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Une analyse de la régulation bancaire par le marché après la crise : la discipline de marché contre-attaque

Gaëtan Le Quang

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Gaëtan Le Quang. Une analyse de la régulation bancaire par le marché après la crise : la discipline de marché contre-attaque. Economies et finances. Université de Nanterre - Paris X, 2019. Français. NNT : 2019PA100092 . tel-02493353

HAL Id: tel-02493353

<https://theses.hal.science/tel-02493353v1>

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Membre de l'université Paris Lumières

Gaëtan Le Quang

Une analyse de la régulation bancaire par le marché après la crise

La discipline de marché contre-attaque

Thèse présentée et soutenue publiquement le 18 novembre 2019
en vue de l'obtention du doctorat de Sciences économiques de l'Université Paris
Nanterre
sous la direction de Mme Camille Cornand (Directrice de recherche, GATE Lyon
Saint-Etienne)
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An analysis of banking regulation through the
market in the post-crisis era

Market discipline strikes back

Gaëtan Le Quang

Remerciements

Il y a très exactement dix ans, j'entrais en classe préparatoire. Parmi les nombreuses disciplines qui m'étaient alors enseignées, l'économie était assurément celle qui me plaisait le moins. C'est qu'à l'époque je ne parvenais pas à me saisir des mécanismes d'un système que je trouvais tellement peu poétique, qu'en réalité, je lui accordais bien peu d'attention. Concours faisant, il a cependant fallu s'y atteler. En économie, tout est question de point d'entrée et pour moi il y en a eu deux: le manuel de macroéconomie de Cohen et Blanchard et les travaux d'Aglietta et Orléan sur la monnaie et la valeur. Ce qui commençait à me plaire alors, c'était tout à la fois la capacité des modèles économiques à résumer en quelques relations des interactions complexes et le caractère tout à fait vertigineux, pour celui qui s'y confronte vraiment, de la question monétaire. Bref, un rapport un peu schizophrène à l'économie (tant les modèles mathématiques sont parfois le remède le plus sûr au vertige) que je sais gré à Camille Cornand et à Laurence Scialom d'avoir laissé s'exprimer dans cette thèse.

C'est à elles que j'adresse ainsi naturellement mes premiers remerciements. A elles qui ont, chacune, dirigé un de mes mémoires de master et qui ont, ensemble, dirigé cette thèse. Merci pour la confiance que vous avez su me

témoigner et pour votre encadrement exceptionnel. Camille, je te remercie du fond du coeur de l'attention que tu m'as accordée non seulement pendant ces années de thèse, mais également depuis notre rencontre à la fin de l'année 2013 et le mémoire que j'ai réalisé à ce moment sous ta direction. Je suis toujours impressionné par les retours que tu fais sur mon travail, très souvent commenté ligne par ligne. Laurence, merci pour l'enthousiasme contagieux que tu transmets ! Je suis toujours très heureux de venir discuter de mon travail avec toi parce que, quoi qu'il arrive, je sors l'esprit vivifié de nos conversations. Si je suis parvenu à mettre en cohérence mon travail de thèse autour d'un motif central, c'est assurément en grande partie grâce à ces discussions. Encore merci à vous deux de m'avoir permis de mener cette thèse comme je le souhaitais. Si j'ai pu m'épanouir dans ce travail, c'est très certainement grâce à vos conseils toujours avisés et à la liberté que vous avez su m'accorder.

Je remercie les membres de mon jury: Vincent Bouvatier et Jean-Charles Rochet d'avoir accepté d'être les rapporteurs de cette thèse ; Eve Chiapello et Oléna Havrylchyk de me faire l'honneur de participer à ce jury.

Je souhaite également témoigner toute ma gratitude à l'ensemble des membres d'EconomiX pour avoir rendu ces années de thèse aussi agréables que possible. Merci à Frédéric Hammerer et à Valérie Mignon pour leur disponibilité et leur grande réactivité. Merci à mes collègues doctorants que je ne peux malheureusement pas tous citer. Je pense, en particulier, à Alexis et à Benjamin avec qui j'ai commencé cette thèse et partagé tant de déjeuners. A Lesly et à Stellio qui ne m'ont pas laissé seul quand mes deux camarades ont déserté la cantine. Je pense bien sûr à mes collègues du

G301, en particulier Baptiste, Chunsoo, Franck, Maxime, Ouafa, Samira et Tatiana.

Je tiens à remercier chaleureusement Aurélien Eyquem qui a accompagné mes premiers pas en économie. Merci pour ton attention toujours bienveillante, tes encouragements et l'intelligence avec laquelle tu sais enseigner. De mes années lyonnaises, je garde aussi le souvenir du fort sympathique atelier d'économie, animé entre autres par Marie Eyquem, Pauline Gandré et Laurine Martinoty, qui a été ma première confrontation à la recherche en économie.

Je suis également reconnaissant à Xavier Freixas de m'avoir accueilli à Barcelone à l'automne 2017. Merci à mes collègues de la Pompeu Fabra pour leur accueil. En particulier, merci à Juan pour les nombreux déjeuners et discussions, sans lesquels ma vie sociale aurait été bien pauvre pendant ces quelques mois.

Merci à Michel Prada d'avoir accepté de lire cette thèse et pour ses commentaires bienveillants et affutés.

Je voudrais bien évidemment aussi remercier mes amis, mes copains de toujours, ceux qui sont là, pour certains, depuis plus de dix ans maintenant, d'autres, depuis moins longtemps. Mon bel ami Charles-André pour toutes nos aventures, de la conquête de la Tyrie à celle du savoir absolu, bref pour tout le temps passé hors du monde, à décrire des ailleurs n'en ayant pas. Merci aux trois plus beaux, Emilien, Jean-Guillaume et Maxence, pour toutes les choses que l'on ne dira pas, mais surtout pour la belle amitié et les souvenirs en chapelet. Merci à mes partenaires du dojo et à mes professeurs d'aïkido de m'offrir au quotidien une autre voie d'épanouissement.

Ceux à qui je pense le plus peut-être cependant, ce sont mes parents, pour leur soutien sans faille, pour leur confiance et leur ouverture d'esprit. Merci de m'avoir permis de suivre mon propre chemin, de ne jamais avoir remis en doute mes choix, d'essayer tant bien que mal de comprendre ce que je fais et ce qui m'intéresse.

Pour finir, merci à Julia pour sa patience aux limites à peine visibles. Merci d'avoir accepté de lire (et de relire) ma thèse. Les mots ne suffisent ici pas à te dire toute ma reconnaissance, comme le raconte Barthes "ce sont des phrases, je fais des phrases avec le plus aimant de moi-même", alors merci simplement de m'avoir accompagné pendant cette thèse et de m'avoir aidé à y mettre un point final.

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Préface

La crise financière de la fin des années 2000 est l'échec d'une conception de la régulation bancaire centrée sur l'idée de discipline de marché. Dans cette perspective, l'ensemble du cadre réglementaire repose sur l'hypothèse que les marchés financiers offrent l'assise la plus sûre aux règles qui encadrent les institutions financières. Quand les marchés financiers fonctionnent correctement, ces règles sont opérantes et elles renvoient alors l'image d'un système auto-régulé qui allie profits élevés, *via* l'innovation financière par exemple, et stabilité. Quand les marchés se mettent à dysfonctionner, au point que certaines grandes banques comme BNP Paribas confessent leur incapacité à déterminer la valeur de certains des actifs détenus par leurs fonds, aucune de ces règles basées sur le marché ne permet de remédier à ces dysfonctionnements. Pire encore, elles participent alors souvent à l'effondrement complet du système. Le ratio de capital pondéré par les risques, c'est-à-dire pondéré par une mesure du risque produite par des modèles qui reposent sur des hypothèses particulières concernant le fonctionnement des marchés financiers, a ainsi renforcé la procyclicité du système bancaire. De fait, à mesure que les prix des actifs baissaient, le ratio en capital réglementaire devenait plus difficile à respecter, forçant les banques à vendre une partie de leurs actifs,

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accélérant ainsi la baisse des prix et précipitant donc l'ensemble du système dans une spirale délétère. Après la crise, le cadre réglementaire a fait l'objet d'une refonte. De nouvelles règles ont été mises en place et, pour nombre d'entre elles, elles témoignent d'une prise de conscience par le régulateur de la nécessité de faire évoluer la réglementation, en particulier pour mieux maîtriser le risque systémique. A ce titre, il est surprenant de constater que la discipline de marché figure toujours au rang des outils mis en avant par le corpus réglementaire. A certains égards, il semble ainsi que la crise financière a plus joué le rôle de catalyseur pour la mise en place de règles reposant sur des idées déjà anciennes que pour le développement d'idées nouvelles.

L'idée de discipline de marché, bien que mise à mal par la crise financière, est, en effet, à nouveau fortement mise en avant. La divulgation d'une information financière de qualité apparaît, de fait, toujours comme une condition nécessaire – ce qu'elle est vraisemblablement – et suffisante – ce qui est grandement sujet à débat – à une auto-régulation du système bancaire. C'est ce qu'indique explicitement le troisième pilier de Bâle III:

"Pillar 3 of the Basel framework aims to promote market discipline through regulatory disclosure requirements. These requirements enable market participants to access key information relating to a bank's regulatory capital and risk exposures in order to increase transparency and confidence about a bank's exposure to risk and the overall adequacy of its regulatory capital." (BCBS, 2015, p.1).

Le troisième pilier de Bâle III s'inscrit ainsi dans la parfaite continuité de

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son prédécesseur. Outre la question de la divulgation de l'information, la discipline de marché est dorénavant promue au travers de la mise en place de contraintes réglementaires en dette subordonnée. La mise en place de mécanismes de résolution interne (*bail-in*)¹ devant protéger les contribuables des coûteux renflouements externes (*bail-out*) a, en effet, été l'un des principaux impératifs guidant la réinvention de la réglementation bancaire après la crise. C'est tout l'objet du TLAC (*Total Loss Absorbing Capacity*) et du MREL (*Minimum Requirement for own funds and Eligible Liabilities*) que de définir les contraintes en "passifs éligibles" devant permettre une résolution interne en cas de faillite bancaire:

"The subordination of MREL-eligible instruments is important both for the signal it sends to investors about the loss absorbency of the instruments and to avoid 'no creditor worse off' (NCWO) issues. The report recommends requiring that globally systemically important banks (GSIBs) meet their MREL with subordinated instruments at least to a level of 14.5% of RWAs² (+ CBR³) in line with the TLAC term sheet. In addition, considering the systemic importance of other systemically important institutions (O-SIIs) but also the level playing field and cost considerations, it is recommended to also require O-SIIs to meet a subordination requirement of 13.5% of RWAs (+ CBR)." (EBA, 2016, p.8).

¹L'expression anglaise "*bail-in*" est généralement traduite en français par "renflouement interne". Cette expression est inappropriée dans la mesure où elle laisse à penser que de nouveaux fonds sont injectés dans la banque, ce qui n'est pas le cas la plupart du temps. Nous avons ainsi fait le choix de traduire "*bail-in*" par "résolution interne".

²Risk-Weighted Assets.

³Capital Buffer Requirements.

PRÉFACE

L'objet de cette thèse est d'étudier de quelle manière la discipline de marché s'inscrit dans le cadre réglementaire mis au point après crise. La thèse est composée de trois parties chacune divisée en deux chapitres. Les chapitres sont tous issus d'articles rédigés en anglais dont certains ont été soumis à des revues internationales. La première partie étudie en détail le lien entre divulgation de l'information, transparence et discipline de marché. La deuxième s'intéresse aux conséquences inattendues de la comptabilité financière, c'est-à-dire l'ensemble des règles qui encadrent l'établissement par les banques de leurs états financiers, sur le fonctionnement du système bancaire. La troisième partie examine de quelle façon les obligations contingentes convertibles, qui sont un type particulier de dette subordonnée, pourraient, ou non, tout à la fois assurer *ex ante* une discipline de marché permettant d'éviter les faillites bancaires et garantir *ex post* qu'une résolution interne ait lieu en cas de faillite. Avant d'entrer dans le coeur de la thèse, l'introduction générale présente ce qu'est la discipline de marché et la manière avec laquelle elle a été réactivée après la crise de la fin des années 2000. La section intitulée "le cadre réglementaire" située en fin d'introduction présente, de façon extrêmement succincte, les diverses normes dont il est question dans cette thèse.

Introduction générale

0.1 Qu'est-ce que la discipline de marché ? A la recherche d'une définition

La discipline de marché est un concept à dimension variable. Il peut être entendu, dans un sens étroit, comme l'ensemble des mécanismes qui permettent de résoudre les problèmes associés à la gouvernance des grandes entreprises tels que mis en avant par la théorie de l'agence (section 0.1.1). Dans un sens plus large, l'idée de discipline de marché renvoie à l'hypothèse générale que les marchés financiers disposent d'une capacité d'auto-régulation. Dans cette perspective, les marchés financiers constituent le fondement naturel de la réglementation financière (section 0.1.2). Ce qui se dégage alors de l'analyse du concept de discipline de marché, c'est un mode de gouvernamentalité spécifique dont Michel Foucault a fait la description dans ses cours au Collège de France (section 0.1.3).

0.1.1 La discipline de marché *stricto sensu*

Au sens strict, la discipline de marché est constituée de l'ensemble des mécanismes issus du marché grâce auxquels les problèmes identifiés par la théorie de l'agence (Jensen et Meckling, 1976), notamment l'aléa moral, sont résolus. Lorsque les fonctions de propriété et de contrôle de la firme sont séparées, il existe, en effet, un problème d'aléa moral dans la mesure où les actionnaires ne peuvent s'assurer complètement que la firme est effectivement gérée dans leurs intérêts et non dans ceux, potentiellement orthogonaux, des gestionnaires. Dans ce contexte, la discipline de marché désigne l'ensemble des

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moyens à disposition des actionnaires pour aligner les intérêts des gestionnaires sur les leurs et garantir ainsi une gestion efficace de la firme, efficacité étant ici entendue dans la perspective d'un capitalisme actionnarial.

Étendue au cas des banques, l'idée de discipline de marché recouvre les divers modes d'action dont disposent les différents créanciers (les actionnaires mais également les déposants et, plus largement encore, tous les détenteurs de titres de dette émis par la banque) pour éviter que des prises de risque excessives ne mènent à une faillite, ce qui les exposerait à des pertes potentiellement importantes. Plus précisément, Bliss et Flannery (2001) définissent la discipline de marché comme une procédure en deux étapes (Figure 1).

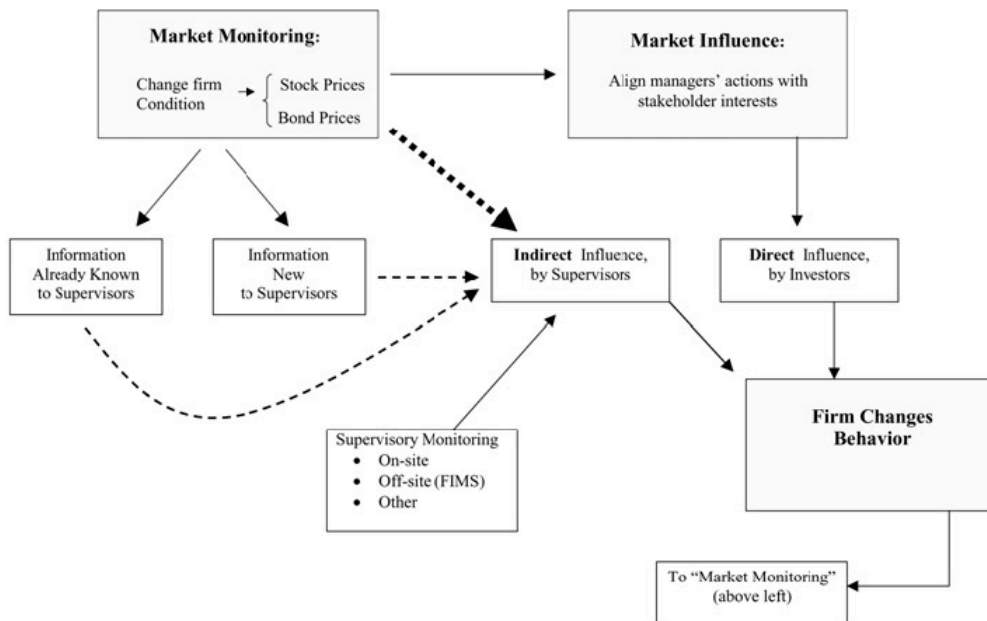


Figure 1: L'anatomie de la discipline de marché (Flannery, 2001, p.109)

Les créanciers de la banque exercent d'abord une activité de surveillance (*market monitoring*) dont le résultat est la production d'une information

qui, sous l'hypothèse d'efficience informationnelle des marchés financiers, est intégrée aux prix. Selon la nature de l'information transmise par les prix, une influence (*market influence*) peut ensuite être exercée sur le comportement de la banque. Si cette influence est exercée directement par les créanciers à l'origine de la production d'information, la discipline de marché est dite directe. Si l'influence est exercée par une tierce partie, une institution de résolution par exemple, la discipline de marché est alors indirecte.

La présentation théorique du concept de discipline de marché au sens strict soulève immédiatement un certain nombre de critiques qui pourraient limiter son efficacité concrète. En particulier, trois critiques peuvent être adressées à la manière avec laquelle est abordée théoriquement la discipline de marché (Bliss et Flannery, 2019).

- La dérivation théorique de l'idée de discipline de marché repose sur l'hypothèse d'un unique investisseur représentatif alors, qu'en réalité, il existe une grande diversité d'investisseurs aux incitations différentes. Il est alors peu probable que l'ensemble de ces incitations convergent de façon à exercer sur la banque une pression qui la force à modifier sa stratégie d'investissement. Il est plus vraisemblable que, lorsqu'un certain type de financement est momentanément difficile à obtenir, la banque se tourne vers une autre source de financement sans pour autant réduire sa prise de risque.
- Dans la même veine, les investisseurs n'investissent pas dans un unique titre, auquel cas ils seraient effectivement incités à surveiller attentivement l'entreprise qui l'a émis, mais investissent dans un portefeuille

d'actifs où le risque idiosyncratique associé à chaque titre est réduit par diversification. L'investisseur est donc, en réalité, peu incité à surveiller chacune des entreprises émettrices des titres constitutifs de son portefeuille.

- L'idée de discipline de marché repose entièrement sur l'hypothèse d'efficience informationnelle. Or, l'activité des banques prend place au sein d'une économie de l'information caractérisée par de fortes asymétries. Le rôle des banques consiste ainsi en grande partie à résoudre les asymétries d'information que ne peuvent résoudre les seuls mécanismes du marché. Il y a donc une incompatibilité théorique entre efficience informationnelle et économie bancaire, ce qui constitue d'emblée une limitation au concept de discipline de marché.

Dans le cas des banques, le schéma simple de la discipline de marché au sens strict est, cependant, encore compliqué par la particularité de l'activité bancaire et par le traitement spécifique accordé aux faillites bancaires. Bien qu'étant des entreprises privées, les banques remplissent, en effet, une mission de service public en contribuant au bon fonctionnement du système de paiement, lequel se présente sous la forme d'un réseau complexe d'interrelations entre les institutions constitutives du système bancaire. La faillite d'une banque peut ainsi avoir un impact sur l'ensemble du système et représenter un coût important pour la société dans son ensemble. Cette spécificité du fonctionnement du système bancaire justifie aussi bien l'activité de prêt en dernier ressort des banques centrales que les renflouements externes dont bénéficient certaines banques en faillite. En particulier, les banques

dites systémiques bénéficient d'une garantie implicite du fait du principe du *too big to fail*. Ce dernier, formulé pour la première fois en 1984 alors que le gouvernement des États-Unis décide de recapitaliser Continental Illinois, est une source importante d'aléa moral à même de ruiner la crédibilité de toute discipline qui voudrait s'exercer sur une banque systémique. Dans le cas du système bancaire, l'essence même de la discipline de marché, c'est-à-dire l'auto-régulation reposant sur la logique de l'intérêt bien compris s'exprimant par le marché, se heurte donc à l'action extrinsèque du régulateur qui vient fausser le jeu des incitations.

0.1.2 La discipline de marché *lato sensu*

Ce qui est visé par l'idée de discipline de marché lorsqu'elle est invoquée dans le cadre de la régulation du système bancaire dépasse, cependant, la définition étroite qui en a été donnée dans la section précédente. La discipline de marché ne se réduit, en effet, pas aux modalités de l'action des créanciers sur le comportement des banques, mais renvoie à l'hypothèse générale selon laquelle le marché, entendu comme un ensemble de prix, doit être le point d'ancrage des règles qui encadrent l'activité des institutions financières. Le ratio de capital pondéré par les risques s'inscrit ainsi dans cette logique de régulation par les prix de marché. Cette transversalité de la discipline de marché a explicitement été exprimée par le comité de Bâle:

"Market discipline has the potential to reinforce minimum capital standards (Pillar 1) and the supervisory review process (Pillar 2)."
(BCBS, 2001, p.1).

Le troisième pilier consiste ainsi moins en la définition de contraintes supplémentaires qui viendraient s'ajouter à celles présentées dans les deux premiers piliers, qu'en la clé de lecture d'un cadre réglementaire qui fait du marché le lieu ultime de véridiction. Définir un ratio de capital pondéré par les risques revient, en effet, à s'en remettre entièrement à la capacité du marché à dire la valeur par les prix. A ce titre, la mise en place, dans la période récente, d'un ratio de levier simple, c'est-à-dire non pondéré par le risque, est peut-être le signe d'une remise en question (au moins partielle) de l'hypothèse de discipline de marché au sens large.

0.1.3 Discipline de marché et gouvernementalité

La discipline de marché s'inscrit, en réalité, dans un processus général de transformation de l'exercice du pouvoir, ou du gouvernement, dont Michel Foucault a fait l'analyse, en particulier dans ses cours au Collège de France.⁴ Constatant que le pouvoir se manifeste dorénavant moins sous une forme directe, extérieure au milieu dans lequel interagissent les individus qui y sont soumis, Foucault développe, en effet, une conception du pouvoir comme action à distance s'exprimant dans et au travers d'un milieu. Ce pouvoir du milieu qui s'exerce sur des individus constitués en sujets intéressés, c'est proprement la discipline de marché si l'on remplace "milieu" par "marché" et "individus" par "institutions financières". Avec la discipline de marché, il s'agit, en effet, moins d'agir directement en réprimant les comportements jugés inadaptés, que de construire un milieu, ici un marché, c'est-à-dire un

⁴En particulier dans le cours de l'année 1979 intitulé "Naissance de la biopolitique". Ce cours a été mis en forme et édité au début des années 2000.

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ensemble de prix, devant permettre au mieux à des individus intéressés, ici des banques, d'effectuer les calculs nécessaires à leur orientation:

"Et ce lieu de formation de la vérité, plutôt que de continuer à la saturer d'une gouvernementalité réglementaire indéfinie, on va reconnaître – et c'est là que les choses se passent – qu'il faut le laisser jouer avec le moins d'interventions possible pour que, justement, il puisse et formuler sa vérité et la proposer comme règle et norme à la pratique gouvernementale. Ce lieu de vérité, c'est bien entendu non pas la tête des économistes, mais le marché."
(Foucault, 2004, p.31).

L'hypothèse de la régulation biopolitique est que les interactions des individus calculateurs aboutissent à une auto-régulation qui rend non nécessaire l'intervention extérieure et directe du pouvoir. Le pouvoir se manifeste, ainsi, désormais sous la forme d'une action indirecte qui prend non plus les individus pour cible, mais leurs intérêts :

"L'intérêt maintenant au principe duquel la raison gouvernementale doit obéir, ce sont des intérêts, c'est un jeu complexe entre les intérêts individuels et collectifs, l'utilité sociale et le profit économique, entre l'équilibre du marché et le régime de la puissance publique, c'est un jeu complexe entre droits fondamentaux et indépendance des gouvernés. Le gouvernement, en tout cas le gouvernement dans cette nouvelle raison gouvernementale, c'est quelque chose qui manipule des intérêts." (Foucault, 2004, p.46).

L'auto-régulation du milieu *via* la poursuite individuelle des intérêts est en-

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suite assurée par la logique panoptique, sorte de "démocratisation de l'exercice du pouvoir" selon Foucault, qui érige l'opinion publique en tribunal permanent dont les verdicts assurent cette régulation endogène :

"C'est d'elle [l'opinion publique] que l'on attend l'exercice le moins coûteux et le plus efficace d'un contrôle régulateur [...] Cette nouvelle forme de pouvoir entend faire l'économie de la répression au profit de la 'manipulation' des intérêts par l'autonomisation de l'action sur le milieu" (Laval, 2018, p.91).

La surveillance de chacun par tous (l'activité de *monitoring* mentionnée à la Figure 1) permise par la transparence du milieu panoptique rend donc non nécessaire, la plupart du temps, l'intervention extérieure du pouvoir souverain. Si, toutefois, la mécanique marchande devait produire des signes de dysfonctionnement, le pouvoir aurait, alors dans la perspective de ce que nous avons appelé une discipline de marché indirecte, à intervenir :

"Et c'est uniquement lorsque le gouvernement, limité d'abord à sa fonction de surveillance, verra que quelque chose ne se passe pas comme le veut la mécanique générale des comportements, des échanges, de la vie économique, qu'il aura à intervenir." (Foucault, 2004, p.69).

