

and adopt a long-term view in contrast to shareholders. Thus, managers should enforce long-term objectives (which are also risk reduction oriented).

On a more general multi-sectorial perspective, *Makunda (2014)* goes further stating that “a recent survey of Chief Financial Officers showed that 78% would give up economic value and 55% would cancel a project with a positive net present value – that is, willingly harm their companies – to meet Wall Street’s targets and fulfill its desire for smooth earnings.”

*Beltratti and Stulz (2012)* give a subtle explanation for the negative relation between governance and performance in their results. The correlation between governance and risks that turned out badly during the crisis explains why good governance could not prevent returns from decreasing, because they would certainly have gone even lower had governance been worse. This sheds light to some counterintuitive results we have explored.

### 1.8 Large banks and financial expertise

Progress had been slow in risk governance for large banks between 2008 and 2010 stated *Mongiardino (2010)*, even if there was some limited change for European Banks (which is the focus of our research in relation to new provisions such as the 8<sup>th</sup> Directive).

Moreover, it is important to mention that *Minton, Taillard and Williamson (2012)* (see previous sub-section) revealed good results for large banks suggesting that there may be more financial experts among board members in large sophisticated or complex banks and thus, we get the connection we were looking for in the previous section using the *Beltratti and Stulz (2012)* results.

Another reason for more risk taking lies in the increased diversification of larger banks that give them an incentive to take more risks, especially if their board members are proficient in Finance. That is what happened increasingly as government support tended to be stronger for large banks (the so-called systemic banks) as we have already hinted.

Some explanations to the previous counterintuitive results have already been given, but it is worth noting that *Minton, Taillard and Williamson (2012)* suggest that independent financial experts who are certainly acquainted with financial products may not prevent their bank from taking high risk activities. This assertion is also consistent with *Shleifer and Vishny (1997)* arguing that investors may be over-confident (i.e. “investor optimism”) when they sometimes bring capital to companies without sufficient control rights.

When *Minton, Taillard and Williamson (2012)* invoke “fiduciary duty to shareholders” to explain risky positions taken by independent financial experts in order to maximize shareholder returns then perhaps the idea of conflicts of interests is appearing. However *Makunda (2014)* remind us that a fiduciary duty relates more to legal obligations, which are not really what executives are confronted to in the USA, rather than the notion of conflicts of interest.



## 1.9 Other determinants used in these fields of literature

It is worth considering other types of determinants for our future regression such as financial, accounting and economic variables as several papers on bank defaults or bank performance take them into account because of their potential impact, though in most cases they serve as control variables.

For instance, *Aebi, Sabato and Schmid (2011)*, *Minton, Taillard and Williamson (2012)*, *Berger et al. (2013)*, *Ellul and Yerramilli (2013)* use the log of total assets in order to characterize the size of a bank. Earlier evidence suggests that if big banks are better diversified than smaller ones then they may take more risks.

*Ellul and Yerramilli (2013)* also use these classical proxies such as deposits to assets, total loan to total assets and return on assets, the first two accounting for the stability and composition of the portfolio of a bank's loans. *Minton, Taillard and Williamson (2012)* directly used total loan and deposit in their regression analysis. Deposit to asset proxies for funding and the risk of illiquidity in the banking field. We could expect that banks that get more deposit financing cope better with any potential failure, should a major financial crisis arise as *Beltratti and Stulz (2012)* and *Aebi, Sabato and Schmid (2011)* have suggested.

Return on asset e.g. *Berger et al. (2013)* is an indicator of how profitable a company is relative to its total assets which indicates how efficient management is at using its assets to generate earnings. So, even if banks are quite special companies as we mentioned earlier this corporate finance ratio should not be neglected.

Non-performing loan to total loans is addressed by *Berger et al. (2013)* in order to deal with portfolio credit risk and concentration while *Ellul and Yerramilli (2013)* prefer to take the ratio of bad loans on assets where bad loans are loans past a due date of 90 days or more.

*Beltratti and Stulz (2012)* and *Aebi, Sabato and Schmid (2011)* also use the Tier 1 Capital Ratio in their regressions. This is defined as the ratio of Tier 1 capital to risk-weighted assets. It is a key regulatory capital ratio, especially in Europe, that measures a bank's financial strength. The smaller it is, the riskier is the bank.

We note that *Minton, Taillard and Williamson (2012)* compare banks using the very classical characteristics of total assets, return on assets, return on equity, equity capital ratio (book equity to total assets), market-to-book i.e. market value of assets divided by the book value of assets, where the market value of assets is computed as the sum of the book value of asset and market value of equity, minus the book value of equity.

In order to investigate whether or not there are connections between the market valuation of the firm and performance, *Aebi, Sabato and Schmid (2011)* have implemented this ratio of market value of equity divided by book value of equity that they call market-to-book ratio.

It is not worth taking CEO and Director's compensation measures into consideration for two main reasons especially as we mainly focus on variables related to Board structure, Board independence and Board or Audit committee families.

Firstly, as *Bhattacharyya and Purnanandam (2011)* underlined, a bank CEO's interest was to foster short-term earnings all the more as his compensations were indexed on EPS level (Earnings Per Share), which in turn explains the importance of risk taking. We also could assert that the bigger the debt is (inside the capital structure), the riskier it is for the debtholders in comparison to the shareholders (*Jensen and Meckling, 1976*). This is in line with *Adams (2012)* showing that banks which got TARP and hence had poorer governance, gave larger performance pay for their CEO. Then, we understand why *Kirkpatrick (2009)* quoted OECD Principles of Corporate Governance stating that the board should fulfil certain key functions including "aligning key executive and board remuneration with the longer term interests of the company and its shareholders".

The CEOs' pay did not even decrease in the second semester of 2007 as the first important signs of the coming crisis had already happened and what is more, banks kept on paying dividends during the crisis which also highlights the power of equity over debt i.e. the priority of short-term versus long-term.

Moreover, *Mehran, Morrison, and Shapiro (2011)* assert that the CEOs' pay in the banking field has been the highest among their peers since 2006. They go even further in correlating between pay and bank size. A vicious circle appears to be being created as we have seen earlier that the deposit insurance driver tends to increase bank size which in turn correlates to banker's pays (endogeneity).

However, some papers tend to give opposite results. *Berger et al (2013)* show that upper-level management shareholders such as outside CFO, CEO or board members are smaller risk takers than lower-level management such as VPs or treasurers. According to him, the main reason concerns their desire to care for their reputation because their career is more exposed as they are often publicly known.

*Ellul and Yerramilli (2013)* also failed to find any connections between CEO compensation and tail risk (from a reduced sample of their data). Thus, we now start to understand why it is a tricky issue and why one need to be cautious about the use of this possible variable.

Secondly, it is absolutely difficult to get exhaustive and consistent data on CEO or Directors compensations and for instance, *Adams (2012)* decided not to use Directors' compensation characteristics for the construction of its governance indices because data were missing for the years 2006 and 2007 in the Execucomp database (only averages being provided). It also explains why she constructed a second index with two less variables i.e. five instead of seven in order to exclude CEO compensation for more consistency because of missing data (cf. sophisticated management insulation index of *Ferreira et al. (2013)*).

*Ellul and Yerramilli (2013)* had the same problem with Execucomp in that the database did not include all the banks they intended to use in their initial sample. Also *Bhattacharyya and Purnanandam (2011)* had the same problem with the Executive Compensation database of Compustat (for their measure of the EPS, because some banks are not covered by Compustat). *Beltratti and Stulz (2012)* have even dared to say that they partly chose their variables depending on data availability.

By not taking CEOs and Directors' compensation into account, this directly alleviate the number or retained variables and in turn reduce possible disturbing noise and potential errors (as some papers gave contradictory results, we could also be suspicious about the intrinsic quality of the data which are indeed quite sensitive). Besides, in Europe, this sort of data is still highly confidential, not to say opaque.

We also think that in doing this we could reduce the issue about some paradoxes even if, *Larcker, Richardson and Tuna (2005)* have already mentioned some concerns in the capacity of present governance measures to correctly assess adequate governance. So, considering all that, we definitely think that this is certainly safer to do regressions without variables that are more or less connected to CEO and Director's compensation.

## 2. Data

### 2.1 Choice of variables, measures of governance and limits

The number of variables to take into consideration is an issue as in *Bebchuk, Cohen and Ferrel (2008)* who showed that the GIM governance index (*Gompers, Ishii and Metrick 2003*) did not have to encompass the chosen 24 variables to be complete. The use of only six of them (the so-called E index of *Bebchuck*) was enough to address the topic of the governance level: the remaining 18 characterized noise. We fundamentally want to avoid this in our measure of governance quality.

Similarly, *Aggarwal, Erel, Stulz, and Williamson (2008)* had used 44 variables to build their GOV index but mention also that when academics study governance they do not really look at 44 determinants and about seven determinants appear to be adequate.

Also, *Adams (2012)* only chooses eight characteristics and constructs two governance indices (taking for these seven or five of the eight characteristics respectively).

In the introduction of our paper, we have proposed reliable objectives in the bullet points on good management governance frameworks. These were:

- Relevant objectives
- Comprehensive delegated authorities
- Clear policies and procedures imposing boundaries on decision-making
- Appropriate internal controls and assurance mechanisms

From our study of the literature we need first to establish appropriate variables that ideally match the SMART check-list i.e. the underlying objectives of these variables are Specific, Measurable, Achievable, Realistic and Timely.

However, *Mariathasan and Merrouche (2012)* quoting to *Haldane (2011)* suggested that three principles of regulatory framework are *robustness, timeliness* and last but not least, *simplicity*. Then, in order to streamline the building of our objectives why not select them optimizing the SMART definition to have core variables that are robust, timely and simple? Under those conditions, characteristics or variables selected to meet the named objectives will be really effective to implement and to measure.

Complex objectives, procedures or rules are not only difficult to be correctly implemented within a banking governance framework but also can be manipulated; for example, some banks incurred high risks before and during the financial crisis by trying to take the advantage of a box ticking approach (*Kirkpatrick, 2009*), in accordance with our previous comments on Basel II.

These practices were totally in breach of another framework set within the evolution of COSO (a repository based on internal control analysis developed by the Committee of Sponsoring Organizations) in COSO II (2004) named Enterprise Risk Management (and ongoing COSO 2013 or COSO III, implemented in big companies).

Also, it is clear that good governance is based on good risk management practices which are partly at the heart of an efficient internal control system defined by COSO, but also inherent principles of SOX or the 8<sup>th</sup> Directive as mentioned in the introduction of this paper.

The foundation of COSO principles is based on the fundamental assertion that good risk management and internal control are necessary for long term success of all organizations. This is why the Internal Institute of Auditors (IIA) agrees with the COSO approach and why it is important inside the French implementation of the 8<sup>th</sup> Directive: the “special committee” is in charge of the follow-up of the efficiency of the internal control system and risk management (see the 2<sup>nd</sup> point of the Article 14 in the introduction of this paper).

It is important to note that French Banking regulations have also fully established and described as of 1997 a set of specific rules that fully described and explained internal control for the banking field in the article “Règlement N°97-02 of the 21<sup>st</sup> February 1997” which was later modified in 2004 “Règlement N°2004-02”.

If we want to proceed we need also try to choose control objectives amongst the variables or characteristics we are going to select.

Thus the characteristics or variables selected from the required objectives should ideally be “in compliance” with at least four of the seven classical audit control objectives used by financial auditors (the Big 4 in particular). They are *real* (unique with no duplicate or fictitious amounts), *recorded* (exhaustive and with complete amounts), *valued* (correct amounts) and *timely* (amounts recorded in the appropriate accounting period).

“In compliance” means in accordance with what we previously showed i.e. the design of governance objectives and the related characteristics should also be control objective oriented.

Consequently, if governance is at the root of the financial crisis as we previously mentioned (*Kirkpatrick, 2009*), we assume that it was specifically cause by a default of risk management (*Ellul and Yerramilli, 2013*) because the so-called “good practices” implemented from 2009 (*Kirkpatrick, 2009*) were poor or not efficient.

The 8<sup>th</sup> Directive disposal (Directive 2006/43/EC) had surely a positive impact on banks’ governance in Europe after 2006, as in French listed companies in particular which now need internal auditors and must control their legal yearly accounts and consolidated accounts. This is the reason why, when possible, it is important also to select variables among the Audit committee families.

Because of the creation of a “special committee” in 2006 which had to be appointed by the Board, it is consistent to look for variables from the Board structure, Board independence and Board committee families. Often, this type of variables is chosen in order to characterize governance as previously stated.

In France, insurance companies and listed companies were covered by this new provision from 2006 as well as banks. Some new types of companies have recently been added from November 30, 2011: payment companies, investment firms, OPCVM (Organismes de Placements Collectifs en Valeurs Mobilières), hedge funds and e-Money companies.

To sum up, as we already stated about the 8<sup>th</sup> Directive and in order to generalize, a governance framework is pointless when integrity and a true corporate culture has not been established.

## 2.2 Sample analysis and data collection

We have selected our banks using the ranking of the Top 100 European banks on their total assets in 2008 (Fitch Ratings companies' data-base) that included 31 countries (EU and European Free Trade Association i.e. EFTA including Iceland, Norway, Switzerland and Liechtenstein). It is necessary to use consolidated accounts and this explains why the data are not always those communicated by the financial department of the related banks, because analysts had to reprocess accounting data.

We have chosen to study 49 European banks for which we have obtained detailed Governance and financial data on Bloomberg during the period 2006 to 2013. We also had to complete our data file with the use of Boardex and Bankscope.

A reason why we were not able to use all the 100 European banks for our regression analysis is because many of them disappeared during this period. Hence, "caja" banks from Spain do not figure in our sample because many of them went bankrupt or were taken over (e.g. with the creation of Bankia on 3/12/10). Sometimes we could not obtain relevant data about banks, because they are just too small or not listed because of their "caja" status as for example "caisses d'épargne" and "mutual banks" in France (Savings-Banks). In addition, Northern Rock had already been nationalized on 17/02/2008 in the UK as it was too dependent on market refinancing after a bank run during the summer 2007, Nationwide was partially nationalised, Bradford & Bingley was nationalised in the UK on 29/09/08. Alliance & Leicester was definitely acquired by Santander UK on 13/10/08, Anglo Irish Bank was also nationalized on 21/01/09 (and would merge later on 1/07/11 with Irish Nationwide Building society i.e. INBS under a new name, Irish Bank Resolution Corporation) and HBOS was bought by Lloyds on 19/09/08 (deal on the 19/01/09).

Outside the UK, ABN Amro was taken over by Fortis, RBS and BNPPARIBAS (offer on 8/10/07), Kaupthing bank was nationalized on 9/10/08, Sachsen LB was taken over by Landesbank Baden-Württemberg (LBBW), IKB was saved by its shareholders, Dresdner merged with Commerzbank on 11/05/09 after this last bank announced this future acquisition on 31/08/2008 and WestLB incurred embezzlement with its prop-trading department. Although the Banques Populaires Group and Caisses d'Epargne Group appear in the ranking of the Top 100 European banks, we have not been able to integrate them into our sample as they later merged creating the BPCE Group. Nor was using Natixis a possibility

as their Corporate and Investment Banking branch depends a lot on this new BPCE Group and its business is quite specialized in comparison to most of the banks in our sample.

### 2.3 Financial Distress (our dependent variable)

In this paper, our approach to qualify a financial distress for a given year is based on a dummy variable with values of 1 or 0. This financial distress will be taken in our regression analysis as the dependent variable.

A financial distress means that at least one of the following credit events occurs for a bank:

- Partial nationalization or total nationalization
- Takeover by another bank or transfer in a group of banks that merge together or forced mergers
- Failure to stress tests leading to the first and second bullet points above
- Substantial Guarantee issued by a state or approved by the EC leading to the first and second bullet points above
- Run on the bank
- Restructuring plan approved by the EC (EBA capital plan)
- “Restructuring”: a change in the terms of debt which are unfavorable to the creditor
- “Failure to pay”: Reference entity fails to make payments when they become due after expiration of any applicable grace period
- “Bankruptcy”: Reference entity is either dissolved or becomes insolvent or is otherwise unable to pay its debts

When we follow this approach, we find that 15 banks had at least one financial distress (28 major events as a whole) with 6 of them that were located in the UK. See the list of bank credit events in appendix (Table 6).

In this paper, we had to avoid specific criteria that lead to financial distress such as recapitalization / new injection of capital of more than €1.5bn or rise of capital by shareholders or rights issue of more than €1.5bn for example.

On the one hand, this article is not designed to forecast bank default or financial distress in the banking field.

On the other hand, this type of decisions are often made by the executives of a bank that could be having hardship and thus, lead to endogeneity. Indeed, the approval by executives for a recapitalization without the help of a government rescue plan or state aid and based only on internal decisions is often subjected to psychological or political decision from management. Thus, this may be connected to some of the explanatory variables by an

endogenous manner (there may be omitted variables that should be included in the vector of explanatory variables) and this is why we have not selected here this specific criteria.

#### 2.4 Explanatory variables

From the Bloomberg detailed governance results we select our related explanatory variables among the different topics of the Governance group of fields (i.e. Environmental, Social or Governance: ESG) in the light of our introduction and related literature:

- Board structure (Size of the Board, % women on board, expressed here as a ratio), Board independence (% Independent Directors, expressed here as a ratio),
- Board committee (Nb of Board Meetings per year),
- Audit committee (Nb of Audit Committee Meetings per year).

To complement this, we also used some data from Boardex data-base.

We also collect or identify:

- Financial and accounting variables such as Total Assets, Deposits to Assets, Non-Performing Loans to Total Assets, Tier 1 Capital Ratio, Return on Asset, Total Loans to Total Assets, Price to Book Ratio (control variables) from Bloomberg and Bankscope data-bases.
- Two dummy economic variables (banks in the Eurozone or not and banks' countries among the group of PIIGS or not). PIIGS countries are Portugal, Italy, Ireland, Greece and Spain.



*Tab 15 => Selected Bloomberg Variables*

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SELECTED BLOOMBERG VARIABLES
<b>GOVERNANCE VARIABLES</b>
BOARD_SIZE
INDEPENDENT_DIRECTORS_RATIO
AUDIT_COMMITTEE_MEETINGS
BOARD_MEETINGS_PER_YR
WOMEN_ON_BOARD_RATIO
<b>FINANCIAL VARIABLES</b>
TOT_ASSET
DEPOSITS_TO_ASSETS (%)
NPLS_TO_TOTAL_ASSETS (%)
TIER1_CAP_RATIO (%)
RETURN_ON_ASSET (%)
TOT_LOAN_TO_TOT_ASSET (%)
PX_TO_BOOK_RATIO
<b>ECONOMIC VARIABLES (*)</b>
EUROZONE
PIIGS

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Source: Bloomberg except (\*) Eurozone and PIIGS countries (Portugal, Italy, Ireland, Greece and Spain) and we take the Log of TOT\_ASSET with TOT\_ASSET in Euro thousands. Cf. description of each variable in Appendix, Table 0.

For our different regressions, our “default” dependent variable is going to be a dummy for a financial distress of a given European bank.

Regarding the financial and accounting variable and to complement the end of the introduction, TOT\_ASSET is a classical proxy that stands for the size of the bank and which because of the “too big to fail” concept should be theoretically negative. DEPOSIT\_TO\_ASSET and TOT\_LOAN\_TO\_TOT\_ASSET qualify indirectly for retail banking i.e. a financial activity that grants loans to companies or individuals from the collection of deposits.

We expect to find a negative sign for the first variable in our regressions. However, we should also remember that shareholders take more risks when deposit insurance is implemented, *Merton (1977)*. Using Total Assets, *Jin, Kanagaretnam, Lobo and Mathieu (2013)* even consider bank size as a driver of risk taking, differentiating large and smaller banks by adding the square and cube of size to a size determinant in their model. They quote prior literature that suggested that the size impact on different dependent variables is non-linear. In order to construct their Risk Management Index, *Ellul and Yerramilli (2013)* use, in their regressions on US Bank Holding companies, determinants such as the size e.g. the Log (Total Assets) and the square of the size i.e. Log [(Total Assets)squared].

Similarly *Minton, Taillard and Williamson (2012)* compute regressions of stock performance of US Banks and board determinants and risk monitoring functions. *Bhattacharyya and Purnanandam (2011)* use the same approach in their regressions relating US banks' systematic risk and idiosyncratic risk to mortgage lending activities. According to them, very large banks tend to cover themselves by hedging their risks in the derivatives markets and should a crisis arise they expect to be saved by their state (too-big-too-fail facilities). However, in most papers, the Log (Total Assets) is used e.g. in *Aebi, Sabato and Schmid (2011)*, *Adams and Mehran (2011)*, *Bertratti and Stulz (2012)* or *Berger, Imbierowicz and Rauch (2013)*, *Cole and White (2012)*. The last two authors suggest that young small banks should probably fail more easily than larger ones, but because the larger ones have invested in toxic RMBS they find difficult to conclude on a particular effect for this variable. *Aebi, Sabato and Schmid (2011)* use the ratio Loans / Total Assets because it indicates the asset side of a bank. However, even though higher values of this ratio characterize banks detaining smaller portfolio of securities, hence performing better should a crisis happen, an interpretation is not easy according to them. *Bertratti and Stulz (2012)* found that banks which possess government securities instead of loans would have performed better. Other authors use this determinant e.g. *Ellul and Yerramilli (2013)*.

*Bertratti and Stulz (2012)* and *Aebi, Sabato and Schmid (2011)* mention that the Deposit To Asset ratio capture the composition of the liabilities and that deposit financing is safer than money market funding as far as bank runs are concerned. Other authors use this determinant such as *Ellul and Yerramilli (2013)* or *Bhattacharyya and Purnanandam (2011)*. In order to measure loan quality, as *Berger, Imbierowicz and Rauch (2013)* we use such Non Performing Loans which classically are loans that are more than 90 days past due and that banks have definitely to disclose (see Bloomberg definition in Appendix) instead of Loan Loss Provisions. *Berger, Imbierowicz and Rauch (2013)* also relate that Non Performing Loans are part of some accounting variables (including earnings and capital) that ease the prediction of bank default.

Quoting a few papers, *Jin, Kanagaretnam and Lobo (2011)* also mention that Non Performing Loans give adequate information concerning loan default because lower loan quality is related to Non-Performing Loans. Indeed, as loans encompass an important part of a bank's assets hence the banks' reporting for loans potentially reveals the state of health a bank is in.

NPLS\_TO\_TOTAL\_ASSETS compares the nonperforming loans to total asset and should be positive though too many "good" loans in a growth period could turn out to be unsafe, should a global financial crisis arise, and early signals not captured by the coefficient the year before the Financial Distress i.e. in the regression with lag.

TIER1\_CAP\_RATIO variable (Tier 1 Capital Ratio) is defined as the ratio of Tier 1 capital to risk-weighted assets. *Jin, Kanagaretnam and Lobo (2011)* use this ratio as a measure of balance sheet strength as in *Aebi, Sabato and Schmid (2011)*.

According to *Beltratti and Stulz (2012)*, banks which possess more capital should have more flexibility in order to response to adverse shocks (see introduction). In their conclusion, they assert that large banks with more deposits, more Tier 1 Capital, less funding fragility and less exposure to US real estate performed better (in terms of stock prices). *Minton, Taillard and Williamson (2012)* even use it in one of their regressions as the dependent variable (OLS regression).