L'idéal de la discipline de marché est donc bien le même que celui du gouvernement panoptique décrit par Foucault. On comprend alors l'attention extrême que le régulateur bancaire porte à la question de la divulgation de l'information financière: la transparence visée ici sert, de fait, l'idéal

panoptique dont Foucault a montré l'importance pour que s'opère une autorégulation du milieu, c'est-à-dire une discipline de marché pour la question qui nous intéresse.

0.2 Les modes d'action de la discipline de marché

Dans cette section, les différents canaux d'exercice de la discipline de marché au sens strict sont présentés. L'efficacité d'une telle discipline est mesurée à la fois par sa capacité *ex ante* à limiter les prises de risque excessives et *ex post* à sanctionner les banques qui auraient pris de tels risques. Concrètement, la pression exercée par les créanciers, qui se matérialise par exemple au travers de la menace d'une hausse des taux demandés si la banque décide d'adopter un comportement plus risqué, doit *ex ante* orienter les décisions d'investissement de la banque vers un portefeuille d'actifs sûr. Dans l'éventualité où la banque déciderait malgré tout de poursuivre une stratégie d'investissement risquée et se retrouverait ainsi en faillite, des mécanismes doivent permettre une résolution interne *ex post*. Quoiqu'il en soit, pour que la discipline de marché soit efficace, il est nécessaire que les différents créanciers des banques soient en mesure d'évaluer correctement leurs situations. Crockett (2002) identifie ainsi quatre conditions qui doivent être remplies pour que la discipline de marché puisse s'exercer:

- les investisseurs doivent détenir suffisamment d'information,
- ils doivent être en mesure de traiter cette information correctement,

- ils doivent être incités (c'est-à-dire exposés à des pertes en cas de faillite) à traiter cette information et, le cas échéant, à exercer une influence sur la banque,
- il doit exister des mécanismes permettant à cette discipline de se matérialiser.

0.2.1 La discipline de marché par les actionnaires

Dans la mesure où l'efficacité de la discipline de marché est liée au risque de pertes en cas de faillite bancaire, les actionnaires se trouvent en bonne position pour exercer une telle discipline. De fait, parmi l'ensemble des créanciers, ils sont ceux appelés à essuyer en premier les pertes associées à une prise de risque excessive. Les actionnaires ont donc, de prime abord, intérêt à faire en sorte que les banques ne prennent pas des risques excessifs. En se penchant plus avant sur la nature d'une action, on se rend compte cependant que l'ensemble d'incitations dans lequel sont pris les actionnaires n'est pas aussi simple qu'une analyse rapide le laisse suggérer. De fait, une action s'apparente fortement à une option d'achat (*call option*) sur la banque qui l'a émise. Merton (1977) montre alors que la valeur de marché de l'action est une fonction croissante de la volatilité du portefeuille d'actifs de la banque: plus la banque prend de risque, plus la valeur de l'action augmente. Les actionnaires sont donc pris dans un faisceau d'incitations contraires. Ils sont, en effet, d'un côté, incités à faire en sorte d'éviter que la banque ne fasse faillite (et donc incités à limiter sa prise de risque) mais, d'un autre côté, ils sont incités à l'encourager à prendre plus de risque pour faire s'accroître la valeur de

marché des actions. La littérature *post* crise indique que l'incitation à la prise de risque l'emporte et que les actionnaires, loin d'exercer une discipline visant à limiter la prise de risque des banques, les ont encouragées à adopter des stratégies dangereuses:

"Shareholders actively encouraged banks to take on greater risks in order to match or exceed the performance of their peers."
(Stephanou, 2010, p.11).

"Market discipline as a mechanism of corporate governance is intrinsically biased in favor of strategies that involve greater risk-taking." (Hellwig, 2009, p.163).

Par ailleurs, la responsabilité limitée des actionnaires apporte une explication supplémentaire à l'idée selon laquelle ils sont, en réalité, incités à encourager les prises de risque. De fait, en tronquant à gauche la fonction de densité associée à différents projets d'investissement, la responsabilité limitée conduit à une allocation inefficace et encourage, en outre, les banques à "jouer pour se refaire" (*gamble for resurrection*) (Gollier *et al.*, 1997).

0.2.2 La discipline de marché par les déposants

Contrairement aux actionnaires, la rémunération des déposants n'est pas liée aux performances des banques. Les dépôts sont, en effet, associés à un taux d'intérêt fixe qui ne dépend pas du rendement de l'actif bancaire. Les déposants sont, ainsi, incités à limiter les prises de risque excessives desquelles ils ne retirent aucun bénéfice mais qui, au contraire, font peser

sur eux la menace de pertes. Deux limites s'opposent toutefois immédiatement au potentiel pouvoir disciplinant des déposants. D'une part, les déposants, de détail en particulier, sont vraisemblablement trop peu sophistiqués pour être capables d'exercer une surveillance efficace sur les banques (Dewatripont et Tirole, 1994). D'autre part, certains déposants bénéficient d'une protection *via* l'assurance des dépôts qui les prémunit contre les pertes éventuelles. L'existence d'une telle assurance des dépôts contrevient, en effet, à la troisième condition de Crockett (2002) puisqu'elle limite, de fait, les incitations des déposants assurés à exercer une surveillance coûteuse. Les données empiriques mettent ainsi en évidence que les banques qui recourent beaucoup aux dépôts assurés ont, en général, une capitalisation plus faible que celles qui y recourent peu (Baumann et Nier, 2006). Dans la même veine, Bartholdy *et al.* (2001) mettent en évidence que la prime de risque associée aux dépôts est, en moyenne, supérieure de quarante points de base dans les pays où il n'y a pas d'assurance des dépôts que dans ceux où une telle assurance existe. Demirgüç-Kunt et Huizinga (2004) et Forssbaeck (2011) apportent des éléments empiriques qui vont également dans le sens de l'idée que l'assurance des dépôts affaiblit la discipline de marché.

Contrairement aux déposants assurés, ceux qui ne bénéficient pas de l'assurance des dépôts sont exposés à des pertes en cas de faillite de la banque dans laquelle ils ont investi. Ces derniers sont donc incités à faire en sorte qu'une telle faillite ne survienne pas. En outre, ces déposants, majoritairement des banques, disposent d'une expertise qui leur permet d'exercer une activité de surveillance efficace et, si nécessaire, une influence. Cette dernière peut prendre la forme soit d'une intervention sur les prix, soit d'une inter-

vention sur les quantités. Dans le premier cas, les déposants demandent un rendement plus élevé à la banque lorsqu'ils estiment que le comportement de cette dernière leur fait porter un risque plus grand. De nombreuses études ont, ainsi, mis en évidence l'existence d'une relation négative entre les taux demandés sur les dépôts non assurés et la probabilité de faillite des banques (Hannan et Hanweck, 1988; Ellis et Flannery, 1992; Hess et Feng, 2007; Uchida et Satake, 2009). Les taux sur les dépôts incluent donc une prime de risque qui est une fonction croissante de la prise de risque de la banque. La discipline de marché s'exerce alors efficacement lorsque les banques, désireuses de limiter la hausse de leurs coûts de financement, décident de réduire leurs prises de risque. Dans le second cas, si les déposants non assurés considèrent que la banque est trop risquée, ils peuvent décider de retirer leur dépôts. On comprend alors pourquoi les banques dont la probabilité de défaut est élevée ne parviennent pas à attirer ce type de déposants (Billet *et al.*, 1998; Jagtiani et Lemieux, 2000; Maechler et McDill, 2006 et Shimizu, 2009). Martinez-Peria et Schmukler (2001) apportent des éléments empiriques qui illustrent l'existence d'une discipline de marché s'exerçant à la fois par les prix et par les quantités pour l'Argentine, le Chili et le Mexique. Calomiris et Powell (2000) font de même pour l'Argentine.

Cependant, dans la mesure où les banques ne sont pas réglementairement tenues de financer une partie de leurs activités avec des dépôts non assurés, une banque qui ferait face à des taux élevés sur ses dépôts non assurés et à des retraits importants de la part de ses déposants non assurés n'aurait qu'à se tourner vers des déposants assurés pour poursuivre ses activités comme elle l'entend. Le pouvoir disciplinant des déposants non assurés est donc

limité par la possibilité offerte aux banques de substituer, à tout moment, des dépôts assurés aux dépôts non assurés (Billet *et al.*, 1998). Bennett *et al.* (2015) mettent en effet en évidence, en étudiant les banques qui ont fait faillite sur la période 2008-2010, qu'à proximité du point de faillite, les banques diminuent la proportion de leur passif constitué de dépôts non assurés pour les remplacer par des dépôts assurés.

0.2.3 La discipline de marché par les autres créanciers

La crise de la fin des années 2000 a mis en évidence une catégorie de créanciers qui ne peuvent ni être considérés comme des actionnaires, ni comme des déposants, il s'agit des agents qui interviennent sur le marché de gros de la liquidité (*wholesale funding*). Le financement de gros regroupe un ensemble varié d'instruments, comme par exemple les contrats de *sale and repurchase agreement* (*repos*) ou les certificats de dépôt, dont la caractéristique principale est d'être associés à des maturités courtes. Une banque qui se finance sur le marché de gros de la liquidité doit ainsi très régulièrement renouveler les contrats arrivés à échéance. Ce type de financement a connu un grand succès dans les années 2000 (Diamond et Rajan, 2009) dans la mesure où il s'agissait, pour les banques, d'une source de financement facile d'accès permettant de compléter les dépôts de détail (Feldman et Schmidt, 2001).

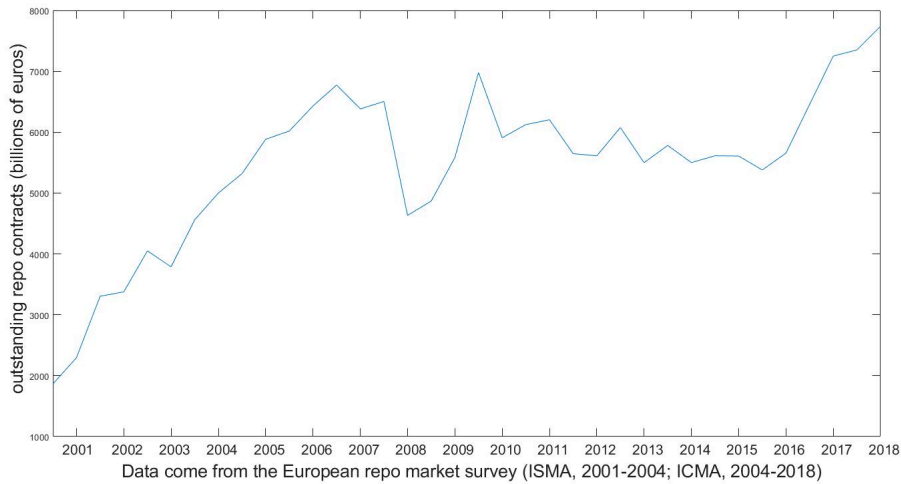


Figure 2: Encours de *repos* sur le marché européen entre 2001 et 2018

La Figure 2 montre de quelle manière l’encours de *repos* a augmenté dans la période qui a précédé la crise, passant ainsi de 2000 milliards d’euros à la fin de l’année 2001 à 6000 milliards à la fin de l’année 2006. A ce moment, les contrats *repos* constituaient, en effet, une source de financement à moindre coût pour les banques, dans la mesure où ils disposaient d’une super-séniorité due à un traitement extrêmement favorable (*safe harbour status*) en cas de faillite (Perotti, 2010).

Le financement *via* le marché de gros de la liquidité était, avant la crise, considéré comme un facteur à même de renforcer la discipline de marché. De fait, contrairement aux petits déposants, les prêteurs qui participent au marché de gros de la liquidité sont souvent des institutions financières sophistiquées, c’est-à-dire à même d’exercer une véritable surveillance sur les banques à qui elles ont prêté (Calomiris et Kahn, 1991; Calomiris, 1999). En outre, l’accès facile à cette source de liquidité à moindre coût devait permettre aux banques de faire face aux retraits non anticipés (et potentiellement

déstabilisateurs) de liquidité de la part des déposants (Goodfriend et King, 1998). En réalité, la crise financière a montré que le rôle disciplinant attendu des créanciers intervenant sur le marché de gros de la liquidité n'a joué, au mieux, qu'à la marge. C'est que, comme le montrent Huang et Ratnovksi (2011), ces créanciers peuvent avoir, dans certaines situations, des incitations faibles à exercer une coûteuse discipline de marché. Pire, ils peuvent contraindre les banques à liquider une partie de leurs actifs en refusant de renouveler les contrats de financement arrivés à échéance. Dans ce cas, la banque se trouve en situation d'illiquidité et doit céder une partie de ses actifs à un prix souvent dégradé, alimentant ainsi potentiellement des spirales d'illiquidité aux effets extrêmement délétères (Brunnermeier et Pedersen, 2009; Morris et Shin, 2016). En outre, puisque l'accès au financement sur le marché de gros est souvent lié à la qualité du collatéral avancé par la banque emprunteuse, à mesure que l'actif de cette banque se dégrade, la valeur du collatéral et donc sa capacité d'emprunt se détériore. C'est ce que démontrent théoriquement Acharya *et al.* (2011). Dans cette perspective, une variation, même faible, de la valeur de l'actif d'une banque peut avoir un impact important sur sa capacité de financement: le risque de liquidité et le risque de solvabilité s'alimentent donc l'un l'autre, c'est peut-être l'enseignement principal de la crise financière de 2007-2008.

0.2.4 La discipline de marché et les produits dérivés

Jusqu'à présent, la discipline de marché a été pensée au travers du schéma simple créancier-banque. L'innovation financière vient, cependant, perturber

ce modèle en introduisant la possibilité pour le créancier de se couvrir contre le risque de mauvaise gestion de la banque à qui il a prêté. Dans ce cas, le créancier se protège contre l'éventualité de la faillite de la banque qu'il n'a, de fait, plus réellement intérêt à empêcher, au prix de l'exercice d'une coûteuse discipline de marché. Les *credit default swaps* (CDS) offrent précisément aux créanciers la possibilité de s'assurer contre la faillite de la banque dans laquelle ils ont investi. Dans ce cas, les incitations à discipliner le comportement de la banque sont transférées des créanciers vers les émetteurs de CDS:

"However, a bondholder who has purchased default protection in the CDS market retains little incentive to monitor. The CDS market can therefore transfer much of the monitoring and influencing incentives from the bondholders to the protection writer. The effect on market discipline depends on the relative abilities and incentives of bondholders vs. protection writers in the CDS market. Because CDS issuers tend to be more concentrated than bondholders, they may have a greater incentive to monitor and thus provide a better market signal to be incorporated into indirect discipline." (Bliss et Flannery, 2019, pp.9-10).

Ce qui est intéressant ici, c'est l'idée qu'il est extrêmement difficile, voire impossible, de déterminer *ex ante* de quelle manière et par quels acteurs la discipline de marché pourrait se matérialiser. Tous les acteurs présentés, qu'il s'agisse des actionnaires, des déposants ou des institutions intervenant sur le marché de gros de la liquidité, sont, en effet, tout à la fois incités à exercer une telle discipline et trop peu incités à le faire. L'impossibilité

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de démêler *ex ante* l'entrelacement d'incitations dans lequel se trouve pris un agent particulier rend donc tout autant impossible la tâche de déléguer totalement le pouvoir régulateur au marché.

Plus précisément, la question de la complexité des incitations individuelles est une question au carré, ou plus exactement à la puissance du marché, dans la mesure où les incitations de chaque agent dépendent du comportement de tous les autres agents. Le schéma simple de la discipline de marché par les quantités, c'est-à-dire l'idée que les déposants influencent le comportement de la banque en exerçant sur elle la menace de retirer leurs dépôts, est alors rendu bien plus complexe puisque se pose désormais la question de la coordination entre ces déposants. Si ces derniers sont en mesure de s'entendre parfaitement et de partager toute l'information dont ils disposent, les retraits n'auront lieu qu'à proximité du point de non-viabilité de la banque. La discipline de marché est ici socialement efficace dans la mesure où elle sanctionne le comportement excessivement risqué d'une banque. Si, au contraire, la situation est telle qu'aucun déposant ne peut anticiper parfaitement le comportement des autres, un défaut de coordination peut conduire à précipiter une banque pourtant solvable dans une crise d'illiquidité.⁵ L'institution de résolution peut alors être forcée d'intervenir pour sauver la banque, ce qui ajoute aux pertes associées au défaut de coordination celles du sauvetage de la banque désormais proche de la faillite. La discipline de marché est donc nécessairement une arme à double tranchant: d'un côté, dans certaines situations, elle permet de réduire efficacement la nécessité d'une intervention

⁵Ce scénario correspond à ce que Bliss (2014) appelle une "discipline de marché destructrice".

extérieure souvent coûteuse ; de l'autre, son efficacité est totalement liée au réseau complexe d'incitations constitutif des marchés financiers dont la forme est *a priori* impossible à déterminer.

0.3 L'échec de la discipline de marché à enrayer la crise de la fin des années 2000

La manière avec laquelle la crise financière s'est déroulée, c'est-à-dire en révélant l'existence d'un risque systémique à même de terrasser l'ensemble du système bancaire, et les instruments utilisés pour contrer ce déroulement, en particulier les renflouements externes et les mesures extraordinaires prises par les banques centrales, illustrent la faillite du cadre réglementaire élaboré au cours des années 2000. Nombre des mécanismes mis en place pour assurer l'auto-régulation du système financier se sont, en effet, avérés puissamment déstabilisateurs (section 0.3.1). Après la crise, la nécessité de mettre en place un cadre réglementaire permettant de contenir le risque systémique est alors apparue être une priorité (section 0.3.2).

0.3.1 Le marché auto-déstabilisateur

Le corpus réglementaire connu sous le nom de Bâle II repose, comme déjà indiqué, sur ce qui a été défini comme la discipline de marché au sens large. L'idée transversale à l'ensemble de ce cadre est, en effet, que les prix de marché constituent le fondement naturel à la définition de la valeur et donc, corrélativement, à celle du risque. C'est le sens du ratio de capital pondéré

par les risques. Une telle conception de la valeur est, par ailleurs, partagée par les normalisateurs comptables internationaux au travers de la promotion de la comptabilité dite à la juste valeur. Encore une fois, s'en remettre complètement aux marchés pour évaluer le risque peut avoir une certaine pertinence si ces marchés fonctionnent correctement, dans le sens où ils parviennent à produire effectivement une définition de la valeur et du risque. En revanche, dès lors qu'ils dysfonctionnent et, si l'ensemble du cadre réglementaire repose sur des données de marché, il n'existe aucun garde fou à même d'enrayer la dynamique auto-destructrice de l'ensemble du système.

Le destin de la comptabilité à la juste valeur à la fin des années 2000 illustre à merveille l'inadaptation du cadre réglementaire à une situation de crise. Pour déterminer la juste valeur de ses actifs, une banque dispose, en effet, de plusieurs options (voir la présentation du cadre réglementaire en fin d'introduction) selon les données disponibles. Dans le cas idéal, celui de la juste valeur de niveau 1, la valeur comptable de l'actif correspond à son prix de marché, la comptabilité à la juste valeur est alors, proprement, comptabilité à la valeur de marché. Le problème est que cela nécessite qu'un tel prix existe et soit observable, ce qui n'est justement pas le cas en situation de crise. Durant la crise, c'est donc bien plus la juste valeur de niveau 3, dont l'estimation repose, en réalité, bien peu sur des données de marché, qui a été utilisée:

"During the crisis, the fraction of assets with Level 1 inputs decreased, while those valued using models and unobservable inputs (Level 3) increased. Presumably, as the crisis unfolded, fewer assets were traded in active markets, requiring banks to use models

to value their assets." (Laux et Leuz, 2010, p.100).

Dans ce contexte, on comprend que, dès octobre 2008, l'IASB ait pris la décision d'apporter un amendement à IAS 39 pour permettre aux banques de reclasser une partie de leurs actifs d'une catégorie ressortissant à la juste valeur à une catégorie ressortissant au coût amorti.

En réalité, l'aspect le plus problématique de la comptabilité à la juste valeur, en période de crise, est son caractère procyclique qui accentue fortement les dynamiques du marché. C'est là quelque chose qu'elle partage avec le ratio de capital pondéré par les risques et qui explique certains des épisodes les plus violents de la crise. En effet, sous l'hypothèse de discipline de marché au sens large, le destin de l'ensemble des institutions financières est lié à celui du marché. Ainsi, lorsque le marché est en crise et que les prix des actifs baissent, le ratio de capital pondéré par les risques devient plus contraignant. Si les banques ne peuvent pas lever plus de capital, ce qui est généralement le cas en période de crise, elles se retrouvent contraintes de vendre une partie de leurs actifs pour remettre leur capital pondéré par les risques à niveau. Le problème est que de telles ventes accentuent encore la baisse des prix des actifs qui se répercutent dans les bilans de l'ensemble des institutions financières lorsque celles-ci utilisent la comptabilité à la juste valeur. Par ailleurs, si les banques recourent massivement au financement collatéralisé de court-terme et que la valeur de leurs actifs se dégrade, des appels de marge peuvent se produire et accentuer encore les difficultés de ces banques (Brunnermeier et Pedersen, 2009; Acharya *et al.*, 2011). Des difficultés surviennent alors des deux côtés des bilans bancaires et la terrible spirale entre risque de liquidité et risque de solvabilité apparaît au grand jour (Morris et Shin, 2016). Ce qui

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devait assurer la stabilité du système bancaire, le ratio de capital et la discipline de marché au sens strict permise par la transparence de l'information financière, a finalement joué un rôle extrêmement déstabilisateur. C'est ce que note le rapport Turner dès 2009:

"The events of the last five years have illustrated the inadequacy of market discipline: indeed, they suggest that in some ways, market prices and market pressures may have played positively harmful roles." (Financial Services Authority, 2009, p.45).

La crise s'est donc largement déroulée comme une dynamique endogène nourrie par le comportement de banques fortement engagées dans ce que Minsky (1986) appelle la finance Ponzi. Cette crise illustre ainsi à la perfection le second théorème de l'instabilité financière (Minsky, 1992). Selon ce théorème, les mêmes éléments qui permettent à un système de prospérer pendant une certaine période, typiquement la Grande Modération des années 2000, sont à l'origine de la crise qui précipite l'effondrement de ce système:

"The second theorem of the financial instability hypothesis is that over periods of prolonged prosperity, the economy transits from financial relations that make for a stable system to financial relations that make for an unstable system." (Minsky, 1992, p.8).

Le maître mot pour comprendre le déroulement de la crise de la fin des années 2000 est donc "endogène". C'est peut-être finalement vers l'école de la Régulation, qui décrit précisément comment un agencement institutionnel particulier explique tout à la fois le succès d'une forme particulière du capitalisme (le fordisme par exemple) et sa crise, qu'il faut se tourner pour

comprendre les dynamiques contemporaines des marchés financiers. Peut-être vaut-il également la peine de retourner encore plus loin et de revenir à Marx et à la minutieuse démonstration qu'il fait du renversement endogène du capitalisme. Quoi qu'il en soit, il est sûrement nécessaire de revenir à Hegel, lui qui a poussé à l'extrême l'exigence d'une pensée ne se nourrissant que d'elle-même et produisant ainsi, de manière parfaitement endogène, aussi bien sa fin que son commencement.

0.3.2 La prise de conscience de l'après crise: risque systémique et politique macroprudentielle

La crise a donc rendu nécessaire une refonte du cadre réglementaire. Une prise de conscience que la nature du risque est, en réalité, autre que celle définie par Bâle II semble désormais affecter aussi bien les universitaires que les régulateurs. Cette prise de conscience s'incarne en deux expressions qui qualifient le nouveau mal et son remède: "risque systémique" et "politique macroprudentielle".

La crise financière a, en effet, mis en évidence que le risque global ne peut être réduit à la somme des risques portés individuellement par les banques: "the riskiness of an asset can diverge from its systemic impact" (Morris et Shin, 2008, p.242). Le risque s'est ainsi plus manifesté du fait des interrelations entre les différentes institutions financières, amplifiées par la promotion de la discipline de marché au sens large par l'ensemble du corpus réglementaire, que du fait de comportements d'investissement individuels inappropriés. Dans cette logique, la discipline de marché au sens strict, par essence

microprudentielle, s'est naturellement montrée incapable d'assurer la mission auto-régulatrice qui lui était attribuée. Dans la mesure où cette discipline de marché au sens strict a été élaborée à un moment où la distinction entre les objectifs micro et macro-prudentiels n'était pas totalement comprise, les deux objectifs lui ont été problématiquement attribués (Stephanou, 2010). La règle de Tinbergen permet alors de comprendre pourquoi ni l'un ni l'autre de ces deux objectifs n'ont *in fine* été atteints.

L'objectif de la politique macroprudentielle est double. Il s'agit, tout à la fois, d'assurer la stabilité du système financier dans le temps et d'éviter que le risque ne soit excessivement concentré en certains endroits à un moment du temps. La politique prudentielle pré-crise ne remplissait aucun de ces objectifs dans la mesure où les banques se sont comportées de manière très procyclique (instabilité dans le temps) et que le risque était massivement concentré parmi quelques banques systémiques inter-connectées *via* un large système bancaire de l'ombre comme le notent Aglietta et Scialom (2010) (instabilité à chaque moment du temps). Le premier pilier a évolué dans un sens qui pourrait permettre d'enrayer la procyclicité du système bancaire. Des volants contracycliques ont ainsi été ajoutés au ratio de capital pondéré par les risques. Par ailleurs, l'introduction d'un ratio de levier simple témoigne du recul de l'hypothèse de discipline de marché au sens large. Deux ratios de liquidité ont, en outre, été ajoutés dans le but d'éviter que la spirale entre risque de liquidité et risque de solvabilité ne se matérialise à nouveau.

0.4 La discipline de marché après la crise

Qu'en est-il désormais de la discipline de marché ? A ce titre, il est intéressant de constater que, malgré ses évolutions récentes, le corpus réglementaire continue de faire la part belle tout à la fois à la discipline de marché dans son acception large – il est en effet toujours question d'un ratio de capital pondéré par les risques – et à la discipline de marché dans son acception stricte – la mise en place de contraintes réglementaires en dette subordonnée correspond bien à la volonté d'instaurer une telle discipline.

0.4.1 Discipline de marché, divulgation de l'information et transparence

La qualité de l'information publiée par les banques figure toujours au premier rang des préoccupations des diverses instances en charge de la réglementation financière. Il existe, d'ailleurs, un large consensus entre la réglementation prudentielle et les normes comptables internationales autour de l'idée que la transparence de l'information financière peut agir comme une condition suffisante à la stabilité financière. On trouve ainsi la citation suivante dans un des documents concernant le troisième pilier:

"The disclosure is intended to enable market participants to make more informed decisions about the risks of coupon cancellation for capital instruments, thereby potentially enhancing both price discovery and market stability." (BCBS, 2018, p.9).

De façon similaire, on trouve la citation suivante sur le site internet de la

fondation IFRS:

"Our mission is to develop IFRS Standards that bring transparency, accountability and efficiency to financial markets around the world. Our work serves the public interest by fostering trust, growth and long-term financial stability in the global economy."

(site de la fondation IFRS).

Dans les deux cas, un lien de causalité est exprimé entre la transparence de l'information et la stabilité financière. L'objet de la première partie de cette thèse consiste, précisément, à étudier les relations entre divulgation de l'information, transparence et stabilité financière. La deuxième partie de la thèse s'intéresse, quant à elle, à l'impact sur les banques de la manière dont l'information est produite, c'est-à-dire aux effets réels des normes comptables.

0.4.2 Discipline de marché et dette subordonnée

La crise financière de 2007-2008 a justifié, aux yeux du régulateur, la mise en place d'une discipline de marché au sens strict au travers d'un instrument qui, s'il n'a rien de nouveau, n'a pourtant jamais été utilisé auparavant: la dette subordonnée. L'idée que la discipline de marché pourrait passer par la mise en place de contraintes en dette subordonnée est ancienne mais n'a, en effet, jamais été exploitée par le régulateur jusque dans la période récente.

Précisément, une telle idée remonte aux années 1980 lorsqu'une première série de travaux, sorte de dette subordonnée de première génération, avance l'idée que la dette subordonnée pourrait avoir un effet disciplinant dans la mesure où elle devrait être plus coûteuse pour les banques dont les stratégies

d'investissement sont risquées (Benston *et al.*, 1986; Horvitz, 1986). Par la suite, d'autres travaux mettent l'accent sur l'idée que les banques en mauvaise position devraient se trouver dans l'impossibilité d'émettre de la dette subordonnée. L'impossibilité d'émettre une telle dette pourrait alors servir de signal devant déclencher l'intervention de l'autorité de résolution dans la perspective de la discipline de marché indirecte (Cooper et Fraser, 1988; Wall, 1989; Calomiris, 1999; Benink et Wihlborg, 2002).

Dans la période récente, la dette subordonnée a bénéficié d'un regain d'attention du fait de la définition de contraintes réglementaires en "passifs éligibles" par le TLAC et le MREL. Plus précisément, les obligations contingentes convertibles (cocos), instrument hybride dont les caractéristiques sont les mêmes que celles des obligations traditionnelles en période normale mais dont la nature change dès lors que survient un événement défini contractuellement, sont mis en avant comme une sorte de solution miracle permettant aux banques de disposer d'une structure de financement caractérisée par une forte capacité d'absorption des pertes à moindre coût (Squam Lake Working Group, 2009). La troisième partie de cette thèse vise à évaluer la pertinence d'une telle affirmation.

0.5 Organisation de la thèse

Le cadre réglementaire qui s'est mis en place à la suite de la crise de la fin des années 2000 fait donc toujours la part belle à la régulation par le marché. L'idéal d'une auto-régulation du système bancaire garantie par la transparence d'un milieu dans lequel interagissent des agents intéressés co-

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existe ainsi à côté d'avancées réglementaires qui témoignent pourtant d'une perte de confiance en les prix de marché. Partant de ce constat, l'objet de cette thèse est double. D'une part, il s'agit d'évaluer, à l'aide des outils traditionnels dont disposent les économistes, les effets potentiellement négatifs associés à la manière avec laquelle la discipline de marché a été réactivée après la crise. Les chapitres 2, 3 et 6 développent ainsi des modèles théoriques et le chapitre 4 propose une analyse économétrique visant à évaluer l'impact des principaux instruments au travers desquels la discipline de marché est aujourd'hui promue. D'autre part, cette thèse vise à apporter une perspective pluridisciplinaire au débat portant sur le renouvellement de la réglementation bancaire. Ce faisant, nous mettons en évidence que ce processus de renouvellement doit non seulement affronter des défis intellectuels nouveaux (développer des outils permettant d'enrayer le risque systémique par exemple), mais également passer outre aussi bien l'inertie associée à un certain équipement cognitif que les résistances politiques de certains groupes d'intérêt privé. Le maintien de la discipline de marché comme outil d'auto-régulation du système bancaire dans un cadre qui contraint, par ailleurs, les banques à se plier à des règles dont la raison d'être est l'échec de la discipline de marché à la fin des années 2000 s'explique, selon nous, par cette double résistance. De telles analyses sont développées, en particulier, dans les chapitres 1 et 5.

Dans le détail, la thèse est organisée en trois parties, chacune divisée en deux chapitres.

La partie I s'intéresse à la relation entre divulgation de l'information, transparence et stabilité financière. Dans cette perspective, dans le chapitre

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1 intitulé "What lies behind transparency", nous nous intéressons en détail à la notion de "transparence" en essayant de mettre au jour ce qui se trouve derrière son invocation quasi incantatoire. Dans le chapitre 2 intitulé "Do regulatory disclosure requirements always strengthen market discipline? A theoretical illustration", nous développons un modèle théorique qui montre qu'un accroissement de la précision de l'information véhiculée publiquement par les banques au travers de leurs états financiers peut, dans certaines situations, encourager les banques à détenir moins de capital et donc nuire à la discipline de marché. Pris ensemble, les résultats des chapitres 1 et 2 nous incitent donc à remettre en question l'attention extrême accordée par le régulateur à la question de la transparence de l'information financière.

Dans la partie II, nous étudions les conséquences que pourraient avoir les nouveautés introduites par IFRS 9. Dans le chapitre 3 intitulé "Taking diversity into account: real effects of accounting measurement on asset allocation", nous développons un modèle théorique qui met en évidence que ni la comptabilité au coût amorti ni la comptabilité à la juste valeur n'est une panacée. Le chapitre 3 insiste ainsi sur la nécessité de développer des normes comptables qui prennent en considération la diversité des institutions intervenant sur les marchés financiers. Une telle diversité apparaît, en effet, comme une condition nécessaire à la stabilité financière. Dans le chapitre 4 intitulé "Discretionary loan loss provisions and market discipline", nous nous intéressons à la relation entre l'établissement des provisions pour pertes et la discipline de marché. Nous montrons, empiriquement, que les banques utilisent la marge de manoeuvre qui leur est laissée au moment de l'établissement de leurs provisions dans un sens qui pourrait affaiblir la

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discipline de marché. En effet, les banques les moins bien capitalisées ont tendance à augmenter leurs provisions consécutivement à un renforcement de la discipline de marché (mesuré par une hausse du taux de dépôt) au lieu d'accroître leur capital.

La partie III s'intéresse à la manière avec laquelle la discipline de marché pourrait, ou non, être efficacement mise en place *via* la dette subordonnée, plus particulièrement les obligations contingentes convertibles (coco). Pour ce faire, le chapitre 5 intitulé "Contingent convertible bonds: one step forward or two steps backward?" présente en détail ce que sont les cocos et les principales raisons qui font craindre qu'ils pourraient, au final, agir contre la stabilité financière. Dans le chapitre 6 intitulé "Mind the conversion risk: contingent convertible bonds as a transmission channel of systemic risk", nous développons un modèle théorique qui montre comment les cocos pourraient servir de canal de transmission au risque systémique.

Le cadre réglementaire

Nous décrivons ici très succinctement le cadre réglementaire qui a été mis en place à la suite de la crise financière de la fin des années 2000. Nous présentons uniquement les normes ou les règles qui font l'objet d'une discussion dans cette thèse.

Bâle III

Bâle III est le nouveau cadre prudentiel concernant les banques. Comme son prédécesseur, il est organisé en trois piliers:

- *Pilier 1: les exigences en capital réglementaire.* La définition du capital réglementaire a été durcie et se centre désormais sur les actions ordinaires. Le capital CET1, c'est-à-dire les actions, doit désormais représenter 4.5% de l'actif pondéré par les risques, ce qui est plus du double de la contrainte précédente. En outre, des volants contracycliques ont été ajoutés et portent à 7% de l'actif pondéré par les risques la contrainte en capital CET1. Un ratio de levier simple, c'est-à-dire non pondéré par les risques, a été introduit.
- *Pilier 2: gestion et surveillance du risque.*

- *Pilier 3: discipline de marché.* Dans sa nouvelle version, le troisième pilier est beaucoup plus explicite concernant la nature des informations à divulguer. Les documents à produire par les banques dans le cadre du pilier 3 sont dorénavant conséquents et leur publication doit être au moins bi-annuelle (Bliss et Flannery, 2019).

En plus des exigences quantitatives en capital réglementaire, deux ratios de liquidité ont été introduit par Bâle III.

- Un ratio de liquidité à court-terme (*liquidity coverage ratio*, LCR) qui contraint les banques à détenir une quantité d'actifs liquides de haute qualité leur permettant de faire face à une crise de liquidité d'une durée d'un mois.
- Un ratio structurel de liquidité à long-terme (*net stable funding ratio*, NSFR) qui vise à assurer que l'ensemble des banques disposent d'une structure de financement stable. Ce ratio est, ainsi, défini comme le rapport entre le montant de financement stable disponible et le montant de financement stable exigé et doit donc être constamment supérieur à un.

Le référentiel IAS/IFRS

Le référentiel IAS/IFRS est constitué des normes produites par l'*International Accounting Standards Committee* (IASC) et, à partir de 2001, par son successeur l'*International Accounting Standards Board* (IASB). En 2005, l'Union Européenne a adopté ce référentiel pour l'ensemble des entreprises cotées.

Les normes comptables qui sont abordées dans cette thèse sont celles concernant la comptabilité à la juste valeur (IFRS 13) et celles concernant la comptabilité des instruments financiers (IAS 39 puis IFRS 9).

IFRS 13

IFRS 13 définit la juste valeur comme "le prix qui serait reçu pour la vente d'un actif ou payé pour le transfert d'un passif lors d'une transaction normale entre des intervenants du marché à la date d'évaluation (un prix de sortie)". Un tel prix n'existe, cependant, pas nécessairement. C'est la raison pour laquelle IFRS 13 propose une triple définition de la juste valeur. Trois niveaux de juste valeur sont ainsi distingués selon la nature de l'information utilisée pour la produire:

- *niveau 1* : il existe un prix de marché pour l'actif considéré, la juste valeur correspond donc à ce prix. On est alors pleinement dans la logique de la comptabilité à la valeur de marché.
- *niveau 2* : il n'existe pas de prix de marché pour l'actif considéré mais il en existe un pour une classe d'actifs similaires. La juste valeur du premier actif correspond alors à ce dernier prix.
- *niveau 3* : il n'existe pas de prix de marché pour l'actif considéré et il n'est pas possible d'en trouver un pour une classe d'actifs similaires. Dans ce cas, la firme utilise un modèle pour déterminer la juste valeur de son actif. On est alors dans une logique *mark-to-model*.

IAS 39 et IFRS 9

En janvier 2018, une nouvelle norme comptable concernant les instruments financiers entre en vigueur: IFRS 9 remplace IAS 39. IFRS 9 est une norme qui comprend trois volets: la mesure des actifs, l'établissement des provisions pour pertes et la comptabilité de couverture. Nous ne nous intéressons ici qu'aux deux premiers volets.

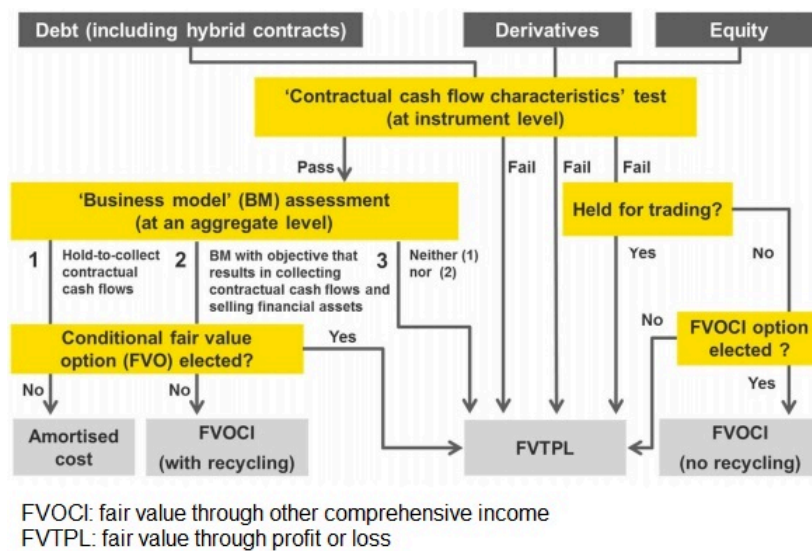


Figure 3: La classification et la mesure des instruments financiers avec IFRS 9 (EY, 2015, p.4)

- *La classification et la mesure des instruments financiers.* IFRS 9 introduit une classification des actifs qui repose sur une procédure en deux étapes présentée à la Figure 3. Dans un premier temps, la nature des flux de trésorerie associés à l'actif est évaluée: c'est le test *solely payment of principal and interests* (SPPI). Dans un second temps, le modèle économique de la banque est étudié et, selon sa nature, c'est la comptabilité au coût ou la comptabilité à la juste valeur qui devra

être retenue. En réalité, comme l'illustre la Figure 3, la juste valeur est largement privilégiée et reste l'option par défaut.

- *L'établissement des provisions pour pertes.* Avant la crise, les provisions pour pertes étaient établies selon un modèle reposant sur la logique de la perte avérée. Dans cette logique, une provision est faite uniquement lorsqu'il existe des preuves objectives de pertes associées au portefeuille de prêts. En 2009, le *Financial Stability Forum* (FSF) appelle les normalisateurs comptables à réviser ce modèle pour permettre une meilleure prise en considération du risque de crédit. Dans cette perspective, IFRS 9 introduit un modèle de provisionnement prospectif qui repose sur l'estimation d'une perte attendue. Plus précisément, IFRS 9 définit trois catégories (*buckets*) de risque de crédit, chacune associée à des exigences différentes en matière de provisions (voir Table 1).

	Quels actifs ?	Méthode de calcul de la provision
Bucket 1	Tous les prêts sont initialement classés dans cette catégorie	Perte espérée à horizon un an soit au niveau du portefeuille soit au niveau individuel
Bucket 2	Détérioration de la qualité de crédit	Perte espérée sur la vie de l'actif soit au niveau du portefeuille soit au niveau individuel
Bucket 3	Détérioration significative de la qualité de crédit	Perte espérée sur la vie de l'actif au niveau individuel

Table 1: L'établissement des provisions pour pertes avec IFRS 9

Solvabilité II

Solvabilité II est une directive européenne qui est entrée en application en janvier 2016 et qui concerne les compagnies d'assurance et de ré-assurance.

La structure de Solvabilité II reprend celle en trois piliers de Bâle II:

- *Pilier 1 : les exigences quantitatives.* Solvabilité II définit deux ratios de capital réglementaire:
 - le SCR (*Solvency Capital Requirements*) : il s'agit de la quantité de capital permettant d'absorber des pertes inattendues sur une période d'un an (techniquement le SCR se calcule comme la *Value-at-Risk* à 99.5% à 1 an);
 - le MCR (*Minimum Capital Requirement*) : c'est le seuil en dessous duquel l'autorité de supervision retire à l'assureur sa licence.
- *Pilier 2 : les exigences qualitatives.*
- *Pilier 3 : les informations à destination du public et du superviseur.*

Le MREL et le TLAC

Les renflouements externes importants de la fin des années 2000 ont motivé le développement de règles devant assurer une résolution interne des banques en faillite:

- le TLAC (*Total Loss Absorbing Capacity*) est une norme produite de façon conjointe par le *Financial Stability Board* (FSB) et par le comité

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de Bâle. Il a été introduit en 2013, sa version finale a été publiée en 2015 et sa mise en place complète est effective en 2019. Le TLAC ne concerne que les trente banques définies comme systémiques par le FSB.

- le MREL (*Minimum Requirement for own funds and Eligible Liabilities*) est une directive européenne qui s'applique à l'ensemble des banques localisées dans l'Union Européenne.

Ces deux standards définissent chacun des contraintes en "passifs éligibles" dont le but est de permettre aux banques de disposer d'une capacité interne d'absorption des pertes.

Part I

Information Disclosure, Transparency and Banks

Chapter 1

What lies behind transparency?

Abstract: Transparency is one of the notions that prove to be really problematic once considered out of well-circumscribed academic fields. While economists seem to agree on the idea that the relationship between transparency and financial stability is not necessarily positive, both banking regulators and accounting standards setters strongly advocate for an increase in financial information transparency. In this chapter, we show that this call for transparency is based on a flawed conception of the way financial markets work, whose main shortcoming is to start from a substantive conception of both "risk" and "value". Using some of the conceptual tools put forward by the social studies of finance, we show that financial markets are shaped by the instruments used to describe them. In this perspective, transparency is often only the mere reflection of the assumptions carried by those instruments.

1.1 Introduction

Transparency belongs to the set of ideas that are rarely questioned in so far as they shape what some economists consider as the most desirable world. This world is made of perfectly informed agents whose interactions naturally lead to the best possible outcome: this is the first theorem of welfare economics. This is a way of understanding why the notion of "transparency" lies at the center of prudential regulation and accounting standards without ever being properly defined or questioned. In fact, in those cases the use of the word "transparency" often seems to act as a "social mantra" (Strathern, 2000). This chapter aims at unraveling the different meanings of the word "transparency" to understand what lies behind its constant invocation.

The notion of transparency is broad-ranging, so that providing a short and comprehensive definition is a difficult if not impossible task. To begin with, transparency is coarsely understood as a particular emphasis put on the way information is produced and disclosed in financial markets. The main purpose of this chapter is therefore to study the impact on the economy of the way this information is produced and disclosed. To do so, section 1.2 presents some results found in the economic literature concerning the relationship between banks and transparency. Section 1.3 questions the very notion of transparency and shows that information disclosure is not synonymous with transparency. We furthermore argue that "transparency" actually appears as an inadequate notion to speak about financial markets. Section 1.4 discusses regulatory issues by first describing the way transparency is currently being addressed by the regulatory framework and then by suggesting new avenues

for further improving this framework.

1.2 Banks and transparency

1.2.1 The rationale behind banking: informational frictions

In a perfect frictionless world, there is no place for an economic theory of banking since the very *raison d'être* of banks is to solve information asymmetries (Freixas and Rochet, 2008). Therefore, economics of banking belongs to the theory of second best and it is consequently not possible to assume right from the start that an increase in information transparency necessarily leads to a better-functioning banking system. In other words, transparency is not necessarily desirable as far as banks are concerned. This is something that must be taken into account whenever discussing whether or not a piece of information has to be disclosed. This is what Goldstein and Sapra (2013) state concerning the disclosure of stress-test results:

"We will also argue that the benefits of disclosing stress-test results are clear: stress tests may uncover unique information about banks allowing both bank supervisors and market participants to exercise discipline on the bank's behavior. However, because banks operate in second-best environments that are prone to externalities, we argue that there are endogenous costs associated with such disclosures."(Goldstein and Sapra, 2013, p.4).

Plantin *et al.* (2008a) also point this idea out in an article that studies

whether or not improving transparency in bank accounting, through the implementation of fair value accounting instead of historical cost accounting, is desirable:

"It is possible to draw an analogy with the theory of the second best from welfare economics. When there is more than one imperfection in a competitive economy, removing just one of these imperfections need not be welfare-improving. It is possible that the removal of one of the imperfections magnifies the negative effects of the other imperfections to the detriment of overall welfare." (Plantin *et al.*, 2008a, p.437).

The specific role played by banks in the process of money creation and transparency do not necessarily go well together. The idea is that banks create short-term debt that can be used for transactions only if its value does not vary too much over time. This is the case if banks keep detailed information about their loans secret (Dang *et al.*, 2017). Recently, Chen *et al.* (2019) provide empirical evidence that transparency may indeed interfere with liquidity creation. Banks consequently need some opacity to fulfill their role properly.

In fact, the very nature of the activities led by banks makes the idea of transparency irrelevant in their case. Banks indeed have a comparative advantage in collecting information through screening and monitoring activities (Diamond, 1984), which explains why they are the best-equipped institutions to fund investments. A distinction is generally made between two kinds of information collected by banks: hard and soft information. In the first case,

information can easily be summarized in a number and interpreted by whoever is able to read statistics. On the contrary, in the second case, information cannot be properly summarized in a number and its value consequently relies strongly on the process by which it has been collected. The distinction between hard information and soft information makes it possible to understand properly what a credit relationship is made of and why transparency cannot be fully implemented in the case of the banking sector. In particular, the literature that considers banks as relationship lenders (Boot, 2000; Freixas, 2005) points out the role played by soft information in the case of the funding of risky projects. Opacity through the collection of soft and not transferable information makes it possible for relationship banks to fund projects that are risky in the short-run but promising in the long-run and consequently plays an important role in the first years of living of young promising firms (Petersen and Rajan, 1994).

1.2.2 The undesirable consequences of disclosure

When it comes to banks, information disclosure may therefore have undesirable consequences that are related to the specificity of banks' activities and thus to that of the banking system.

The stability of the banking system indeed rests on the ability of banks to share risk through the interbank market (Allen and Gale, 2000). In this perspective, when risk-averse agents face idiosyncratic shocks, *ex ante* risk-sharing opportunities allow for *ex post* efficient transfers *via* insurance mechanisms. However, such risk-sharing opportunities only exist provided that

idiosyncratic shocks are unknown *ex ante*. On the contrary, when the realizations of the shocks are disclosed early, agents that suffer from a bad realization are no longer able to get insured against it. No transfers occur and welfare is reduced from an *ex ante* perspective. This is what is known as the Hirshleifer (1971) effect. Goldstein and Leitner (2018) indeed demonstrate that in good times full disclosure is never desirable because of the Hirshleifer effect. However, they show that in bad times, disclosure is a necessary condition for risk-sharing through the interbank market to start.

Information disclosure may in addition have an adverse impact on the *ex ante* incentives of banks. Studying the impact of disclosure frequency, Gigler *et al.* (2014) show that more frequent disclosures may indeed incentivize banks to adopt shorter-sighted investment strategies. When disclosures are very frequent, banks may have interest in investing in short-term assets to send a good signal to the market in the short run. In this case, price efficiency – ensured through frequent disclosures – goes against economic efficiency. More precisely, price efficiency goes against the funding of long-term investments. For those investments to be funded, the behavior of financial institutions should indeed not be excessively tied to very short-term market fluctuations.

The way agents interact in financial markets furthermore makes information disclosure a two-edged sword as far as banks are concerned. As Keynes (1936) noted it for the first time, financial markets can be understood through the beauty contest metaphor. In this perspective, each agent does not only seek to act the closest possible to what is expected to be the state of nature, but also tries to act the closest possible to what are expected to be the

actions of the others. In this context and assuming that agents are granted two signals (one private and the other public), Morris and Shin (2002) show that an increase in the precision of the public signal can be detrimental to welfare if the precision of the private signal is very high by comparison to that of the public signal. The mechanism behind this result is that agents tend to overreact to public information in so far as they pay greater attention to their public signal than to their private signal. The coordination value of the public signal is indeed greater than that of the private signal since all agents observe the same public signal and they all know that they are all observing it. Consequently, if the precision of the private signal is greater than that of the public signal, an increase in the precision of the public signal can make agents coordinate in an equilibrium that is further away from the true value of the fundamental than the equilibrium that would have been reached otherwise:

"In the highly sensitized world of today's financial markets populated with Fed watchers, economic analysts, and other commentators of the economic scene, disclosure policy assumes great importance. Our results suggest that private sources of information may actually crowd out the public information by rendering the public information detrimental to the policy maker's goals. The heightened sensitivities of the market could magnify any noise in the public information to such a large extent that public information ends up by causing more harm than good." (Morris and Shin, 2002, p.1532).