In conclusion, the smaller it is, the riskier is the bank.

We have also taken here the RETURN\_ON\_ASSET, because this is largely used in such contexts, though banks are quite special companies (see introduction). For instance, *Jin, Kanagaretnam and Lobo (2011)* use it, as one of the three conditions (“ROA is less than minus 5%”, added to a Tier one capital under 4% and a ratio of Loan Loss Provision divided by total loan over 1%) they require to classify a given bank as a troubled one, when *Jin, Kanagaretnam, Lobo and Mathieu (2013)* refer to a large loss. Based on this and *Krishnan (2005)* who proposes to measure a financial distress in particular by a dummy variable indicating a loss (if Net Income < 0) during the current year, we claim that ROA proxies for a loss and provides substantial information on the financial health of the bank.

*Berger, Imbierowicz and Rauch (2013)* also use the ROA in their multivariate logistic regressions and *Ellul and Yerramilli (2013)* in their panel regressions.

PX\_TO\_BOOK\_RATIO is a classical ratio which is market oriented being equal to the last price divided by the BOOK\_VAL\_PER\_SH i.e. book value per share (book value of equity). This variable proxies for the market’s growth expectations, *Aebi, Sabato and Schmid (2011)*. *Campbell, Hilscher and Szilagyi (2008)* also use it in their logit model of bankruptcy and failure on US firms.

EUROZONE AND PIIGS (banks in the Eurozone or not and banks’ countries among the group of PIIGS or not that include Portugal, Italy, Ireland, Greece and Spain) consist of our two dummy economic variables which are supposed to be country sensitive, as we are going to explain hereafter.

Firstly, *Shleifer and Vishny (1997)* conclude that good Governance originates from legal protection of investors as well as concentrated ownerships. Supporting this *La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998)* suggest that legal rules in a given country (and the distinction between common law and civil law) have an impact on the concentration of ownership. Secondly *Laeven and Levine (2008)* and *Beltratti and Stulz (2012)* show that banks which have more powerful owners are at greater risk (more important specific risks), but turn out to be safer should a country enforce stronger protections laws. Similarly *Beltratti and Stulz (2012)* agree that, during the financial crisis, large banks belonging to countries with stricter legal protection on bank activities performed better and decreased loans less, even though differences across countries on banking regulations are not correlated to bank performance. Thirdly, *Aggarwal, Erel, Stulz and Williamson (2008)* claim

that countries where the protection level is low for investors foreign firms are not inclined to invest in governance as much as firms have to do in the US.

Now, using two “macro” economic variables as they divide several countries into two specific groups is worth being tested especially in the context of this article on European banks. For example, the Directive 8 is a set of European regulation rules for firms and PIIGS countries (Portugal, Italy, Ireland, Greece and Spain) have all in common the fact that they have, one way or another, let their debt burn.

## 2.5 Summary statistics

### Table A of global summary statistics

*Tab 16 => Table A of global summary statistics*

This table shows the main summary statistics for our variables for the 49 European banks from which we get detailed Governance and financial data from 2006 to 2013. We obtained 307 complete sets of observations.

Variable	Obs	Mean	SD	Min	Max
Log_TOT_ASSET	307	8,552	0,486	7,604	9,399
DEPOSITS_TO_ASSETS	307	37,440	12,013	2,885	66,435
NPLS_TO_TOTAL_ASSETS	307	3,312	4,285	0,105	25,380
TIER1_CAP_RATIO	307	10,873	3,220	4,300	21,400
RETURN_ON_ASSET	307	0,134	1,120	-10,853	3,155
TOT_LOAN_TO_TOT_ASSET	307	53,512	17,614	9,929	90,972
PX_TO_BOOK_RATIO	307	0,980	0,677	-0,600	5,564
BOARD_SIZE	307	15,798	4,548	6,000	31,000
INDEPENDENT_DIRECTORS_RATIO	307	0,599	0,254	0,000	1,000
AUDIT_COMMITTEE_MEETINGS	307	9,534	8,144	0,000	53,000
BOARD_MEETINGS_PER_YR	307	13,300	7,050	3,000	43,000
WOMEN_ON_BOARD_RATIO	307	0,155	0,129	0,000	0,600

We may find some variable observations that have a minimum of 0 that can be explain easily:

- INDEPENDENT\_DIRECTORS\_RATIO = 0 when all the board members are Executives,
- AUDIT\_COMMITTEE\_MEETING = 0 if there is no Audit Committee,
- WOMEN\_ON\_BOARD\_RATIO = 0 if there is no woman among the Board members.

**Table B of summary statistics “Observations with Financial Distress”**

*Tab 17 => Table B of summary statistics “Observations with Financial Distress”*

This table shows the main summary statistics for our variables for the 49 European banks from which we get detailed Governance and financial data from 2006 to 2013. We obtained 28 complete sets of observations.

Variable	Obs	Mean	SD	Min	Max
Log_TOT_ASSET	28	8,665	0,449	7,890	9,399
DEPOSITS_TO_ASSETS	28	34,142	15,762	3,797	62,764
NPLS_TO_TOTAL_ASSETS	28	5,470	7,425	0,105	23,175
TIER1_CAP_RATIO	28	10,200	2,613	4,300	15,900
RETURN_ON_ASSET	28	-0,745	1,507	-6,361	0,909
TOT_LOAN_TO_TOT_ASSET	28	49,237	18,247	14,808	74,502
PX_TO_BOOK_RATIO	28	0,645	0,624	-0,600	2,480
BOARD_SIZE	28	14,464	3,967	7,000	22,000
INDEPENDENT_DIRECTORS_RATIO	28	0,501	0,263	0,000	0,917
AUDIT_COMMITTEE_MEETINGS	28	9,536	4,418	0,000	18,000
BOARD_MEETINGS_PER_YR	28	19,143	10,434	7,000	43,000
WOMEN_ON_BOARD_RATIO	28	0,127	0,080	0,000	0,250

**Table C of summary statistics “Observations with no Financial Distress”**

*Tab 18 => Table C of summary statistics “Observations with no Financial Distress”*

This table shows the main summary statistics for our variables for the 49 European banks from which we get detailed Governance and financial data from 2006 to 2013. We obtained 279 complete sets of observations.

Variable	Obs	Mean	SD	Min	Max
Log_TOT_ASSET	279	8,540	0,489	7,604	9,398
DEPOSITS_TO_ASSETS	279	37,771	11,554	2,885	66,435
NPLS_TO_TOTAL_ASSETS	279	3,096	3,787	0,108	25,380
TIER1_CAP_RATIO	279	10,940	3,271	5,130	21,400
RETURN_ON_ASSET	279	0,222	1,036	-10,853	3,155
TOT_LOAN_TO_TOT_ASSET	279	53,941	17,525	9,929	90,972
PX_TO_BOOK_RATIO	279	1,013	0,674	0,022	5,564
BOARD_SIZE	279	15,932	4,587	6,000	31,000
INDEPENDENT_DIRECTORS_RATIO	279	0,609	0,251	0,000	1,000
AUDIT_COMMITTEE_MEETINGS	279	9,534	8,432	0,000	53,000
BOARD_MEETINGS_PER_YR	279	12,710	6,303	3,000	41,000
WOMEN_ON_BOARD_RATIO	279	0,158	0,132	0,000	0,600

**Table D of mean-comparison (p-values) for “Observations with no-lag”**

*Tab 19 => Table D of mean-comparison (p-values) for “Observations with no-lag”*

This table shows the p-values that result from the mean-comparison test between observations with Financial Distresses and observations with non-Financial Distress using our full sample of 307 observations, when the variances are equal. We have written the p-value result in bold characters when the hypothesis of the variance equality applied.

Variable	P_value
Log_TOT_ASSET	<b>0,198</b>
DEPOSITS_TO_ASSETS	0,128
NPLS_TO_TOTAL_ASSETS	0,005***
TIER1_CAP_RATIO	<b>0,247</b>
RETURN_ON_ASSET	0,000***
TOT_LOAN_TO_TOT_ASSET	<b>0,178</b>
PX_TO_BOOK_RATIO	<b>0,006***</b>
BOARD_SIZE	<b>0,104</b>
INDEPENDENT_DIRECTORS_RATIO	<b>0,032**</b>
AUDIT_COMMITTEE_MEETINGS	0,999
BOARD_MEETINGS_PER_YR	0,000***
WOMEN_ON_BOARD_RATIO	0,235

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

See comments in the following section and our Pearson matrix of correlations in the appendix, table 7.

### 3. Methodology (empirical analysis)

#### 3.1 Models

The dependent variable has a value of 0 or 1 for financial distress and our explanatory variables consist of our accounting and financial variables for a yearly basis.

Then, the marginal probability of a financial distress may be given by the following equation:

$$P_{i,t} = P(Y_{i,t+1} = 1) = \frac{1}{1 + \exp(-\alpha - \beta x_{i,t})}$$

where  $Y_{i,t+1} = 1$  if the bank gets a financial distress in year  $t+1$  i.e. with a lag of  $+1$ , and  $x_{i,t}$  is equal to the vector of explanatory variables that arose the year before,  $\alpha$  is the constant coefficient (intercept) and  $\beta$  is the vector of the coefficients related to the explanatory variables.

With a probit model, the previous equation would be written as followed:

$$P_{i,t} = P(Y_{i,t+1} = 1) = F(\alpha + \beta x_{i,t})$$

where  $F$  is the standardized normal cumulative distributive function.

We combine our two main sets of variables (governance and financial / accounting) and we make panel regressions as described above for  $t$  for the period 2006-2013 (+2014 for Financial Distress in regressions with the lag). See the related regressions in tables 1 to 5 in appendix as well as the list of bank credit events (Table 6).

Initially, we wanted to explore the Fixed Effects and the Random Effects approaches including the results for the year ongoing i.e. with no lag (in this last case, we measure the exogenous variables the same year as the dependent variable).

However, by construction of the variables Eurozone and PIIGS, taking a constant value per year for each bank (0 or 1), these two dummies are estimated by Stata for the Fixed Effects model as if they were null (with no effects), hence the logit model with fixed effect is not really acceptable for our study.

Furthermore, even if banks are not randomly selected in the whole population of European banks because we have tried to retain the largest ones based on their assets, we quite “automatically” gets a random sample as we have only selected 49 of them and thus, our component effect has no other choice than to be random as well.

So, the discussion here-above tends to give more credence to the Random Effect approach. We eventually selected the probit model which is more adapted and easier for calculations with random effects than the logit model, as suggested by some econometricians like *Pirotte (2011)*, all the more as the Random Effects’ estimator here give more detailed results. Indeed, the probit model with Random Effects simplifies calculations for integrations

using marginal non-conditional likelihood after the computation of the conditional likelihood.

Note that we have initially made all of our regressions with both models, although based on the previous explanations, probit models appear to be more satisfying for our study (even if logit regressions which use a Random Effects' estimator lead to similar results).

### 3.2 Main results

Consistent with our previous discussion, we are now going to comment on the probit regressions that are found in our tables in the appendix. The results are consistent with the mean-comparison test for observations with no-lag in that all the variables that give significant results in this template are also significant with our no-lag regressions except NPLS\_TO\_TOTAL\_ASSETS. Inversely, TIER\_CAP\_RATIO that appears significant in our no-lag regression gives no significant result in this test.

#### **Lag regression with 14 variables (see Table 1 in appendix)**

With regards to the regressions with all of our chosen 14 variables in the probit table 1 (from 2006 to 2013), our full columns (1) and (2) contain the lag and no-lag regression results.

When we examine the results for the probit model with Random Effects (with a lag of +1 year for the financial distress), we see that three variables are significant at the 5% level i.e. the TIER\_CAP\_RATIO, the INDEPENDENT\_DIRECTORS\_RATIO and the EUROZONE all having a negative sign.

This shows that, as the ratio of Tier 1 capital to risk-weighted assets that is supposed to be risk oriented by definition, it is a very good indicator of financial distress.

Theory agrees with this result, as the TIER\_CAP\_RATIO is used as a key risk indicator implemented within the Basel II and now Basel III banking regulation in most risk management departments in European banks.

Regarding the EUROZONE variable, it is important to remember that northern banks which do not belong to the Eurozone experienced a large crisis in the 90's and have developed during the following years a culture of risk which may have put them in a safer position when hit by the financial crisis in 2007/2008.

We could expect to find a positive sign for the related coefficient, but we must pay attention to this particular group of banks. Indeed, when we look at our non-Eurozone banks, it contains 1 Danish bank, 4 Swedish banks and 1 Norwegian bank, plus must 4 English, 1 Scottish and 3 Swiss banks. Most of these banks particularly suffered during the financial crisis.



So, our negative coefficient sign is consistent with the fact that the ratio of lines with a financial distress among non-Eurozone banks is larger than the ones with a financial distress among Eurozone banks in our sample.

Commenting on the results for the INDEPENDENT\_DIRECTORS\_RATIO needs caution, as we have mentioned in the introduction that contradictory results were found among papers. However, it is important to point out here that if this variable is significant at the 5% level for this lag regression yet we only find significance at the 10% level for the no lag regression. This may show that a sudden change of the composition of the independence of the board could reveal that some wrongdoings have been made leading more quickly to a potential financial distress, as in the Enron scenario. Indeed, by weakening the number of independent directors as a first step, Enron's CFO was able to "succeed" later in its wrongdoings (see introduction).

We also note that RETURN\_ON\_ASSET and WOMEN\_ON\_BOARD\_RATIO are only weakly significant at the 10% level.

#### **No-lag regression with 14 variables (see Table 1 in appendix)**

If we now focus on the no-lag regression, we see that two variables are significant at the 5% level both with negative signs i.e. the PX\_TO\_BOOK\_RATIO and the TIER\_CAP\_RATIO.

The PX\_TO\_BOOK\_RATIO is significant at the 5% level showing the market impact on the market price of shares relatively to the book value of equity (BOOK\_VAL\_PER\_SH) during the year of the financial distress. As the financial situation of a given bank may have started to weaken seriously week or months before, a substantial number of investors only react negatively to such news during the current financial year i.e. the one of the financial distress. Furthermore, this variable is never significant for our lag regressions.

The governance BOARD\_MEETINGS\_PER\_YR variable is significant at the 1% level in the no-lag regression. When we look directly at our data, we observe that for most of our banks that had at least a year with a financial distress, the number of meetings begins to increase the year before, then may even grow during the year of the financial distress, and then, decreases after.

In fact, it reveals potential difficulties or ongoing large changes in a bank which surely arise the previous year and lead to this sudden rise of the board meetings.

We note that EUROZONE is weakly significant at the 10% level whereas WOMEN\_ON\_BOARD\_RATIO is less significant than in the lag analysis.

Because of their poor significance levels, the remaining variables have no power of explanation i.e. log\_TOT\_ASSET, DEPOSITS\_TO\_ASSETS, NPLS\_TO\_TOTAL\_ASSETS, and TOT\_LOAN\_TO\_TOT\_ASSET among our financial and accounting determinants, BOARD\_SIZE

and AUDIT\_COMMITTEE\_MEETINGS among our governance determinants and PIIGS among our economic determinants, either for the lag or no-lag regressions.

This may be explain by the different controversial results or paradoxes with have found in our literature review.

### **Lag regression with 7 variables (see Table 2 in appendix)**

With regards to these new regressions with 7 variables (3 financial, 3 governance and 1 economic ones) in our related probit table 2, our full columns (1) and (2) contain the lag and no-lag regressions.

When we examine the results for the probit model with Random Effects (with a lag of +1 year for the financial distress), we see that the same variables as in the regression with 14 are significant at the 5% level with a negative sign i.e. the TIER\_CAP\_RATIO, INDEPENDENT\_DIRECTORS\_RATIO and the EUROZONE.

We also note that RETURN\_ON\_ASSET is now significant at the 5% level and WOMEN\_ON\_BOARD\_RATIO is still weakly significant at the 10% level.

So, the predictive characteristics of TIER\_CAP\_RATIO and especially for RETURN\_ON\_ASSET appear to be better represented by this regression with less variables, as both are significant at the 5% level. Based on our selected 7 variables, this regression better reveals the power of this determinant in comparison to the others, as we have seen that the ROA could reveal for a loss, hence a financial distress, which is more consistent if we take a lag of 1 year.

The intercept appears to be also significant at the 5% level.

### **No-lag regression with 7 variables (see Table 2 in appendix)**

If we now focus on the no-lag regression, we see that the same two variables are significant as with the 14 variables at the 5% level both with negative signs i.e. the PX\_TO\_BOOK\_RATIO and the TIER\_CAP\_RATIO.

However, the BOARD\_MEETINGS\_PER\_YR variable is more significant at the 1% level in the no-lag regression as in the one with 14 variables.

This time, we note that EUROZONE is very significant at the 1% level while WOMEN\_ON\_BOARD\_RATIO is not significant any more, but it is not easy to give any interpretation.

We have selected 7 variables (3 financial, 3 governance and 1 economic ones) from our past 14 variable regressions with the best p-values in order to build more robust ones, but also to try to mix the different type of variables.

Some of them possess an even more significant power of explanation in regards to the others, as the variable RETURN\_ON\_ASSET in the no-lag regressions and EUROZONE in the lag regression.

#### **Lag regression with 7 variables (see Table 3 in appendix)**

With regards to the regression with 7 variables (5 governance and 2 economic ones) in our related probit table 3, our full columns contain the lag and no-lag regressions.

When we examine on the results for the probit model with Random Effects (with a lag of +1 year for the financial distress), we see that one variable is even more significant i.e. the INDEPENDENT\_DIRECTORS\_RATIO at the 1% level with a negative sign.

The significance of EUROZONE variable is at the 5% level with a negative sign and WOMEN\_ON\_BOARD\_RATIO is again weakly significant at the 10% level.

#### **No-lag regression with 7 variables (see Table 3 in appendix)**

If we now focus on the no-lag regression, we see that two variables are significant i.e. BOARD\_MEETINGS\_PER\_YR at the 1% level with a positive sign and INDEPENDENT\_DIRECTORS\_RATIO at the 5% level with a negative sign, confirming their power of explanation as governance determinants among our group of variables.

These regressions also lend even more credence to the absence of significance for the rest of the chosen governance variables, as we have already noticed, i.e. BOARD\_SIZE and AUDIT\_COMMITTEE\_MEETINGS or the PIIGS economic variable. We could partly explain the non-significance of this last variable by the absence of “caja” banks for Spain in our sample for the PIIGS group, especially because many of them went bankrupt or were taken over by others or simply because we have not obtained relevant data about them from our data bases, because they are just too small or not listed.

We might be surprised to admit that AUDIT\_COMMITTEE\_MEETINGS is never significant in our regressions in opposition to BOARD\_MEETINGS\_PER\_YR. One explanation could be a lighter connection between audit committee and the business cycles, as internal auditors work following to a planned schedule on very diverse processes that do not necessarily depend on business cycles and bad or good results in particular.

Then, potential difficulties or big changes ongoing in the bank which could arise the previous year and lead to a rise of the board meetings do not affect similarly AUDIT\_COMMITTEE\_MEETINGS, as the variable is never significant.

#### **Lag regression with 14 (see Table 4 in appendix)**

With regards to the regressions with all of our 14 variables in the probit table 4 (from 2007 to 2009 this time i.e. at the peak of the financial crisis, especially in 2008 and 2009), our results are quite different from Table 1.

When we examine the results for the probit model with Random Effects (with a lag of +1 year for the financial distress), we see that only one variable is significant at the 5% level i.e. the INDEPENDENT\_DIRECTORS\_RATIO while the EUROZONE and NPLS\_TO\_TOTAL\_ASSETS are weakly significant at the 10% level with an expected positive sign for this last variable.

This is quite consistent with the regression that covers the period from 2006 to 2013, even though the quality of the model requires that we be cautious, as we have necessarily less observations except that we obtain a relative larger number of financial distresses for this period of study (2007 to 2009) during the financial crisis.

#### **No-lag regression with 14 variables (see Table 4 in appendix)**

If we now focus on the no-lag regression, we see that only 2 variables are in common with those of the full period regression (see Table 1) i.e. INDEPENDENT\_DIRECTORS\_RATIO and EUROZONE, knowing that here, the quality of the model does not let us come to any robust conclusion especially as in both these regressions, the TIER\_CAP\_RATIO is never significant.

#### **Lag regression with 14 variables (see Table 5 in appendix)**

With regards to the regressions with all of our 14 variables in the probit table 5 (from year 2010 to 2013 this time i.e. after the financial crisis), our results are quite different again from Table 1.

When examine on the results for the probit model with Random Effects (with a lag of +1 year for the financial distress), we see that only one variable is significant at the 5% level i.e. the RETURN\_ON\_ASSET.

#### **No-lag regression with 14 variables (see Table 5 in appendix)**

If we now focus on the no-lag regression, we see that only one variable, BOARD\_MEETINGS\_PER\_YR, is significant at the 5% level knowing that here, the quality of the model does not let us come to any robust conclusion as well, because we have necessarily less observations all the more as we obtain a relative smaller number of Financial Distresses given our period of study (2010 to 2013) after the financial crisis.

However, this variable BOARD\_MEETINGS\_PER\_YR was amazingly never significant in the regressions for the period 2007 to 2009.

#### **Pearson matrix (see Table 7 in appendix)**

In addition to those results, the Pearson matrix of correlations gives satisfying results, as we see that we have little correlation between our significant variables.

## 4. Conclusion

We studied 49 European banks (among the TOP 100 European banks) for which we obtained detailed Governance, financial and economic data on Bloomberg (with a complement of Boardex and Bankscope) from 2006 to 2013. Thus, we have chosen core variables that are decisive for governance regarding topics in line, in particular, with the 8<sup>th</sup> Directive. This is why we have selected these variables among the Board structure, Board independence and Board or Audit committee families, as well as financial and economic data for control variables. However, in the introduction and the data sections, we have shown that governance variables are not easily measurable and highlighted some paradoxes from the results gathered from the different papers we cited.

We have regressed the financial distresses (dummy) and have obtained results for our European banks using our 14 selected explanatory variables (7 financial and accounting, 5 governance and 2 economic variables).

For the period 2006 to 2013 on our largest regression analysis with all of our 14 variables, we show that only 6 of them (3 financial, 2 governance and 1 economic variables) do matter while the rest have no significant effect (except that the sign of their coefficient tends to match our initial predictions).

We first suggested that this weak importance of some governance or economic variables may be explained by different controversial results or paradoxes that we have found in our literature review (see introduction).

The three financial variables that have importance are the Tier 1 capital ratio, the price to book ratio and the return to asset. That agrees also with the related reduced second panel regression using only 7 variables (3 financial, 3 governance and 1 economic). The first financial variable i.e. the ratio of Tier 1 capital to risk-weighted assets is particularly used in the banking field by risk management departments and the two others (i.e. the price to book ratio and the return to asset) are often selected in regressions that are undertaken in the banking governance or corporate governance papers.

In our study, two governance variables appear to be important in all of our regressions i.e. Board meetings per year and independent Directors ratio.

The board meetings per year variable is only very significant in the no-lag regressions at the 1% level. In fact, it reveals potential difficulties or big ongoing changes in a bank which surely arise the previous year and lead to this sudden rise of the board meetings. This variable is never significant in our lag regression and neither is the price to book ratio.

The independent Directors ratio is significant in all of our regression at the 5% or even 1% level, except for the no-lag regression with 14 variables where it is only weakly significant at the 10% level.

The Eurozone economic variable is also significant with a negative sign in most of our regression, but it is hard to conclude as the non-Eurozone group of banks includes northern ones as well as banks from the UK or Switzerland.

The women on Board ratio is weakly significant at the 10% level in our lag regressions, so it is not appropriate to come to a conclusion that would confirm any impact of gender diversity on boards, as suggested in our literature review (see introduction).

Considering our regression during the financial crisis period from 2007 to 2009 (see table 4) and after the financial crisis period from 2010 to 2013 (see table 5), the quality of the models requires that we be cautious in its interpretation as less data is available for this time. Indeed for our 6 variables that are important in our previous regressions three tend to give convergent results: the independent Directors ratio, the return to capital ratio and the Board meetings per year.

It is worth remembering that finding both adequate and numerous governance variables for banks is an issue (even more in Europe than in USA), as mentioned earlier in the data section. So, like *Beltratti and Stulz (2012)* we partly chose our variables depending on data availability and this is why we only chose 5 governance variables.

In the period 2006 to 2013, it is important to note that mixing our types of variables is relevant as we find interesting results with not only governance variables, but also financial and economic ones, as our control variables.

Besides, these financial variables are of paramount interest because the Tier 1 capital ratio indicates capital adequacy hence measuring the balance sheet strength, return on asset represents asset quality and could proxy for a loss, and the price to book ratio characterizes sensitivity to markets.

Furthermore, the Tier 1 capital ratio is also risk oriented which explains its greater use among risk management departments in the banking field because of enforced regulation, such as Basel rules.

So, as an efficient banking governance cares for risks (see introduction), re-strengthening supervision (and regulation) and giving a good assurance that Boards are really independent could mitigate against risks for banks by reducing financial distresses or defaults.

And we have shown in the regressions for our 49 European banks that our Tier 1 capital ratio and independent Directors ratio determinants do explain our Financial Distress dependent variable, hence the importance of using these as key indicators as suggested in Basel II and III for the first one or in the 8<sup>th</sup> Directive for the second.

## 5. Appendix

**Table 0: variable definitions**

*Tab 20 => Table 0: variable definitions*

BLOOMBERG VARIABLES	VARIABLE DEFINITIONS
TOT_ASSET	<p>BANKS</p> <p>Total Assets: This is the sum of Cash &amp; bank balances, Fed funds sold &amp; resale agreements, Investments for Trade and Sale, Net loans, Investments held to maturity, Net fixed assets, Other assets, Customers' Acceptances and Liabilities.</p>
DEPOSITS_TO_ASSETS	<p>BANKING</p> <p>Total deposits as a percentage of total assets. Total deposits include demand, savings, time and other deposits.</p>
NON_PERFORM_LOANS	<p>Nonperforming Loans, which are loans in default or close to default, and do not accrue interest. All loans that have an impairment provision are classified as non-accrual. This field returns for Banks and Finance companies.</p>
NPLS_TO_TOTAL_ASSETS	<p>Ratio comparing the amount of nonperforming loans (NPLs) to total assets in percentage. Calculated as</p> <p>Non-Performing Loans * 100 / Total Assets</p> <p>Where: Non-Performing Loans is BS510, BS_NON_PERFORM_LOANS</p> <p>Available for Banks and Financials.</p>

<p>TIER1_CAP_RATIO</p>	<p>Banks</p> <p>Tier 1 Capital Ratio: Tier 1 or Core capital ratio. Tier 1 is used for commercial banks and core capital is used for savings and loans in the United States (U.S.).</p> <p>The ratio of Tier 1 capital to risk-weighted assets.</p> <p>For Core Tier 1 Capital Ratio see Core Tier 1 Capital Ratio (BS895, BS_CORE_TIER1_CAPITAL_RATIO).</p> <p>Common stockholders' equity: Qualifying perpetual preferred stock. Minority Interest in consolidated subsidiaries less Goodwill and other disallowed intangibles.</p> <p>Core capital for savings and loans: Common stockholders' equity. Noncumulative perpetual preferred and surplus. Minority interests less intangible assets (other than PMSR). The ratios are discussed in the Cooke Committee and adopted by each country. The information is provided in terms of absolute numbers and percentages. If the absolute amounts are disclosed, the percentages should be computed for this account. Slightly different ratios are defined for commercial banks and savings and loans. The minimum ratios set by the U.S. Federal Reserve and OTC are 4% for commercial banks and 3% for savings and loans, respectively.</p> <p>Europe: The Bank of International Settlements in Basel requires a Tier I ratio of 4.4%. In Europe it is referred to as the BIS ratio, the European Solvency ratio, or the Cooke ratio as the Cooke committee established it.</p>
<p>RETURN_ON_ASSET</p>	<p>Indicator of how profitable a company is relative to its total assets, in percentage. Return on assets gives an idea as to how efficient management is at using its assets to generate earnings.</p> <p>INDUSTRIALS, BANKS, FINANCIALS, UTILITIES, &amp; REITS</p> <p>Calculated as:</p> <p><math>(\text{Trailing 12M Net Income} / \text{Average Total Assets}) * 100</math></p> <p>Where: Trailing 12M Net Income is RR813, TRAIL_12M_NET_INC Average Total Assets is the average of the beginning balance and ending balance of TOT_ASSET (Cf. above)</p>



TOT_LOAN_TO_TOT_ASSET	<p>BANKS</p> <p>Total Loans: Includes Commercial loans, Consumer loans and Other loans.</p> <p>France: Loans are not separated into commercial and consumer. Some banks break out mortgage loans and lease financing. TOT_ASSET: cf. above.</p>
BOOK_VAL_PER_SH	<p>Measure used by owners of common shares in a firm to determine the level of safety associated with each individual share after all debts are paid accordingly. Units: Actual Calculated as:</p> <p>Total Common Equity / Number of Shares Outstanding</p> <p>Where: Total Common Equity is RR010, TOT_COMMON_EQY Shares Outstanding is BS081, BS_SH_OUT</p>
PX_TO_BOOK_RATIO	<p>Ratio of the stock price to the book value per share. Calculated as:</p> <p>Price to Book Ratio = Last Price / Book Value Per Share</p> <p>Where: Last Price is PR005, PX_LAST Book Value Per Share is RR020, BOOK_VAL_PER_SH</p> <p>Data from the most recent reporting period (quarterly, semi-annual or annual) used in the calculation.</p> <p>Portfolio: Computed as the Total Market Value (IN089, INDX_MARKET_CAP) divided by the sum of Book Value from holdings. Contributions are computed as the value of Book Value Per Share (RR020, BOOK_VAL_PER_SH) of the security multiplied by the number of shares held.</p>
BOARD_SIZE	<p>Number of Directors on the company's board, as reported by the company. Full time Directors only. Deputy members of the Board will not be counted. Europe: Where the company has a Supervisory Board and a Management Board, this is the number of Directors on the Supervisory Board. Field is part of the Environmental, Social and Governance (ESG) group of fields.</p>
INDEPENDENT_DIRECTORS_RATIO	<p>Independent directors as a percentage of total board membership. Field part of Environmental, Social or Governance (ESG) group of fields.</p>
AUDIT_COMMITTEE_MEETINGS	<p>Number of meetings of the Board's Audit Committee during the reporting period. In the case of Japanese companies, this number will reflect the number of audit committee meetings for those companies with a committees based structure, or the number of board of auditor meetings for those companies with a board of auditor based structure. Field part of Environmental, Social or Governance (ESG) group of fields.</p>

Does better governance necessarily reduce financial distress for European banks?

BOARD_MEETINGS_PER_YR	Total number of corporate board meetings. Field part of Environmental, Social or Governance (ESG) group of fields.
WOMEN_ON_BOARD_RATIO	Percentage of Women on the Board of Directors, as reported by the company. Europe: Where the company has a Supervisory Board and a Management Board, this is the Percentage of Women on the Supervisory Board. Field is part of the Environmental, Social and Governance (ESG) group of fields.

*EUROZONE: equals to 1 (0 otherwise) if a bank belongs to Eurozone (not selected from Bloomberg variable definitions)*

*PIIGS: is equal to 1 (0 otherwise) if a bank belongs to the following group of countries: Portugal, Ireland, Italia, Greece and Spain (not selected from Bloomberg variable definitions).*

**Table 1: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)**

*Tab 21 => Table 1: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)*

This table shows the panel regressions for our 49 banks with variables from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and Column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
Log_TOT_ASSET	0.567 (0.719)	0.628 (0.699)
DEPOSITS_TO_ASSETS	-0.00367 (0.0191)	0.00738 (0.0183)
NPLS_TO_TOTAL_ASSETS	0.0160 (0.0462)	0.0616 (0.0505)
TIER1_CAP_RATIO	-0.137** (0.0620)	-0.135** (0.0656)
RETURN_ON_ASSET	-0.220* (0.127)	-0.0407 (0.108)
TOT_LOAN_TO_TOT_ASSET	0.00592 (0.0202)	-0.0151 (0.0187)
PX_TO_BOOK_RATIO	0.0326 (0.233)	-0.796** (0.363)
BOARD_SIZE	-0.0146 (0.0505)	-0.0294 (0.0497)
INDEPENDENT_DIRECTORS_RATIO	-2.285** (1.010)	-1.765* (0.945)
AUDIT_COMMITTEE_MEETINGS	0.0194 (0.0294)	-0.0218 (0.0293)
BOARD_MEETINGS_PER_YR	-0.0364 (0.0278)	0.0673*** (0.0230)
WOMEN_ON_BOARD_RATIO	-3.335* (1.943)	-1.992 (1.595)
EUROZONE	-1.596** (0.760)	-1.150* (0.618)
PIIGS	0.350 (0.872)	-0.0645 (0.827)
Constant	-2.387 (6.983)	-2.938 (6.689)
Wald Chi2	20.30	29.26
p-value	<u>0.1208</u>	<u>0.0096</u>
Observations	307	307
Number of banks	49	49

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 2: PROBIT (7 variables: 3 financial, 3 governance and 1 economic variables)**

*Tab 22 => Table 2: PROBIT (7 variables: 3 financial, 3 governance and 1 economic variables)*

This table shows the panel regressions for our 49 banks with variables from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and Column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
TIER1_CAP_RATIO	-0.136** (0.0579)	-0.138** (0.0634)
RETURN_ON_ASSET	-0.227** (0.115)	-0.0885 (0.0973)
PX_TO_BOOK_RATIO	-0.0290 (0.234)	-0.822** (0.333)
INDEPENDENT_DIRECTORS_RATIO	-1.953** (0.857)	-1.954** (0.856)
BOARD_MEETINGS_PER_YR	-0.0309 (0.0265)	0.0664*** (0.0214)
WOMEN_ON_BOARD_RATIO	-3.494* (1.897)	-1.847 (1.593)
EUROZONE	-1.462** (0.583)	-1.658*** (0.572)
Constant	2.500** (1.201)	1.822 (1.177)
Wald Chi2	19.68	24.70
p-value	<u>0.0063</u>	<u>0.0009</u>
Observations	307	307
Number of banks	49	49

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 3: PROBIT (7 variables: 5 governance and 2 economic variables)**

*Tab 23 => Table 3: PROBIT (7 variables: 5 governance and 2 economic variables)*

This table shows the panel regressions for our 49 banks with variables from Bloomberg data from 2006 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and Column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD lag 1	(2) FD
BOARD_SIZE	-0.00971 (0.0473)	-0.0320 (0.0379)
INDEPENDENT_DIRECTORS_RATIO	-2.585*** (0.987)	-1.649** (0.759)
AUDIT_COMMITTEE_MEETINGS	0.00898 (0.0307)	-0.0133 (0.0267)
BOARD_MEETINGS_PER_YR	-0.0391 (0.0272)	0.0649*** (0.0194)
WOMEN_ON_BOARD_RATIO	-3.327* (1.804)	-1.867 (1.368)
EUROZONE	-1.521** (0.761)	-0.595 (0.514)
PIIGS	0.619 (0.642)	-0.142 (0.472)
Constant	1.328 (1.117)	-0.305 (0.969)
Wald Chi2	11.12	20.28
p-value	<u>0.1334</u>	<u>0.0050</u>
Observations	307	307
Number of banks	49	49

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 4: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)**

*Tab 24 => Table 4: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)*

This table shows the panel regressions for our 49 banks with variables from Bloomberg data from 2007 to 2009. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and Column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD_lag_1	(2) FD
Log_TOT_ASSET	0.784 (0.945)	10.89** (5.472)
DEPOSITS_TO_ASSETS	0.00424 (0.0286)	0.432** (0.195)
NPLS_TO_TOTAL_ASSETS	0.275* (0.152)	-0.0120 (0.644)
TIER1_CAP_RATIO	0.0616 (0.130)	-0.179 (0.462)
RETURN_ON_ASSET	0.273 (0.547)	-10.54** (4.192)
TOT_LOAN_TO_TOT_ASSET	0.0226 (0.0281)	-0.171 (0.131)
PX_TO_BOOK_RATIO	0.411 (0.439)	-1.726 (1.881)
BOARD_SIZE	-0.0158 (0.0694)	-0.893* (0.542)
INDEPENDENT_DIRECTORS_RATIO	-4.177** (1.927)	-19.55** (9.007)
AUDIT_COMMITTEE_MEETINGS	0.00142 (0.0578)	-0.932* (0.519)
BOARD_MEETINGS_PER_YR	-0.0908 (0.0633)	-0.0218 (0.170)
WOMEN_ON_BOARD_RATIO	-5.970 (4.227)	9.397 (8.629)
EUROZONE	-2.203* (1.269)	-10.66*** (3.996)
PIIGS	-0.469 (1.176)	16.36** (6.919)
Constant	-5.288 (9.408)	-70.64 (44.14)
Wald Chi2	7.84	12.63
p-value	<u>0.8977</u>	<u>0.5560</u>
Observations	119	119
Number of banks	44	44

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 5: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)**

*Tab 25 => Table 5: PROBIT (14 variables: 7 financial, 5 governance and 2 economic variables)*

This table shows the panel regressions for our 49 banks with variables from Bloomberg data from 2010 to 2013. Column (1) contains a lag of +1 for a Financial Distress (FD\_lag\_1) and Column (2) no-lag for a Financial Distress (FD) which is the dependent variable in each case. Wald chi2 i.e. the Wald test result (with the related underlined p-value) stands at the bottom of the table. Log\_TOT\_ASSET in Euro/1000. Standard errors are reported in parentheses below the coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

VARIABLES	(1) FD_lag_1	(2) FD
Log_TOT_ASSET	0.395 (0.771)	0.287 (0.933)
DEPOSITS_TO_ASSETS	-0.0203 (0.0228)	0.00191 (0.0262)
NPLS_TO_TOTAL_ASSETS	-0.0276 (0.0705)	0.00159 (0.0764)
TIER1_CAP_RATIO	-0.0631 (0.0842)	-0.155 (0.117)
RETURN_ON_ASSET	-0.306** (0.140)	-0.0899 (0.126)
TOT_LOAN_TO_TOT_ASSET	0.00363 (0.0228)	0.00472 (0.0248)
PX_TO_BOOK_RATIO	-0.0696 (0.656)	-0.264 (0.758)
BOARD_SIZE	-0.0519 (0.0608)	-0.0280 (0.0652)
INDEPENDENT_DIRECTORS_RATIO	-1.099 (0.982)	-1.364 (1.191)
AUDIT_COMMITTEE_MEETINGS	0.0134 (0.0242)	-0.00376 (0.0306)
BOARD_MEETINGS_PER_YR	0.0102 (0.0362)	0.114** (0.0491)
WOMEN_ON_BOARD_RATIO	-1.892 (2.448)	-1.082 (2.242)
EUROZONE	0.0204 (0.782)	-0.191 (0.830)
PIIGS	0.110 (0.882)	-1.084 (0.999)
Constant	-2.326 (7.538)	-2.117 (9.179)
Wald Chi2	15.65	10.57
p-value	<u>0.3350</u>	<u>0.7194</u>
Observations	165	165
Number of banks	47	47

Standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 6: List of European bank credit events (per year) from 2006 to 2013**

Tab 26 => Table 6: List of European bank credit events (per year) from 2006 to 2013

Results for our 49 banks: one possible credit event per year (28 in total). 0 represents no Financial Distressed.

Ident	Company Name	Bank Credit Events
1	Allied Irish Banks PLC	2009 / 2010
2	Alpha Bank AE	0
3	Banca Monte dei Paschi di Siena SpA	2011
4	Banca Popolare di Milano Scarl	0
5	Banco Bilbao Vizcaya Argentaria SA	0
6	Banco BPI SA	0
7	Banco Comercial Portugues SA	2012
8	Banco de Sabadell SA	0
9	Banco Espirito Santo SA	0
10	Banco Popolare SC	0
11	Banco Popular Espanol SA	0
12	Banco Santander SA	0
13	Bank of Ireland	2010 / 2011
14	Bankinter SA	0
15	Barclays PLC	2007 / 208
16	BNP Paribas Fortis SA	2008
17	BNP Paribas SA	0
18	Caixa Bank	0
19	CIC	0
20	Commerzbank AG	2008 / 2009 / 2011
21	Credit Agricole SA	0
22	Credit Suisse Group AG	0
23	Danske Bank A/S	0
24	Deutsche Bank AG	0
25	Deutsche Postbank AG	0
26	Dexia SA	2008 / 2010 / 2011
27	DNB ASA	0
28	Erste Group Bank AG	0
29	Eurobank Ergasias SA	2013
30	HSBC Holdings PLC	0
31	Hypo Real Estate Holding Ag	2008
32	ING Groep NV	0
33	Intesa Sanpaolo SpA	0
34	KBC Groep NV	0
35	Lloyds Banking Group PLC	2008 / 2009
36	Mediobanca SpA	0
37	National Bank of Greece SA	2009 / 2012
38	Nordea Bank AB	0
39	Piraeus Bank SA	0
40	Raiffeisen Bank International AG	0
41	Royal Bank of Scotland Group PLC	2008 / 2009
42	Skandinaviska Enskilda Banken AB	0
43	Societe Generale SA	0
44	Standard Chartered PLC	2008 / 2010
45	Svenska Handelsbanken AB	0
46	Swedbank AB	0
47	UBS AG	2007 / 2008 / 2011
48	UniCredit SpA	0
49	Unione di Banche Italiane SCpA	0



Does better governance necessarily reduce financial distress for European banks?

**Table 7: Pearson matrix of correlations**

*Tab 27 => Table 7: Pearson matrix of correlations*

Variables	Log_TOT_ASSET	DEPOSITS_TO_ASSETS	NPLS_TO_TOTAL_ASSETS	TIER1_CAP_RATIO	RETURN_ON_ASSET	TOT_LOAN_TO_TOT_ASSET	PX_TO_BOOK_RATIO	BOARD_SIZE	INDEPENDENT_DIRECTORS_RATIO	AUDIT_COMMITTEE_MEETINGS	BOARD_MEETINGS_PER_YR	WOMEN_ON_BOARD_RATIO
Log_TOT_ASSET	1,000											
DEPOSITS_TO_ASSETS	-0,402	1,000										
NPLS_TO_TOTAL_ASSETS	-0,330	0,397	1,000									
TIER1_CAP_RATIO	0,182	-0,079	-0,068	1,000								
RETURN_ON_ASSET	0,087	-0,003	-0,447	0,039	1,000							
TOT_LOAN_TO_TOT_ASSET	-0,769	0,451	0,436	-0,219	-0,060	1,000						
PX_TO_BOOK_RATIO	0,002	0,119	-0,173	-0,061	0,328	-0,065	1,000					
BOARD_SIZE	-0,018	0,067	-0,021	-0,169	-0,009	-0,083	-0,177	1,000				
INDEPENDENT_DIRECTORS_RATIO	0,041	0,094	0,011	0,028	0,114	0,076	0,140	-0,302	1,000			
AUDIT_COMMITTEE_MEETINGS	-0,054	0,010	0,228	-0,096	-0,083	0,143	-0,159	0,119	0,138	1,000		
BOARD_MEETINGS_PER_YR	-0,160	-0,024	0,224	-0,009	-0,156	0,201	-0,157	-0,217	0,041	0,313	1,000	
WOMEN_ON_BOARD_RATIO	0,252	-0,226	-0,181	0,284	0,060	-0,164	-0,009	-0,289	0,043	-0,247	-0,044	1,000



## **Chapter III: CDS and the forecasting of bank default**

### **Abstract**

The last financial crisis hit worldwide economies with an unprecedented magnitude. In order to predict bank default or banking crises, some empirical papers have been written ever using sophisticated tools that can use models from operational research. Based on a short analysis of the forecasting power of several types of financial products, we conclude that CDS characteristics are the best measure to forecast and thus ideally prevent the potential default of a bank. Thanks to the economics of CDS and the results of other empirical studies, we show that CDS spreads are undoubtedly a good, though not a perfect proxy for bank risk, even though they are more sensitive to information changes than other products.

So, by creating and using a specific trigger based on CDS and the appropriate response, in the case of the trigger being activated, we examine if we could prevent the default of a bank. But as CDS spread cannot be taken as a perfect proxy for the true probability of default of the underlying corporate entity, we had to investigate further to try to find another benchmark. Initially, a good candidate appeared to be the Markit 5-year iTraxx Senior Financial index. So, using the CDS of each bank and this index, we first applied the following procedure: an intervention should be triggered whenever the CDS price (or spread) is above 100 bps for at least 20 of the last 30 trading days.

We studied 50 among the TOP 100 European banks for the period from 2007 to 2013 and examined a few in detail results. We found that one or even two triggers at 100 bps gave disappointing results, as most of the banks went over this limit during the second year of our period of study. Subsequently, we were better able to see how to manage some properties that we had identified by using a meta-rule that took account of the lapse of time between two thresholds based on CDS spreads in order to forecast any significant financial distress for a bank. This gave more reliable results for forecasting bank default than our less sophisticated first approach and could be useful to regulators.

## 1. Introduction

By the end of the 90's a few researchers had addressed the question of the prediction of bank default and banking crisis. We are going to deal with this larger topic before directly focusing on the purpose of this study in section 2. Indeed, the two last decades of the past century ended with a substantial amount of different types of banking crises everywhere in the world i.e. situations where banks can no longer perform their role as intermediates because they become insolvent i.e. their liability value is larger than their asset value.

Three-quarters of IMF countries experienced banking distresses in the period 1980-1996 state *Davis and Karim (2008 a)*. These two decades of financial liberalization have also been accompanied by an increase of new financial products with enhanced effects because of computerization and internationalization of financial markets. The major changes to the American Glass-Steagall Act, adopted in 1999 under the Gramm-Leach-Bliley Act, allowed commercial banks, investment banks and insurance companies to consolidate and then to become universal which permits these new whole entities to fully diversify their investments with negative and positive effects on risk-taking as a result.