In the same vein, when bankruns are the result of a coordination default among creditors, Bouvard *et al.* (2015) derive a result close to that of Goldstein and Leitner (2018). They indeed show that information disclosure is desirable in bad times but not in good times. When no specific information concerning banks is disclosed, creditors are assumed to take information from the market and decide to run when the financial system as a whole seems weak, while they do not run when it seems strong. In other words, in good times runs never happen, while they always happen in bad times. In this context, disclosing bank-specific information in good times may precipitate (coordination-based) bank runs that would not have occurred otherwise. Disclosing information in good times thus have an adverse impact. Similarly, in an article that starts from a framework close to that of Diamond and Dybvig (1983), Kaplan (2006) shows that it is sometimes preferable for banks to keep some information about their assets secret to prevent bank runs from happening. In addition, Chen and Hasan (2006) develop a theoretical model that allows them to show that improving transparency may reduce depositors' welfare by increasing the chance of an inefficient contagious run on other banks.

In the perspective of indirect market discipline, Bond and Goldstein (2015) show that information disclosure may reduce the informational content of prices and thus prevents a timely and efficient regulatory intervention based on those prices from happening. The idea is that disclosure may disincentivize speculators to trade on their private information, which on aggregate reduces the informational content carrying by the transactions and thus by prices. More precisely, Bond and Goldstein (2015) state that information

disclosure is only desirable when it concerns issues on which traders have no informational advantage.

Transparency is thus not necessarily synonymous with financial stability and can harm the functioning of the banking system. In chapter 2, we develop a theoretical model to properly demonstrate that, under certain circumstances, increasing the precision of public information may weaken market discipline. Transparency is however an abstract notion. In reality, what is meant by transparency covers a process that goes from the way information is produced to how it is interpreted by market participants. This is the topic of the next section.

1.3 What does transparency sit on?

Transparency is an abstract idea that cannot be ordained by regulatory decision. The only thing regulators can do is to set how information has to be produced by financial actors. Whether information disclosure translates or not into transparency does not therefore fall within regulators' abilities. In this section, we show why information disclosure and transparency are not equivalent. In section 1.3.1, we explain how more information can sometimes have adverse consequences. Due to the complexity of banks' activities, information production is not an easy task. In section 1.3.2, we indeed show that risk models, which are used to compute risk-weighted assets or expected credit losses, sometimes yield biased information so that transparency cannot be expected from financial information produced this way. In section 1.3.3, resorting to analyses coming from the social studies of finance, we finally

argue that transparency is not relevant when it comes to discussing financial issues.

1.3.1 More information: transparency or the illusion of knowledge?

Improving information disclosure does not necessarily mean improving the transparency of the financial system. The relationship between information availability and transparency cannot indeed be thought of as being undoubtedly positive: its shape depends on the way information is produced and treated throughout the communication model (Nielsen and Madsen, 2009). The main idea of this model is that communication involves three elements: an issuer willing to communicate a particular piece of information, the message that consists in this information once it has properly been shaped, and the receiver. The very possibility of communication consequently rests on the ability of the issuer and on that of the receiver to agree on the meaning carrying by the message, which is not always easy. Freixas and Laux (2011) point this out when they insist on the difference between disclosure and transparency:

"For a given level of disclosure, transparency depends on investor's information processing capability, behavioral biases, and information needs. Thus, disclosure is a necessary but not a sufficient condition for transparency in the information transmission process." (Freixas and Laux, 2012, p.70).

Morris and Shin (2007) develop this idea in a model that is based on the

distinction between the quantity of information and the shared nature of this information. Starting from the idea that information has to be understood to be properly used, they point out that the optimal disclosure policy is based on a trade off between coarse – but easily understandable – information and precise – but only understood by few agents – information:

"The setting of optimal accounting standards is like finding an optimal language; the task is to find the language (the accounting system) that will enable fine discrimination of the states of the world while preserving, as much as possible, the common understanding of the numbers that are generated by the system."

(Morris and Shin, 2007, p.595).

Thinking of transparency using the communication model makes it possible to understand why the relationship between the amount of information available and financial stability does not need to be positive. Despite the great availability of information concerning securitized products at the end of the 2000s, the financial system did not seem to be perfectly transparent at that time, as shown by BNP Paribas when, in 2007, the bank confessed its inability to evaluate properly some assets held by two of its funds. At that time, the amount of information available was such that it was impossible to properly deal with it: instead of improving the transparency of the financial system, information might have contributed to its opacity. Haldane (2009) indeed gives us an idea of the number of pages to read to be perfectly informed about some financial products. According to Figure 1.1, for a CDO-squared, the number of pages to read is for instance more than one

billion one hundred twenty-five millions. This is an example of a situation where a great amount of information increases opacity instead of increasing transparency.

Typical contract details(a)		
[1]	Pages in CDO ² prospectus	300
[2]	Pages in ABS CDO prospectus	300
[3]	Pages in RMBS prospectus	200
[4]	Number of ABS CDO tranches in CDO ²	125
[5]	Number of RMBS in a typical CDO	150
[6]	Number of mortgages in typical RMBS	5,000
Metrics of complexity(a)		
[1] + [3]*[5]*[2]*[4]	Pages to read for a CDO ² investor	1,125,000,300
[2] + [3]*[5]	Pages to read for an ABS CDO investor	30,300
[4]*[5]*[6]	Max. number of mortgages in a CDO ² (b)	93,750,000
[5]*[6]	Max. number of mortgages in an ABS CDO(c)	750,000
Sources: Bloomberg, deal documents and Bank calculations		
(a) CDO ² is used as short-hand for CDO of ABS CDO.		
(b) Assuming there is no overlap in the composition of the RMBS pools that back the CDO or the CDO pools that back the CDO ² .		
(c) Assuming there is no overlap in the composition of the RMBS pools that back the CDO.		

Figure 1.1: "Climbing the complexity tree" (Haldane, 2009, p.21)

In addition, more information can increase deciders' confidence without increasing their ability to make the correct decision. This is what is known as the illusion of knowledge: "more information often increases confidence in judgments even when the accuracy of judgments is not affected" (Hall *et al.*, 2007, p.278). This illusion of knowledge is illustrated by Nicholas Taleb when he gives the following example in his 2007 book:

"In 1965, Stuart Oskamp supplied clinical psychologists with successive files, each containing an increasing amount of information about patients; the psychologists' diagnostic abilities did not grow with the additional supply of information. They just got more confident in their original diagnosis." (Taleb, 2007, p.144).

Taleb points indeed out that a great deal of information can justify and motivate behaviors that are based on a flawed interpretation of this information. This is one of the main problems associated with the idea that more information – since it presumably gives birth to transparency – is always desirable. To understand properly why this idea is particularly dangerous when finance is concerned, let us recall the main argument of Taleb’s book. According to Taleb, when considering random issues we have to make a distinction between two different worlds: Mediocristan and Extremistan. In Mediocristan, events follow a Gaussian distribution so that an additional observation always makes it possible to characterize with more precision the distribution of the considered random variable. In this case, an increase in information availability generally leads to a better understanding of the way the world works. In Extremistan, events on the contrary do not follow a Gaussian distribution so that even with a great number of observations, it is not possible to anticipate with certainty what comes next. This is the very logic that underlies what Taleb calls a black swan: an event that could not have been anticipated based on information found in the past. Since the financial system is vulnerable to black swans, there is no way to establish once and for all a relationship between information availability, transparency and financial stability.

1.3.2 How risk models put transparency at risk

The computation of regulatory constraints often rests on the production of information concerning the risk associated with banks’ activities. Basel capital

requirements alongside with the constraints in eligible liabilities put in place by the MREL and the TLAC are indeed defined as functions of risk-weighted assets (RWA). Under IFRS 9, loan loss provisions are similarly defined as a function of the expected credit loss (ECL) associated with the loan portfolio. In both cases, risk models are used to compute the required values. What seems *a priori* paradoxical is that at the same time as it promotes transparency (through the third pillar), the Basel framework introduces opacity through the first pillar with what is known as the Advanced Internal Ratings-Based (A-IRB) approach. With the approval of their local regulators, banks are indeed authorized under Basel III to resort to internal models to compute their RWA and consequently to determine regulatory capital requirements. Banks are also allowed to resort to the A-IRB approach to compute the ECL on the basis of which loan loss provisions are calculated under IFRS 9. In fact, the use of such risk models is seen by regulators as something through which transparency might eventually be achieved. The rationale behind this idea is that since banks are in the best position to assess the risk associated with their activities, allowing them to use their private information to compute the regulatory constraints they are subject to should have a positive impact on the informational content of those constraints:

"Supervisors also expect banks to provide useful public disclosures about credit risk exposures, credit risk management, provisioning and related matters to bring about a higher degree of transparency that facilitates market discipline and promotes market confidence." (Cohen and Edwards, 2017, p.53).

However, when made through an internal model, the computation of RWA (the same goes for ECL) is subject to manipulations, which can lead to an underestimation of those RWA and consequently of regulatory requirements (Mariathasan and Merrouche, 2014). In addition, as shown by Danielsson *et al.* (2004), risk is strongly procyclical, meaning that the constraint represented by regulatory requirements when calculated as a function of RWA is also procyclical: this constraint is loose during booms and becomes binding during busts. Finally, all the regulatory constraints computed thanks to risk models could eventually fail to ensure market discipline and financial stability for two reasons: *ex ante* because investors are not properly incentivized to monitor banks in booms because of the procyclical nature of risk; *ex post* because of possible manipulations of risk models that could lead to an underestimation of regulatory requirements.

1.3.3 Performativity, accounting and finance

Let us take now some perspective and put aside the debate concerning whether transparency is desirable and, if so, how to make sure that information disclosure translates into transparency. What seems indeed really problematic is that the very notion of transparency carries a flawed idea of the way financial markets work. In particular, it can give the false impression that financial markets are some kind of social vacuum where value and risk can easily be disclosed if proper rules are put in place. On the contrary, value and risk cannot be understood from a substantive perspective but have to be comprehended as shaped by instruments that carry with them a certain idea

of the way things work. Those instruments thus need to be now put under close scrutiny.

We are specifically interested here in one of the issues raised by the communication model that has been briefly presented in section 1.3.1: the way the message is shaped in order to become a piece of information that can be communicated from an issuer to a receiver. Consequently we are here in the realm where the models, the conventions and the instruments that make it possible to standardize financial information are analyzed. This realm is that of the study of "market devices" (Callon *et al.*, 2007) whose purpose is to inquire how they shape the decisions and behaviors of market participants by providing them with a specific cognitive equipment. These devices are initially meant to reduce the complexity of the environment in which market participants evolve in order to make it possible for organizational routines – which ensure organizational efficiency – to be put in place. If market devices are more than useful when it comes to making a decision in a highly uncertain environment, it is important to keep in mind that more than only describing objectively what the reality of the economy is, they contribute to the shaping of this economy. In that sense, they are performative (Callon, 1988; MacKenzie, 2006). Performativity can be defined as the process by which the mere fact of telling things – through words or through mathematical models – make those things become real. More precisely, MacKenzie (2006) makes a distinction between three forms of performativity:

- generic performativity: an aspect of economics is used by participants in economic processes,

- effective performativity: the practical use of an aspect of economics has an effect on economic processes,
- barnesian¹ performativity: the practical use of an aspect of economics makes economic processes more like their depictions by economists.

Treating accounting and finance through the idea of performativity makes it possible to understand transparency in a brand new way. Applying the concept of performativity to accounting consists in ruling out the idea according to which accounting could be seen as a mere instrument whose purpose is to show a reality that exists independently from the way it has been observed. On the contrary, accounting has to be considered as a convention that plays an important role in defining what the economy is (Chiapello, 2005). Several conventions can be distinguished: that concerning the valuing method chosen, that concerning the definition of economic activities and that concerning the question of aggregation. These conventions are not neutral but carry with them a particular vision of the world that tends to overshadow every other possible conception as they are being used. In this respect, using the word "transparency" to characterize accounting information does not seem relevant. Transparency is indeed generally considered as the property of an environment that makes it possible for a subject to see an object. When using the word "transparency", we consequently always refer to three elements: a subject, an environment that is said to be transparent and an object that exists independently from what makes it visible. The idea of performativity, on the contrary, consists in assuming that it is impossible to

¹The term "barnesian" comes from the name of the sociologist Barry Barnes.

think of the object independently from the instrument that makes it visible. Instead of speaking of "transparency", we would better speak of "reflection" to characterize the relationship between accounting and the economy it supposedly describes. Morris and Shin (2018) provide a convincing description of the consequence of such reflection in the context of central bank forward guidance:

"Monetary policy works through financial markets, where the central bank uses its influence over market prices to steer the economy. At the same time, market prices inform the central bank on where to steer the economy. Monetary policy relies on market prices, and yet monetary policy influences market prices." (Morris and Shin, 2018, p.572).

The "reflection problem" that is described here is essential to understand the specific nature of the information conveyed by market prices. The greater importance is given to market prices, the less informative those are indeed likely to be. Market prices are thus less a depiction of some substantial value than the reflection of the way they are used by agents. This idea is at the core of the model developed in chapter 6. In this model, the central bank monitors the market value of a bank's regulatory capital and may decide to intervene whenever this price falls below a certain threshold. At the same time, this price is determined on the basis of the expectation of the action taken by the central bank. There therefore is a clear circularity between the action of the central bank that is based on the observation of a market price and this price that includes an expectation of the action that will be

undertaken by the central bank.

Speaking of the transparency of financial information thus leads to convey a flawed image of the way financial markets work. This image rests on a flawed idea of what value and risk are made of. Applied to financial markets, the notion of "transparency" indeed suggests that these markets are ruled by laws that are similar to those of nature. Value and risk would thus be produced by those laws and revealing them would therefore make it possible to define substantively what value and risk are. On the contrary, the idea of "reflection" states that value and risk are the mere depiction of the models used to apprehend them. In this perspective, value and risk are the product of what is embedded in those models, what Walter (2016) calls the "financial *logos*". All the models used by market participants are infused with this *logos*, which explains why changes cannot happen all of a sudden through regulatory way:

"Despite the 2008 financial crisis, the financial *logos* continues to 'talk' and continues to influence the ideas at work in attempts to overhaul the economic system." (Walter, 2016, p.598).

Despite all the evidence that goes against the idea that transparency is *per se* desirable, regulators therefore find themselves captive of old ideas that are emblematic of how the financial *logos* still talk through what Chiapello and Walter (2016) call the third "financial quantification convention". This convention is based on the idea of risk-neutral probability, which appears as the theoretical ground of the convergence between prudential and accounting rules that will be presented in the next section. The idea behind the concept

of risk-neutral probability is that, if the no-arbitrage condition holds true, all assets yield the same return: the riskless rate. This probability can consequently be understood as a transaction price: in a perfectly arbitrated world, it is possible to find a price for every possible asset (Walter, 2015). This idea is indeed what lies behind both prudential rules – Basel III and Solvency II – and the concept of fair value put forward by the IAS/IFRS framework. In a way, fair value can thus be interpreted as one of the most salient incarnations of the spirit of the "third financial quantification convention". By stating that a price can be attached to every asset, this convention thus builds a false notion of transparency that actually entirely rests on the assumptions on which are based contemporary financial models, the no-arbitrage condition in particular.

1.4 Rethinking financial regulation

In the previous two sections, we have shown that transparency, even as an abstract idea, is not fully desirable as far as banks are concerned (section 1.2) and that, furthermore, the way through which transparency is attempted to be reached – information disclosure – can nourish opacity or overconfidence instead of leading to a better-functioning financial system (section 1.3). In this section, we show how, despite all the evidence provided in the two previous sections, there currently is a convergence between prudential rules and accounting rules around the idea of transparency. We then argue that the lessons of the two previous sections provide new avenues for improving the regulatory framework.

1.4.1 The current convergence between prudential and accounting rules

In 2005, the European Union adopted IAS/IFRS as the accounting framework for listed companies. The general spirit of these accounting standards is presented in the conceptual framework for financial reporting. Concerning the purpose of financial reporting, the framework clearly states that the primary goal of financial information is to provide support to financial decisions. The IAS/IFRS consequently adopt the point of view of investors and assume that their interest is in line with that of all the stakeholders of the firm:

"Other parties, such as regulators and members of the public other than investors, lenders and other creditors, may also find general purpose financial reports useful. However, those reports are not primarily directed to these other groups." (IASB, 2015, paragraph 1.10).

The purpose of the IAS/IFRS framework is therefore to promote a way of elaborating financial statements that makes it possible for investors to determine, at every moment, the value of a particular firm. In other words, opacity should be fought and transparency promoted:

"The general idea that drives accounting standardization is that every element that could potentially have an influence on the future of the firm, as for instance upcoming liabilities or unrealized gains, has to be taken into consideration while elaborating the balance sheet. The political project, more commonly known as

"transparency", consists in communicating every news, whether good or bad, and in evaluating every possible risk, liability and asset. The purpose is to improve the information provided to investors in order to help them determine the true value of the firm, namely its stock price." (Chiapello, 2005, p.370, translation by the author).²

Transparency is consequently one of the key notions of the IAS/IFRS framework. This is what is explicitly presented as the mission of the IASB:

"Our mission is to develop IFRS Standards that bring transparency, accountability and efficiency to financial markets around the world. Our work serves the public interest by fostering trust, growth and long-term financial stability in the global economy."
(website of the IFRS foundation).

What is worth pointing out here is that a clear link is established between transparency and financial stability, and thus implicitly between the missions of accounting standards setters and those of banking regulators.

As already mentioned in the introduction, the third pillar of Basel III entirely rests on the idea that there is a positive relationship between information disclosure and market discipline. The Basel Committee therefore explicitly promotes a disclosure policy that aims at improving transparency

²"La logique générale qui oriente les travaux du normalisateur international est la volonté que soient comptabilisés dans le bilan tous les éléments susceptibles de déterminer l'avenir, le poids des engagements déjà contractés comme les plus-values latentes. Le projet politique, plus communément appelé 'transparence', est une communication totale des bonnes et mauvaises nouvelles et la valorisation de tous les risques, engagements et avantages futurs connus. Le but est d'améliorer au maximum l'information des investisseurs pour les aider à déterminer la valeur de l'entreprise et donc le cours de l'action."

throughout the banking sector. In this perspective, information displayed by banks in their financial statements should be produced according to five guiding principles. If information produced by banks fulfill those principles, the BCBS states that it would make investors behave in such a way that they would exert a discipline over banks that would eventually ensure financial stability:

"This standard introduces two new disclosure templates (Templates KM1 and KM2) to provide users of Pillar 3 data with a set of key prudential metrics in a format that facilitates comparisons of a bank's performance and trends over time, improving market discipline in the process." (BCBS, 2017, p.7).

What is striking is that there is a deep consensus between banking regulation – through the third pillar of Basel III – and the accounting standards published by the IASB. This consensus rests on the idea that financial information has to be as precise as possible in order to best meet the needs of investors, which is supposed to ensure financial stability through market discipline. In consequence, the qualitative characteristics of financial information presented in the conceptual framework for financial reporting are very similar to the guiding principles put forward by the third pillar of Basel III, as shown in Table 1.1. The convergence between the concerns of banking regulators and those of accounting standards setters can be explained by the wide use of mathematical models that rest on the principle of actualization to estimate the value of an asset or a liability. Implicitly, these models are based on the idea that it is possible to attach a unique value to every asset or

liability and that the accuracy of this value is an increasing function in the amount of information available. This is indeed the main idea of the third financial quantification convention (Chiapello and Walter, 2016) presented in section 1.3.3.

Third pillar of Basel III	Conceptual framework for financial reporting
Disclosure should be <ul style="list-style-type: none"> • clear • comprehensive • meaningful to users • consistent over time • comparable across banks 	<ul style="list-style-type: none"> • relevance • faithful representation • comparability • verifiability • timeliness • understandability

Table 1.1: Characteristics of financial information according to the third pillar and to the conceptual framework for financial reporting

1.4.2 Diversity and the financial ecosystem

We think that the third financial quantification convention leads to a flawed conception of value and risk that has problematically been introduced at the very core of financial regulation. This conception of risk and value rests on a substantive definition of those terms according to which there exists a value and a risk attached to every asset, which is independent both from the way the asset is considered and from the financial institution that holds it.

The third convention is the rationale behind the homogenization of financial regulation around a particular definition of risk. Despite their differ-

ences, banks and insurance companies are indeed treated the same way by prudential rules. Solvency II has been explicitly built on the framework of Basel II and the way capital requirements are computed under Solvency II rests on the same philosophy as that underlying its calculation in the Basel III framework: regulatory capital is an increasing function in RWA, where risk is understood as short-term volatility. Technically, the computation of the solvency capital requirement (SCR) is based on an estimation of a 99.5 percent Value-at-Risk over one year. In other words, the regulatory capital should be able to cover all expected losses over one year in 99.5 percent of the cases. What is troubling in this calculation is that it forces insurers to focus on the short-term volatility of their assets whereas these financial institutions are funded mainly by long-term instruments. Solvency II could then potentially distort insurers incentives by making them invest in shorter term assets than those in which they would have invested otherwise, which could be detrimental to the funding of long-term investments (Persaud, 2015b).

The use of the same management rules by all financial institutions – namely the rules inferred from the third financial quantification convention – associated with the necessity for those institutions to fulfill similar capital requirements is however worrying since it may lead to a homogenization of behaviors on financial markets (Danielsson *et al.*, 2004). This homogenization of behaviors is problematic since it makes it impossible for endogenous stability mechanisms to be effective in the case of a sudden fall in assets' prices for instance. Indeed, if all financial institutions are incentivized to behave the same way, they will all sell their assets when a fall in their prices occurs. On the contrary, if some institutions were incentivized to manage their assets

in the long-run – as insurers normally do – they could act as buyers of assets whose prices were falling if they expected that these prices would eventually go up again. This is the logic of what some financial economists call "time diversification", which can in some respects be considered as an endogenous stabilizing mechanism in the short-run since it can prevent liquidity spirals – as described by Brunnermeier and Pedersen (2009) – from occurring.

We consequently think that an asset should be evaluated according to the financial institution that holds it instead of being evaluated in the perspective of a substantive value that could be revealed using probabilistic models. The main idea is that the risk associated with a particular asset is not the same whether this asset is held by a financial institution that mainly relies on short-term debt instruments or by an institution that relies on long-term instruments. For instance, an illiquid asset that yields a certain return in the long-run represents a big risk for a bank – since a bank constantly faces the risk of an unexpected short-term liquidity need because of the very nature of its activity that mainly consists in transforming maturities –, but can be considered as a safe investment for an institution whose liabilities' maturities are long, as is the case for an insurer or a young pension fund. Such an asset should consequently not be considered – from the perspective of accounting rules and from that of prudential rules – the same way by a bank or by an insurer (Persaud, 2015a). This idea is explored in more detail in chapter 3. In other words, value and risk cannot be considered as substantive features of assets but depend on the nature of the financial institution that holds them.

1.5 Conclusion

"Transparency" is one of the notions that prove to be really problematic once considered out of well-circumscribed academic fields. While economists seem to agree on the idea that it is impossible to conclude once and for all on the existence of a positive relationship between transparency and financial stability, institutions in charge of financial regulation strongly advocate for an increase in financial information transparency. This is the case of banking regulation with the third pillar of Basel III, and also of accounting rules with the IAS/IFRS framework and its central notion of fair value.

More than the discrepancy between theoretical results and regulatory decisions, it is the very way transparency is defined that is troubling. Transparency is indeed always thought of as being an increasing function in information availability and a sufficient condition for market discipline to be effective. Rarely questioned, these relationships are however essential since opposite regulatory recommendations can be derived from the way they are considered. For instance, if we start from the idea that there is a clear positive relationship between, on the one hand, information disclosure and transparency, and, on the other hand, transparency and financial stability, we can easily justify fair value accounting and the third pillar of Basel III; while when these relationships are questioned, we are forced to reconsider the link between disclosure and market discipline, and thus the very essence of the third pillar of Basel III.

When we ask the question of how information is shaped, we find ourselves confronted with two problems: that of the models that are used to

standardize information and that of the ability of the receiver to properly interpret the message he receives. This second problem lies at the heart of what can be thought of as a dialectic between transparency and opacity, namely the idea that there exists a threshold beyond which the relationship between the amount of information available and transparency becomes negative. The question of the models that make it possible to shape information is more general and echoes that of the tools and instruments that equip market participants when they take their decisions. In this perspective, works coming from social studies of finance prove of great value when it comes to tackling the question of the performativity of financial markets. Following the assumption according to which market devices – including accounting – perform the reality more than they describe it, we are indeed forced to rule out the word "transparency" from financial vocabulary. In fact, the use of the word "transparency" to characterize the information conveyed by financial statements leads to the institutionalization of a flawed conception of risk and value: that of what has been described as the third financial quantification convention. This convention is based on a vision of financial markets as a social vacuum where homogeneous and abstract agents interact, whereas in reality there is a wide diversity of financial institutions. We think that financial regulation would be better off taking this diversity into account by, for instance, making a distinction between institutions engaged in long-term strategies – such as young pension funds or insurance companies – and institutions engaged in much shorter term strategies – such as banks.

Chapter 2

Do regulatory disclosure requirements always strengthen market discipline? A theoretical illustration

Abstract: In this chapter, we model a game between a bank and its depositors. The bank invests in an asset portfolio that is funded thanks to capital and deposits. Depositors may decide to withdraw their deposits in the intermediate period. The proportion of capital the bank decides to raise depends on expected withdrawals, while depositors' decision to withdraw partly rests on the funding structure chosen by the bank. In that sense, depositors exert market discipline over the bank through the threat of withdrawals. When fire sales are more costly than raising capital, we show that this discipline can be adversely affected by the precision of the information publicly disclosed

by the bank through its financial statements.