The financial crisis that peaked between 2008 and 2009 began in the US in 2007 with the collapse of subprime mortgages. *Demyanyk and Hasan (2011)* state the subprime securitized mortgage outstanding debt of the US market amounted to \$1.8 trillion in 2008 (for securities issued between 2000 and 2007) in comparison to the total of the US securitized mortgage debt of \$6.8 trillion. We now know that the strong impact on economy was because of the grouping together of individual securities that were later repackaged to create even more sophisticated products. Nevertheless, it is difficult to explain the extent of this crisis to such a level and how it impacted so heavily outside the US. *Levine (2010)* finds that during the preceding decade with regards to financial policies, major conflicts of interests appeared among Credit Rating Agencies and banks started to purchase a massive amount of CDS from 1996 because of the Fed's decision permitting them to reduce their bank capital, thereby encouraging risk-taking (not to mention the lack of transparency within OTC markets). This regulatory decision had a terrible impact on the banks which then reallocated capital to higher-risk assets, higher-expected returns, *Stulz (2010)*. Indeed, before the beginning of the financial collapse in 2007, CDS have grown dramatically from the mid-1990s to reach a notional value of \$62 trillion in 2007 *Levine (2010)*, inside a market of derivative products of \$615 trillion at the end of 2009 where more than 80% are OTC traded.

In particular, according to International Swaps and Derivatives Association (ISDA), the outstanding credit derivatives have increased by 128% from June 2004 to June 2005.

Obviously, other factors or determinants must be considered as *Taylor (2008)* shows that due to lenient monetary policy, interest rates fell from 2002 to 2004 and this resulted in a monetary excess that in turn contributed to the housing boom and then the subsequent burst and collapse (cf. Taylor rule). The rise of housing prices was confirmed in *Reinhart and Rogoff (2008)* and they also show a far larger growth rate for the house prices in the US than

in Sweden (1991), Finland (1991), Spain (1977), Japan (1992) and Norway (1987) at the time of their financial crises. A sudden lack of banking liquidity for bank credit markets must also be considered, hence leading to contagion.

*Demirgüç-Kunt and Detragiache (1998)* show that a banking crisis tends to arise more often in countries that have experienced financial liberalization and that the related effects are reduced by a strong institutional environment. Their study during 1980 to 1994 is based on a multivariate logit model linking the likelihood of a crisis to a vector of explanatory variables. They find that if the macroeconomic context is not strong enough then low GDP growth, high real interest rates and high inflation and an explicit deposit insurance system can lead to banking crisis.

However, in theory, an explicit deposit insurance system should mitigate against the fragility of banks as a self-fulfilling panic as described by *Diamond and Dybvig (1983)*, but this implies some more risk-taking by bank decision makers (i.e. a moral hazard), all the more as we are considering the years after 1999 i.e. post the Gramm-Leach-Bliley Act. They focus mainly on macroeconomic determinants and assert that this is partly because of a lack of data among the potential choice microeconomic variables of banking and regulation, hence the need to investigate further bank level information. This was confirmed by *Demirgüç-Kunt and Detragiache (2005)* for an extended period from 1980 to 2002 for this study with 94 countries and up to 77 crisis occurrences in their enriched sample.

Another methodology was used by *Kaminsky and Reinhart (1999)* who found that financial liberalization often results in a banking crisis and subsequently a currency crisis, which in turn fuels the banking crisis, creating a vicious circle. Their sample consisted of 20 countries and included 76 currency crises and 26 banking crises from 1970 to 1995. They find 26 currency crises and 3 banking crises for the period from 1970 to 1979 and 50 currency crises and 23 banking crises between 1980 and 1995. This major increase of banking crises is linked to the post-liberalization era, whereas that of the 70's may be attributed to a very regulated decade. They use a non-parametric approach based on a signal extraction model to reach their conclusions (\*). With the help of a minimization of their Noise To Signal Ratio given by a Probability of Type II error / (1 – Probability of Type I error), they construct a country specific threshold and then obtain a benchmark for an Early Warning System with univariate indicator signals. Their most valid variables are among the group of capital account (reserves for instance) and financial liberalization (such as real interest rate that predicts 50% of banking crises and domestic credit / GDP that produces 100% of banking crises).

For crisis prediction, *Demirgüç-Kunt and Detragiache (2000)* went further revealing that this type of model produces less in-sample Type I and Type II errors regarding probability estimations than in the signal extraction model of *Kaminsky and Reinhart (1999)*.

(\*) Defining a specific interval of time between signals and crisis, they establish specific thresholds for each of their fifteen variables in order to compute their related time series of 1 (signal of crisis) or 0 (no-signal of crisis) measures any time their determinants go over their given threshold during the selected elapse of time. Then, they operate a reconciliation between those series and actual events (crisis or no-crisis) in order to design their measure of predictive accuracy.

Using their model, the monitor selects the probability threshold that would minimize a loss function characterizing the likelihood of either the costs of taking an action should no crisis happen or the costs of no action when problems arise. Two frameworks are contemplated: the first attempts to assess how deep the fragility is in order to intervene or not, and the second involves the rating of the fragility of the banking system. They consider six banking crises that span the years 1996 and 1997 i.e. the Jamaican crisis of 1996 and the five East Asian crises of 1997, building related out-of-sample forecasted probabilities. For three of these six crises the results are too optimistic and the authors explain this by the novelty of their econometric evaluation of systemic banking crises, in particular the use of their forecasting and monitoring tools. Furthermore, as a crisis is often triggered by new phenomena, coefficients that were used inside in-sample models might be pointless out-of-sample. In addition, it is important to consider the inherent following bias for this type of study: banking crises do not occur often and so consist of rare events (36 crisis episodes only compared to 766 observations used for in-sample estimation), not to mention extreme events regulators incorporated since the previous financial crisis.

By comparison between the multivariate Logit models in *Demirgüç-Kunt and Detragiache (2005)* and the signal extraction method in *Kaminsky and Reinhart (1999)*, *Davis and Karim (2008 a)* we conclude that, as far as the in-sample predictive ability is concerned, the multivariate logit model gives more acceptable results than those from signal extraction. Also, their results show that the multinomial logit model is more likely to agree with global Early Warning Systems whilst the signal extraction methodology is better for country specific Early Warning Systems. They find that changes in terms of trade and real GDP growth are the best predictors for banking crises for their sample.

Binary Recursive Trees (BRT) or decision tree techniques are used in research on machine learning and often feature in medical research. Based on a recursive partitioning algorithm using “If-Then” rules to undertake solving prediction questions implemented in Early Warning Systems, these rules can classify banks as in *Davis and Karim (2008 b)* or later, in *Davis, Karim and Liadze (2011)*, using a proprietary software package (“CART”, Salford Systems Inc.). Instead of addressing the question of the likelihood of a banking crisis in  $n$  years as in a multivariate logit model, BRT partitioning tries to guess what non-linear variable interactions are more likely to weaken an economy with regards to banking crises. Moreover, the BRT non-parametric approach requires no specific statistical distribution which is a substantial advantage, especially as there is no need that all variables follow the same distribution as each variable takes the same distribution across cross-sections. However, the results for OECD countries (including emerging market countries) in *Davis and Karim (2008 b)* with both BRT and logit models give no robust results regarding a potential increase of crisis probability before the subprime crisis (i.e. for the preceding two years). Specifically, the Logit model gives better performances for the UK and the US. This is probably why *Davis, Karim and Liadze (2011)* showed that global samples are irrelevant

when they pool data so it was more efficient to use both models to assess zones separately (such as Asia, or Latin America) in order to deal with policy objectives.

The movements of Distant to Default (DD) which is a classical market-based measure of corporate default risk has been found to be a tool with predictive power for major Japanese banks, *Harada, Ito and Takahashi (2013)*. Indeed, by investigating specifically three major failed banks they find that the DD is a reliable measure of bank failure prediction, as well as the DD spread (DD of a failed bank minus the DD of sound banks i.e. a benchmark defined by the average of the five largest regional banks' DD). However, this sample is not very large and what is more, one of the three failed banks did not produce the expected results because its financial statements were window-dressed, even though *Harada et al. (2013)* tried to control results in an econometric probit model using panel data of three failed plus eight former banks.

Another non-European study partly confirms the forecasting power of Distant to Default (DD), *Miller, Olson and Yeager (2015)*. Between 2006 and 2012, they estimate the quality of prediction (accuracy) of market signals i.e. Expected Default Frequency (EDF) and Subordinated Note and Debenture (SND) yield spreads against accounting-based signals which would turn out to indicate distress.

In particular, they show that if EDF signals from 2007 to 2008 succeeded in identifying Bank Holding Companies (using 473 BHCs) in the USA that became distressed within two following years, their economical impact concerning reducing missed distress events is not significant.

*Wilson (1998)* and the McKinsey company proposed a model, CreditPortfolioView, which is based on a discrete time multi-period model and that only measures default risk. In this multi-factor model, default probabilities which are generated by a Logit model depend on macroeconomic variables (such as growth rate, level of interest rates, unemployment, etc.). These variables are specified for each country and they capture their state of economy. Furthermore, each of these independent variable is assumed to follow an autoregressive model of order 2 (AR(2)). Then, the main idea of CreditPortfolioView consists of connecting those macroeconomic factors to the default and migration probabilities.

However, in order to calibrate the model, reliable default data for each country and their related industry sector are needed as mentioned *Crouhy et al. (2000)*, and another limitation also exists because the model requires a specified procedure to adjust the migration matrix. Indeed, because of the brevity of historical past records, it is really difficult to cover several credit cycles and test the inherent model robustness in case of a crisis.

Another strategy used to improve results consists of improving an existing methodology. Thus, *Calabrese and Giudici (2015)* propose a model that deals with extreme values, applied to 783 small Italian banks (less than 20 are listed) during the period 1996-2011. Through a Generalized Extreme Value (GEV) link function they implement the Generalized Linear Model

(GLM) of *Calabrese and Osmetti (2013)* that explains the use of a dependent variable i.e. a distress event from macroeconomic and banking oriented microeconomic explanatory variables.

Indeed, they show that their regressions are of better quality than those which are based on logistic models with an important reduction of the false negatives that correspond to bank failures that are classified as correct (or type I errors) especially as this is important for Early Warning System criteria.

In fact an asymmetric link function such as the GEV mitigates against the problem of the symmetry around the value 0.5 for the logistic link function by more appropriately taking account of information that exists in the default distribution tail when approaching the value of one.

In order to compute the probability of failure, a discrete-time survival model can also be used, *Fiordelisi and Mare (2013)* following *Männasoo and Mayes (2009)*. Working on one of the largest cooperative banking markets (Italy) that is mainly composed of small credit institutions between 1997 and 2009 they show that the more efficient banks are, then the higher is their probability of survival. In their paper, efficiency determines three funding hypotheses that are related to cost minimization, revenue maximization and profit maximization.

If cooperative banks are more fragile than commercial banks with regards to failure in a period of financial stability then they also find that a higher capital adequacy capacity decreases the probability of default, hence giving credence to the European banking regulation enforcement with the Basel III agreement (addressing moral hazard mitigation and increased capability of loss absorbency). We note that this study mainly focuses on small credit institutions that constitute the group of cooperative banks in Italy which is far different from the bigger banks in Europe that we have studied.

Other very technical and sophisticated tools have been developed in the empirical literature using operational research models such as Case-based reasoning, Neural Networks, Trait Recognition, Multicriteria decision aid, etc. as described in *Demyanyk and Hasan (2011)*. Interestingly, none of these methods appear to be substantially better than another, if we compare their results. This is why it may be more efficient to combine at least two of them e.g. *Davis and Karim (2008 a)* or *Davis, Karim and Liadze (2011)*, depending on either the global or country / zone specific Early Warning Systems we want to focus on.



## 2. A well-balanced approach for CDS forecasting power: justifications

### 2.1 Why use CDS in our approach?

Our main purpose is to focus on empirical ways to examine how CDS should be used to forecast and prevent the potential default of a bank. So, this research could be useful to the regulator which could make an intervention in due time before a bank defaults provided that an ad hoc procedure is conceived.

We define “bank default” in terms of “financial distress” (see sub-section 2.6).

CDS or Credit Default Swaps are part of the credit derivative group of financial products. They provide a type of insurance against credit risk. In 1994, these CDS credit derivatives were developed by Blythe Masters of JP Morgan. Initially, banks used them to hedge credit exposures on their balance sheets.

We could pose the question why use CDS instead of other financial products?

Portfolio strategy became more efficient and more sophisticated in the early 90’s when credit derivatives first appeared. Basically, one can now separate credit risk management from the underlying asset risk.

So, because of this financial innovation, markets change e.g. risk pricing, risk transfer or risk buying have become more widespread for nearly all maturities, products or states. Thus, degrees of freedom have been increased by dividing risk factors and in doing so, they have allowed a more active risk management for asset managers.

With a more liquid market and the capacity of hedging under specific conditions for risk management, we can now regard markets as complete because of credit derivatives.

One of the main reason for using CDS lies in the potential of a CDS market to lead other markets in terms of information discovery. As such it leads the stock market and the bond market (*Hart and Zingales, 2009, Chiaramonte and Casu, 2011, Flannery et al, 2010*).

By comparison the bond market tends to lack liquidity since there is a lack of standardization. Under these circumstances, bond prices are a less reliable indicator in terms of solvency than CDS prices. Having greater liquidity, CDS success results from their standardized nature.

We could also use equity prices, but these are not a good measure of financial distress, despite their related liquid markets and market prices which are hard to manipulate. If equity is insensitive to the downside, because of limited liability, it is very sensitive to the upside. Furthermore, high prices do not mean that the SIFI (Systematically Important Financial Institutions) have no problems.

This is why it is important to have a more detailed view of exactly what approach to default risk we need exactly. If we consider CDS as relevant products, we can proceed using a specific trigger based on CDS followed by the appropriate intervention action: should the trigger be activated the default of a bank could be prevented.

But are we sure that CDS spreads are a good indicator of a bank default or the best one (*Chiaramonte and Casu, 2011, Sundaresan and Wang, 2011, Flannery et al, 2010*)?

These empirical studies and others have attempted to answer this question as well as the specific CDS type of trigger to choose. Exactly what spread and what level of spread is required to activate the trigger is definitely important to investigate.

It remains to evaluate if CDS could become a relevant product and what are the triggers for that and what precisely CDS are and how they operate, especially in order to predict and avoid bank default.

*Hart and Zingales (2009)* have found that the following condition would make sense in order to detect the right time to intervene, based on an indicator and a trigger that are both relevant:

“Trigger intervention whenever the CDS price is above 100 bps for at least 20 of the last 30 trading days”. Moreover, this rule will be safer for manipulations than one that states that the CDS price could never go above 100.

We could also examine the need to use a trigger of 100 bps rather than for example 50 or 150 and try to justify the choice with a qualitative study on several banks. It may also be interesting to mention cases where CDS did not react as we would have expected and to understand why.

In addition, we could also build a dynamic indicator instead of using a static “barrier” like the previous one of 100 bps. As it happens that CDS may not always react efficiently to a fixed level, why not compare or mix two indicators i.e. the first one based on CDS and the second one, based on another type of financial indicator (or index of CDS) and establish a decision rule based on the interpretation of this comparison (or a ratio)?

Thus, as *Hart and Zingales (2009)* specifically illustrated that we could use CDS contracts to monitor banks’ solvency, we would like to show that the observation of CDS (combined this time with another indicator) is a better measure for an increasing probability of default. With the addition of a smart trigger it could also result in an efficient way to take steps when a rescue is still possible.

Based on evidence from the financial crisis, *Chiaramonte and Casu (2011)* focus on the field of bank CDS spreads on a true international level in comparison to other less specialized studies.

Their approach is original in that they focus specifically on balance sheet ratios, because these provide brief and direct information on a firm’s financial health. Their paper also includes recent events of the financial crisis starting in July 2007.

Their analysis appears to be sufficiently extensive as it consists of three time periods which are a pre-crisis period (1 January 2005 / 30 June 2007), a crisis period (1 July 2007 / 31 March 2009) and its less acute phase period (1 July 2007 / 31 March 2010).

The study was based on a sample of 57 mid-tier to top-tier international banks (in terms of assets) and with senior CDS spreads of 5 years.

The results come from a fixed-effects panel regression and the explanatory variables are essentially balance sheet variables relating to Asset quality, capital, liquidity, and earning potential. Their main conclusions are:

- Bank CDS spreads reflect the risk captured by the bank balance sheet ratio and this becomes more sensitive over the two crisis periods.
- During the two crisis periods, the relationship between balance sheet ratios and bank CDS spread became stronger because there was a growth in the number of significant explanatory variables.

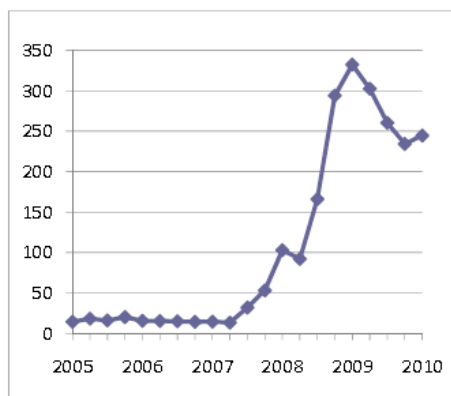
Furthermore, the ratio “loan loss reserve” to “gross loans” (an asset quality determinant) is basically a unique ratio which is appropriate for all three periods.

Indeed, there is an increase of the probability of default for those banks which obtain poor quality loan portfolios.

We also learn from their results that the crisis made the change in sign for liquidity (cf. liquidity variable and its relationship with CDS spreads, their dependent variable that measures the probability of default). Thus, the authors can assert that the financial crisis led finally into a liquidity crisis.

Hence with these conclusions their results (in bps i.e. basis points) in the following chart are hardly surprising.

*Figure 3 => Trend of average CDS spread values for the 57 sample banks chosen world-wide*



(Source: Datastream database).

Their conclusion and results serve to confirm and support the authors with the aim “not to predict, but to explain credit spreads”.

## 2.2 Aspects of the forecasting potential of CDS

The prediction capacity is precisely what we would like to investigate further.

Unfortunately, according to for *Anderson (2009)*, changes in CDS tend to reflect mainly the market's trend to bear default risk of a company rather than changes in the solvency of that company. Indeed, he has found that the volatility of the price of default risk was ten times larger than the physical default intensity.

Thus, things are certainly more complex than *Hart and Zingales (2009)* claimed. The reliance upon CDS spreads for the purpose of macro-prudential regulation is likely to be misguided or an adapted control for the change in spread (absolutely resulting from changes in the markets' pricing of credit risk) is needed.

It is of paramount importance to note that there is a convergence of the relevance of some proxies used in the *Anderson (2009)* and the *Chiaramonte and Casu (2011)* papers.

One of the main results of the *Anderson's (2009)* paper is that credit market tightness exerts a profound influence on the market price of default risk (the proxy used is a measure of non-performing commercial loan).

From a conceptual point of view, it comes very close to the ratio "loan loss reserve" to "gross loans" (Asset quality determinant) used by *Chiaramonte and Casu (2011)* and both of those proxies have been shown to be the best ones for the regressions in each study.

Of course, this implies that considering CDS spreads, there is a market consensus on the creditworthiness of the underlying corporate (and also for a bank). However, according to *Rama Cont (2010)*, the market practice of computing the implied default probability of a company from its CDS spreads incorporates this characteristic by using default probabilities for the pricing of credit derivatives.

As implied volatilities are derived from option prices, we suggest that such implied default probabilities do not necessarily provide any information of a potential default or even the actual likelihood of a default of the reference entity. They may simply be the result of the market consensus on the CDS premium for default protection at different maturities.

In this context, it is important to remember that hazard rates and implied default probabilities are dependent on the hypothesis set for recovery rates.

Now, the use of the CDS spreads as sign of credit quality have been appropriate in the CitiGroup and Washington Mutual case with a trigger intervention mechanism as described by *Hart and Zingales (2009)*, hence the relevance for an earlier potential intervention of the regulator.

### 2.3 Choice of a possible second indicator to complement CDS spreads

The major contribution in the article by *Huang, Zhou and Zhu (2009)* was the design of a new indicator to assess the systemic risk of the banking sector (examining a group of 12 major US banks for their sample period 2001-2008) using the price of insurance against financial distress for those banks in the following 12 weeks.

They proposed a regularly capital surcharge that could be estimated on these major US banks based on information from the CDS market.

Thus, this capital charge is based on ex ante measures of the large individual banks' CDS spreads to obtain their probability of default (PD) and an estimation of asset return correlations was undertaken using high-frequency equity information.

In particular, their results suggest that *“the systemic risk indicator, the theoretical insurance premium required to protect against insurance default losses that equal or exceed 15% of total liabilities of the 12 US banks, stood at \$ 110 billion in March 2008 and had a projected upper bound of \$ 250 billion in July 2008”*.

Thus, this indicator is higher when the average failure rate increases or when the exposure to common factor rises.

In the previous sub-section, we have noted that CDS spread cannot really be taken as a perfect proxy of the true probability of default (PD) of the underlying corporate. In fact, the market price of a CDS is based on the risk-neutral distribution of the underlying risk. And one of the 10 major conclusions of *Jarrow (2010) about CDS* is the following:

*“CDS spreads can be decomposed into: (a) the expected loss, plus (b) a default risk premium (reflecting the market price of default risk), plus (c) asymmetric information monitoring costs, plus (d) a liquidity risk premium due to a quantity impact of trades on the price. Of course, these components are interrelated”*.

Note: the expected loss can be seen as the market's assessment of the physical default distribution (PD, LGD). Note that LGD stands for Loss Given default.

So, any of these four factors could have an impact on changes over time observed in CDS spreads. Then, there is little possibility that factors b to d are always stable and come from a rise in spreads that the underlying corporate's probability of default (PD) had increased, even if these factors are obviously interrelated.

As we have already stated using the assertion by *Hart and Zingales (2009)*, the reliance upon CDS spreads for the purpose of macro-prudential regulation is likely to be misguided or an adapted control for the change in spreads (entirely resulting from changes in the markets' pricing of credit risk) is needed.

Hence, we are strongly suggesting that only monitoring CDS spreads on banks might not provide a complete explanation for bank solvency and a potential default.

This is why we would like to produce a combined approach to monitor banks' solvency based on both observations of CDS and another indicator (which could be an index of CDS) as well as their interrelation.

It is also worth knowing that the credit triangle relation (simple case of CDS valuation) correlates with the previous conclusions of *Jarrow (2010)* and *Raunig (2011)*, i.e.

$$1\text{YearCDS\_Spread} = 1\text{YearDefault probability} \times (1 - \text{Expected Recovery Rate})$$

where  $1 - \text{Expected Recovery Rate} = \text{Loss Upon Default (or Loss Given default)}$ .

Note that expected recovery rates and default probabilities are both often unobservable but the CDS spread is observable and it can be used to calculate default probabilities given a recovery rate assumption.

#### 2.4 Factors that create conditions for a trigger

As stated by *Hart and Zingales (2009)* concerning indicators and especially a trigger we do not want to get a static barrier such as 100 bps, because it could lead to the same sort of bias obtained using triggers based on market price, for example, or induce potential market price manipulation.

It may be better to look for a dynamic trigger. *Prescott (2012)* proposes four properties of Contingent Capital and concludes *“the trigger is the weak point of contingent capital and, more specifically, a trigger based on market price”*.

Furthermore, it is not acceptable to price contingent capital, whether the trigger is a fixed one or a regulator’s intervention based on a signal.

*Sundaresan and Wang (2011)* illustrated why contingent capital with a market equity trigger did not produce an obvious solution. It is worth examining why and seeing if there are some conditions or a path which could sufficiently be useful without condemning or rejecting this approach totally.

They assert that *“a contingent capital with market equity trigger does not in general lead to a unique equilibrium in the prices of the bank’s equity and contingent capital”*.

Depending on the design of the contingent capital and the underlying dynamics assets, unique, multiple or even no equilibrium may result: if conversion strongly dilutes equity, then there are multiple equilibria and if conversion increases the equity value, then there are no equilibria.

Indeed, this is contradictory to the definition of this type of equilibrium which requires that a unique price should be consistent with the chosen rule of conversion.

In addition, no agent is authorized to select a policy conversion for their best interest. So, conversion rules should make sure that it does not change the security value (on which the trigger is set).

In conclusion concerning equity triggers, they showed that no value transfer should be created by the conversion ratio which gives a unique equilibrium. And, dilutive ratio especially shaped to punish bank management or to promote coercive issuance will lead to multiple equilibria.

Similarly with the accounting ratios consequences, whether multiple or no equilibrium, contingent capital of this kind not only leads to price manipulation, but also to capital allocation of poor quality, market uncertainty and no reliable conversion. If contingent capital cannot evolve into loss-absorbing equity when necessary, then contingent capital will not be a true substitute for common equity as a capital buffer.

This still occurs even if banks have the capacity to issue new equity in order to avoid conversion.

Naturally, it is even more problematic if there are bankruptcy costs and sudden jumps in bank assets; then, we must not transfer value between equity holders and contingent capital investors, in order to obtain a unique equilibrium, at the trigger price. However, this unique equilibrium will deprive contingent capital from its incentive component that prevents management from taking excessive risks (hence, no punitive conversion can be expected!).

As a 1<sup>st</sup> short set of conclusions using the research above, we would like to make two fundamental points:

1. To generalize the example of the non-efficient market price trigger we looked at with Contingent Capital, it appears that a fixed trigger is certainly not totally reliable, sufficiently independent of regulators' intervention, objective enough and timely or even difficult to manipulate.
2. Thus, instead of a market price, Credit Default Swap could be the convenient indicator in the light of the previous findings.

This is why we are attempting to establish conditions for a dynamic trigger used with CDS as indicators. Of course, if we could find a trigger that prevents Capital Contingent with a market equity trigger from not leading to a unique equilibrium or that gives minor inefficiencies, this would be perfect.

Unfortunately, we have just shown that this is not realistic and these results may apply to all triggers if they depend on market value of equity (directly or indirectly).

Now, *Sundaresan and Wang (2011)* (quoting *Pennachi (2010)*, *McDonald (2011)*, *Glasserman and Nouri (2010)*), came to the conclusion that under the conditions that the trigger's variables should not be affected by the capital conversion or in other words they are exogenous, thus we obtain a unique equilibrium and hence get a price for Contingent Capital.

As a 2<sup>nd</sup> set of conclusions, we come to three additional fundamental points:

3. Any trigger that depends on market value of equity (directly or indirectly) is not appropriate; hence, the relevance of CDS. The same effect applies to the intervention of a regulator. *Bond, Goldstein and Prescott (2010)* find that interventions in the operations of a bank by regulators do not produce robust solutions.
4. The variables upon which the trigger is based for the conversion should be as much exogenous as possible.
5. Considering the four previous fundamental points, we should not use a single indicator based only on the CDS of the concerned bank.

Market manipulation is another issue we must also address. *McDonald (2011)* showed that a reduction of the potential impact of manipulation could be considered provided that we implement the following 3<sup>rd</sup> set of conclusions:

6. If we look for a second indicator as an index as in the dual price trigger approach used by *McDonald (2011)*, then the index conversion should be based on an average price over time, or see also the point 7. These two processes are indeed suggested to prevent traders from manipulating the index when the bond is close to maturity.
7. The main drawback of the point 6 lies in the delay that may be induced by a multi-day average. So, by randomly and gradually withdrawing the bond as maturity approaches, one can mitigate against the big gains that may happen at maturity.
8. A rather direct consequence based in part on the point 7 requires that conversion must occur transparently, automatically and above all, promptly (as soon as the trigger is released, see *Flannery, 2009*).

#### 2.5 Suggesting a new indicator to optimize the forecasting power of CDS

In order to build our trigger mechanism, we are going to use the Markit 5-year iTraxx Senior Financial index given by the Bloomberg company (by default we call it iTraxx or iTraxx SF). It comprises 25 equally weighted CDS on investment grade European entities (16 Banks and 9 insurance companies).

The composition of each Markit 5-year iTraxx index is determined by the Index Rules. Market iTraxx indices roll every 6 months in March and September.

It is important to understand that the iTraxx is sensitive to perceived risk in the economic world. It expresses the credit risk related to the lending to bank and insurance companies. Then, an increase of the iTraxx suggests that lenders think that the risk of default on interbank loans is rising.

And, this is exactly what we want to look at. Indeed, credit market tightness exerts a profound influence on the market price of default risk.

As the use of an index brings at least one more condition (or constraint), taking the iTraxx spread is really appropriate and more robust in our context, as it is based on the 25 banks and insurance companies shown in the following page.



Tab 28 =&gt; Bank and Insurance companies that are used by the iTraxx

Company name (1/2)	Company name (2/2)
Aegon NV	Hannover Rueckversicherung AG
Allianz SE	HSBC Bank PLC
Assicurazioni Generali SpA	ING Bank NV
Aviva PLC	Intesa Sanpaolo SpA
AXA SA	Lloyds TSB Bank PLC
Banco Santander SA	Muenchener Rueckversicherungs AG
Barclays Bank PLC	Societe Generale SA
BNP Paribas SA	Standard Chartered Bank
Commerzbank AG	Swiss Reinsurance Co Ltd
Credit Agricole SA	Royal Bank of Scotland PLC/The
Credit Suisse Group AG	UBS AG
Deutsche Bank AG	UniCredit SpA
	Zurich Insurance Co Ltd

A broad financial stock index could relate too strongly to a particular bank's own stock price. This is why even if we have independently selected in our study 16 of the banks among this list (and 34 more to get 50), 9 insurance companies had been added to it in order to build the index.

Consequently, as *McDonald (2011)* suggested using Contingent Capital with a dual price trigger, we are going to use two indicators.

Then, our decision rules state that these triggers be activated if and only if:

1. The CDS price is above an absolute number of 100 bps for at least 20 of the last 30 trading days. The corresponding date is termed T100.
2. The iTraxx SF is above an absolute number of 100 bps for at least 20 of the last 30 trading days. The corresponding date is termed T100 and we would have termed it T200 or T300 if we had chosen an absolute number of 200 bps or 300 bps respectively.

The conditions 1 and 2 must be met in order that any relevant action should be taken. However, considering Large Financial Institutions (LFI) especially (i.e. systemic banks), it is vital not to wait for the second condition to be realized; otherwise, it could lead to multiple equilibria, as *McDonald (2011)* showed (in its 9<sup>th</sup> footnote in particular) about Too Big To Fail institution and the use of an index trigger.

Now, if the first trigger is set off with a non-LFI, we also suggest that this bank should immediately be placed under careful scrutiny. An equivalent rationale leads us to suggest that the calculated T100 for the iTraxx Senior Financial index produces an important starting date to put all the declared systemic banks under careful scrutiny, even if their own trigger has not been reached yet.

However, in this case, it would not be such a big problem if in normal times we let a non-LFI performing badly go bankrupt. So, this process permits a non LFI to collapse in good times which is in accordance with classical liberal views, by giving a strong signal to too many risk takers.

Basically, giving the Too Big To Fail institutions a false feeling of security in that they believe that they will always be saved at the expense of the states, it makes them increase their risks. This is the reason why we must clearly distinguish between the systemic banks and non-systemic ones.

Indeed, we definitely require fixed triggers that are activated if absolute barriers are breached.

Note that the 1<sup>st</sup> condition was introduced by *Hart and Zingales (2009)*, but no combination with another trigger to build a more sophisticated process was used.

## 2.6 Conditions for Bank default or financial distress

A bank default consists of a bank failure that leads more often to a big bank bailout which is “not so common” in Europe.

This is why we are going to examine the factors that lead to significant financial distress. Of course, it sometimes happens that a bank financial distress becomes a bank failure that may require a big bank bailout i.e. a national rescue.

Then, a financial distress means that at least one of the following credit events occurs:

- Recapitalization / new injection of capital of more than €1.5bn
- Rise of capital by shareholders or rights issue of more than €1.5bn
- Partial nationalization or total nationalization
- Takeover by another bank or transfer in a group of banks that merge together or forced mergers
- Failure to stress tests leading to the first and second bullet points above
- Important credit downgrade
- Run on the bank
- Substantial Guarantee issued by a state or approved by the EC
- Restructuring plan approved by the EC (EBA capital plan)
- “Restructuring”: a change in the terms of debt which are unfavorable to the creditor

- “Failure to pay”: Reference entity fails to make payments when they become due after expiration of any applicable grace period
- “Bankruptcy”: Reference entity is either dissolved or becomes insolvent or is otherwise unable to pay its debts

Note that these credit events are quite different from the one used by the ISDA (International Swaps and Derivatives Association) for the Big Bang and Small Bang changes (*ISDA supplements, 2009 and see also Markit study, 2009*). Indeed, our criteria are less restrictive and more numerous than the ISDA ones, especially because we want to be sure to illustrate sufficient financial distress cases because there were far less bank collapses in Europe than in USA.

The last bullet point above that concerns a “Bankruptcy” credit event, for the Reference entity (a bank in our case), comes from the ISDA repository (*Source: Barclays Capital*). We refer to the same source for the two previous bullet points concerning a “Failure to pay” credit event and “Restructuring” credit event, both defined by the Reference entity’s obligations.

It is also essential to check that a financial distress when it exists occurs not too far from our prediction date; otherwise the connection is less significant.

## 2.7 Description of iTraxx indices

Figure 4 =&gt; Markit 5-year iTraxx indices (from Bloomberg)



Between the 01/01/07 and the 17/05/10, the iTraxx SF and the iTraxx Europe indexes moved closely together, except from the beginning of October 2008 to the end of March 2009, when the iTraxx SF curve was lower than the iTraxx Europe curve (showing the impact of the financial crisis on big corporates as a whole).

The 5-year Markit iTraxx HIVOL index consists of 30 equally weighted CDS on the widest spread of non-financial European corporate entities.

The 5-year Markit iTraxx Europe index consists of 125 equally weighted CDS on investment grade European corporate entities, distributed among 4 sub-indices: Financials (Senior & Subordinated), Non-Financials and HIVOL. It is also interesting to note that the 25 companies included in the iTraxx SF and the 30 companies included into the iTraxx HIVOL are also part of the 125 companies figuring in the iTraxx Europe. Therefore, this last index is really a global one for European companies in comparison to the two others which are much more specialized. *Hull (2009)* also used the iTraxx Europe by dealing with Credit Indices.

The composition of each Markit iTraxx index is determined by the Index Rules and Markit iTraxx indices roll out every six months in March and September.

Note: we use T100 (BIS) for the second time the trigger is activated and T100 (Ter) for the third calculated T100 during the period of study.

## 2.8 Our initial approach and its limitations

In our list of European Bank Credit Events (see appendix), we list for each bank our calculated T100 trigger that is activated by the decision rule n°1, based on the simple mechanism of *Hart and Zingales (2009)*. As the T100 for the iTraxx Senior Financial gives the 14/03/08 date, we just have to evaluate if each bank is considered as systemic in order to follow our decision rules.

Should we opt for a systemic LFI, then the relevant trigger is necessarily the T100 found for that specific LFI, whatever the iTraxx date may be (14/03/08) in the decision rule n°2 i.e. condition n°2. In our list of bank credit events (see appendix), the 16 banks out of 25 financial companies that include 9 insurance companies used in the iTraxx SF index are named in quotes and (S) means that we consider that they are systemic in Europe which is not ideal, though it adds more stability.

For a non-systemic bank, the relevant trigger should be the bank trigger if its date is after the T100 of the iTraxx. On the contrary, the resulting T is going to be the T100 for the iTraxx Senior Financial and we show this in our list of bank credit events (see appendix) using “T=iTraxx SF”.

Only 8 banks belong to this category and most of the time, their calculated T100 in March or even February 2008 is very close to the final calculated T=iTraxx SF, excepted for Bancaja with a T100=03/12/07.

44 out of 50 banks had their T100 trigger activated in 2008 and for the 6 remaining banks it was activated in 2007 and 2009, so does a trigger at 100 bps also makes sense for our period of study?

### Highlighting some interesting results using our initial approach with four banks

(See in appendix our graphed data for these four systemic banks).

From Bloomberg Business week (07/01/13): *“since 2008, the EC has approved more than \$6.6 trillion in state aid to banks. So far only a quarter of that has been used, with the UK, Germany and Ireland receiving the bulk of the funds” (John Glover)*. L’Express on 3/07/13 mentions a recapitalization plan of €1.7 trillion to rescue banks and that is consistent with the Bloomberg figure.

Thus, we could directly observe the advantages of our rule using the selected banks such as the following four.

**Banca Monte dei Paschi di Siena S.p.A. (MPS):** T100=30/12/08 (S). The third largest bank in Italy (Information from 12/04/13). From our research, it appears that the first capital injection was on 27/03/09. If our model had been used intervention could have happened 3 months earlier, but we should bear in mind that ideally, all the declared systemic banks should have been under rigorous scrutiny from 14/03/08, consistent with the condition n°2 (iTraxx SF).

After a year of hesitation and rumours about recapitalization in 2011, in July 2012, a final bailout request of €3.9bn on 26/01/13 was approved by Banca d'Italia (CDS spread at 459.22 bps).

Conclusion for this initial approach: ideally a state intervention should have occurred on 30/12/08, but it is hard to understand why no serious action had been taken in 2011, especially because our second condition for the T100 had then been activated 3 times (the last time being 17/05/10) and also because the second 2011 half year was so difficult for the European banks, because of the Greek crisis.

So, more than one year of time could have been saved for this bank using our model!

Note that "Le monde" (10/08/13) reported that the bank did some window-dressing of its accounts before their near collapse at the beginning of the year 2013.

**Allied Irish Bank (AIB):** T100=26/02/08 (S). Allied Irish Bank is one of the "Big Four" financial institutions in that country along with Bank of Ireland, Ulster and National Irish banks (Information from 21/02/13).

Being considered as systemic, our rule predicts a trigger activation on 26/02/08, even if our iTraxx SF=14/03/08. According to our research, it appears that the first planned bailed out of €3.5bn arranged by the Irish government commenced on 12/02/09. By March 2011, the total sum of the required bailout was expected to climb up to €13.3bn.

The ISDA Determination Committee, consisting on 15 USA and European banks, decided that a restructuring credit event ONLY occurred on 9/06/11 (spread at 1193.65 bps)! No more Bloomberg data was available after 01/08/2011.

Conclusion for this initial approach: using our rule, intervention could have taken place a year earlier and even more, if we rather take into account the late date of the ISDA decision.

**Banco Commercial Portugues SA (BCP):** T100=13/03/08 (S). According to our research, it appears that the first available information for BCP, but also for Caixa Geral de Depositos SA (T100=14/03/08) and Banco Espirito Santo SA (BES) (T100=11/03/08) starts on of 5/05/10 with a status "on review" by Moody's for a possible downgrade.

BCP was actually downgraded on 2/06/10 by Moody's which also downgraded 7 other Portuguese banks (including the two previously mentioned) on 15/07/10, following the downgrading of the Portuguese government to A1.

The fact that Moody's has chosen this period of time appears all the more relevant as there were three bank CDS spreads over 500 bps in May 2010 (with a peak at 562.09 bps on 07/05/10 and at 1739.05 bps on 25/11/11, for BCP).

Conclusion for this initial approach: in April 2012, there was a Portuguese Government commitment for a €3.5bn recapitalization that led to a €3bn rescue on 7/06/12 with a CDS spread at 1162.91 bps!

Being a systemic bank, a state intervention should have occurred on 13/03/08, but it is hard to understand why no serious action had been done at least in 2011, because our second condition for the T100 had then been activated 3 times (the last time being on 17/05/10) and also because the second half year of 2011 was so difficult for the European banks (see at the iTraxx Financial CDS curve and the BCP one), because of the Greek crisis.

**Dexia Credit Local SA:** T100=16/07/08 (S). Unfortunately in this case, our data does not start at the beginning of our period of study i.e. 1/01/07, but only 16/06/08 with a huge slope. However, given the spread curve for many of banks before this date, we consider that our T100=16/07/08 is correctly calculated.

So, being considered as systemic, our rule would have required the bank to raise capital especially as the second condition had already been triggered with an iTraxx SF on 14/03/08. Using our rule, intervention could have occurred more than 2 months earlier as French, Belgian and Luxembourg states injected €6.4bn capital in Dexia on 30/09/08 and later the Belgian part was rescued by the Belgian Federal Government for €4bn on 10/10/11 (CDS at 956.7 bps on 25/11/11).

It is also interesting to note that the Belgian Government undertook a rescue near the 9/05/11 date when the iTraxx SF and the iTraxx HIVOL began to converge. Indeed the European banking value dropped during the second half year of 2011, mainly because of the Greek crisis.

Conclusion for this initial approach: since 2008, the global cost for the French state has amounted to a €5.5bn pure loss and to €2.5bn loss for the Belgian state (*Isabelle Rey-Lefebvre, Le Monde 6/06/13*) and this would have been undoubtedly been smaller if the rescue had happened sooner, with careful scrutiny of this systemic bank starting from 14/03/08, when the second condition of our rule was triggered.

### Limits

We could continue to do this for many banks, as nearly all of them had their T100 activated during the second year of our period of study. In addition, we have been able to calculate other T100 for many banks such as T100 (BIS) or T100 (Ter).

Our results also reveal that our second indicator is not as efficient in predicting a default. So, we intend to tackle the subject differently as our initial approach does not appear to be sufficiently efficient and robust.



### 3. Theoretical approach

#### 3.1 Issue with the level of the trigger

*Hart and Zingales (2009)* have suggested the following procedure:

“Trigger intervention whenever the CDS price is above 100 bps for at least 20 of the last 30 trading days”.

It is now appropriate to discuss whether it is relevant to use a trigger value of 100 bps as we have done so far. Basically, their model suggests an intervention every time the CDS price is above 0, which is not really adequate, hence the need to select a value above 0 such that the given spread may be traded.

They use the following credit triangle relation to estimate the one year default probability for a CDS price of 100 bps given an expected recovery rate set at 80% (100% - 20% = 80% where 20% is the Loss Upon Default).

Using:

$1\text{YearCDS\_Spread} = 1\text{YearDefault probability} \times (1 - \text{Expected Recovery Rate}),$

they obtained a risk neutral probability of default of 5% provided that their rule had been designed to include the probability of regulatory mistakes. However, following the CDS standardization in 2009, the recovery rate is fixed by convention at 40% or 20% for contract referencing sub debt. As we use Bloomberg 5-year Senior CDS spread for our selected banks, we are obliged to use this 40% recovery rate.

Then, using the same rational in reverse, it implies a default probability of 1.66% (5/3) which is three times inferior to theirs, hence leading to a huge value of CDS price at 300 bps if we want to keep the same error ratio at 5%.

Given the imposed 40% recovery rate, a default probability of 5% is more consistent with the chart from Barclays capital (see the next sub-section).

At the beginning of our period of study i.e. 01/01/2007 and during the first half year, CDS daily spreads were below 25 bps for our selected banks and this is also indicated either by the iTraxx SF or the iTraxx Europe indices for the first half year.

So, apparently, there is no need to use a trigger at 300 bps when 100 bps seems sufficient as a barrier and in addition this provides us with a shorter and more sensitive risk neutral probability of default at 1.66% rather than 5%.

Now, a CDS spread below 25 bps for our banks is definitely connected to low levels of risk which is not the reality in the long term for bank CDS spreads (even if a trigger at 100 bps worked quite well with the 6 American banks used during 2007 / 2008 in the *Hart and Zingales* paper).

As mentioned previously, nearly all of our selected banks had their T100 activated during the second year of our period of study suggesting that a 100 bps level may not be the best choice for our European banks, because it is too low.

Thus, we need to consider a larger level for our trigger, but what number exactly and can we determine it theoretically, if possible?

So returning to our theoretical approach that produced a larger trigger at 300 bps when we decided to maintain the default probability at a maximum of 5%, why not conclude that under these circumstances that we consider both a high “upper bound” of 300 bps and a low “upper bound” of 100 bps for our triggers?

Consequently, this possibility implies implementation of two levels of trigger, one for the period where the CDS spread are low and one for the period where the CDS spreads are high.

But, in doing so we would perhaps be moving from the fundamental idea of our initial rule based on two conditions using two different indicators with the same trigger at 100 bps (or 300 bps now).

### 3.2 CDS exposures and quantification

From a CDS position, the main related risks or exposures consist of a credit event risk and its “spread delta” (the same concept as that used by the Greeks indicators for options) that can be calculated from the credit triangle relation, as well as the interest rate sensitivity, the recovery rate sensitivity and exposure to the passage of time.

Based on the credit triangle relation that we have mentioned above it follows that the CDS spread is not really sensitive to recovery rate. In effect, the implied probabilities of default are roughly commensurate to  $1/(1-\text{Expected Recovery Rate})$  and the CDS payoffs are proportional to  $1-\text{Expected Recovery Rate}$ .

Consistent with that, we notice that on the default probability on the following page, when the recovery rate increases from 20% to 60%, it produces a rise of less than 5% for the default probability. So, if we raise the recovery rate, then we implicitly raise the default probability, but not significantly until a recovery rate of 80% (and conversely).

This explains why with a recovery rate that falls from 80% to the 40% rule, the probability of default diminishes more than for a fall of the recovery rate from 60% to 20%.

For instance, with a recovery rate of 40%, the corresponding spread of 200 bps i.e. the midpoint between 100 bps (our low “upper bound”) and 300 bps (our high “upper bound”) gives an implied probability of default of 3.33%.

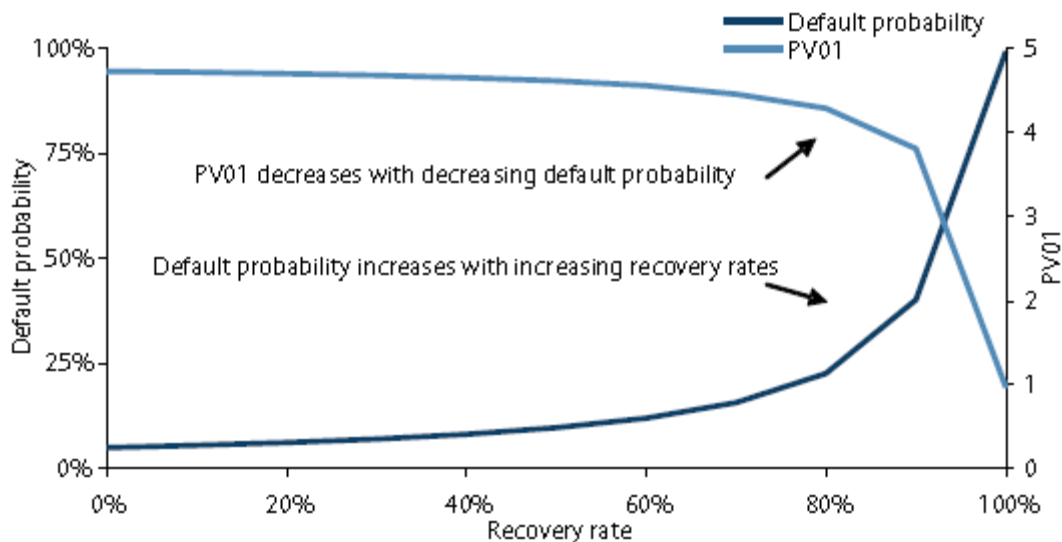
CDS-based estimates of default probabilities assume a 40% recovery rate, which is the average recovery rate estimated for North America by the Moody’s rating agency (1985-2005). In 2009, CDS standardization also fixed recovery rate at 40% by convention, as previously mentioned.