2.1 Introduction

The third pillar of the Basel III framework intends to promote "market discipline through regulatory disclosure requirements" (BCBS, 2015, p.1). In other words, transparency is here assumed to mechanically ensure market discipline.

We develop a theoretical model to assess whether this statement is correct or not. Our model is very close to that of Rochet and Vives (2004). We model a game between a bank and its depositors. In $t = 0$, the bank invests in an asset portfolio and decides how to fund it. Funding comes from two sources: capital and short-term deposits. Depositors can withdraw their deposits at an intermediate period. This is how market discipline materializes in the model: the bank chooses to raise more capital in $t = 0$ when it expects depositors to withdraw their deposits in $t = 1$. The game between the bank and its depositors is thus as follows: the bank chooses its funding structure in $t = 0$ based on its expectation of withdrawals, while depositors decide to withdraw or not depending on the proportion of capital held by the bank. Depositors are assumed not to know the true distribution of the return associated with the asset portfolio. Depositors' set of information on the true return is made of information found in the financial statements of the bank and of their own assessment of the financial situation of the bank. The former type of information is referred to as public information, in the sense that it is common to all depositors, and the latter is referred to as private information. An increase in the precision of public information can therefore be understood as the implementation of stricter regulatory disclosure requirements.

We show that there are situations where the proportion of capital the bank decides to raise in $t = 0$ is adversely affected by the precision of the public information available to depositors. In other words, the bank holds less capital when public information is more accurate and market discipline is thus weakened. This result is in line with the literature on the impact of transparency on the banking sector that has been presented in chapter 1 (in particular see section 1.2.2).

The model is presented in the next section and the main results are presented in section 2.3. Section 2.4 concludes.

2.2 The model

There are three periods.

In $t = 0$, a bank that invests in an asset portfolio that yields a random return θ has to choose its funding structure. To do so it has to choose the proportion of its asset portfolio it wants to fund thanks to short-term deposits (let us denote this proportion by y) and thanks to capital (this proportion thus amounts to $1 - y$). We denote the deposit return by r_d and assume that raising capital is costly and denote by c this cost per unit. c and r_d are exogenous and such that $1 < r_d < c$.

In $t = 1$, short-term depositors may withdraw their deposits. Let us denote by $s \in [0, 1]$ the proportion of depositors that decide to withdraw their deposits. Depositors are assumed not to know the true distribution of θ . They receive a public signal that allows them to know that θ is normally distributed with mean μ and with variance $\frac{1}{\alpha}$. $\alpha > 0$ is here the precision

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of the public signal. The public signal is assumed to be common knowledge to all depositors. This signal can be thought of as embedding all the information that can be found in the financial statements of the bank. In this perspective, an increase in α can be interpreted as the implementation of stricter regulatory disclosure requirements. Each depositor is additionally assumed to assess the financial situation of the bank on his own. Assessment of depositor i is summarized in a private signal $v_i = \theta + \varepsilon_i$ with $\varepsilon_i \hookrightarrow \mathcal{N}(0, \frac{1}{\beta})$. The noises associated with private signals are independent of each other (i.e. $\mathbb{E}(\varepsilon_i \varepsilon_j) = 0$ for $i \neq j$) and of θ (i.e. $\mathbb{E}(\varepsilon_i \theta) = 0$). If depositors decide to withdraw, the bank has to fire sell some of its asset portfolio.

In $t = 2$, the asset portfolio pays and depositors are paid.

We are here particularly interested in the impact of the threat of withdrawals on the $t = 0$ decision of the bank. Withdrawals are the way through which market discipline materializes in our model: the more the bank expects short-term depositors to withdraw, the more capital it decides to raise. There consequently is a game between the bank and its depositors since the bank chooses the value of y based on its expectation of s , while depositors decide to withdraw or not depending on the value of y . This game is solved using the global game technique when players have two noisy – a public and a private – signals (Morris and Shin, 1998; Metz, 2002; Morris and Shin, 2003; Morris and Shin, 2004). We are here exclusively interested in the impact of an increase in the precision α of the public signal – in policy terms the impact of stricter regulatory disclosure requirements – on the proportion $1 - y$ of capital. If an increase in α translates into an increase in $1 - y$, regulatory

disclosure requirements do strengthen market discipline since the bank is incentivized to hold more capital when depositors are better-informed. On the contrary, if $1 - y$ is a decreasing function in α , improving the transparency of public information incentivizes the bank to hold less capital.

2.2.1 The bank

In $t = 0$, the bank has to choose its funding structure. To do so, it has to choose the proportion y of its asset portfolio it wants to fund thanks to deposits and the proportion $1 - y$ it wants to fund thanks to capital. The bank knows that depositors may withdraw their deposits in the intermediate period, in which case the bank has to fire sell some of its asset portfolio. Let us denote by $\kappa > 1$ the cost associated with fire sales. In $t = 0$, the bank decides to raise more capital whenever the marginal cost associated with raising capital instead of deposits (i.e. $c - r_d$) is smaller than the expected marginal cost associated with fire sales (i.e. $s(\kappa - r_d)$). That is whenever the following inequality holds:

$$c - r_d < s(\kappa - r_d) \iff s > \frac{c - r_d}{\kappa - r_d}. \quad (2.1)$$

When $c > \kappa$, capital is very costly and the bank is never incentivized to raise capital since $\frac{c - r_d}{\kappa - r_d} > 1$ and therefore $s < \frac{c - r_d}{\kappa - r_d}$ for all $s \in [0, 1]$. In this case, we have $y = 1$. In the rest of the paper, we assume that $c < \kappa$. In this case, fire sales are more costly than raising capital and the bank is thus incentivized to hold capital. More precisely, when $s > \frac{c - r_d}{\kappa - r_d}$ the bank raises more capital. Since depositors are less incentivized to withdraw when the probability that

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the bank ends up insolvent decreases (see section 2.2.2), s decreases when y decreases. In consequence, when $s > \frac{c-r_d}{\kappa-r_d}$, the bank raises capital until $s = \frac{c-r_d}{\kappa-r_d}$. The reverse happens when $s < \frac{c-r_d}{\kappa-r_d}$: as far as $s < \frac{c-r_d}{\kappa-r_d}$, the bank chooses a larger value of y . Since s increases with y , the equilibrium is reached when $s = \frac{c-r_d}{\kappa-r_d}$. Finally the equilibrium value of y is given by the following expression:

$$s = \frac{c - r_d}{\kappa - r_d}. \quad (2.2)$$

To find the expression of s , we assume that depositors follow a threshold strategy. In that case, depositor i decides to withdraw its deposit when the private signal v_i he observes is smaller than a certain threshold v^* . Since v_i is independent of both v_j and θ , s is given by the probability with which depositor i observes a private signal below v^* :

$$s = \Pr [v_i \leq v^* | \theta] = \Phi \left[\sqrt{\beta}(v^* - \theta) \right], \quad (2.3)$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. We can thus rewrite the indifference function of the bank to find the expression of v_B^* , i.e. the threshold value of the private signal below which depositors decide to withdraw their deposits:

$$\Phi \left[\sqrt{\beta}(v_B^* - \theta) \right] = \frac{c - r_d}{\kappa - r_d}. \quad (2.4)$$

The indifference function of the bank can thus be rewritten as follows:

$$v_B^* = \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right) + \theta. \quad (2.5)$$

2.2.2 The depositors

Depositors has to decide whether to withdraw or not their deposits at the intermediate period. We assume that depositors are indifferent between withdrawing their deposits or not when the following equality holds:

$$\Pr[\theta \geq yr_d | \mu, v_i] r_d = r^*, \quad (2.6)$$

where r^* is the return paid by an outside investment opportunity and $\Pr[\theta \geq yr_d | \mu, v_i]$ the probability that the bank is solvent conditional on the signals μ and v_i . Since ε_i and θ are normally distributed and assuming that their joint distribution is normal as well, the conditional distribution of θ is normal. The expected value of θ conditional on μ and v_i is thus given by $\mathbb{E}[\theta | \mu, v_i] = \frac{\alpha\mu + \beta v_i}{\alpha + \beta}$ and its variance is given by $\text{Var}[\theta | \mu, v_i] = \frac{1}{\alpha + \beta}$. Equation (2.6) can therefore be rewritten as follows:

$$\left(1 - \Phi \left[\sqrt{\alpha + \beta} \left(yr_d - \frac{\alpha\mu + \beta v_i}{\alpha + \beta} \right) \right] \right) r_d = r^*. \quad (2.7)$$

We can express the threshold value of the private signal, denoted v_{Cr}^* , below which depositors decide to withdraw their deposits:

$$v_{Cr}^* = \frac{\alpha + \beta}{\beta} yr_d - \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) - \frac{\alpha}{\beta} \mu. \quad (2.8)$$

2.3 The equilibrium

Using equations (2.5) and (2.8), we can find an expression for the equilibrium value of y , denoted y^* :

$$\frac{\alpha + \beta}{\beta} y^* r_d - \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) - \frac{\alpha}{\beta} \mu = \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right) + \theta. \quad (2.9)$$

Proposition 1 summarizes the equilibrium value of y^* as a function of θ .

Proposition 1. *Let us define $\underline{\theta} \equiv -\frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) - \frac{\alpha}{\beta} \mu - \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right)$ and $\bar{\theta} \equiv \frac{\alpha + \beta}{\beta} r_d - \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) - \frac{\alpha}{\beta} \mu - \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right)$. The equilibrium value of y^* as a function of θ is as follows:*

- when $\theta < \underline{\theta}$, we have $y^* = 0$,
- when $\theta \in [\underline{\theta}, \bar{\theta}]$, we have

$$y^* = \frac{\beta}{(\alpha + \beta)r_d} \left[\theta + \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right) + \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) + \frac{\alpha}{\beta} \mu \right],$$

- when $\theta > \bar{\theta}$, we have $y^* = 1$.

When the return θ associated with the asset is below a threshold $\underline{\theta}$, the quality of the asset portfolio is so bad that the bank is constrained by market discipline to rely exclusively on capital. On the contrary, when θ is above a threshold $\bar{\theta}$, the asset portfolio is of high quality, market discipline is weak and the bank is thus able to rely solely on deposits. For intermediate values of θ , the funding structure of the bank is a mix between deposits and capital that depends on θ and on the parameters of the model.

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In $t = 0$, the bank thus decides on the proportion of capital to raise depending on the expected value of θ . More precisely, the proportion of deposits y_e held by the bank in $t = 0$ is as follows:

$$y_e = \mathbb{E}[y^*|\theta] = \int_{\underline{\theta}}^{\bar{\theta}} y^*(\theta) f(\theta) d\theta + \int_{\bar{\theta}}^{+\infty} f(\theta) d\theta. \quad (2.10)$$

Consequently, in $t = 0$ the bank decides to raise a proportion K_e of capital that is as follows:

$$K_e = 1 - y_e. \quad (2.11)$$

Proposition 2. *An increase in the precision α of the public signal has an ambiguous impact on the proportion K_e of capital raised by the bank in $t = 0$:*

- if $\Phi^{-1}\left(1 - \frac{r^*}{r_d}\right) \geq 0$, we always have $\frac{\partial K_e}{\partial \alpha} \leq 0$,
- if $\Phi^{-1}\left(1 - \frac{r^*}{r_d}\right) < 0$, we have $\frac{\partial K_e}{\partial \alpha} \leq 0$ when $\mu \geq \bar{\mu}$ and $\frac{\partial K_e}{\partial \alpha} > 0$ otherwise.

Proof. See Appendix 2.A. □

According to Proposition 2, the impact of an increase in the precision α of the public signal on the proportion K_e of capital the bank decides to raise in $t = 0$ is ambiguous. Most of the times, it seems that increasing the precision of the public signal has a negative impact on K_e and thus on market discipline. Figures 2.1 and 2.2 plot the proportion of capital K_e the bank decides to raise in $t = 0$.

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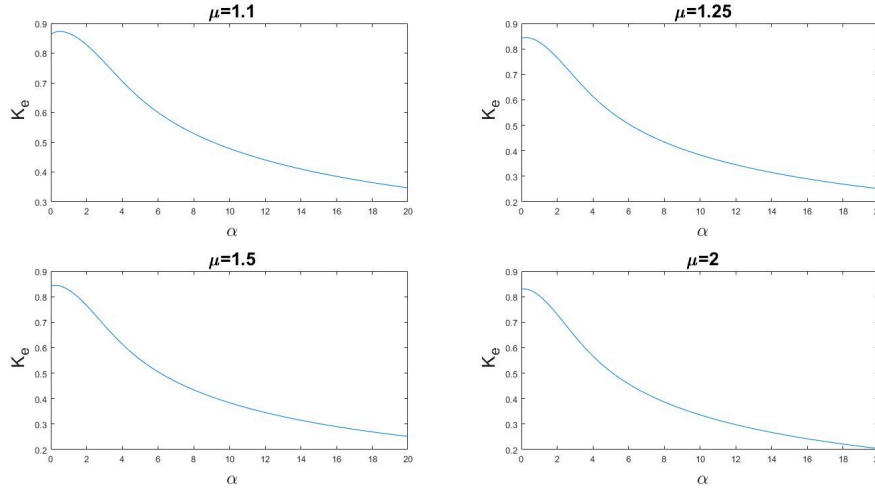


Figure 2.1: The proportion of capital K_e the bank decides to raise in $t = 0$ as a function of the precision α of the public signal ($r^* = 1$, $r_d = 1.05$, $c = 1.1$, $\kappa = 1.15$, and $\beta = 1$)

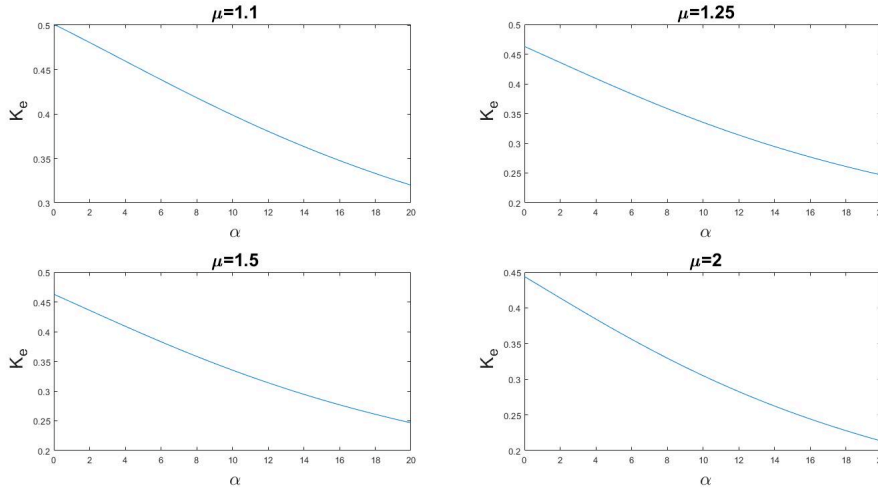


Figure 2.2: The proportion of capital K_e the bank decides to raise in $t = 0$ as a function of the precision α of the public signal ($r^* = 1$, $r_d = 1.05$, $c = 1.1$, $\kappa = 1.15$, and $\beta = 10$)

We notice that when the precision of the signal privately held by depositors is small ($\beta = 1$ in Figure 2.1), increasing the precision α of the public

signal has a positive impact on the proportion K_e of capital held by the bank when α is initially very small. For bigger values of α and/or β (see Figure 2.2), an increase in α has on the contrary an adverse effect on K_e .

2.4 Conclusion

We develop a theoretical model that shows that increasing the transparency of public information can have a negative impact on market discipline. When fire sales are more costly than raising capital, we indeed show that the bank is most of the times less incentivized to raise capital when the precision of public information increases. In this situation, the probability that the bank eventually goes bankrupt increases. This result forces to qualify the idea according to which transparency is a sufficient condition for market discipline to be effective.

2.A Proof of Proposition 2

We know that $\text{sign} \left\{ \frac{\partial K_e}{\partial \alpha} \right\} = -\text{sign} \left\{ \frac{\partial y_e}{\partial \alpha} \right\}$. Let us differentiate y_e with respect to α :

$$\frac{\partial y_e}{\partial \alpha} = \frac{\partial \bar{\theta}}{\partial \alpha} y^*(\bar{\theta}) f(\bar{\theta}) - \frac{\partial \underline{\theta}}{\partial \alpha} y^*(\underline{\theta}) f(\underline{\theta}) + \int_{\underline{\theta}}^{\bar{\theta}} \frac{\partial y^*}{\partial \alpha} f(\theta) d\theta - \frac{\partial \bar{\theta}}{\partial \alpha} f(\bar{\theta}). \quad (2.12)$$

According to Proposition 1, we know that $y^*(\bar{\theta}) = 1$ and that $y^*(\underline{\theta}) = 0$. We can thus rewrite (2.12) as follows:

$$\frac{\partial y_e}{\partial \alpha} = \int_{\underline{\theta}}^{\bar{\theta}} \frac{\partial y^*}{\partial \alpha} f(\theta) d\theta, \quad (2.13)$$

where

$$\frac{\partial y^*}{\partial \alpha} = \frac{\beta}{(\alpha + \beta)^2 r_d} \left[-\frac{\sqrt{\alpha + \beta}}{2\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) + \mu - \theta - \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right) \right]. \quad (2.14)$$

According to equation (2.13), the sign of $\frac{\partial y_e}{\partial \alpha}$ entirely rests on that of $\frac{\partial y^*}{\partial \alpha}$. We therefore know that:

$$\begin{cases} \frac{\partial y_e}{\partial \alpha} \geq 0 & \text{if } \mu \geq \bar{\mu} \equiv \theta + \frac{\sqrt{\alpha + \beta}}{2\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) + \frac{1}{\sqrt{\beta}} \Phi^{-1} \left(\frac{c - r_d}{\kappa - r_d} \right), \\ \frac{\partial y_e}{\partial \alpha} < 0 & \text{otherwise.} \end{cases} \quad (2.15)$$

In addition, we know that $\theta \leq \bar{\theta}$ (see equation (2.13)) and thus that $\bar{\mu} + \frac{\sqrt{\alpha + \beta}}{2\beta} \Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) \leq \mu$ since we necessarily have $r_d \leq \mu$ otherwise the bank does not invest in the asset. When $\Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) \geq 0$, we always have $\mu \geq \bar{\mu}$ and therefore $\frac{\partial y_e}{\partial \alpha} \geq 0$. When $\Phi^{-1} \left(1 - \frac{r^*}{r_d} \right) < 0$, the sign of $\frac{\partial y_e}{\partial \alpha}$ is given by the condition stated in (2.15).

Conclusion of part I

In part I, we showed that transparency was a questionable objective for financial regulation (chapter 1) and that information disclosure might in some cases weaken market discipline (chapter 2). The way information is disclosed in financial statements is constrained by accounting rules. For listed European companies, and thus also for listed banks, the framework to use is that published by the International Accounting Standards Board. When it comes to banks, the standard that is particularly interesting is the one that sets the way financial instruments are to be reported in financial statements. In 2018, IFRS 9 has replaced IAS 39 as the standard concerning financial instruments. In part II, we study what could be the unintended consequences of two of the main novelties introduced by IFRS 9: the classification and measurement of financial instruments (chapter 3) and the way loan loss provisions are set (chapter 4).

Part II

Financial Accounting and Market Discipline

Chapter 3

"Taking diversity into account": real effects of accounting measurement on asset allocation

Abstract: In the wake of the financial crisis, accounting issues have caught the attention of both economists and regulators. Fair value accounting has indeed been charged of amplifying the procyclicality of the banking system. Real effects of accounting are therefore to be taken into consideration when discussing the issues raised by the crisis. We develop a theoretical model to study what the real effects of accounting on financial institutions' investment decision are. Doing so, we show that fair value accounting may deter banks from investing in long-term assets, while historical cost accounting may incentivize them to invest too much in those assets. At first sight, bank

accounting thus appears as a choice between bad and worse. We show that this is not necessarily the case. More precisely, if financial institutions are subject to different accounting rules depending on their time horizon – i.e. long-sighted financial institutions are subject to historical cost accounting while shorter-sighted financial institutions are subject to fair value accounting – the inefficiencies associated with both accounting rules are softened.

3.1 Introduction

In the wake of the global financial crisis, accounting issues, particularly those related to fair value accounting, have become more and more popular among economists, as suggested by the growing literature on the matter (Beatty and Liao, 2014). In particular, fair value accounting is accused of intensifying and synchronizing financial institutions' responses to changes in their economic environment and consequently to further harm the financial system in times of crisis (Plantin *et al.*, 2008b). This is the reason why the International Accounting Standards Board (IASB) decided to amend IAS 39 in October 2008 by making it possible for financial institutions (FIs) to reclassify financial instruments from a class resorting to fair value to a class resorting to historical cost.

This article aims at assessing the impact of accounting rules on FIs' investment decision. More precisely we study how, on the one hand, fair value accounting (FVA) and, on the other hand, historical cost accounting (HCA) might incentivize FIs to either overinvest or underinvest in a long-term risky asset. To do so we develop a theoretical model where FIs have two successive decisions to make: each FI first chooses the composition of its asset portfolio by allocating an initial endowment between a risky and a riskless asset and then each FI decides whether to hold its risky asset until maturity or not. Real effects of accounting arise when FIs' time horizon is shorter than the duration of the risky asset they want to invest in. We compare two cases: one where FIs are subject to FVA and another where FIs resort to HCA. We show that when FIs' time horizon is shorter than the duration of the

risky asset, FIs generally underinvest in the risky asset when they use FVA. Provided that the market is not too illiquid and that the expected return associated with the risky asset is large enough, FVA incentivizes however FIs to overinvest in the risky asset. We show in addition that when FIs are subject to HCA, they always overinvest in the risky asset. In particular, the more short-sighted FIs are, the more they tend to overinvest in the risky asset when they resort to HCA.

Our paper belongs to the burgeoning literature on the real effects of accounting regimes (Kanodia, 2006). This literature starts from the hypothesis that measurement and disclosure rules have real effects on the economy in the sense that they have a direct influence on the way managers behave. Those effects have to be taken into consideration when comparing accounting regimes since "how accountants measure and disclose a firm's economic transactions changes those transactions" (Kanodia and Sapra, 2016, p.624). In this context, FVA does not *a priori* outperforms HCA solely because it supposedly increases the quality of the information displayed in financial statements.

Theoretical works indeed demonstrate that, in some cases, FVA distorts the behavior of banks' managers in such a way that HCA can be preferable. For instance, O'Hara (1993) shows that market value accounting incentivizes banks to shorten the maturity of their portfolio of assets, which can prove detrimental to the funding of the economy. Freixas and Tsomocos (2004) demonstrate that HCA makes it possible for banks to perform a better intertemporal smoothing than FVA. Plantin *et al.* (2008a) point out that FVA is a bad option for FIs that manage long-lived, illiquid and senior assets.

Allen and Carletti (2008) show that, because of the existence of contagion mechanisms between the insurance and the banking sector, mark-to-market accounting can be detrimental to FIs when markets are illiquid. Yet, their main point is to insist on what would be the advantages of a mixed accounting regime that would make it possible to combine the best features of FVA and those of HCA. Heaton *et al.* (2010) show that some of the problems that have arisen with the introduction of FVA are in fact due to its interaction with capital requirements. Otto and Volpin (2018) show that mark-to-market accounting can make banks take inefficient investment decisions if the behavior of banks' managers is driven by a reputational motive. Plantin and Tirole (2018) show that mark-to-market accounting can have deleterious effects in terms of liquidity.

Empirical evidence on the real effects of accounting are relatively sparse (Leuz and Wysocki, 2016). Some papers provide evidence that banks' behavior responds to changes in accounting rules if those changes are expected to have an influence on regulatory capital ratios (Beatty, 1995; Hodder *et al.*, 2002; Bens and Monahan, 2008). Beatty (2006) goes further by showing that accounting changes do affect banks' behavior even when regulatory capital calculations are not affected. Ellul *et al.* (2015) provide empirical evidence that HCA can induce insurers to engage in gains trading to shore up capital.

As those of O'Hara (1993) and Otto and Volpin (2018), our model tackles the question of the real effects of accounting on FIs' investment decisions. However the main reason why those real effects materialize in our model is the mismatch between FIs' time horizon and the duration of the asset they want to invest in. As in Plantin *et al.* (2008a), this mismatch gives rise to self-

fulfilling panic sales of the risky asset whose expectation deters FIs to invest in this asset when they are subject to FVA. In this case, the idea is that when FIs choose the composition of their asset portfolio, they try to anticipate the amount of the risky asset that will be sold. The rationale is that if a lot of FIs decided to sell their risky assets, their market price would decrease sharply and it would have been less interesting to have invested in them in the first place. Therefore, the more a FI expects the others to sell their risky assets, the less it invests in these assets. On the contrary, when FIs are subject to HCA, they totally disregard short-term market fluctuations and may thus invest too much in the risky asset. Our model makes it possible to reconcile some results found in the literature that might *a priori* have seemed contradictory. In line with O'Hara (1993) we show that FVA can deter FIs from investing in risky assets especially when the duration of these assets is long. In line with the empirical evidence provided by Ellul *et al.* (2015), we show that HCA is no more than FVA a panacea since it does not provide FIs with the right incentives to assess properly the risk associated with long-term assets. We therefore agree with the conclusion of Allen and Carletti (2008) and Otto and Volpin (2018) that neither FVA nor HCA is the panacea and that the "one-size-fits-all" approach does not suit accounting issues well. Furthermore we show that a mixed accounting regime where long-sighted FIs are allowed to use HCA while shorter-sighted FIs resort to FVA can lead to an asset allocation closer to the one that would arise in the first-best world.