In the following figure, we show the default probability and PV01 against expected recovery rate (keeping the CDS spread constant) and we observe that:

A rise of the recovery rate => a “small” rise of the default probability on [0, 60] %

=> a “small” fall of PV01 on [0, 70] %

Figure 5 => Default probability and PV01 against expected recovery rate



(Source: Barclays Capital; note that PV01 decreases with **increasing** probability)

Note that the PV01 (or duration), sometimes referred as the risky PV01 or the CDS duration mentioned above is defined by:

PV01 = PV (Present Value) of a stream of 1bp payments at each CDS coupon date

Thus citing *Jarrow (2010)* concerning spread decomposition, it is commonly accepted to suggest that the credit risk applied to the reference entity and consists of three parts which are:

- The default
- The spread signature variation
- The variation of the underlying asset rating

This provides good evidence that there is a strong link between the probability of default and the CDS price in the credit triangle, although the initial 5% ratio of errors introduced by *Hart & Zingales* cannot appear as an absolute number which is not an issue because we should primarily consider it just as a target.

## 4. Empirical study

### 4.1 Data sample

We have selected our banks using the ranking of the Top 100 European banks on their total assets in 2008 (Fitch Ratings companies' data-base) that included 31 countries (EU and European Free Trade Association i.e. EFTA including Iceland, Norway, Switzerland and Liechtenstein). It is necessary to use consolidated accounts and this explains why the data are not always those communicated by the financial department of the related banks, because analysts had to reprocess accounting data.

Specifically, our sample encompasses the data for more than 63 European banks (the maximum of banks we found in the Bloomberg data-base for our European study), but we decided to choose 51 banks from these.

In our European study, more than half i.e. 32 of these banks are considered to be systemic or LFI. If we had strictly decided to take into account their total assets in Europe (over US\$ 1 trillion, for instance), then in 2008, the top ten systemic banks would have been only RBS, Barclays PLC, Deutsche Bank, BNPPARIBAS SA, HSBC Holdings PLC, Credit Agricole SA, ING Group, UBS AG, Société Générale SA, Banco Santander SA. However, we also decided to take into account the contribution of any bank to its country which increases the total number of selected banks.

A reason why we were not able to use all the 100 European banks for our regression analysis is because many of them disappeared during this period. Hence, "caja" banks from Spain do not figure in our sample because many of them went bankrupt or were taken over (e.g. with the creation of Bankia on 3/12/10). Sometimes we could not obtain relevant data about banks, because they are just too small or not listed because of their "caja" status as for example "caisses d'épargne" and "mutual banks" in France (Savings-Banks). In addition, Northern Rock had already been nationalized on 17/02/2008 in the UK as it was too dependent on market refinancing after a bank run during the summer 2007, Nationwide was partially nationalised, Bradford & Bingley was nationalised in the UK on 29/09/08. Alliance & Leicester was definitely acquired by Santander UK on 13/10/08.

Outside the UK, ABN Amro was taken over by Fortis, RBS and BNPPARIBAS (offer on 8/10/07), Kaupthing bank was nationalized on 9/10/08 but we kept it in our study, Sachsen LB was taken over by Landesbank Baden-Württemberg (LBBW), IKB was saved by its shareholders, Dresdner merged with Commerzbank on 11/05/09 after this last bank announced this future acquisition on 31/08/2008 and WestLB incurred embezzlement with its prop-trading department. Although the Banques Populaires Group and Caisses d'Epargne Group appear in the ranking of the Top 100 European banks, we have not been able to integrate them into our sample as they later merged creating the BPCE Group. Nor was using Natixis a possibility as their Corporate and Investment Banking branch depends a lot on this

new BPCE Group and its business is quite specialized in comparison to most of the banks in our sample.

Hopefully, for more than 80% of the retained 50 banks in our empirical part (and not 51 because we did not keep Bankia as its Bloomberg data covered a too short period), we have succeeded in obtaining from Bloomberg Company their 5-year Senior CDS spread for each of the trading days from 1/01/07 to 12/03/13.

When we did not obtain the data for the whole period for less than 20% of our bank, it was not an issue as we were in a position to get what we needed concerning the evolution of their CDS and potential activation of our relevant indicators and triggers.

We also obtained CDS curves directly from Bloomberg for our studied period (1/01/07 to 12/03/13).

Note: this is more specifically the mid-spread (mid-point) that we studied. PCS=Pricing source: CBIN i.e. BBG CDS Intra NY.

As stated previously, we also use the 5-year Markit iTraxx Senior Financial index which comprises 25 equally weighted CDS for investment grade European entities (Bank and insurance companies). We selected exactly the same period as for the banks and insurance companies.

Also, we collected a lot of information on credit events for the 51 different banks with regards to the rise of capital, capital injection, nationalisation, rescue, run on bank, recapitalization, failure or default.

In order to gather the maximum amount of information, we extensively used the Factiva database and direct article extracts from classical newspapers (Les Echos, l'Express, le Monde, The Financial Times, etc.). See the list of bank credit events in appendix (restricted version in this paper that does not include tedious facts and figures on the credit events).

#### 4.2 Descriptive statistics (indices)

Now, it is appropriate to specify the adapted trigger for our empirical approach, using the theoretical approach we have just developed.

As previously mentioned, between 01/01/07 and 17/05/10, the iTraxx SF and the iTraxx Europe tended to move closely together, except that from the beginning of October 2008 to the end of March 2009, the iTraxx SF curve was lower than the iTraxx Europe one (showing the impact of the financial crisis on big corporates as a whole).

Note that this is precisely on 17/05/10, when climbing again the 5-year iTraxx SF gets a third calculated T100 (Ter). Then, there was a transition period from 17/05/10 to 9/05/11, before the iTraxx SF and the iTraxx HIVOL started to move closely together from 9/05/11 until the

12/03/13. Indeed, as we noticed earlier, the 5-year iTraxx SF rose again and its curve went over the iTraxx HIVOL on 9/05/11.

This may also explain why the spreads of the European banks reached record levels from 13/09/11.

Now, we understand that the iTraxx Europe is definitely global, so it may be useful to consider that it consists of a kind of repository or reference which is very practical in order to shed light on our results.

The table below (in bps) gives the results for our three iTraxx indices covering the period of study from 01/01/07 to 12/03/13:

*Tab 29 => Descriptive statistics of the three iTraxx indices*

	iTraxx Europe	iTraxx HIVOL	iTraxx Sr Financial
Mean	107,67	179,16	131,40
Median	105,61	169,42	125,88
StDev	45,29	90,87	76,37
High	216,87	552,52	355,31
Low	20,16	38,78	6,95
High (date)	05/12/2008	05/12/2008	25/11/2011

If we focus on the iTraxx Europe statistics, we see that its curve fluctuates between 20.16 and 216.87 bps i.e. [0,200].

It is also of paramount importance to see that its median is very close to 100 (and also very close to its mean), which can then mimic a practical barrier (low “upper bound”) at 100 bps, consistent with our 1<sup>st</sup> and 2<sup>nd</sup> conditions and give a complementary explanation to the *Hart and Zingales (2009)* trigger at 100 bps and to our previous theoretical discussion.

However, we showed that with the same rationale and a new condition due to ISDA standardization of 2009, it should lead to a trigger at 300 bps (with a probability of default at 5%).

Of course, before July 2007 the trend for the low values is weak (under 25 bps) and around the low numbers we observe in our chart i.e. a low at 20.16 bps for the iTraxx Europe index, all the more that we are aware that the subprime crisis started in July.

To simplify, it shows that European CDS for any big company during the period of our study are within a tunnel approximately between 0 and 200 bps i.e. [0, 200].

### 4.3 Analysis

From what we have just developed we might ask: what if our rule has been set off for a given bank and that for example, we now are more than 6 months in front of its initial T100, especially as this trigger at 100 bps is not optimum?

We have already calculated a T100 (BIS) on 20/10/08 and a T100 (Ter) on 17/05/10 for our iTraxx SF, that certainly may be of interest after a period of decrease which was not at all the case.

So, what if the curve keeps on rising after the first T100 is exceeded?

Going over 200 bps (rather than 300 bps which would be too high) shows that we exceed the natural tunnel set by the iTraxx Europe global index, meaning that the situation for a given bank is structurally abnormal and it is at risk.

It is important to consider this concept of a tunnel because it leads to subtle conclusions and we had to find an acceptable approach to monitor spreads on banks.

We now know that using a combined approach of a bank CDS and the iTraxx SF is not really efficient, especially once a still increasing spread exceeds the obtained T100.

So, a relevant response to that might now be designing our high “upper bound” at 200 bps, in the light of the conclusion of *Anderson (2009)* article, claiming that “spreads may be good proxies for differences in default probabilities in a cross section of firms”.

Indeed, we can now understand why a T200 (200 bps giving an implied probability of default of 3.33% when the recovery rate amounts to 40%) is going to be a better choice than a T300. What is more, the goal we had really tried to achieve, deals with the capability to monitor the bank spreads in our tunnel [0,200] bps with two practical barriers at 100 bps and 200 bps than to issue “perfect” forecasts of bank defaults.

In short, staying within [0, 100] appears safe and logical for a given bank, but going over 100 bps within [100, 200] should require most of the time an intervention under conditions 1 (and 2), especially if the iTraxx SF is still deeply into [0, 100].

Thus, staying within [100, 200] has not to be considered as a normal situation and if nothing happens for a given bank after its two conditions gave a first T100, this bank need to be maintained under a very careful ongoing scrutiny and probably recapitalized one way or another.

Furthermore, if we are now for example more than 6 months ahead of that initial T100 and if the curve keeps on rising and goes over 200 bps, then crossing this high upper barrier of T200 means an intervention has to be made (substantial recapitalization or even rescue).

Of course, extreme economic conditions may cause this situation such as the Greek crisis in 2011 which resulted in a profound impact on European banks spreads.

However, lots of spreads were already comprised within [100, 200] before the mid-year 2011 and the Greek crisis new outbreak meant that most of the banks have not yet fully recovered from the subprime and financial crisis from 2007 to 2009.

This is why it is not at all surprising that our calculated T200 for our iTraxx SF index is released on 31/08/11, two weeks before European banking values fell on 12/09/11 and nearly two months before its peak on 25/11/11 within our whole period.

Obtaining a T200 for iTraxx SF means that the situation is more than preoccupying for the banking field, and luckily, this happened only once (31/08/11) within our period of study, even though we had found a first peak at 207 bps on 09/03/09 and 2 others before the 31/08/11.



## 5. Applied study

### 5.1 Optimization of our rule

As a result of the previous analysis, a way to tackle the issue of finding a correct trigger level requires not just one trigger, but two which produces a more dynamic approach by including the time for which a given bank spread goes from the first trigger to the second.

However, we are not going to calculate a growth rate for the differences between our two selected triggers i.e. 100 bps and 200 bps.

In effect, it is far more convenient and appropriate to calculate the number of days between the obtained T200 minus the obtained T100 for a given bank (using the 30/360 convention): the shorter this period, the more risky is the bank!

It also important to observe, for it produces some consistency, that a significant financial distress (requiring massive recapitalization, nationalization, rescue, etc.) occurs mainly most of the time pretty close to a given bank T200 trigger and hopefully intervention follows very soon afterwards.

Thus, we can design a meta-rule that would add a very strong dynamic third condition.

This third decision rule requires that we should:

3. trigger a “real intervention” when the number of days between the T200 and the T100 is under or equal to 180 days i.e.  **$T200 - T100 \leq 180$  days**

From now on, note that the second decision rule is no more taken into account. Thus, we can now show empirically in this applied study that it works well for any substantial financial distress for our sample of European banks. It remains to explain why we decided to use a period of 180 days.

Intuitively we might suggest that this chosen length of time of 180 days must be neither too short nor too long. In fact, if it is too short, that might not be sufficient time to observe a financial distress and if it is too long, there might be too many.

When the first trigger at 100 bps is activated, the concerned bank should raise equity and its Management should commit itself to take all necessary decisions in order to make the bank spread go down (under 100 bps). Regarding LFI that are systemic banks, the regulator could also undertake a stress test to determine, for example, if the LFI debt is at risk.

However, no institution is perfect and regulators can make mistakes in classifying as adequately capitalized a bank which is not, hence our selection of a risk neutral probability of default equal to 3.66% (and not 1.66% or 5%).

After a careful observation of the CDS price for a bank the regulator should decide to intervene if the Management of the bank has not succeeded in reversing a dangerous trend.

So, we consider that 6 months approximately is a classic period of time to turn around a company or at least, to notice the first positive profits made by decision makers of that company. Hence, the necessary intervention of the regulator if the number of days between the T200 and the T100 is inferior to 180 days i.e. 6 months.

This is consistent with *Hart and Zingales (2009)* by developing this dynamic approach within our regulation procedure. Indeed, their selected Washington Mutual and especially Bear Stearns examples showed that the difference between the T200 and the T100 of these banks is inferior to 6 months (See the CDS curve of these banks in their paper).

## 5.2 Detailed applied study methodology

We choose to use a Probit model

- $P(y_i=1 \mid x_i) = F(x_i' \beta)$  in the general case, where  $x_i$  is a vector of bank characteristics and  $\beta$  a vector of parameters to be estimated.
- $F$  is the standardized normal cumulative distribution function (Probit model).

In our particular case, we just use one regressor,  $x_i$

- where  $x_i$  is a dummy for the bank  $i$  such that  $x_i=1$ , if  
$$T200 - T100 \leq 180 \text{ days} \Leftrightarrow 180 - (T200 - T100) \geq 0$$
- and  $y_i=1$ , for a financial distress (bank  $i$ )

We could have tried a smaller period than the 6 month classical lapse of time i.e. 180 days. However, if 180 days is relatively close to 160 days, this last period of time created issues with our regression because of specification problems (the issues are even worse if we chose 150 days or less).

Indeed, a short period means that all financial distress that is correctly predicted based on our meta-rule is automatically linked to a true financial distress (if we choose 150 or 160 days, there is not a single bank with one prediction given an activated trigger of 1 when in fact, no financial distress has been reported).

Basically, our model gives quite reasonable results with a number of days spanning from 180 to 220 as 160 days is absolutely too short and 240 days too large.

However, in comparison with other periods, 220 days produces better balanced results (see robustness check in the next sub-section with the help of TABLE A "Global results per bank" for a number of 220 days and the related regression, especially with regards to the statistical results that accompany it, in appendix).

Incidentally, it is important to note that for a few banks some trading days are missing, so if we consider the expected number of trading days we find that:

- A period of 200 days implies a maximum of 146 trading days
- A period of 220 days implies a maximum of 160 trading days

This is why we consider that even if a few trading days are missing we should get at least 150 trading days using a period of 220 days. Moreover, this is a better way of reducing the risk of a specification model than using the option of 180 or 200 days.

It is also consistent with what we obtain from our data for each bank. We find that the maximum number of trading days for one of the banks on our total period of study from 01/01/2007 to 12/03/2013 is equal to 1611 days (the relevant Excel function gives a result of 1617 theoretical trading days between these two dates for a total number of days amounting to 2231). Nevertheless, we had better consider that waiting 40 days more (220 minus 180) may be more risky and that an earlier intervention would normally be less costly i.e. the sooner, the better hence our theoretical choice of a 180-day period i.e. 6 months.

We have proposed some hypotheses for the types of our credit events, but we should not forget to check that a financial distress when it exists, does not occur too far from our prediction date; otherwise the connection is less significant.

If a sampled bank has no financial distress during the entire period of our study then, this is the simplest and reveals nothing. Furthermore, we need to draw attention to the fact that all of our 6 banks that did not get a T200 trigger automatically had no financial distress which reduces any doubts we might have had about the choice of this trigger at 200 bps. Now we consider what happened for more than half of our banks when we suggest that a financial distress did effectively occur.

If we have correctly defined a “financial distress” what part for the whole period of our study do we have the right to take into account when the 3<sup>rd</sup> condition has been activated?

Firstly, a given financial distress has to exist before our prediction using our 3<sup>rd</sup> condition (meta-rule), although we even took into consideration a few credit events that happened before, and even some weeks before the calculated first T100 (cf. Standard Chartered Bank). We take into account the financial distress for this approach, even when the trigger was not activated for example Fortis and Lloyds TSB banks.

Secondly, if during our period of study there was a first pair (T100, T200) that did not lead to trigger activation for our 3<sup>rd</sup> condition, then if another pair (T100, T200) that works this time or appears later, we would not take into account the trigger activation. This is why even if we retained a financial distress for UBS we decided that no 3<sup>rd</sup> condition had to be activated.

Finally, we state that counting a credit event occurring more than two years after the 3<sup>rd</sup> condition has been activated does not make much sense and so, though we find an

activated trigger with Banco Popular Espanol SA, we did not keep it as a financial distress despite the fact that it had eventually to raise €2.5bn capital.

Indeed, this two-year period is consistent with *Miller, Olson and Yeager (2015)* as we mentioned in the introduction, because they used Expected Default Frequency (EDF) signals from 2007 to 2008 that succeeded in identifying Bank Holding Companies (using 473 BHCs) in the USA that became distressed within two following years (even if their economic impact concerning reducing missed distress events is not significant). They also examine signals based on the Federal Reserve SEER model that have directly a two-year failure probability for a Bank Holding Company (BHC) such as the Current Failure Probability (CFP) or the Dated Failure Probability (DFP).

Highlighting on some interesting results: using our new approach and discussion using the same four banks

(See in appendix our graphed data for these four systemic banks).

**Banca Monte dei Paschi di Siena S.p.A. (MPS)**: T100 (Ter)=18/05/10, T200=29/09/10.

Revised Conclusion: with our 3<sup>rd</sup> condition, it is now clear that a stronger intervention should have occurred on 29/09/10. In fact, our first condition for the T100 had then been activated the last time on 18/05/10 followed by a T200 on 29/09/10, and  $T200 - T00 = 131 (\leq 180 \text{ days})$ .

So, using our revised model intervention could have been indicated nearly two years earlier for this bank (recapitalization in July 2012, followed by a bailout request of €3.9bn on 26/01/13).

**Allied Irish Bank (AIB)**: T100=26/02/08, T200=05/01/09.

Revised Conclusion: according to our research, we saw that the first plan (€3.5bn) arranged by the Irish government started on 12/02/09 which is hopefully after but quite close to the date of our calculated T200 giving this last trigger some meaningful properties!

However, although that an intervention should have certainly been made at least on 05/01/09, our 3<sup>rd</sup> rule did not predict what happened later in 9/06/11 (restructuring credit event issued by the ISDA), because  $T200 - T100 = 309 > 180 \text{ days}$ .

**Banco Commercial Portugues SA (BCP)**: T100 (Ter)=11/02/10, T200=12/05/10.

Revised Conclusion: we mentioned previously that BCP was downgraded on 2/06/10 by Moody's, following the downgrading of the Portuguese government to A1.

The fact that Moody's chose this date is satisfying as it is consistent with our model as the 3<sup>rd</sup> rule was activated on 12/05/10 and we obtain a period of 91 days between the last T100 and the T200. Then, it is all the more remarkable to notice now that our bank CDS spread went

for a peak at 562.09 bps on 07/05/10 confirming the rapid growth between our last T100 and the following T200 (only 91 days).

It is even harder to understand why no serious action had been undertaken at least in 2011, as we “simply” got a peak at 1739.05 bps on 25/11/11!

With our 3<sup>rd</sup> rule the intervention could have been implemented nearly two years earlier as all ended with a €3bn rescue on 7/06/12.

**Dexia Credit Local SA**: T100=16/07/08, T200=16/09/08 and T200 (BIS)=18/05/10.

Revised Conclusion: as French, Belgian and Luxembourg states injected €6.4bn capital into Dexia on 30/09/08, but our calculated T200 and the 3<sup>rd</sup> condition had already been activated and it produces a very short period of 60 days that does not add a strong added value. Indeed, it just confirms that the trends were not good at all for this bank as it indicated possible risks.

However, it is worth noting that Dexia announced a restructuring plan on 6/02/10 approximately 3 months before our T200 (BIS) date, even if this time the 3<sup>rd</sup> rule was not released.

Strictly speaking, our 3<sup>rd</sup> rule would have suggested an intervention only 2 weeks earlier for this bank.

### 5.3 Robustness check

The econometrics tests of robustness are linked to our theoretical discussion as well as the discussion on the methodology of the applied study. The dependent variable is the Financial Distress (FD).

Indeed, the z-statistic of the explanatory variable FD\_Predicted which stands for a prediction sets to one issued by our model, is really significant, especially when the number of days is equal to 180, 200 and 220 with a p-value at the 1% level as shown in the regressions in Appendix. The Price to Book Ratio is significant at the 5% level for 180, 200 and 220 days and the Tier1 Capital Ratio has its best coefficient at the 5% level for 220 days and only at the 10% level for 180 and 200 days. The Return On Asset variable is never significant.

These correct results for the regression coefficients are also backed by the quality of the model when looking at the p-value of the Likelihood ratio test which is significant at the 1% level for the first three columns (180, 200 and 220 days).

The 180, 200 and 220-day columns also give the best Schwartz criterion i.e. the smallest numbers for our different simulations as well as the larger Log-likelihood when we look the related statistical results for each regression in the appendix.

But if the 220-day column gives the best result for the McFadden R-squared at 0.33 and the lowest p-value at the 1% level for the Likelihood ratio test indicating that the coefficients of the regression are really significant, the number of cases correctly predicted at 79.5% is the second best. Indeed, the 240-day column has the highest level at 82.1%. However, the FD\_Predicted variable is only significant at the 10% level for 240 days (and not significant for 260 days).

We could add other explanatory variables in order to raise the value of the McFadden R-squared, but this could create interference or noise in our results. Primarily, we want to capture the best direct link between bank CDS spread thresholds that build the FD\_Predicted variable and the potential related Financial Distress.

It is also important to mention that we eventually had to consider for the regressions only 39 European banks among the 50 for which we have obtained detailed financial data on Bloomberg year by year between 2007 to 2013 (this is definitely a subset of the 50 described earlier).

Indeed, from the Bloomberg data-base, we collected some financial variables such as Return On Assets, Tier 1 Capital Ratio and Price to Book Ratio which are used as control variables (see in appendix the table of the variable definitions given by Bloomberg).

Consequently, we had to reduce here our study from 50 banks to 39 because of a lack of data at some points for these financial variables (307 observations for our panel data: Cf. table A).

RETURN\_ON\_ASSET is an indicator of how profitable a company is relative to its total assets, expressed as a percentage. It gives an idea as to how efficient management is at using its assets to generate earnings.

TIER1\_CAP\_RATIO variable (Tier 1 Capital Ratio) is defined as the ratio of Tier 1 capital to risk-weighted assets.

The smaller it is, the riskier the bank is.

PX\_TO\_BOOK\_RATIO is a classical ratio which is market oriented for being equal to the last price divided by the BOOK\_VAL\_PER\_SH i.e. book value per share (book value of equity).

It is also interesting to note that the subset of the 39 banks maintain the same properties as the set with 50 banks when we only regress the Financial Distress on the dummy variable (FD\_Predicted). However, this very specific univariate regression is as robust as the previous case from an econometrical point of view, hence we do not show these results in this study.

#### 5.4 Practical insights

We can now be absolutely confident and suggest that once the T100 calculated for the iTraxx SF is achieved, not only the systemic banks need to be under a careful scrutiny, but also the non-systemic ones. However, as mentioned earlier, all of our European banks had

their T100 activated during the second year of our period of study, but that does not mean that nothing has to be done.

The same rationale applied to the T200 calculated for the iTraxx SF, especially because when the 200 bps level is reached, the economic environment parameters happen to be fundamentally much worse for the banking field, implying extreme ongoing conditions. However, the T200 was activated very late on 31/08/11 revealing abnormal conditions that led lots of banks outside our [0, 200] tunnel.

Above all, our main approach consists of examining very carefully the difference between a given T100 for a bank and the next following T200 (if there is one). Then, when the number of days between the T200 and the T100 is under or equal to 180 days i.e.  $T200 - T100 \leq 180$  days, trigger a “real intervention”! As previously stated, all of our 6 banks that did not get a T200, automatically did not come under any financial distress.

Note that during the first quarter of 2009, the iTraxx SF unsurprisingly went over 200 bps at 207 bps on 09/03/09. It is also worth pointing out that in the graph of the trend of average CDS spread values we also find a peak during the first quarter of 2009, and that it nearly reached 350 bps. Now, this striking difference may be explained by the fact that these 57 banks are chosen from all over the world and are not necessarily systemic, like the sixteen European ones that are used in the iTraxx SF index.

Indeed, we have to consider that we have only studied European banks and that it would seem to be an asset that the iTraxx SF is based on systemic ones, for precisely being an index. Our rationale is all the more consistent in that the two more indices mentioned in our study belong to the iTraxx family and are complementary to the iTraxx SF.

A quite similar approach can give meaningful results when monitoring the iTraxx SF (with both other indices) in that, for example, on 9/05/11 the iTraxx SF climbs again and its curve goes over the iTraxx HIVOL on this day and then, they move closely together till the 12/03/13.

Consequently, we have reason to worry if we remember that between 01/01/07 and 17/05/10, the iTraxx SF and the iTraxx Europe moved closely together, except that from the beginning of October 2008 to the end of March 2009, where the iTraxx SF curve was higher than that of iTraxx Europe which indicated that bank and insurance companies incurred more risks during that period than the companies from other industries.

It is also worth noting that during our period of study, the 3<sup>rd</sup> decision rule / condition has been never activated for the iTraxx SF. Indeed, being an index, its curve fluctuations are smoother than a classic bank spread curve. This also shows that our 3<sup>rd</sup> condition is more adapted for a single name CDS spread which is consistent for each bank we studied.

## 6. Conclusion

In order to focus on our theme i.e. “CDS and the forecasting of bank default” for the European Market, we first tried to explain why CDS were sufficiently reliable to lead other markets in terms of information and price discovery, after having undertaken a short review on different Early Warning System models (for bank default or banking crises) that gave various results.

Though CDS spread cannot be taken as a perfect proxy of the true probability of a default (PD) of the underlying corporate, it still may be of interest to use them as an indicator for this purpose, provided that the relevant trigger has been activated. That was our initial proposal partly based on the article of *Hart and Zingales (2009)* using the following procedure: “trigger intervention whenever the CDS price is above 100 bps for at least 20 of the last 30 trading days”.

However, as the CDS forecasting power is not optimal, we had to investigate further to show with our three short sets of conclusions (point one to eight) that a second indicator was necessary to optimize the procedure giving two conditions. Initially, a good candidate appeared to be the Markit 5-year iTraxx Senior Financial index that comprises 25 equally weighted CDS on investment grade European entities (Banks and insurance companies).

We studied 50 among the TOP 100 European banks and selected a few to examine the reliability of both indicators with a trigger at a 100 bps threshold but the results were disappointing.

Considering a theoretical approach and with the help of the iTraxx Europe index (125 corporate entities), we identified a tunnel for their spread curve that fluctuates within [0, 200] during our period of study. Our period of study spans more than six years and from our results we realised that we needed to add another trigger level at 200 bps. In fact, we had had first to address the question: what if the curve keeps on rising after the first T100 is exceeded?

Consequently, we changed our approach slightly in that we found that if the forecasting power of the banks' spreads matters it was also appropriate to directly monitor the bank spread in the [0, 200] tunnel with 2 practical barriers for triggers at 100 and 200 bps. It also led us to design a meta-rule that added a strong dynamic 3<sup>rd</sup> decision rule / condition: trigger a “real intervention” when the number of days between the T200 and the T100 is under or equal to 180 days i.e.  $T200 - T100 \leq 180$  days (Note that the second decision rule is no more taken into account as mentioned previously).

But it still remains to understand completely why the use of CDS spread for the forecasting of bank default is not more efficient and should this rule be activated, what to do and when exactly, concerning the intervention of regulators as this could be really helpful to them.



## 7. Appendix

### 7.1 Tables of the applied study for the 50 banks

**TABLE A: Global results per bank (Nb of days = 220)**

Tab 30 => TABLE A: Global results per bank (Nb of days = 220)

Company Name	FD	FD_Predicted	Systemic	T100	T200	Nb of days (T200- T100)	Nb of days (threshold)
Allied Irish Bank	1	0	1	26/02/2008	05/01/2009	309	220
Anglo Irish Bank (Irish Bank Resolution)	1	1	1	21/11/2007	17/03/2008	116	
Bancaja	1	1	0	03/12/2007	26/02/2008	83	
Banca Monte dei Paschi di Siena S.p.A (MPS)	1	1	1	18/05/2010	29/09/2010	131	
Banco Comercial Portuges SA (BCP)	1	1	1	11/02/2010	12/05/2010	91	
Banco Esperito santo SA (BES)	0	0	1	11/03/2008	12/05/2010	781	
Banco Popular Espanol SA	0	1	0	14/03/2008	27/08/2008	163	
Banco de Sabadell SA	0	1	1	13/02/2008	05/09/2008	202	
Banco Popolare	1	0	0	14/03/2008	16/03/2009	362	
Banco Popolare di Milano Scarl (BPM)	0	0	0	25/05/2010	05/07/2011	400	
Banco Santander SA	1	0	1	16/02/2010	21/12/2010	305	
Bank of Ireland	1	1	1	15/02/2008	22/09/2008	217	
Bankinter SA	0	0	1	18/03/2008	28/11/2008	250	
Barclays Bank PLC	0	0	1	23/07/2008	20/03/2009	237	
Bayerische Landesbank (Bayern LB)	0	0	0	14/03/2008	05/09/2011	1251	
BBVA	1	1	0	16/02/2010	14/06/2010	118	
BNP Paribas SA	0	0	1	01/06/2010	06/09/2011	455	
Credit Suisse Group	0	0	1	16/10/2008		0	
Caja Madrid	0	1	0	14/03/2008	02/10/2008	198	
Caixa Geral de Depositos	1	1	0	23/02/2010	20/05/2010	87	
Commerzbank AG	1	0	1	25/05/2010	30/08/2011	455	
Credit Agricole SA	1	0	1	19/05/2010	01/09/2011	462	
DNB Bank ASA	0	0	1	07/11/2008		0	
Dankse Bank A/S	1	0	1	10/12/2010	09/09/2011	269	
Deutsche Bank AG	0	0	1	19/05/2010	01/12/2011	552	
Dexia Credit Local SA	1	1	1	16/07/2008	16/09/2008	60	
Esrte Group Bank AG	1	1	1	23/07/2008	02/03/2009	219	
Fortis	1	0	0	28/05/2010	08/09/2011	460	
HBOS	1	1	0	14/03/2008	29/09/2008	195	
HSBC Holdings PLC	0	0	1	16/12/2008		0	
ING Bank NV	1	0	1	31/05/2010	08/12/2011	548	
Intesa Sanpaolo SpA	1	0	1	20/05/2010	04/08/2011	434	
Kaupthing Bank Hf	1	1	0	13/09/2007	03/12/2007	80	
KBC Bank NV	1	1	0	16/10/2008	30/12/2008	74	
Lloyds TSB Bank PLC	1	0	1	26/12/2008	16/06/2010	530	
Mediobanca	0	0	1	27/05/2010	05/08/2011	428	
Nordea Bank Ab	0	0	1	29/10/2008		0	
Norddeutsche Landesbank Girozentrale	1	0	0	13/11/2008	19/09/2011	1026	
Rabobank	0	0	1	15/12/2008		0	
Raiffensen	1	1	1	24/07/2008	16/12/2008	142	
Santander UK	0	0	0	19/05/2010	31/08/2011	461	
SEB	0	0	0	05/08/2008	26/03/2009	231	
SNS Bank NV	1	1	0	14/03/2008	16/10/2008	212	
Societe Generale SA	1	0	1	19/05/2010	30/08/2011	461	
Standard Chartered Bank	1	1	1	18/11/2008	10/03/2009	112	
Svenska Handelsbanken AB	0	0	0	31/12/2008		0	
Royal Bank of Scotland PLC/The	1	0	1	11/03/2008	16/06/2010	815	
Ubi Banca	0	0	0	15/10/2008	20/01/2011	815	
UBS AG	1	0	1	13/03/2008	13/01/2009	300	
UniCredit SpA	1	1	1	30/10/2008	16/03/2009	136	
<b>Sum of 1 / Average nb of days (T200-T100)</b>	<b>30</b>	<b>19</b>	<b>32</b>			<b>304,66</b>	

"FD" = the Financial Distress or Event is the dependent variable.

"FD\_Predicted" = explanatory variable sets to 1 if our model truly predicts a financial distress.

**TABLES 1 and 2 – Probit regressions and related statistical results**

The first table shows the regressions for our 39 banks with our variables taken from Bloomberg data that span the period 01/01/2007 to 12/03/2013 (307 observations for our panel data of 50 banks: Cf. table A). The Financial Distress or Event is the dependent variable. Standard errors (based on Hessian) are reported in parentheses below coefficient values. Significance levels: \*\*\* for 1%, \*\* for 5%, and \* for 10%.

**TABLE 1: Probit regressions**

Tab 31 => TABLE 1: Probit regressions

VARIABLES	(1) nDays=180	(2) nDays=200	(3) nDays=220	(4) nDays=240	(5) nDays=260
TIER1_CAP_RATIO	0.205* (0.119)	0.205* (0.119)	0.270** (0.131)	0.175 (0.111)	0.184 (0.113)
PX_TO_BOOK_RATIO	-2.018** (0.964)	-2.018** (0.964)	-2.371** (1.038)	-1.303* (0.745)	-1.404* (0.739)
RETURN_ON_ASSET	-0.805 (0.587)	-0.805 (0.587)	-0.905 (0.592)	-0.566 (0.494)	-0.548 (0.491)
FD_Predicted	2.188*** (0.849)	2.188*** (0.849)	2.335*** (0.853)	0.896* (0.501)	0.825 (0.502)
Constant	-0.482 (1.130)	-0.482 (1.130)	-0.973 (1.196)	-0.670 (1.111)	-0.679 (1.121)
Observations	39	39	39	39	39
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

**TABLE 2: statistical results for each regression**

Tab 32 => TABLE 2: statistical results for each regression

STATISTICAL RESULTS	(1) nDays=180	(2) nDays=200	(3) nDays=220	(4) nDays=240	(5) nDays=260
McFadden R-squared	0,299893	0,299893	0.332365	0.170564	0.160167
Log-likelihood	-18.48360	-18.48360	-17.62632	-21.89804	-22.17254
Schwarz criterion	55.28501	55.28501	53.57044	62.11388	62.66289
Likelihood ratio test:Chi-square (4) and its p-value	15.835*** (0.0032)	15.835*** (0.0032)	17.5496*** (0.0015)	9.00616* (0.0609)	8.45715* (0.0762)
Nb cases correctly predicted	76.9%	76.9%	79.5%	82.1%	76.9%
Observations	39	39	39	39	39
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

**TABLES of events and predictions: number of events and number of correct predictions for each of the five probit regression***Tab 33 => TABLES of events and predictions*

Regression (1): Nb of days = 180

	Nb of events	Nb correct predictions
Default=0	16	10
Default=1	23	20
Total	39	30

Regression (2): Nb of days = 200

	Nb of events	Nb correct predictions
Default=0	16	10
Default=1	23	20
Total	39	30

Regression (3): Nb of days = 220

	Nb of events	Nb correct predictions
Default=0	16	10
Default=1	23	21
Total	39	31

Regression (4): Nb of days = 240

	Nb of events	Nb correct predictions
Default=0	16	11
Default=1	23	21
Total	39	32

Regression (5): Nb of days = 260

	Nb of events	Nb correct predictions
Default=0	16	10
Default=1	23	20
Total	39	30

**TABLE “Variable definitions”**

Tab 34 =&gt; TABLE “Variable definitions”

BLOOMBERG VARIABLES	VARIABLE DEFINITIONS
TOT_ASSET	<p><b>BANKS</b></p> <p>Total Assets: This is the sum of Cash &amp; bank balances, Fed funds sold &amp; resale agreements, Investments for Trade and Sale, Net loans, Investments held to maturity, Net fixed assets, Other assets, Customers' Acceptances and Liabilities.</p>
RETURN_ON_ASSET	<p>Indicator of how profitable a company is relative to its total assets, in percentage. Return on assets gives an idea as to how efficient management is at using its assets to generate earnings.</p> <p><b>INDUSTRIALS, BANKS, FINANCIALS, UTILITIES, &amp; REITS</b></p> <p>Calculated as:</p> <p><math>(\text{Trailing 12M Net Income} / \text{Average Total Assets}) * 100</math></p> <p>Where: Trailing 12M Net Income is RR813, TRAIL_12M_NET_INC Average Total Assets is the average of the beginning balance and ending balance of TOT_ASSET (Cf. above)</p>
TIER1_CAP_RATIO	<p><b>Banks</b></p> <p>Tier 1 Capital Ratio: Tier 1 or Core capital ratio. Tier 1 is used for commercial banks and core capital is used for savings and loans in the United States (U.S.).</p> <p>The ratio of Tier 1 capital to risk-weighted assets.</p> <p>For Core Tier 1 Capital Ratio see Core Tier 1 Capital Ratio (BS895, BS_CORE_TIER1_CAPITAL_RATIO).</p> <p>Common stockholders' equity: Qualifying perpetual preferred stock. Minority Interest in consolidated subsidiaries less Goodwill and other disallowed intangibles.</p> <p>Core capital for savings and loans: Common stockholders' equity. Noncumulative perpetual preferred and surplus. Minority interests less intangible assets (other than PMSR). The ratios are discussed in the Cooke Committee and adopted by each country. The information is provided in terms of absolute numbers and percentages. If the absolute amounts are disclosed, the percentages should be computed for this account. Slightly different ratios are defined for commercial banks and savings and loans.</p> <p>The minimum ratios set by the U.S. Federal Reserve and OTC are</p>

	<p>4% for commercial banks and 3% for savings and loans, respectively.</p> <p>Europe: The Bank of International Settlements in Basel requires a Tier I ratio of 4.4%. In Europe it is referred to as the BIS ratio, the European Solvency ratio, or the Cooke ratio as the Cooke committee established it.</p>
<p>BOOK_VAL_PER_SH</p>	<p>Measure used by owners of common shares in a firm to determine the level of safety associated with each individual share after all debts are paid accordingly. Units: Actual Calculated as:</p> <p>Total Common Equity / Number of Shares Outstanding</p> <p>Where: Total Common Equity is RR010, TOT_COMMON_EQY Shares Outstanding is BS081, BS_SH_OUT</p>
<p>PX_TO_BOOK_RATIO</p>	<p>Ratio of the stock price to the book value per share. Calculated as:</p> <p>Price to Book Ratio = Last Price / Book Value Per Share</p> <p>Where: Last Price is PR005, PX_LAST Book Value Per Share is RR020, BOOK_VAL_PER_SH</p> <p>Data from the most recent reporting period (quarterly, semi-annual or annual) used in the calculation.</p> <p>Portfolio: Computed as the Total Market Value (IN089, INDX_MARKET_CAP) divided by the sum of Book Value from holdings. Contributions are computed as the value of Book Value Per Share (RR020, BOOK_VAL_PER_SH) of the security multiplied by the number of shares held.</p>

7.2 CDS curves for our interesting results from Bloomberg

Figure 6 => Banca Monte dei Paschi di Siena S.p.A. (MPS) curve

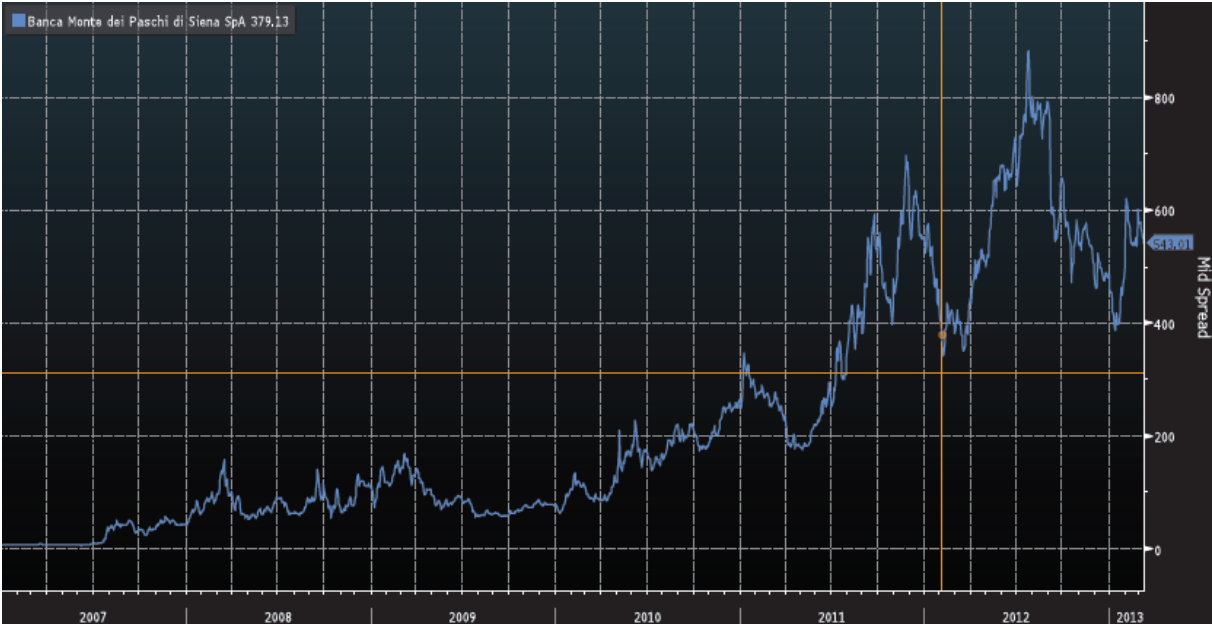


Figure 7 => Allied Irish Bank (AIB) curve



Figure 8 => Banco Commercial Portugues SA (BCP) curve



Figure 9 => Dexia Credit Local SA curve



### 7.3 Timeline

*Tab 35 => A timeline of prominent events*

- 8/02/07: HSBC plunges to its weakest level for 9 months, because of a rise of its provision for bad debts (real estate i.e. subprime mortgage) at \$10bn.
- July 2007: because of the subprime mortgage the losses announced by HSBC, that make CDS spread rise sharply and this can be taken as a sign for the beginning of the crisis.
- 14/03/08: Bear Stearns is about to fail (it will be taken over on 16 March by JP Morgan). The 5-year iTraxx Senior Financial reaches the 20 out of 30 sessions above 100 bps on the same date i.e. our calculated T100 for this iTraxx SF index happens also on 14/03/08.
- 15/09/08: Lehman brothers file for bankruptcy.
- 20/10/08: after staying under 100 bps during 6 months, iTraxx SF gets a second calculated T100 (BIS) on 20/10/08.
- 11/01/10: weakest point since mid-2008 for the 5-year iTraxx SF during our period of study spanning from 1/01/07 to 12/03/13.
- 17/05/10: climbing again, the 5-year iTraxx SF gets a third calculated T100 (Ter) on 17/05/10.
- 9/05/11: the 5-year iTraxx SF climbs again and its curve goes over the iTraxx HIVOL on this day and they move closely together until 12/03/13.
- 31/08/11: The 5-year iTraxx Senior Financial reaches the 20 out of 30 sessions above 200 bps i.e. our calculated T200.

Note: we use T100 (BIS) for the second time the trigger is activated and T100 (Ter) for the third calculated T100 during the period of study.