Our theoretical framework is based on Plantin *et al.* (2008a). We however introduce two features in our model that are not present in the latter: a variable that accounts for the time horizon of FIs and an explicit modeling

of the portfolio optimization problem they face. Specifically, FIs are allowed to choose between a risky and a riskless asset. We therefore borrow from the literature on portfolio optimization. In particular we make great use of the mean-variance analysis put forward by Markowitz (1952) and of its application to the analysis of the behavior of FIs developed by Pyle (1971) and Hart and Jaffee (1974).

The model is presented in the next section. In section 3.3, we study what are the real effects of FVA on the investment decision of FIs. The case of HCA is presented in section 3.4. Section 3.5 discusses our results and their policy implications. Section 3.6 concludes.

3.2 Model

3.2.1 General framework

We present here the general framework of the model. We consider a unit continuum of FIs. There are three dates.

In $t = 0$, each FI chooses the composition of its portfolio of assets. FIs have to allocate an initial endowment of 1 between a risky asset that yields a random return θ at an uncertain date and a riskless asset that yields a return 1. The risky asset yields in $t = 1$ with probability $1 - d$ and in $t = 2$ with probability d . d can thus be interpreted as the duration of the risky asset. Since the risky asset is a long-term asset, its valuation is subject to uncertainty. We thus assume that FIs do not directly observe θ but each have a noisy estimation of it. We denote by $x_i = \theta + \varepsilon_i$ where $\varepsilon_i \hookrightarrow \mathcal{N}(0, \sigma^2)$

the estimation of θ made by FI i . Conditional on x_i , θ is therefore normally distributed with mean x_i and variance σ^2 . We make the assumption that the time horizon of FIs does not necessarily match the duration of the risky asset. FIs are assumed to maximize in $t = 0$ a weighted average of their short-term (ST) book-value and of their long-term (LT) earning. Specifically, the ST book-value of the risky asset (i.e. its $t = 1$ value) is given by the probability that the asset pays in $t = 1$ (i.e. $1 - d$) times the payoff of the asset (i.e. θ) plus the probability that the asset pays in $t = 2$ times its accounting value, which depends on the accounting rule chosen (i.e. either FVA or HCA). The ST book-value of the risky asset is therefore given by the following expression:

$$(1 - d)\theta + d\theta_a, \tag{3.1}$$

where θ_a denotes the $t = 1$ accounting value of the risky asset when it pays in $t = 2$. The LT earning associated with the risky asset is simply its payoff θ and FIs consequently seek to maximize the following weighted average:

$$(1 - \rho)[(1 - d)\theta + d\theta_a] + \rho\theta, \tag{3.2}$$

where $\rho \in [0, 1]$ accounts for the weight FIs grant to their LT earning. ρ can therefore be interpreted as the time horizon of FIs: the larger ρ , the longer the time horizon of FIs. In particular, when ρ equals 0, FIs are very short-sighted since they only focus on their ST book-value, while they are long-sighted when $\rho = 1$ since in this case they maximize their LT earning.

Between $t = 0$ and $t = 1$, each FI has to decide whether to sell the

proportion it has invested in the risky asset or to hold it to maturity. We make the assumption that there is no market price for this asset and FIs consequently need to resort to a model to price it. This model yields the following price per unit of the risky asset:

$$p(\theta) = \delta\theta - \gamma\alpha s, \quad (3.3)$$

where δ is a positive constant that can be interpreted as the liquidity risk associated with the risky asset, γ is a positive constant that captures market liquidity (the larger γ is, the less liquid the market is), s is the proportion of FIs that have sold their risky asset. We assume that $\delta \leq 1$. In this case, sales of the risky asset are only driven by the shortsightedness of FIs. When $\delta \leq 1$ we indeed know that $\theta \geq p(\theta)$: the LT earning associated with the risky asset is always above its market price and a FI that seeks to maximize its LT earning would therefore never find it interesting to sell it. Sales of the risky asset are therefore assumed to be only motivated by the interaction between the incentives coming from accounting rules and those coming from the shortsightedness of FIs. Table 3.1 summarizes the timing of the model.

$t = 0$	Between $t = 0$ and $t = 1$	$t = 1$	$t = 2$
FIs have a noisy signal x of θ based on which they allocate a proportion α of their portfolio to the risky asset	FIs can sell their risky asset or hold it to maturity	The risky asset pays θ with probability $1 - d$	The risky asset pays θ with probability d

Table 3.1: Timing of the model

3.2.2 Benchmark case

We define the benchmark case as that where FIs' time horizon is longer than or equal to the duration of the risky asset. In this case, FIs only focus on the LT earning associated with the risky asset (i.e. $\rho = 1$) and never decide to sell it when $\delta \leq 1$. Since FIs only focus on the return of the risky asset, accounting rules do not play any part in their decision-making process. We assume that each FI behaves like a portfolio manager when deciding which proportion of its asset portfolio to allocate to the risky asset. In particular, we resort to the mean-variance analysis to compute this proportion: we assume that a FI chooses the composition of its portfolio by maximizing a utility function $U(\mu_p, \sigma_p^2)$ where μ_p is the expected value of the portfolio and σ_p^2 its variance. We assume that $\frac{\partial U(\cdot)}{\partial \mu_p} > 0$ and that $\frac{\partial U(\cdot)}{\partial \sigma_p^2} < 0$, meaning that FIs are risk-averse. Let us denote by $\hat{\alpha}$ the proportion of their portfolio FIs invest in the risky asset in the benchmark case. The random value of the asset portfolio of a FI (denoted by $\tilde{\pi}_p$) consists in the proportion $\hat{\alpha}$ it invests in the risky asset times its return plus the proportion invested in the riskless asset (i.e. $1 - \hat{\alpha}$). Since FIs are assumed to maximize their LT earning, we can express $\tilde{\pi}_p$ as follows:

$$\tilde{\pi}_p = \hat{\alpha}(\theta - 1) + 1. \quad (3.4)$$

Following the mean-variance assumption, the value of $\hat{\alpha}$ is given by the following first-order condition:

$$\frac{\partial U}{\partial \mu_p} \frac{\partial \mu_p}{\partial \hat{\alpha}} + \frac{\partial U}{\partial \sigma_p^2} \frac{\partial \sigma_p^2}{\partial \hat{\alpha}} = 0. \quad (3.5)$$

Let us denote the expectation operator by $\mathbb{E}[\cdot]$ and the variance operator by $V[\cdot]$. Using equation (3.4) we can therefore express μ_p and σ_p^2 conditional on x as follows:

$$\mu_p = \mathbb{E}[\tilde{\pi}_p|x] = \hat{\alpha}(x - 1) + 1, \quad (3.6)$$

and

$$\sigma_p^2 = V[\tilde{\pi}_p|x] = \hat{\alpha}^2 \sigma^2. \quad (3.7)$$

The value of $\hat{\alpha}$ is consequently given by the following expression:

$$\hat{\alpha} = \lambda \frac{x - 1}{\sigma^2}, \quad (3.8)$$

where $\lambda = -\frac{1}{2} \frac{\partial U}{\partial \mu_p} \left[\frac{\partial U}{\partial \sigma_p^2} \right]^{-1}$ is the risk-aversion coefficient: the greater λ is, the less risk-averse the agent is. $\hat{\alpha}$ is therefore the proportion of their asset portfolio FIs would decide to invest in the risky asset if their time horizon was such that they only focused on the LT payoff associated with the risky asset. From now on, this allocation between the risky and the riskless asset will consequently be referred to as the first-best allocation.

3.3 Fair value accounting

We now assume that FIs' time horizon does not perfectly match the duration of the risky asset. In this case, FIs are no longer only interested in the LT earning associated with the risky asset but focus on a weighted average of its ST book-value and of its LT earning. Accounting therefore plays a role in FIs' decision-making since different accounting rules induce different

ST book-values. Contrary to the benchmark case, real effects of accounting measurement therefore arise and are the consequence of the mismatch between FIs' time horizon and the duration of the risky asset. In this section we assume that FIs resort to FVA to determine the book-value of their portfolio.

To compute the proportion of their asset portfolio that FIs decide to invest in the risky asset, we proceed by backward induction. We first determine in which situations FIs decide to sell their risky asset between $t = 0$ and $t = 1$ and only then do we compute the proportion invested in the risky asset in $t = 0$.

3.3.1 Selling *versus* holding

As previously mentioned, each FI can either sell its risky asset or hold it to maturity. A FI holds its risky asset to maturity if the weighted average of its ST book-value and of its LT earning is larger than its estimated market price. Since the market is not perfectly liquid (i.e. $\gamma > 0$), the price of the risky asset depends on the proportion of FIs that decide to sell their risky asset. There consequently is an uncertainty concerning the price a FI would face if it decided to sell its asset between $t = 0$ and $t = 1$. Indeed, since the price responds immediately to the proportion of FIs that decide to sell, the price faced by a particular FI depends on the date on which it decides to sell. The idea is that FIs do not take the decision to sell exactly at the same time but continuously decide to sell or hold their risky asset between $t = 0$ and $t = 1$. The price expected in $t = 0$ by a particular FI consequently depends on its expected position in the sellers' line – i.e. on the expected proportion

of FIs that will already have sold their asset when the FI will decide to do so. We make the assumption that the expected position of a particular FI in the sellers' line follows a uniform distribution on $[0, s]$. Let us denote by s_i the random variable that accounts for the position of FI i in the sellers' line. The price FI i would face if it decided to sell its risky asset between $t = 0$ and $t = 1$ is consequently given by the following equation:

$$p_i(\theta) = \delta\theta - \gamma\alpha_{FV}\mathbb{E}[s_i] = \delta\theta - \gamma\alpha_{FV}\frac{s}{2}, \quad (3.9)$$

where α_{FV} is the proportion of their asset portfolio FIs invest in the risky asset when they are subject to FVA. Finally, a FI holds its risky asset to maturity if:

$$\underbrace{(1 - \rho)[(1 - d)\theta + d(\delta\theta - \gamma\alpha_{FV}s)] + \rho\theta}_{\text{weighted average of ST book-value and LT earning}} \geq \underbrace{\delta\theta - \gamma\alpha_{FV}\frac{s}{2}}_{\text{market price}}, \quad (3.10)$$

which can be rewritten as follows:

$$\theta \geq \frac{\gamma s \alpha_{FV} \left[(1 - \rho)d - \frac{1}{2} \right]}{(1 - \delta)[1 - d(1 - \rho)]}. \quad (3.11)$$

We notice that sales of the risky asset only occur when the time-horizon ρ of FIs is too short in comparison to the duration d of the risky asset, that is whenever $\rho < 1 - \frac{1}{2d}$. In this case, according to (3.11), when $\theta > \frac{\gamma\alpha_{FV}[(1-\rho)d - \frac{1}{2}]}{(1-\delta)[1-d(1-\rho)]}$ FIs always hold their risky asset to maturity. Conversely, if $\theta < 0$, all FIs sell their asset. When $\theta \in \left[0, \frac{\gamma\alpha_{FV}[(1-\rho)d - \frac{1}{2}]}{(1-\delta)[1-d(1-\rho)]} \right]$, we use the global game technique (Carlsson and Van Damme, 1993; Morris and Shin, 1998;

and Morris and Shin, 2003; Plantin *et al.*, 2008a) to show that FIs resort to a threshold strategy. In other words, FI i decides to sell its risky asset whenever $x_i < x^*$ and to hold it to maturity whenever $x_i \geq x^*$. Since we are dealing with a continuum of FIs on $[0, 1]$, the proportion of FIs that sell their risky asset when $\theta = \theta^*$ is given by:

$$s(\theta^*) = \Pr(x_i \leq x^* | \theta^*) = \Pr\left(\frac{x_i - \theta^*}{\eta} \leq \frac{x^* - \theta^*}{\eta}\right) = \frac{1}{2}. \quad (3.12)$$

We can therefore express the value of θ^* as follows:

$$\theta^* = \gamma \alpha_{FV} \frac{[(1 - \rho)d - \frac{1}{2}]}{2(1 - \delta)[1 - d(1 - \rho)]}, \quad (3.13)$$

Lemma 1. *There exists a unique threshold value of θ , denoted θ^* , such that when $\theta < \theta^*$ all FIs sell their risky asset and when $\theta \geq \theta^*$ they all decide to hold it to maturity.*

3.3.2 Portfolio optimization

We now determine which proportion of their asset portfolio FIs decide to allocate to the risky asset. As in section 3.2.2, we resort to the mean-variance assumption. The random value $\tilde{\pi}_{FV}$ of the portfolio of a FI consists in the proportion α_{FV} it invests in the risky asset times its return plus the proportion invested in the riskless asset. Recall that the $t = 0$ value of the risky asset is given by a weighted average of its long-term value θ and of its ST book value. The ST book-value of the risky asset is equal to θ if the asset pays in $t = 1$. If the asset pays in $t = 2$, FIs resort to a model to estimate

its accounting value in $t = 1$, that is equation (3.3) when FIs are subject to FVA. Therefore, $\tilde{\pi}_{FV}$ is given by the following expression:

$$\tilde{\pi}_{FV} = \alpha_{FV} \{ (1 - \rho) [(1 - d)\theta + d(\delta\theta - \gamma\alpha_{FV}s)] + \rho\theta \} + 1 - \alpha_{FV}. \quad (3.14)$$

Lemma 2. *The proportion α_{FV} of their asset portfolio FIs decide to invest in the risky asset is such that $\alpha_{FV} = \frac{x^{A-1}}{\lambda^{-1}A^2\sigma^2 + 2s(1-\rho)d\gamma}$ where $A = 1 - d + d\delta + \rho d(1 - \delta)$.*

Proof. See Appendix 3.A.1. □

Taken together Lemmas 1 and 2 allow us to express the proportion of their asset portfolio FIs invest in the risky asset when they are subject to FVA:

$$\alpha_{FV} = \frac{Ax - 1}{\lambda^{-1}A^2\sigma^2 + 2F(\theta^*)(1 - \rho)d\gamma}, \quad (3.15)$$

where $F(\cdot)$ is the cumulative distribution function of θ .

Proposition 1. *Provided that $0 \leq \frac{x^{A-1}}{\lambda^{-1}A^2\sigma^2 + 2F(\theta^*)(1-\rho)d\gamma} \leq 1$, there always exists an equilibrium value of $\alpha_{FV} \in [0, 1]$ such that equation (3.15) holds true.*

Proof. See Appendix 3.A.2 □

Proposition 2. *When FIs are long-sighted (i.e. $\rho = 1$), FVA achieves the first-best: no sales of the risky asset occur and $\alpha_{FV} = \hat{\alpha}$.*

Proof. Sales of the risky asset only occur when $\rho < 1 - \frac{1}{2d} \leq \frac{1}{2}$. When $\rho = 1$, no sales of the risky asset are therefore expected. We thus have

$$\alpha_{FV} = \frac{[1-d+d\delta+d(1-\delta)]x-1}{\lambda^{-1}[1-d+d\delta+d(1-\delta)]^2\sigma^2} = \hat{\alpha}. \quad \square$$

The next section studies in detail what conclusions can be drawn from those results.

3.3.3 Fair value accounting and asset allocation

FVA incentivizes FIs to pay attention to the $t = 1$ expected price of the risky asset. When FIs are short-sighted and the market is illiquid, they anticipate that sales of the risky asset will occur and that its price will therefore decrease. This expected drop in the price of the risky asset causes its fair value to decrease: short-sighted FIs that focus a lot on the ST book-value of their portfolio will consequently grant less value to the risky asset and invest less in it. In other words, FVA makes FIs overreact to others' behaviors, which gives rise to self-fulfilling sales. Those expected sales in turn incentivize FIs to underinvest in the risky asset. However, this relationship between self-fulfilling sales of the risky asset and under-investment in this asset because of the expectation of those sales only occur as far as the market is rather illiquid. When the market is not too illiquid and provided that x is large enough, FVA makes FIs understate the risk associated with their asset portfolio. In this case, since the risky asset is expected to pay a high return, few sales are expected, i.e. $F(\theta^*)$ is small, and thus FIs decide to invest a lot in the risky asset. Assume for example that $F(\theta^*) = 0$, i.e. no sales of the risky asset are expected. According to Proposition 1, FIs thus invest a proportion $\lambda \frac{x - \frac{1}{A}}{A\sigma^2}$ of their asset portfolio in the risky asset. Recall that the first-best allocation is $\hat{\alpha} = \lambda \frac{x-1}{\sigma^2}$. It is easy to show that $A < 1 \iff \rho < 1$. Thus when $\rho < 1$, i.e. when FIs are short-sighted, the risk σ^2 associated with the risky asset is

underestimated since it is multiplied by a factor $A < 1$. When no sales of the risky asset are expected, short-sighted FIs therefore underestimate the risk associated with the risky asset and, provided that the expected return x of this asset is large enough, they overinvest in it.

Proposition 3. *When short-sighted FIs (i.e. $\rho < 1$) are subject to FVA:*

- *when the market is rather illiquid (i.e. $\gamma \geq \bar{\gamma}$), FIs overreact to expected drops in the price of the risky asset by under-investing in it (i.e. $\alpha_{FV} < \hat{\alpha}$),*
- *provided that the market is not too illiquid (i.e. $\gamma < \bar{\gamma}$), when the expected return associated with the risky asset is large enough (i.e. $x > \bar{x}$), FIs underestimate the risk associated with a high-yield risky asset and overinvest in it (i.e. $\alpha_{FV} > \hat{\alpha}$).*

Proof. See Appendix 3.A.3. □

Proposition 3 provides some support to one of the main criticisms addressed to FVA: its procyclicality. During expansion phases – i.e. when markets are liquid and assets are expected to yield high returns – FVA indeed encourages FIs to overinvest in risky assets, which makes their prices increase further. Yet, in depression phases – i.e. when markets become illiquid – FVA deters FIs from investing in risky assets, which causes their prices to decrease further.

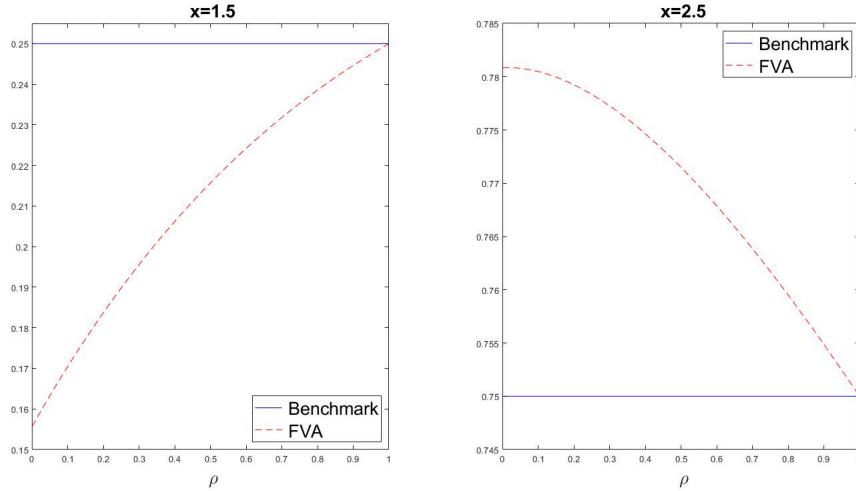


Figure 3.1: Proportions of portfolios invested in the risky asset in the FVA case and in the benchmark case ($\lambda = 0.5$, $\delta = 0.75$, $\sigma^2 = 1$, $d = 0.8$ and $\gamma = 0.05$)

Figure 3.1 plots the proportions of their asset portfolio FIs invest in the risky asset when they are subject to FVA (dotted line) and in the benchmark case (solid line) as functions of ρ and for some values of x when the market is rather liquid ($\gamma = 0.05$). In this case, we notice that FIs tend to underinvest in the risky asset when x is small: the dotted curve is indeed below the solid line when $x = 1.5$. On the contrary, when $x = 2.5$, FIs overinvest in the risky asset: the dotted curve is above the solid line. The difference between the first-best allocation and the one that occurs when FIs are subject to FVA is in addition larger when FIs are more short-sighted. Those indeed overreact the most to expected sales. When the market is more illiquid ($\gamma = 2$), Figure 3.2 shows that even when $x = 2.5$, FIs whose time horizon is below a certain threshold underinvest in the risky asset. FVA thus deters short-sighted FIs to invest in long-term assets, which can prove detrimental to the funding of

long-term investments.

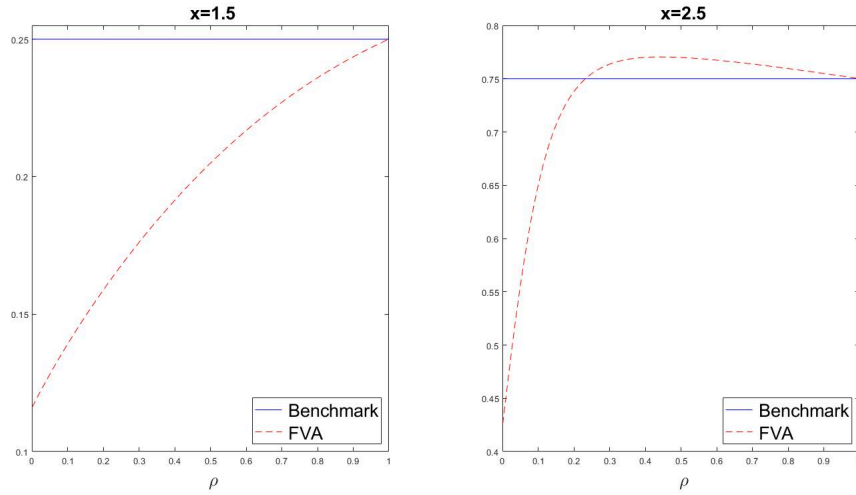


Figure 3.2: Proportions of portfolios invested in the risky asset in the FVA case and in the benchmark case ($\lambda = 0.5$, $\delta = 0.75$, $\sigma^2 = 1$, $d = 0.8$ and $\gamma = 2$)

3.4 Historical cost accounting

3.4.1 Portfolio optimization

We now assume that FIs resort to HCA. In this case, the $t = 1$ accounting value of the risky asset if it pays in $t = 2$ is no more given by its market price but by its historical value θ_0 . When FIs resort to HCA, the weighted average of the ST book-value of the risky asset and of its LT earning is therefore equal to:

$$(1 - \rho)[(1 - d)\theta + d\theta_0] + \rho\theta. \quad (3.16)$$

We assume that the historical value of the risky asset θ_0 is determined in $t = 0$ as the rational expectation of the weighted average of the ST book-value of

the risky asset and of its LT earning:

$$\theta_0 = \mathbb{E}[(1 - \rho)((1 - d)\theta + d\theta_0) + \rho\theta|x] \iff \theta_0 = x. \quad (3.17)$$

As previously we resort to the mean-variance analysis to determine the proportion of their portfolio of assets FIs invest in the risky asset in $t = 0$. The random value $\tilde{\pi}_{HC}$ of the asset portfolio of a representative FI that is subject to HCA is given by:

$$\tilde{\pi}_{HC} = \alpha_{HC}\{(1 - \rho)[(1 - d)\theta + d\theta_0] + \rho\theta - 1\} + 1, \quad (3.18)$$

where α_{HC} is the proportion of their asset portfolio FIs invest in the risky asset when they resort to HCA. Following the mean-variance assumption and replacing θ_0 by its value, we compute the value of α_{HC} :

$$\alpha_{HC} = \lambda \frac{x - 1}{[1 - d(1 - \rho)]^2 \sigma^2}. \quad (3.19)$$

Proposition 4. *When FIs are long-sighted (i.e. $\rho = 1$), HCA achieves the first-best: no sales of the risky asset occur and $\alpha_{HC} = \hat{\alpha}$.*

Proof. We indeed have $\alpha_{HC} = \lambda \frac{x-1}{\sigma^2} = \hat{\alpha}$ when $\rho = 1$. □

3.4.2 Historical cost accounting and asset allocation

When they are subject to HCA, FIs do not take short-term market fluctuations into account. For long-sighted FIs whose business model makes it possible to focus on the long-term earning, the distorting impact of HCA on

the allocation between the risky and the riskless asset is therefore expected to be smaller than that for short-sighted FIs. This is what Proposition 5 states.