## 7.4 List of European bank credit events (restricted version with no detail)

Tab 36 =&gt; List of European bank credit events (restricted version with no detail)

Company Name	Bank Credit events based on trigger activation
Allied Irish Bank	T100=26/02/08 (S). T200=05/01/09
Anglo Irish Bank (Irish Bank Resolution)	T100=21/11/07 (S). T200=17/03/08
Bancaja	T100=03/12/07. T200=26/02/08. T=iTraxx SF
Banca Monte dei Paschi di Siena S.p.A (MPS)	T100=30/12/08 (S). T100(Ter)=18/05/10. T200=29/09/10
Banco Comercial Portuges SA (BCP)	T100=13/03/08 (S). T100(Ter)=11/02/10. T200=12/05/10
Banco Esperito santo SA (BES)	T100=11/03/08 (S). T200=12/05/10
Banco Popular Espanol SA	T100=18/02/08. T=iTraxx SF. T200=27/08/08. T200 (BIS)=14/05/10
Banco de Sabadell SA	T100=13/02/08 (S). T200=05/09/08. T200(BIS)=03/03/10
Banco Popolare	T100=28/02/08. T=iTraxx SF. T200=16/03/09. T200 (BIS)=16/06/10
Banco Popolare di Milano Scarl (BPM)	T100=02/12/08. T100(BIS)=25/05/10. T200=05/07/11
"Banco Santander SA"	T100=21/03/08 (S). T100(Ter)=16/02/10. T200=21/12/10
Bank of Ireland	T100=15/02/08 (S). T200=22/09/08
Bankinter SA	T100=18/03/08 (S). T200=28/11/08. T200 (BIS)=21/05/10
"Barclays Bank PLC"	T100=23/07/08 (S). T200=20/03/09
Bayerische Landesbank (Bayern LB)	T100=11/03/08. T=iTraxx SF. T200=05/09/11
BBVA	T100=16/02/09. T100(Ter)=16/02/10. T200=14/06/10
"BNP Paribas SA"	T100=31/03/09 (S). T100 (Ter)=01/06/10. T200=06/09/11
"Credit Suisse Group"	T100=16/10/08 (S). No T200
Caja Madrid	T100=18/02/08. T=iTraxx SF. T200=02/10/08
Caixa Geral de Depositos	T100=14/03/08. T100 (Ter)=23/02/10. T200=20/05/10
"Commerzbank AG"	T100=14/03/08 (S). T100(Ter)=25/05/10. T200=30/08/11
"Credit Agricole SA"	T100=19/03/08 (S). T100 (Ter)=19/05/10. T200=01/09/11
DNB Bank ASA	T100=07/11/08 (S). No T200
Dankse Bank A/S	T100=23/10/08 (S). T100(Ter)=10/12/10. T200=09/09/11
"Deutsche Bank AG"	T100=10/10/08 (S). T100(Ter)=19/05/10. T200=01/12/11
Dexia Credit Local SA	T100=16/07/08 (S). T200=16/09/08. T200 (BIS)=18/05/10
Esrte Group Bank AG	T100=06/03/08 (S). T100(BIS)=23/07/08. T200=02/03/09
Fortis	T100=11/03/08. T100(Ter)=28/05/10. T=iTraxx SF. T200=8/09/11
HBOS	T100=13/03/08. T=iTraxx SF. T200=29/09/08
"HSBC Holdings PLC"	T100=16/12/08 (S). No T200
"ING Bank NV"	T100=11/03/08 (S). T100(Ter)=31/05/10. T200=08/12/11
"Intesa Sanpaolo SpA"	T100=24/12/08 (S). T100(Ter)=20/05/10. T200=04/08/11
Kaupthing Bank Hf	T100=13/09/07. T200=03/12/07
KBC Bank NV	T100=16/10/08. T200=30/12/08. T200 (BIS)=04/02/11
"Lloyds TSB Bank PLC"	T100=10/10/08 (S). T100(Ter)=26/12/08. T200=16/06/10
Mediobanca	T100=13/10/08 (S). T100(Ter)=27/05/10. T200=05/08/11
Nordea Bank Ab	T100=29/10/08 (S). T100(BIS)=05/10/11. No T200
Norddeutsche Landesbank Girozentrale	T100=13/11/08. T200=19/09/11
Rabobank	T100=15/12/08 (S). No T200
Raiffensen	T100=24/07/08 (S). T200=16/12/08
Santander UK	T100=25/02/09. T100(Ter)=19/05/10. T200=31/08/11
SEB	T100=05/08/08. T200=26/03/09. T200(BIS)=07/10/11
SNS Bank NV	T100=04/03/08. T=iTraxx SF. T200=22/06/10. T200 (BIS)=16/10/08
"Societe Generale SA"	T100=16/12/08 (S). T100 (Ter)=19/05/10. T200=30/08/11
"Standard Chartered Bank"	T100=23/07/08 (S). T200=20/03/09
Svenska Handelsbanken AB	T100=31/12/08. T100(BIS)=21/10/11. No T200
"Royal Bank of Scotland PLC/The"	T100=11/03/08 (S). T200=16/06/10.
Ubi Banca	T100=15/10/08. T200=20/01/11
"UBS AG"	T100=13/03/08 (S). T100(Ter)=27/06/11. T200=13/01/09. T200 (BIS)=15/12/11
"UniCredit SpA"	T100=30/10/08 (S). T200=16/03/09. T200(BIS)=12/07/11

**Note:** we use T100 (BIS) for the second time the trigger is activated and T100 (Ter) for the third calculated T100 during the period of study. (S) is used for a systemic bank.



## References

- Adams, R. (2012), "Governance and the financial crisis", *International Review of Finance*, 12:1, 2012: pp. 7-38.
- Adams, R. (2012 "bis"), "Foreword to special issue: Governance, policy and the crisis", *International Review of Finance*, 12:1, 2012: pp. 1-5.
- Adams, R. and D. Ferreira (2009), "Women in the boardroom and their impact on governance and performance", *Journal of Financial Economics* 94 (2009) 291-309.
- Acharya, VV., and N. Mora (2011), "Are passive banks liquidity backstops? Deposit rates and flows during the 2007-2009 crisis", Working paper, Stern School of Business, New York University, and Federal Reserve Bank of Kansas City, November 13, 2011.
- Adams, R., H. Mehran (2011), "Bank board structure and performance: evidence from Large Bank Holding companies", *Journal of Financial Intermediation*, DOI: 10.1016/j.jfi.2011.09.002 and the version we read, *J. Finan. Intermediation* 21 (2012) 243-267. NB: parts of this paper previously circulated in two others papers, in particular, Adams, R., H. Mehran, "Corporate performance, board structure, and their determinants in the banking industry", *Federal Reserve Bank of New York Staff Reports*, no. 330 (2008), (or 2010).
- Admati, A. (2014), short article in *Time* in which her book written with Martin Hellwig "The bankers' New Clothes" is quoted.
- Aebi, V., G. Sabato and M. Schmid (2011), "Risk Management, Corporate Governance, and bank performance in the financial crisis", *SSRN (and Journal of banking and Finance* 36 (2012), 3213-3326).
- Aggarwal, R., I. Erel, R. Stulz and R. Williamson (2008), "Differences in Governance practices between U.S. and foreign firms: measurement, causes and consequences", *Oxford Journals*, Oxford University Press, The Society for Financial Studies.
- Anderson, RW. (2009), "What accounts for time variation in the price of default risk?", *London School of Economics and CEPR*.
- Anderson, RW. (2010), "Credit Default: what are the social benefits and costs", *Financial Stability Review*, N°14.

- Arena, M. (2008), "Bank failures and bank fundamentals: a comparative analysis of Latin America and East Asia during the nineties using bank-level data", *Journal of Banking & Finance* 32 (2008) 299-310.
- Barclays Capital (2010), "Standard Corporate CDS Handbook (ongoing evolution on the CDS market)".
- Bebchuck, L., A. Cohen and A. Ferrel (2008), "What matters in corporate finance?", *Oxford Journals*, Oxford University Press, The Society for Financial Studies.
- Beltratti, A. and RM. Stulz (2012), "The credit crisis around the globe: why did some banks perform better during the credit crisis?", *Journal of Financial Economics* 105 (2012) 1-17.
- Bennett, RL., V. Hwa and ML. Kwast (2014), "Market discipline by bank creditors during the 2008-2010 crisis", *FDIC CFR WP* 2014-03
- Betz, F., S. Oprica, TA. Peltonen and P. Sarlin (2014), "Predicting distress in European banks", *Journal of Banking & Finance*, 45 (2014) 225-241.
- Berger, AN. and SM. Davies (1998), "The information content of bank examinations", *Journal of Financial Services Research* 14:2 117-144 (1998).
- Berger, AN., SM. Davies and MJ. Flannery (2000), "Comparing market and supervisory assessment of bank performance: who knows what when?", *Journal of Money, Credit, and Banking*, Vol. 32, N°.3 (August 2000, Part 2).
- Berger, AN., B. Imbierowicz and C. Rauch (2013), "The roles of corporate governance in bank failures during the recent financial crisis", *SSRN*.
- Berger, AN. and CHS. Bouwman (2013), "How does capital affect bank performance during financial crisis?", *Journal of Financial Economics* 109(2013) 146-176.
- Bhattacharyya, S. and A. Purnanandam (2011), "Risk-taking by banks: what did we know and when did we know it?", *SSRN*.
- Billett MT., JA. Garfinkel and ES. O'Neal (1998), "The cost of market versus regulatory discipline in banking", *Journal of Financial Economics* 48 (1998) 333-358.
- Bond, P., I. Goldstein and ES. Prescott (2009), "Market-based corrective actions", *Oxford University Press*.
- Boone, L., L. Casares Field, J. Karpoff and C. Raheja (2007), "The determinants of corporate board size and composition: an empirical analysis", *Journal of Financial Economics* 87 (2007) 66-101.

- Calabrese, R. and SA. Osmetti (2013), "Modelling small and medium enterprise loan defaults as rare events: the generalized extreme value regression model", *Journal of Applied Statistics*, 40:6, 1172-1188.
- Calabrese, R. and and P. Giudici (2015), "Estimating bank default with Generalised Extreme Value regression models", *Journal of the Operational Research Society* (2015) 1–10.
- Campbell, JY., Jens Hilscher and Jan Szilagyi (2008), "In Search of Distress Risk", *The Journal Of Finance*, Vol. LXIII, NO. 6, December 2008.
- Capelle-Blancard, G. and T. Chauveau (2002), "L'efficacité technique peut-elle contribuer à l'évaluation du risque d'insolvabilité? (Can technical efficiency improve default risk forecasts? Empirical evidence from European commercial banks)", travail réalisé avec le soutien financier de la Fondation Banque de France pour la recherche en économie monétaire, financière et bancaire.
- Chiaramonte, L. and B. Casu (2011), "Are CDS spreads a good proxy of bank risk? Evidence from the financial crisis", SSRN.
- Coles, JL., N. Daniel and L. Naveen (2008), "Boards: does one size fit all?", *Journal of Financial Economics* 87 (2008) 329-356.
- Cole, RA. and JW. Gunther (1998), "Predicting bank failures: a comparison of On- and Off-Site monitoring systems", *Journal of Financial Services Research* 13:2 103-117 (1998).
- Cole, RA. and LJ. White (2012), "Déjà Vu All Over Again: The causes of U.S. Commercial Bank Failures This Time Around", *J Financ Serv Res* (2012) 42:5-29.
- Cont, R. (2010), "Credit Default Swap and financial stability", *Financial Stability Review*, N°14.
- Crouhy, M., D. Galais and R. Mark (2000), "A comparative analysis of current credit risk models", *Journal of Banking & Finance* 24 (2000) 59-19.
- Dahl, D., JP. O'Keefe and GA. Hanweck (1998), "The influence of examiners and auditors on loan-loss recognition", *FDIC Banking Review* 1998 - VOL. 11, No. 4.
- Davis, EP., and D. Karim (2008a), "Comparing early warning systems for banking crisis", *Journal of Financial Stability*, 4(2), 89-120.
- Davis, EP., and D. Karim (2008b), "Could early systems have helped to predict the sub-prime crisis", *National Institute Economic review*, 206(1), 35-47.

- Davis, EP., D. Karim and I. Liadze (2011), "Should multivariate early warning systems for banking crises pool across regions?", *Review of World Economies / Weltwirtschaftliches Archiv*, Vol. 147. No. 4 (November 2011), pp. 693-716.
- Demirgüç-Kunt, A. and E. Detragiache (1998), "The determinants of banking crisis in developing and developed countries". *IMF staff papers*, 45(1), 81-109.
- Demirgüç-Kunt, A. and E. Detragiache (2000) "Monitoring banking sector fragility: a multivariate logit approach", *The World Bank Economic Review*, Vol. 14 No. 2 (May, 2000), pp. 287-307.
- Demirgüç-Kunt, A., E. Detragiache and P. Gupta (2000), "Inside the crisis: an empirical analysis of banking system in distress", 2000 International Monetary Fund, WP/00/156.
- Demirgüç-Kunt, A. and E. Detragiache (2005), "Cross-country empirical studies of systemic bank distress: a survey". (IMF Working paper 05/96). Washington, DC: International Monetary Fund.
- Demyanyk, Y and I. Hasan (2009), "Financial crisis and bank failures: a review of prediction methods", *Omega* 38 (2010) 315-324.
- Dermine, J. (2011), "Bank corporate governance, beyond the global crisis", INSEAD Working Paper collection, 2011/33/FIN.
- Deyoung, R., MJ. Flannery, WW. Lang and SM. Sorescu (2001), "The Information Content of Bank Exam Ratings and Subordinated Debt Prices", *Journal of Money, Credit, and Banking*, Vol. 33, No. 4 (November 2001).
- Deyoung, R., MJ. Flannery, WW. Lang and SM. Sorescu (1998), "The informational advantage of specialized monitors: the case of bank examiners", Working paper No. 98-4, 1998, Federal Reserve Bank of Chicago. This article may had another title "Could publication of CAMELS rating improve market discipline?", WP, January 1998, but I was not able to find a version of this article.
- Diamond, D. and P. Dybvig (1983), "Banks runs, deposit insurance and liquidity", *Journal of Political Economy* 91, 401-419.
- Ellul, A. and V. Yerramilli (2013), "Stronger risks controls, lower risks: evidence from U.S. Bank Holding Companies", *The Journal of Finance*, VOL. LXVIII, N°. 5.
- Ferreira, D., D. Kershaw, T. Kirchmaier and E. Schuster (2013), "Shareholder empowerment and bank bailouts", Working Paper, LSE Research Online at <http://eprints.lse.ac.uk/56083>, originally available from European Corporate Governance Institute (ECGI).

- Fiordelisi, F. and DS. Mare (2013), "Probability of default and efficiency in cooperative banking", *Journal of International Financial Markets, Institutions & Money*, 26 (2013) 30– 45.
- Flannery, MJ. (1998), "Using market information in prudential bank supervision: a review of the U.S. empirical evidence", *Journal of Money, Credit, and Banking*, Vol. 30, No. 3 (August 1998, Part 1).
- Flannery, MJ. (2009), "Stabilizing Large Financial Institutions with Contingent Capital", SSRN.
- Flannery, MJ., J. Houston and F. Partnoy (2010), "Credit Default Swap spreads as viable substitute for credit ratings", *Research Paper N°*. 10-31.
- Flannery, MJ. and SM. Sorescu (1996), "Evidence of bank market discipline in subordinated debenture yields: 1983-1991", *The Journal Of Finance*, VOL. LI, NO. 4, September 1996.
- Gilbert, RA., AP. Meyer and MD. Vaughan (2002), "Could a CAMELS downgrade model improve Off-Site surveillance?", *The Federal Reserve Bank of St. Louis*.
- Glasserman, P. and B. Nouri (2010), "Contingent Capital with a Capital-Ratio Trigger", *Working paper, Columbia University*.
- Gompers, P., J. Ishii and A. Metrick (2003), "Corporate Governance and equity prices", *The Quartely Journal of Economics*, vol. 118, N° 1, pp. 107-155.
- Guerrera, F. and PT. Thal-Larsen (2008), "Gone by the Board: why banks directors did not spot credit crisis", *Financial Times*, June 25.
- Haldane, A G. (2011), "Capital discipline", *Speech given at the American Economic Association, Denver*.
- Harada, K., T. Ito and S. Takahashi (2013), "Is the Distance to Default a good measure in predicting bank failures? A case study of Japanese major banks", *Japan and the World Economy* 27 (2013) 70-82.
- Hart, O. and L. Zingales (2009), "A new capital regulation for Large Financial Institutions", SSRN and Univ. of Chi. Booth Sch. Of Bus, Working Paper N°. 09-36, eventually published in *American Law & Economics review* 13, 453-490 (2011).
- Hirtle, BJ. and JA. Lopez (1999), "Supervisory information and the frequency of bank examinations", *FRBNY Economic Policy Review / April 1999*.
- Huang X., H. Zhou and H. Zhu (2009), "A framework for assessing the systemic risk of major financial institutions", SSRN.

- Hull, J.C. (2009), "Options, Futures and other Derivatives", 7<sup>th</sup> Edition, Pearson.
- Jarrow, R. (2010), "The economics of credit default swaps (CDS)", Johnson School Research Paper Series.
- Jensen, M. and W. Meckling (1976), "Theory of the firm: managerial behavior, agency costs and ownership structure", *Journal of Financial Economics*, 3, 305-60.
- Jin, JY., K. Kanagaretnam, G. Lobo and R. Mathieu (2013), "Impact on FDICIA internal controls on bank risk taking", *Journal of Banking and Finance* 37 (2013) 614-624.
- Jin, JY., K. Kanagaretnam and G. Lobo (2011), "Ability of accounting and audit quality variables to predict bank failure during the financial crisis", *Journal of Banking and Finance* 35 (2011) 2811-2819.
- Jordan, J.S., J. Peek and E.S. Rosengren (1999), "The impact of greater bank disclosure amidst a banking crisis", Federal Reserve Bank of Boston 1999 series No 99-1, but also version in *Journal of Financial Intermediation* 9 (July 2000): 298-319.
- Kaminsky, G.L. and C.M. Reinhart (1999), "The twin crisis: the causes of banking and balance-of-payments problems", *American Economic Review*, 89(3), 473-500.
- Kashyap, K., R.G. Rajan and J.C. Stein (2008), "Rethinking Capital Regulation", Federal Reserve Bank of Kansas City Symposium.
- Kirkpatrick, G. (2009), "The corporate governance lessons from the financial crisis", ISSN 1995-2864, *Financial Market Trends*, ©OECD 2009, Pre-publication version for Vol. 2009/1.
- Krishnan, J. (2005), "Audit committee quality and internal control: an empirical analysis", *The Accounting Review*, Vol. 80, N°2, PP. 649-675.
- Laeven, L. and R. Levine (2008), "Bank governance, regulation and risk taking", SSRN (and 2009, "Corporate governance, regulation and bank risk taking", *JOF* 93, 259-275).
- La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. Vishny (1998), "Law and Finance", *Journal of political Economy*, 1998, vol. 106, no.6.
- Larcker, D., S. Richardson and I. Tuna (2005), "Ratings add fire to the governance", *Financial Times*, Mastering Corporate Governance (in association with Ernst & Young).
- Levine, R. (2010), "An autopsy of the US financial System", National Bureau of Economic Research (NBER Working paper series).



- Lorsch, J. (2005), "Building better boards by design", Financial Times, Mastering Corporate Governance (in association with Ernst & Young).
- Makunda, G. (2014), "the price of Wall Street's power", Harvard Business Review.
- Männasoo, K. and DG. Mayes (2009), "Explaining bank distress in Eastern European transition economies", Journal of Banking & Finance 33 (2009) 244–253.
- Mariathasan, M and O. Merrouche (2012), "The manipulation of Basel risk-weights. Evidence from 2007-10". ISSN 1471-0498, University of Oxford, Department of Economics Discussion Paper Series.
- Markit study (2009), "The CDS Big Bang: understanding the changes to the global CDS contract and North American Conventions".
- McDonald, R L. (2011), "Contingent Capital with a dual price trigger", SSRN.
- Mehran, H., A. Morrison, and J. Shapiro (2011), "Corporate Governance and banks: what have we learned from the financial crisis?", Federal Reserve Bank of New York Staff Reports no. 502 June 2011.
- Merton, RC. (1977), "An analytic derivation of the cost of deposit insurance and loan guarantees: an application of modern option pricing theory", Journal of Banking and Finance 1, 3-11.
- Minton, B., J. Taillard, and R. Williamson (2012), "Financial expertise of the board, risk taking, and performance: evidence from the Bank Holding Companies", SSRN.
- Miller, S., E. Olson and T J. Yeager (2015), "The relative contributions of equity and subordinated debt signals as predictors of bank distress during the financial crisis", Journal of Financial Stability 16 (2015) 118-137.
- Mongiardino, A. (2010), "Risk governance at large banks. Have any lessons been learned?", Presentation at Moody's investor services (related paper with A. Plath, same title, in Journal of Risk Management in Financial Institutions 3, 116-123).
- O'Keefe, J., and J. Reidhill (1997) "Off-Site Surveillance Systems." In Federal Deposit Insurance Corporation, History of the Eighties, Lessons for the Future, Vol. 1, Washington D. C. (1997), 477-520.
- O'Keefe, J. and JA. Wilcox (2009), "How has bank supervision performed and how might it be improved?", The Federal Reserve Bank of Boston's 54th Economic Conference, "After the Fall: Re-evaluating Supervisory, Regulatory and Monetary Policy." October 20-23, 2009.

- Pennacchi, G. (2010), "A Structural Model of Contingent Bank Capital", University of Illinois, College of Business.
- Pirotte, A. (2011), *Econométrie des données de panel (Théorie et applications)*, Economica.
- Prescott, ES. (2012), "Contingent Capital: the trigger problem", *Economic Quarterly* – Volume 98, Number 1 – First Quarter 2012 – Pages 33-50.
- Raunig, B. (2011), "The credit risk of banks and non-banks during the crisis: evidence from the CDS market", SSRN.
- Reinhart CM. and KS. Rogoff (2008), "Is the US sub-prime crisis so different? An international historical comparison", *American Economic Review* 98, no. 2:339-344.
- Shleifer, A. and R. Vishny (1997), "A survey of corporate governance", *The Journal of Finance*, VOL LII, N°. 2.
- Sing, V., S. Terjesen and S. Vinnicombe (2008), "Newly appointed directors in the boardroom: how do women and men differ?", *European Management Journal* (2008), 26, 48-58.
- Stulz, RM. (2010), "Credit Default Swap and the Credit Crisis", *Journal of Economic Perspectives*, Volume 24, No 1, 73-92.
- Sundaresan, S. and Z. Wang (2010 and 2011), "On the design of contingent capital with market trigger", *Federal Reserve Bank of New York, Staff Report no. 448*.
- Taylor, JB. (2008), "The Financial crisis and the policy responses: an empirical analysis of what went wrong", *Bank of Canada. A Festschrift in honour of David Dodge*. November 2008.
- Useem, M. (2005), "Structures to help Directors reach the point", *Financial Times, Mastering Corporate Governance (in association with Ernst & Young)*.
- Wheelock, DC. and PW. Wilson (2000), "Why do banks disappear? The determinants of US bank failures and acquisitions", *The Review of Economics and Statistics*, February 2000, 82(1): 127-138.
- Wilson, T., (1998), "Portfolio Credit Risk", *FRBNY Economic Policy Review / October 1998*.



## Résumé

Fort d'un regard sur la régulation et la gouvernance, l'objet de cette thèse est d'étudier les mécanismes de prévision du défaut d'une banque qui légitiment l'intervention du régulateur.

Nous analysons la pertinence de la classification CAMELS et de ses déterminants afférents en utilisant des banques non exclusivement américaines.

Les variables financières réagissant selon la zone observée, nous en déduisons la nécessité d'une supervision locale efficace, même si des institutions globales de régulation contribuent à davantage de sécurité et de transparence.

Puis, nous examinons si une gouvernance renforcée réduit nécessairement les problèmes financiers des banques européennes en montrant que certains déterminants améliorent la supervision et la régulation.

Enfin, pour l'intervention du régulateur nous proposons un mécanisme de prévision du défaut bancaire basé sur une différence temporelle minimum à ne pas franchir, à partir du spread de CDS de la banque suivie selon 2 seuils fixés.

## Abstract

Based on previous knowledge of regulation and governance, the aim of this thesis is to study the factors that forecast bank default and hence legitimize regulator intervention.

We consider the relevance of using the CAMELS classification and related determinants, not only for American banks but a more global sample.

As financial variables react differently depending on a bank's location, we find that efficient local supervision is essential, even if global regulation may help to ensure more security and transparency.

Then, we examine whether better governance necessarily reduces the possibility of financial distress for European banks, finding that some determinants suggest the need for increased supervision and regulation.

Finally, for regulator intervention we suggest a model to forecast bank default based on a minimum lapse of time, which should not be exceeded, from the CDS spread of the monitored bank using 2 triggers set initially.

## Mots Clés

banque, gouvernance, régulation, crises financières, risque de défaut, CDS, prévision, ratio de tier 1 capital, bâle III

## Keywords

banks, governance, regulation, financial crises, default risk, CDS, forecast, tier 1 capital ratio, basel III