Proposition 5. *When $\rho < 1$, HCA makes FIs overinvest in the risky asset. In particular, the more short-sighted FIs are (i.e. the smaller ρ is), the more they overinvest in the risky asset (i.e. $\frac{\partial \alpha_{HC}}{\partial \rho} \leq 0$).*

Proof. When $\rho < 1$, we indeed have $\alpha_{HC} = \lambda \frac{x-1}{[1-d(1-\rho)]^2 \sigma^2} > \hat{\alpha} = \lambda \frac{x-1}{\sigma^2}$ and $\frac{\partial \alpha_{HC}}{\partial \rho} = -\frac{2d\lambda(x-1)}{\sigma^2 (d(\rho-1)+1)^3} \leq 0$ when $x \geq 1$. □

When short-sighted FIs resort to HCA, they focus much on the historical value of the risky asset. This makes them understate the real risk associated with the risky asset, which induces them to overinvest in it. Recall indeed that:

$$\alpha_{HC} = \lambda \frac{x-1}{[1-d(1-\rho)]^2 \sigma^2} \quad \text{and that} \quad \hat{\alpha} = \lambda \frac{x-1}{\sigma^2}. \quad (3.20)$$

The drift between the first-best allocation and the one that arises when FIs are subject to HCA is measured by $d(1-\rho)$: the bigger $d(1-\rho)$, the bigger the drift. We notice that $d(1-\rho)$ is an increasing function in d and a decreasing function in ρ , which means that when the mismatch between FIs' time horizon and the duration of the risky asset increases, the allocation between the risky and the riskless asset that arises when FIs are subject to HCA goes further away from the first-best allocation.

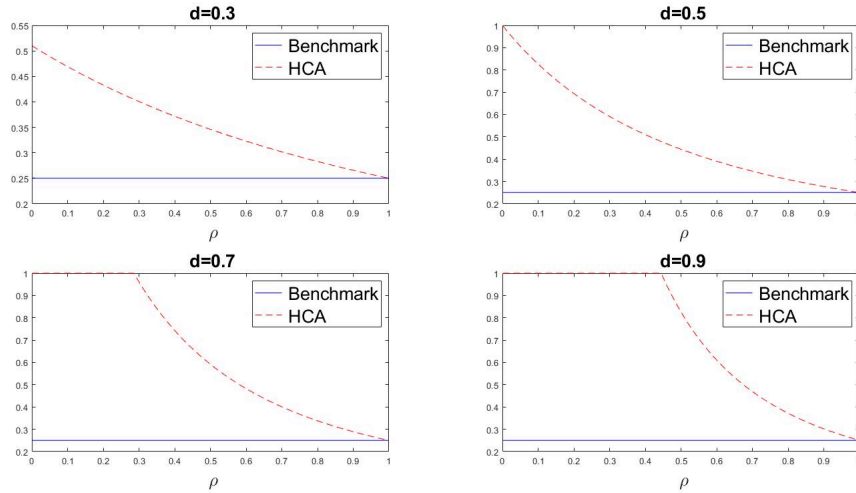


Figure 3.3: Proportions of the asset portfolio invested in the risky asset in the HCA case and in the benchmark case ($\lambda = 0.5$, $\delta = 0.75$, $\sigma^2 = 1$, $x = 1.5$ and $\gamma = 1$)

Figure 3.3 plots the proportions FIs invest in the risky asset when they are subject to HCA (dotted line) and in the benchmark case (solid line) as functions of ρ for some values of d . We notice that the dotted curve is always above the solid line. In addition, the distance between the two lines is indeed bigger for smaller values of ρ – i.e. when FIs are the most short-sighted. Furthermore, when the duration of the asset increases, this distance grows and the most short-sighted FIs blindly invest all their initial endowment in the risky asset.

3.5 Discussion and policy implications

Neither FVA nor HCA is *per se* a panacea. Most of the time, FVA incentivizes FIs to underinvest in long-term assets. HCA, on the contrary, makes FIs ignore short-term market fluctuations and may therefore incen-

tivize them to overinvest in long-term and illiquid assets. In the two cases, problems arise because the time horizon of FIs is shorter than the maturity of the assets they invest in, which is precisely the case as far as banks are concerned. Is bank accounting therefore a choice between bad and worse? We do not think so precisely because banks are not the only FIs acting on financial markets. Long-term investors, such as insurers or pension funds for instance, are characterized by far longer time horizons than banks and are therefore less affected by the problems that arise because of maturity mismatch. According to our model, the main reason why banks may underinvest in long-term assets when they resort to FVA is the expectation of inefficient sales. In this perspective, long-term FIs could play the role of market stabilizers by diminishing the likelihood of such sales happening. As long-term investors rely on long-term funding, they are very unlikely to face unexpected liquidity needs and they will therefore not sell their assets at distressed prices. On the contrary, when prices of long-term assets are collapsing because of self-fulfilling panics rooted in short-sighted FIs' fear of illiquidity, long-term investors could act as buyers in last resort since they are in a position of waiting for those long-term assets to pay. In other words, they are able to deal with the liquidity risk and thus to benefit from the associated risk premium (Persaud, 2015a). However, this mechanism is likely to take place only if those long-term FIs are permitted to disregard short-term market fluctuations when establishing their financial statements, meaning if they are subject to HCA. This is by the way the main criticism that can be addressed to the way Solvency II has been designed: by forcing insurers to compute their solvency capital requirement as the one-year Value-at-Risk

of their asset portfolios, it may prevent those institutions from investing in long-term assets (Persaud, 2015b).

Our model provides some insight on how a mixed accounting regime could allow lessening the distorting impact associated with FVA. Assume that the market is rather illiquid such that $\gamma \geq \bar{\gamma}$. Assume a continuum of FIs on $[0, 1]$. Assume in addition that half of those FIs are long-term investors (i.e. $\rho = 1$), while the other half is made of banks in which case $\rho < 1$. Assume that FIs know their type but have no clue about the type of other FIs. If all FIs are subject to FVA, long-term FIs invest a proportion $\hat{\alpha} = \lambda \frac{x-1}{\sigma^2}$ (Proposition 2) of their asset portfolio in the risky asset, while banks invest a proportion $\alpha_{FV} = \frac{Ax-1}{\lambda^{-1}A^2\sigma^2+2F(\theta^*)(1-\rho)d\gamma}$ (Proposition 1). In this case, the total investment in the long-term asset is under its optimal value (Proposition 3). Suppose now that FIs are subject to an accounting rule allowing long-term FIs to resort to HCA, while other institutions resort to FVA. In this case, banks know that at least half of the market is made of long-term FIs since those report the historical value of the risky asset on their balance sheet, which is public information. Half of the market will assuredly not sell the risky asset before its maturity and panic sales are consequently less likely to occur. In this case, banks invest a proportion $\frac{Ax-1}{\lambda^{-1}A^2\sigma^2+F(\theta^*)(1-\rho)d\gamma} \geq \alpha_{FV}$ of their asset portfolio in the risky asset while long-term FIs invest as before a proportion $\lambda \frac{x-1}{\sigma^2}$. In this case the total investment in the risky asset is higher than when all FIs are subject to FVA. Figure 3.4 plots the discrepancy between the first-best allocation and the ones that arise when long-term FIs are subject to FVA (solid curve) and when they are subject to HCA (dotted curve) as a function of the time horizon ρ of banks. We indeed notice that when long-

term FIs are subject to HCA, the total investment in the risky asset is closer to the first-best allocation than when long-term FIs are subject to FVA.

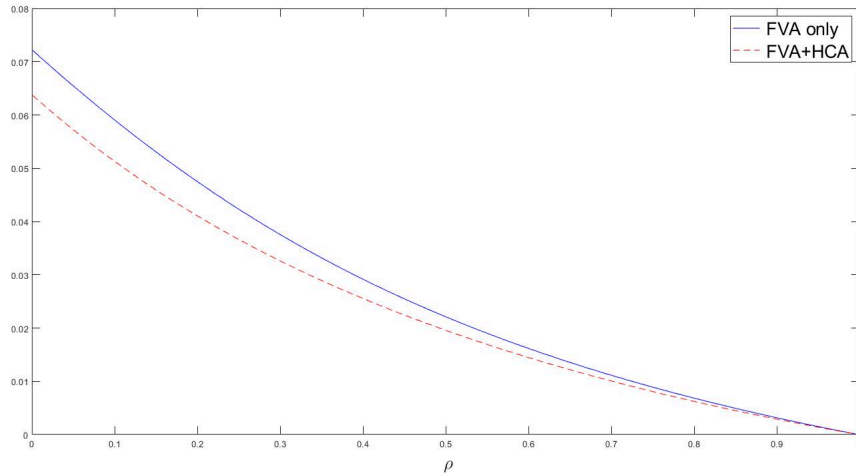


Figure 3.4: Reducing the distorting impact of FVA through a mix accounting regime ($d = 0.8$, $\delta = 0.75$, $\gamma = 2$, $\lambda = 0.5$, $\sigma^2 = 1$ and $x = 1.5$)

An accounting regime that allows long-term investors to resort to HCA makes it therefore possible to limit the deterrent effect of FVA on long-term investments. It may consequently be preferable to design different accounting standards for different FIs instead of implementing the same standard for all institutions, regardless of their type.

3.6 Conclusion

This paper presents a theoretical model that assesses the impact of accounting rules on the investment's decision of financial institutions. We show that the mismatch between financial institutions' time horizon and the duration of the risky asset they invest in gives rise to real effects of accounting. Those real

effects are not the same whether FIs resort to FVA or to HCA. FVA makes FIs overreact to the expectations they forge concerning the behavior of others. Strategic complementarities arise and they give birth to self-fulfilling sales of the risky asset whose expectation incentivizes FIs to underinvest in the risky asset when its expected return is low. When the expected return associated with the risky asset is on the contrary high enough – and provided that the market is not too illiquid – FVA makes FIs understate the risk associated with the risky asset, which induces them to overinvest in it. When FIs are subject to HCA, they always overinvest in the risky asset. We show that an accounting regime where long-sighted financial institutions are allowed to resort to HCA while shorter-sighted institutions use FVA makes it possible to lessen the distortions induced by the use of FVA.

These results are in line with the idea that accounting rules should be designed in accordance with the nature of the activities led by financial institutions. In this perspective, since insurers are engaged in long-term activities, they should be offered the possibility to use HCA while banks are better off resorting to FVA. This is more or less what is to be found in IFRS 9 since it offers the opportunity for FIs to resort to HCA for long-term assets that are expected to be held until their maturity. However, under IFRS 9 FVA remains the default option for all FIs, HCA being only an available option for certain types of assets.

3.A Appendix

3.A.1 Proof of Lemma 2

According to the mean-variance assumption FIs maximize the following utility function:

$$U(\mu_p, \sigma_p^2), \quad (3.21)$$

where μ_p is the mean and σ_p^2 the variance of the random return $\tilde{\pi}_{FV}$ associated with the asset portfolio:

$$\tilde{\pi}_{FV} = \alpha_{FV} \{ (1 - \rho)[(1 - d)\theta + d(\delta\theta - \gamma s \alpha_{FV})] + \rho\theta - 1 \} + 1. \quad (3.22)$$

We therefore have:

$$\mu_p | x = \alpha_{FV} \{ (1 - \rho)[(1 - d)x + d(\delta x - \gamma s \alpha_{FV})] + \rho x - 1 \} + 1, \quad (3.23)$$

and

$$\sigma_p^2 | x = \alpha_{FV}^2 \{ (1 - \rho)[(1 - d) + d\delta] + \rho \}^2 \sigma^2. \quad (3.24)$$

The value of α_{FV} is given by the following first-order condition:

$$\begin{aligned} & \frac{\partial U}{\partial \mu_p} \frac{\partial \mu_p}{\partial \alpha_{FV}} + \frac{\partial U}{\partial \sigma_p^2} \frac{\partial \sigma_p^2}{\partial \alpha_{FV}} = 0 \\ \iff & \frac{\partial U}{\partial \mu_p} \{ [1 - d + d\delta + \rho d(1 - \delta)]x - 2(1 - \rho)\gamma s \alpha_{FV} d - 1 \} \\ & + 2\alpha_{FV} \frac{\partial U}{\partial \sigma_p^2} [1 - d + d\delta + \rho d(1 - \delta)]^2 \sigma^2 = 0. \end{aligned} \quad (3.25)$$

We can consequently compute the value of α_{FV} as follows:

$$\alpha_{FV} = -\frac{\frac{\partial U}{\partial \mu_p} \{[1 - d + d\delta + \rho d(1 - \delta)]x - 1\}}{2\frac{\partial U}{\partial \sigma_p^2} [1 - d + d\delta + \rho d(1 - \delta)]^2 \sigma^2 - \frac{\partial U}{\partial \mu_p} 2(1 - \rho)\gamma sd}. \quad (3.26)$$

Therefore, the value of α_{FV} is given by:

$$\alpha_{FV} = \frac{[1 - d + d\delta + \rho d(1 - \delta)]x - 1}{\lambda^{-1}[1 - d + d\delta + \rho d(1 - \delta)]^2 \sigma^2 + 2(1 - \rho)\gamma sd}. \quad (3.27)$$

3.A.2 Proof of Proposition 1

We want to show that there exists a unique value of α_{FV} that satisfies the following equation:

$$\alpha_{FV} = \frac{Ax - 1}{\lambda^{-1}A^2\sigma^2 + 2F(\theta^*)(1 - \rho)d\gamma}, \quad (3.28)$$

where $\theta^* = \gamma\alpha_{FV} \frac{(1-\rho)d-\frac{1}{2}}{2(1-\delta)(1-d(1-\rho))}$. Given that α_{FV} is a proportion, we necessarily have $\alpha_{FV} \in [0, 1]$. Thus for α_{FV} to exist we must necessarily have $\frac{Ax-1}{\lambda^{-1}A^2\sigma^2+2F(\theta^*)(1-\rho)d\gamma} \in [0, 1]$. Let us define the following function:

$$g(\alpha_{FV}) = \alpha_{FV} - \frac{Ax - 1}{\lambda^{-1}A^2\sigma^2 + 2F(\theta^*)(1 - \rho)d\gamma}. \quad (3.29)$$

We have:

- $g(0) < 0$ provided that $Ax - 1 > 0$ (if $Ax - 1 = 0$, we immediately have α_{FV} exists, unique and equal to 0),
- $g(1) \geq 0$,
- $\frac{\partial g(\alpha_{FV})}{\partial \alpha_{FV}} \geq 0$.

The intermediate value theorem ensures that there exists a unique value of $\alpha_{FV} \in [0, 1]$ such that equation (3.28) is satisfied.

3.A.3 Proof of Proposition 3

Let us define $A = 1 - d + d\delta + \rho d(1 - \delta)$ and $B = 2F(\theta^*)\lambda(1 - \rho)d$. In this case, we have $\alpha_{FV} = \frac{Ax-1}{\lambda^{-1}[A^2\sigma^2+B\gamma]}$ and $\hat{\alpha} = \lambda\frac{x-1}{\sigma^2}$. We thus have:

$$\begin{aligned} \alpha_{FV} &\geq \hat{\alpha} \\ \iff x[A\sigma^2(1-A) - B\gamma] &\geq \sigma^2(1-A^2) - B\gamma. \end{aligned} \tag{3.30}$$

It is easy to show that there exists a threshold value of γ , denoted by $\bar{\gamma}$, such that $A\sigma^2(1-A) - B\gamma > 0$ when $\gamma < \bar{\gamma}$ and $A\sigma^2(1-A) - B\gamma \leq 0$ otherwise. Similarly, there exists a threshold value $\bar{\bar{\gamma}} \geq \bar{\gamma}$ such that $\sigma^2(1-A^2) - B\gamma > 0$ when $\gamma < \bar{\bar{\gamma}}$ and $\sigma^2(1-A^2) - B\gamma < 0$ otherwise. We thus have:

- when $\gamma < \bar{\gamma}$, (3.30) holds true when $x \geq \bar{x} \equiv \frac{\sigma^2(1-A)-B}{A\sigma^2(1-A)-B}$,
- when $\gamma \in [\bar{\gamma}, \bar{\bar{\gamma}}]$, (3.30) never holds true and we therefore always have $\hat{\alpha} \geq \alpha_{FV}$,
- when $\gamma > \bar{\bar{\gamma}}$, (3.30) holds true when $x \leq \frac{B\gamma - \sigma^2(1-A)}{B\gamma - A\sigma^2(1-A)} \leq 1$, we thus always have $\hat{\alpha} \geq \alpha_{FV}$ in this case.

Finally, when $\gamma < \bar{\gamma}$, we have $\alpha_{FV} \geq \hat{\alpha}$ provided that $x \geq \bar{x}$. When, $\gamma > \bar{\bar{\gamma}}$, we always have $\alpha_{FV} \leq \hat{\alpha}$.

Chapter 4

Discretionary loan loss provisions and market discipline

Abstract: Using a panel of 456 American universal commercial banks from 2008 to 2017, we provide empirical evidence that discretionary loan loss provisions increase when market discipline – proxied by deposit rates – strengthens. In particular, least-capitalized banks increase their discretionary loan loss provisions following an increase in deposit rates. Loan loss provisions can thus act as a substitute for capital to respond to market discipline. This result partly qualifies the enthusiasm raised by the implementation of forward-looking provisioning models. These models indeed grant great discretion to banks in the setting of loan loss provisions since the valuation method underlying them is subject to uncertainty. In this perspective, regulators should make sure that the implementation of forward-looking provisioning models

is not done in a way that would encourage banks to substitute provisions for capital, which would prove detrimental to market discipline.

4.1 Introduction

As soon as 2009, the Financial Stability Forum (FSF) noted that "earlier recognition of loan losses could have dampened cyclical moves in the current crisis" (FSF, 2009, p.4) and consequently called for a renewal of loan loss provisioning models. At that time, provisions were made according to a model that is commonly referred to as the incurred loss model both in the IFRS and in the US GAAP framework. Following the call of the FSF, accounting standards setters – both the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB) – have begun to work on new standards concerning loan loss provisioning. Those standards rest on a forward-looking provisioning model and will come into effect between 2018 and 2021.

The philosophy of those models is that from the very moment a loan is granted, a provision that consists in the expected loss associated with this loan has to be created. While the incurred loss model gives banks few room for maneuver since loan loss provisions are directly related to contemporary problem loans, forward-looking provisioning models entirely rest on the computation of an expected credit loss. In other words, while the incurred loss model deals with what is known (i.e. actual information supported by objective evidence), forward-looking provisioning models deal with the future and thus with uncertainty. This uncertainty has therefore to be modeled, and risk models are used to compute the expected credit loss on which loan loss provisions are based. Those models are however subject to manipulations and could eventually lead to an underestimation of loan loss provisions

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(Mariathasan and Merrouche, 2014). In addition, the three-bucket approach introduced by IFRS 9 is not very clear concerning the circumstances under which an asset has to be transferred from one bucket to another. This adds to the discretionary power granted to banks subject to IFRS 9 when setting their loan loss provisions.

This paper studies the relationship between discretionary loan loss provisions and market discipline. It is a well-established result that strong market discipline translates into high capital buffers (Baumann and Nier, 2006). But when capital is costly and hard to raise, it may be difficult for banks to deal with market discipline by holding large capital buffers. In that case, depending on the discretion let to banks when setting their loan loss provisions, those provisions could act as a substitute for capital: when capital is scarce, banks can make provisions to signal their strength and thus to soften market discipline. We provide empirical evidence to support this idea. Using a panel of 456 American universal commercial banks from 2008 to 2017 we show that discretionary loan loss provisions are indeed increasing when deposit rates – which are considered as a proxy for market discipline – increase. Furthermore we show that least-capitalized banks increase more their loan loss provisions following an increase in their deposit rates than other banks do. To our knowledge, our paper is the first to empirically show that banks use their loan loss provisions to cope with market discipline. Accounting standards setters thus have to take into account the potential impact of accounting rules on market discipline. This suggests that accounting standard setters have to work hand in hand with prudential regulators.

This paper lies at the intersection between the literature on market disci-

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pline and that on loan loss provisions. Market discipline and the mechanisms through which it is supposed to work have been precisely defined in the introduction (see sections 0.1 and 0.2). Accounting figures, including loan loss provisions, are built according to rules whose purpose is to provide the most faithful representation of reality (see chapter 1 for a discussion of this notion of "reality"). Applying those rules always involves managerial judgment and thus discretion:

"[...] the true bank balance sheet is itself unobservable. What we actually observe is the accounting balance sheet, which is a quantitative depiction of a bank's economic reality constructed through the application of managerial judgment and discretion to existing accounting rules." (Bushman, 2016, p.132).

The literature thus traditionally splits loan loss provisions into two components: a *non-discretionary* component that accounts for identified losses associated with the loan portfolio, and a *discretionary* component. The non-discretionary component is typically backward-looking since it is mainly related to problem loans, while the discretionary component is constituted of provisions often made for management purposes. Using a theoretical model, Bouvatier and Lepetit (2012) show that a backward-looking system amplifies the effect of the business cycle on the loan market while a forward-looking system does not. This result is supported by empirical evidence showing that loan loss provisions are negatively correlated with GDP (Laeven and Majnoni, 2003; Bikker and Metzmakers, 2005; Bouvatier and Lepetit, 2008). Concerning the discretionary component of loan loss provisions, it is shown

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that it is essentially made for management purposes such as income smoothing, signaling or regulatory capital management (Beaver and Engel, 1996; Ahmed *et al.*, 1999, Kanagaretnam *et al.*, 2004). Recently, Tomy (2019) shows that banks may hide profits by increasing their loan loss provisions to deter competitors from entering the market. Bushman and Williams (2012) show that discretion in the setting of loan loss provisions – proxied by both delayed expected loss recognition and income smoothing – is associated with smaller changes in capital following an increase in banks’ risk. Discretion here has an adverse impact on banks’ behavior. In the same vein, Bushman and Williams (2015) show that delayed expected credit loss recognition is associated with larger downside risk. In fact, as Bushman (2016) argues, accounting discretion is a double-edged sword: on the one hand, it makes it possible for banks’ managers to rely more on their private information while setting loan loss provisions – which can have a positive impact on the quality of the information carried by loan loss provisions –; on the other hand, it allows for more opportunistic accounting behaviors.

The present paper bridges the gap between those two strands of the literature by showing that banks may use the discretionary component of their loan loss provisions to deal with market discipline. Controlling for the non-discretionary component of loan loss provisions, we indeed provide evidence that banks respond to an increase in their deposit rate by increasing their loan loss provisions. In addition, the more a bank is capitalized, the less it tends to increase its loan loss provisions in response to an increase in its deposit rate. Banks that find it difficult to raise capital may therefore use their loan loss provisions as a signal to soften the market discipline they are

subjected to. The next section presents tested hypotheses and data. Section 4.3 brings evidence that banks do resort to their loan loss provisions to face market discipline. Section 4.4 provides evidence that discretionary loan loss provisions are used as a substitute for regulatory capital. Section 4.5 concludes.

4.2 Hypotheses, data and descriptive statistics

4.2.1 Hypotheses

Depositors exert market discipline over banks. This discipline may materialize through deposit rates. Higher deposit rates are indeed often interpreted as stronger market discipline. In order to soften this market discipline, banks may decide to raise more capital. Banks however often find it costly to hold large capital buffers. In this case, banks can instead increase their loan loss provisions to signal their soundness to their depositors. Those might indeed interpret higher provisions as a sign that the bank is sound and might thus demand lower deposit rates. This is hypothesis 1 (H1).

Hypothesis 1. *Banks increase their discretionary loan loss provisions to cope with market discipline.*

H1 is verified if discretionary loan loss provisions increase when deposit rates do.

The relationship between discretionary loan loss provisions and market

discipline is however expected to be particularly strong when banks are weakly capitalized. Weakly-capitalized banks are indeed expected to be strongly constrained by market discipline and may be thus more incentivized than better-capitalized banks to soften this discipline through provisioning. In addition, weakly-capitalized banks are likely to find it more difficult than other banks to raise regulatory capital. In other words, loan loss provisions may be used as a substitute for capital by banks that find it particularly hard to raise capital. This is hypothesis 2 (H2).

Hypothesis 2. *Banks use their loan loss provisions as a substitute for regulatory capital to respond to market discipline. More precisely, weakly-capitalized banks rely more on discretionary loan loss provisions than better-capitalized banks to deal with market discipline.*

H2 is verified if well-capitalized banks increase less their discretionary loan loss provisions than less well-capitalized banks do when deposit rates increase.

H1 is tested in section 4.3 and H2 is confronted to the data in section 4.4.

4.2.2 Data

We use a panel of 456 American universal commercial banks from 2008 to 2017. Data come from the Fitch Connect database. We only focus on universal commercial banks to ensure homogeneity among banks. The Fitch Connect database comprises 1076 American universal commercial banks. We deleted 620 banks because they fall at least in one of the following categories:

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their loans to assets ratio was below 5%, more than five years of time series observations were missing (this is by far the main reason for deletion), one of the variables presents extreme values. Tables 4.1 and 4.2 respectively present the variables and descriptive statistics.

<i>LLP</i>	loan loss provisions / total assets
<i>L</i>	loans / total assets
<i>NPL</i>	non performing loans / gross loans
<i>i</i>	interest income on loans / average gross loans
<i>rd</i>	interest expense on customer deposits / average customer deposits
<i>T1</i>	Tier 1 regulatory capital ratio

Table 4.1: Definition of the variables

	mean	sd	min	max
LLP	.004788	.0090349	-.0232038	.1230964
L	.6236828	.1502547	.0547	.9552
NPL	.0251062	.028822	0	.307
T1	.1499885	.0693035	.0242	.9224
i	.052398	.0166684	.0052	.2968
rd	.0062511	.0053767	0	.044
<i>N</i>	3834			

Table 4.2: Descriptive statistics

Deposits can be either insured or not. In the case of insured deposits, market discipline is expected to be weak since depositors incur few or no risk. If deposits are mainly made of insured deposits, deposit rates are therefore a bad proxy for market discipline. To tackle our research question, we thus need to focus on uninsured deposits. To do so we define the following variable:

$$rd1 = \begin{cases} rd & \text{if } rf < rd \\ 0 & \text{otherwise} \end{cases}, \quad (4.1)$$

where rf is the risk-free rate. We assume that insured deposits can be assimilated as risk-free investments and thus have to pay a return that cannot exceed the risk-free return. If deposit rates are larger than the risk-free rate, they include a risk premium. In this case, depositors incur a risk and are thus incentivized to exert market discipline over banks. Figure 4.1 plots the histogram of variable $rd1$.

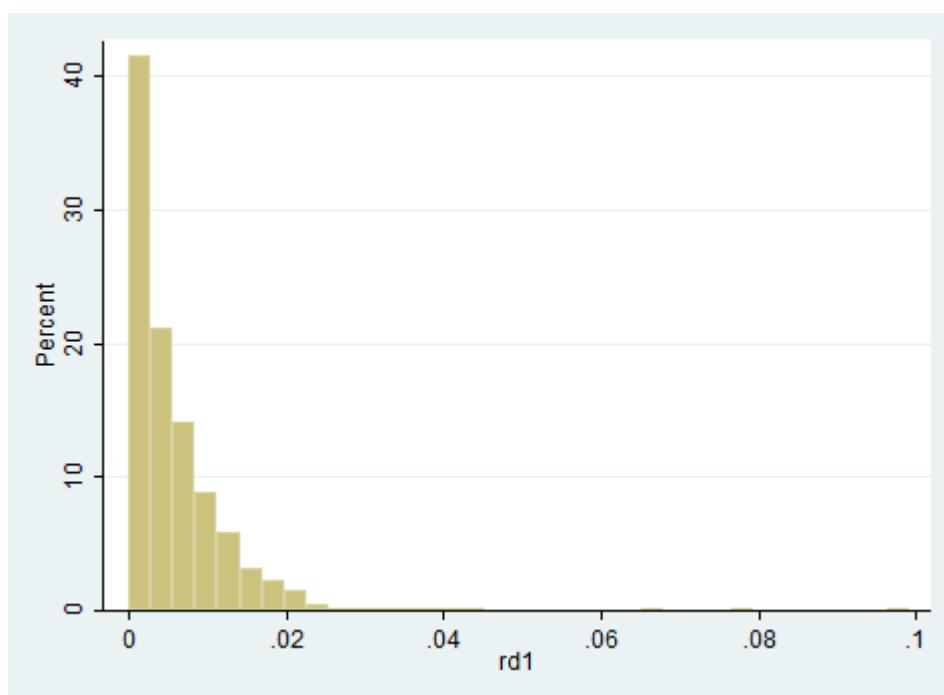


Figure 4.1: Histogram of variable $rd1$

4.3 Do banks deal with market discipline through discretionary provisioning?

4.3.1 Preliminary analysis

We evaluate here whether H1 holds true or not. Table 4.3 presents the correlation matrix for variables LLP , $T1$ and $rd1$. What is particularly worth noticing is the 0.1% significant positive correlation between variables LLP and $rd1$. If a higher value of $rd1$ is indicative of stronger market discipline, it seems that banks may indeed make more provisions when market discipline strengthens. This is consistent with H1. In addition, we notice that the correlation between $T1$ and LLP is both significant and negative, which is consistent with H2.

	LLP	T1	rd1
LLP	1		
T1	-0.140***	1	
rd1	0.438***	0.0432**	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.3: Correlation matrix

4.3.2 System generalized method of moments

To investigate further the relevance of H1, we regress LLP on $rd1$. To control for the non-discretionary component of loan loss provisions we include contemporary non performing loans NPL and the size L of the loan portfolio. We also control for the risk associated with the loan portfolio by including

the loan rate i . We also include the Tier 1 regulatory capital ratio $T1$. Finally, we include the lagged dependent variable among explanatory variables to account for dynamic adjustments in loan loss provisions (Bouvatier and Lepetit, 2008). We therefore want to estimate the following equation:

$$\begin{aligned}
 LLP_{it} = & \alpha_0 + \alpha_1 LLP_{it-1} + \alpha_2 L_{it} + \alpha_3 NPL_{it} + \alpha_4 T1_{it} \\
 & + \alpha_5 i_{it} + \alpha_6 rd1_{it} + \sum_{l=2008}^{2017} \alpha_l \mathbf{1}_l + \varepsilon_{it},
 \end{aligned} \tag{4.2}$$

where LLP_{it-1} is the lagged value of LLP_{it} and $\mathbf{1}_l$ with $l \in \{2008, \dots, 2017\}$ are time dummies that are equal to 1 when $l = t$ and to 0 otherwise. To perform an unbiased estimation of equation (4.2) we resort to the system generalized method of moments (GMM) estimator (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). We use both orthogonal deviations and first differences and perform both one-step and two-step estimations. When performing one-step GMM, we ensure that standard errors are robust to heteroskedasticity and to autocorrelation. When using two-step GMM, we perform the Windmeijer correction (Windmeijer, 2005) to correct the downward bias in standard errors traditionally associated with two-step estimations. For H1 to be verified we need α_6 to be positive and significant. Table 4.4 presents estimations of equation (4.2) using orthogonal deviations. Results using first differences are presented in the Appendix.

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	One-Step GMM		Two-Step GMM	
	LLP		LLP	
L.LLP	0.148***	(0.008)	0.155***	(0.005)
L	0.00594***	(0.000)	0.00582***	(0.000)
NPL	0.0849***	(0.000)	0.0834***	(0.000)
T1	-0.00898***	(0.002)	-0.00901***	(0.002)
i	0.0166	(0.629)	0.0238	(0.561)
rd1	0.251**	(0.027)	0.228**	(0.017)
2008.Year	0	(.)	0	(.)
2009.Year	0.00293	(0.208)	0.00288	(0.217)
2010.Year	-0.00130	(0.527)	-0.00145	(0.514)
2011.Year	-0.00389*	(0.059)	-0.00411*	(0.063)
2012.Year	-0.00425**	(0.033)	-0.00446**	(0.041)
2013.Year	-0.00471**	(0.014)	-0.00493**	(0.019)
2014.Year	-0.00433**	(0.019)	-0.00454**	(0.022)
2015.Year	-0.00387**	(0.034)	-0.00407**	(0.038)
2016.Year	-0.00280	(0.120)	-0.00305	(0.121)
2017.Year	-0.00266	(0.145)	-0.00294	(0.145)
Observations	3746		3746	
Instruments	17		17	
Hansen p	0.514		0.514	
Sargan p	0.381		0.381	
AR(1) p	0.00102		0.000946	
AR(2) p	0.858		0.892	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.4: System-GMM estimations of equation (4.2) (orthogonal deviations)

Coefficients before variable *rd1* are always positive and significant at 5%, which is in line with the idea that banks respond to an increase in their deposit rate by increasing their loan loss provisions. If we consider deposit rates as a proxy for market discipline, a stronger market discipline therefore has a positive impact on loan loss provisions. Market discipline has thus an impact on loan loss provisions when it materializes through prices. H1 is

thus verified.

4.4 Loan loss provisions and regulatory capital: substitutes or complements?

Banks thus increase their loan loss provisions when market discipline strengthens. However the extent to which banks respond to market discipline through their provisions may be a function of their level of Tier 1 capital. This is hypothesis 2, which states that well-capitalized banks may be less incentivized than weakly-capitalized banks to use their loan loss provisions as a means to deal with market discipline. In this perspective, discretionary provisions and capital are seen as substitutes to respond to market discipline. To test whether this hypothesis holds true or not, we estimate the specific and the joint effects of capital and market discipline on discretionary loan loss provisions. We thus estimate the following equation:

$$\begin{aligned}
 LLP_{it} = & \alpha_0 + \alpha_1 LLP_{it-1} + \alpha_2 L_{it} + \alpha_3 NPL_{it} + \alpha_4 T1_{it} \\
 & + \alpha_5 i_{it} + \alpha_6 rd1_{it} + \alpha_7 rd1_{it} \# T1_{it} + \sum_{l=2008}^{2017} \alpha_l \mathbf{1}_l + \varepsilon_{it},
 \end{aligned} \tag{4.3}$$

where $rd1_{it} \# T1_{it}$ represents the interaction between variables $rd1_{it}$ and $T1_{it}$. Estimations of equation (4.3) are presented in Table 4.5. Results using first differences instead of orthogonal deviations are here again presented in the Appendix.

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	One-Step GMM		Two-Step GMM	
	LLP		LLP	
L.LLP	0.148***	(0.005)	0.153***	(0.004)
L	0.00617***	(0.000)	0.00603***	(0.000)
NPL	0.0818***	(0.000)	0.0806***	(0.000)
i	0.0215	(0.519)	0.0272	(0.493)
rd1	0.434***	(0.001)	0.410***	(0.001)
T1	-0.00135	(0.683)	-0.00158	(0.636)
c.rd1#c.T1	-1.153***	(0.000)	-1.138***	(0.000)
2008.Year	0	(.)	0	(.)
2009.Year	0.00124	(0.590)	0.00131	(0.565)
2010.Year	-0.00284	(0.151)	-0.00284	(0.175)
2011.Year	-0.00538***	(0.006)	-0.00546***	(0.009)
2012.Year	-0.00572***	(0.002)	-0.00581***	(0.005)
2013.Year	-0.00620***	(0.001)	-0.00629***	(0.001)
2014.Year	-0.00583***	(0.001)	-0.00592***	(0.001)
2015.Year	-0.00533***	(0.002)	-0.00543***	(0.003)
2016.Year	-0.00424**	(0.011)	-0.00438**	(0.016)
2017.Year	-0.00413**	(0.015)	-0.00429**	(0.022)
Observations	3746		3746	
Instruments	18		18	
Hansen p	0.544		0.544	
Sargan p	0.406		0.406	
AR(1) p	0.00102		0.000861	
AR(2) p	0.849		0.873	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.5: System-GMM estimations of equation (4.3) (orthogonal deviations)

The coefficients before *rd1* are positive and significant at 1%. In addition, we notice that the coefficients before the interaction term are both significant and negative. This is consistent with the idea that the more a bank is capitalized, the less it tends to deal with market discipline by increasing its loan loss provisions.

To determine to what extent the level of Tier 1 capital impacts the pro-

visioning behavior of banks, we compute the average marginal effects of an increase in the deposit rate on provisions depending on the level of Tier 1 capital. Results are presented in Figure 4.2. We notice that in accordance with hypothesis 2, least capitalized banks increase more their loan loss provisions to respond to an increase in the return demanded by their depositors than better capitalized banks do. H2 is thus verified.

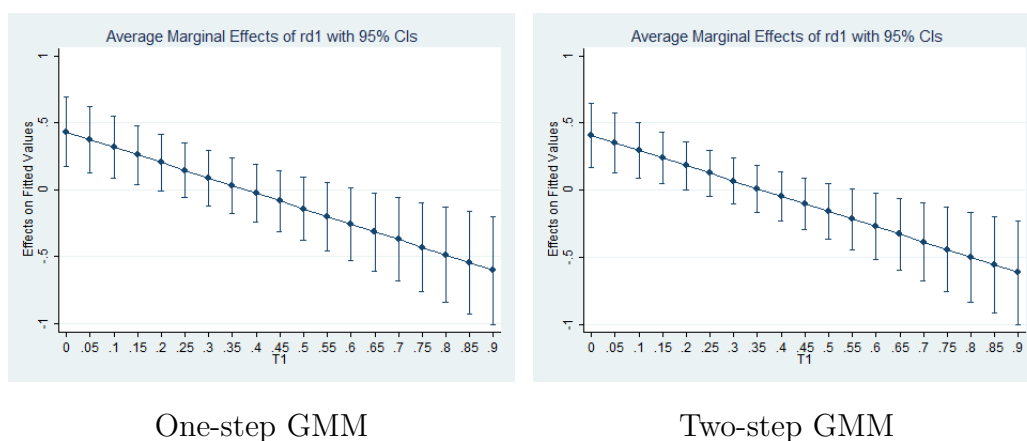


Figure 4.2: Average marginal effects of $rd1$ on LLP depending on $T1$ (orthogonal deviations)

4.5 Conclusion

This paper studies whether banks use their loan loss provisions to deal with market discipline. Using a panel data of 456 American universal commercial banks we indeed show that loan loss provisions increase when deposit rates do. In addition, we show that best-capitalized banks tend to increase their loan loss provisions in a lesser extent than other banks do when market discipline strengthens. This is in line with the intuition according to which provisions are used as a substitute for capital to deal with an increase in

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market discipline when capital is hard to raise.

This result is neither good news nor bad news. On the one hand, the possibility banks have to make such discretionary loan loss provisions can help market discipline work efficiently since it incentivizes weakly-capitalized banks to provision more – and thus to limit their risk exposure. On the other hand, it could disincentivize banks to raise more capital to deal with market discipline since this could be done through an increase in loan loss provisions. Discretionary provisioning is therefore a double-edged sword. The implementation of forward-looking provisioning models, as put forward by the IASB and the FASB, should thus be done cautiously. If more discretion is to be granted to banks' managers because of the valuation uncertainty and of the subjectivity inherent to the models used to compute expected credit losses, regulators should cautiously monitor that it is not done in a way that would encourage banks to substitute loan loss provisions for capital, which would prove detrimental to market discipline. It is therefore in the best interest of both accounting standards setters and prudential regulators to work together.

4.A Appendix

	One-Step GMM LLP		Two-Step GMM LLP	
L.LLP	0.315***	(0.000)	0.300***	(0.000)
L	0.00411***	(0.000)	0.00408***	(0.000)
NPL	0.0588***	(0.000)	0.0603***	(0.000)
T1	-0.0127***	(0.001)	-0.0130***	(0.000)
i	0.0317	(0.420)	0.0230	(0.427)
rd1	0.247***	(0.007)	0.252***	(0.003)
2008.Year	0	(.)	0	(.)
2009.Year	0.00322	(0.156)	0.00375**	(0.032)
2010.Year	-0.00193	(0.404)	-0.00131	(0.429)
2011.Year	-0.00376	(0.102)	-0.00313*	(0.050)
2012.Year	-0.00349	(0.107)	-0.00296*	(0.061)
2013.Year	-0.00373*	(0.072)	-0.00325**	(0.036)
2014.Year	-0.00318	(0.110)	-0.00273*	(0.069)
2015.Year	-0.00268	(0.176)	-0.00223	(0.137)
2016.Year	-0.00164	(0.406)	-0.00119	(0.427)
2017.Year	-0.00162	(0.424)	-0.00115	(0.454)
Observations	3746		3746	
Instruments	17		17	
Hansen p	0.648		0.648	
Sargan p	0.441		0.441	
AR(1) p	0.0000906		0.000152	
AR(2) p	0.744		0.772	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.6: System-GMM estimations of equation (4.2) (first differences)

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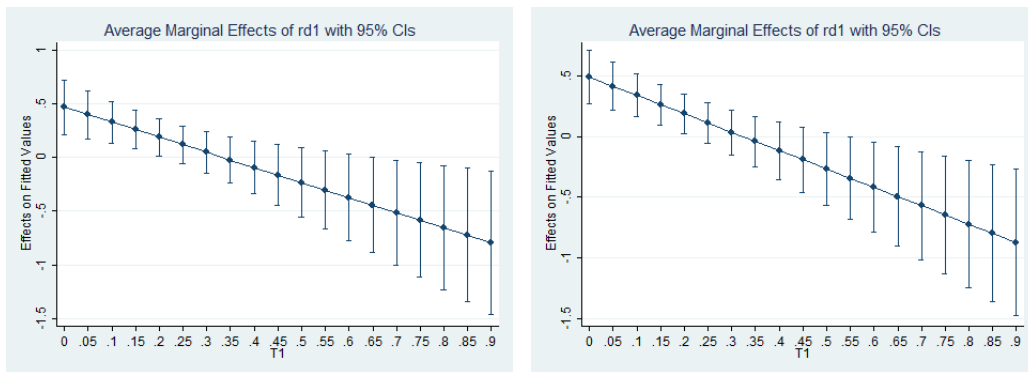
	One-Step GMM		Two-Step GMM	
	LLP		LLP	
L.LLP	0.320***	(0.000)	0.303***	(0.000)
L	0.00432***	(0.000)	0.00431***	(0.000)
NPL	0.0554***	(0.000)	0.0569***	(0.000)
i	0.0379	(0.328)	0.0287	(0.311)
rd1	0.467***	(0.000)	0.491***	(0.000)
T1	-0.00327	(0.354)	-0.00288	(0.394)
c.rd1#c.T1	-1.401***	(0.003)	-1.516***	(0.000)
2008.Year	0	(.)	0	(.)
2009.Year	0.00116	(0.582)	0.00157	(0.355)
2010.Year	-0.00384*	(0.065)	-0.00330**	(0.036)
2011.Year	-0.00561***	(0.007)	-0.00503***	(0.001)
2012.Year	-0.00530***	(0.007)	-0.00486***	(0.001)
2013.Year	-0.00555***	(0.003)	-0.00516***	(0.000)
2014.Year	-0.00500***	(0.006)	-0.00464***	(0.001)
2015.Year	-0.00445**	(0.014)	-0.00410***	(0.003)
2016.Year	-0.00340*	(0.058)	-0.00304**	(0.028)
2017.Year	-0.00342*	(0.061)	-0.00304**	(0.031)
Observations	3746		3746	
Instruments	18		18	
Hansen p	0.562		0.562	
Sargan p	0.338		0.338	
AR(1) p	0.0000693		0.000126	
AR(2) p	0.748		0.779	

p-values in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4.7: System-GMM estimations of equation (4.3) (first differences)

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One-step GMM

Two-step GMM

Figure 4.3: Average marginal effects of $rd1$ on LLP depending on $T1$ (first differences)

Conclusion of part II

In part II, we studied what could be the unintended consequences of two of the main novelties introduced by IFRS 9: the classification and measurement of financial instruments and the way loan loss provisions are set. Recall that accounting information may be the main way through which information is disclosed. The results established in part II are thus to be taken together with those established in part I. More specifically, we showed in part II that fair value accounting – which is the accounting incarnation of the notion of transparency – can have a distorting impact on banks' asset allocation that can be detrimental to the funding of long-term investments. Historical cost accounting is however not a panacea either and the main message of chapter 3 was thus that instead of implementing financial standards that are the same for all financial institutions irrespective of their activities, it would be better to discriminate financial institutions on the basis of their time horizon. Doing so would indeed ensure diversity of behaviors on financial markets, which is a condition for those to work properly. Chapter 4 showed that granting more discretion to banks in the setting of their loan loss provisions may weaken market discipline by incentivizing banks to use their provisions as a substitute for regulatory capital.

CONCLUSION OF PART II

Parts I and II thus tackle the question of market discipline in relation to that of information disclosure and transparency. As said in the introduction, this is indeed one of the two main instruments that can be used to enforce market discipline. The second instrument we mentioned in the introduction was subordinated debt. Part III thus addresses the issues that arise when subordinated debt is thought of as a way to implement market discipline. More precisely, we consider a specific type of subordinated debt: contingent convertible bonds.

Part III

Market Discipline and Contingent Convertible Bonds

Chapter 5

Contingent convertible bonds: one step forward or two steps backward?

Abstract: Contingent convertible (coco) bonds count among the solutions that have been put forward to reduce both the likelihood of banks' default and their cost when they occur. This chapter introduces what coco bonds are and assesses their risk. This risk cannot be solely thought of as a micro risk – i.e. the risk for one specific bank –, but also has to be understood as a macro or systemic risk. Doing so, we show that coco bonds share a lot with structured financial products: they are complex products that may give the false impression that risk is under control. The will to ensure financial stability through complex financial instruments whose risk is very hard to assess properly, such as coco bonds, thus appears as a dangerous oversight of history.

5.1 Introduction

At the end of the 2000s, massive public bailouts of defaulting banks have forced regulators to redefine the environment in which banking takes place. The crisis has indeed shown that it was necessary to put in place mechanisms to limit occurrences of defaults and to design rules to reduce the exposure of taxpayers to defaults when they happen. The implementation of market mechanisms that allow defaulting banks to be bailed in instead of bailed out counts among the regulatory responses to the crisis. The idea is that if market discipline cannot prevent a bank from defaulting, mechanisms should make it possible for an orderly resolution to be enforced in order to protect taxpayers from costly bailouts. The definition of regulatory constraints in eligible liabilities – as for instance those defined by the TLAC and the MREL – could allow to fulfill this twofold objective. This is at least what the Squam Lake Working Group (2009) suggests:¹

"We recommend support for a new regulatory hybrid security that will expedite the recapitalization of banks. This instrument resembles long-term debt in normal times, but converts to equity when the financial system and the issuing bank are both under financial stress. The goal is to avoid *ad hoc* measures such as those taken in the current crisis, which are costly to taxpayers and may turn out to be limited in effectiveness. The regulatory hybrid security we envision would be transparent, less costly to taxpayers,

¹Members of the Squam Lake Working Group are Martin N. Baily, John Y. Campbell, John H. Cochrane, Douglas W. Diamond, Darrell Duffie, Kenneth R. French, Anil K. Kashyap, Frederic S. Mishkin, David S. Scharfstein, Robert J. Shiller, Matthew J. Slaughter and René M. Stulz.

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and more effective." (Squam Lake Working Group, 2009, p.2).

The type of debt considered here by the Squam Lake Working Group is coco bonds. Coco bonds are hybrid securities that behave like regular bonds in normal times but are converted into equity or written down under certain circumstances. The literature on coco bonds has been constantly growing in the last few years. Raviv (2004) and Flannery (2005) were precursors when they discussed what they called "debt-for-equity swap" (Raviv, 2004) and "reverse convertible debentures" (Flannery, 2005) whose main features were close to those of coco bonds. More recently, the Squam Lake Working Group (2009), McDonald (2013), Pennacchi *et al.* (2014) and Flannery (2016) have defended the idea of contingent capital requirements. Among the advantages associated with coco bonds, their ability to provide banks with the incentives to manage safely their balance sheet is particularly put forward. Coco bonds are however debated and there is no consensus concerning their expected impact. Koziol and Lawrenz (2012) for instance show that coco bonds can distort risk-taking incentives and therefore conclude that those instruments should be used with great caution.

Coco bonds are recent financial instruments. In 2009, Lloyds issued what was called "enhanced capital notes", which can be considered as the first coco bonds ever issued. Those notes would automatically be converted into equity whenever Lloyds' core Tier 1 capital would fall below 5% of RWA. In 2011, the Credit Suisse issued in turn two billions francs worth of coco bonds. Those coco bonds have a dual trigger: their conversion into equity is triggered either by regulatory decision or whenever the Credit Suisse ratio of equity over RWA falls below 7%. In May 2013, BBVA issued for the first time

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coupon cancellable coco bonds. The novelty is that when the conversion is triggered, coupons are canceled but coco bonds are not converted into equity. According to Avdjiev *et al.* (2017) banks all around the world issued a total of \$521 billions in coco bonds between 2009 and December 2015. As for Europe, the outstanding amount of coco bonds has grown from 33.8 billions euros in January 2014 to 107 billions in November 2016 (Bologna *et al.*, 2018).

This chapter assesses whether coco bonds are or not a good solution to strengthen *ex ante* market discipline and to protect *ex post* taxpayers from bailouts. To do so, coco bonds are presented in detail in section 5.2. In section 5.3, we show that the complexity associated with coco bonds could be a channel through which systemic risk could propagate. In section 5.4, we discuss the political economy behind the implementation of coco bonds. Section 5.5 concludes.

5.2 What are coco bonds?

Coco bonds are defined by two features that are described in detail in this section (see also Avdjiev *et al.*, 2013).

Triggering mechanism			Loss absorption mechanism		
Mechanical trigger		Discretionary trigger	Conversion into equity		Principal write down
Book value	Market value	Regulatory institution	Fixed price	Market price	
Low trigger → gone-concern		High trigger → going-concern			

Table 5.1: Defining features of coco bonds

5.2.1 The triggering mechanism

Coco bonds are defined by a triggering mechanism that modifies their repayment terms. There are two different kinds of triggering mechanisms. Coco bonds can either be *mechanically* converted into equity (or written down), in which case the conversion happens whenever a pre-defined event occurs; or *discretionarily* converted, in which case the conversion is decided by the regulatory authority. In the case of a mechanical trigger, the definition of the event can be based either on market value or on book value.

The way the triggering mechanism is designed is the most highly debated question among authors in favor of coco bonds (Avdjiev *et al.*, 2017). No option is indeed fully satisfying since they are all associated with flaws that could eventually lead to adverse consequences. For instance, since it relies on backward-looking information, a mechanical trigger based on book values could force the conversion of coco bonds too late and thus prove ineffective at establishing a credible market discipline. A mechanical trigger based on market values is more transparent than a trigger based on book values, but it could incentivize coco bonds' holders to manipulate market prices in order to make profit:

"Holders of cocos, it is feared, could have incentives to short the common stock to cause a trigger event and then profit from their new holdings of common shares when the price of the stock subsequently returns to its normal level." (Cahn and Kenadjian, 2014, p.8).

The efficiency of the discretionary trigger relies on the quality of the infor-

mation possessed by the regulatory institution and on its ability to act in a timely fashion. The crisis has however shown that regulatory forbearance is often an obstacle to a timely and efficient regulatory action.

Depending on the definition of the triggering mechanism, coco bonds can act in two different perspectives. If the trigger is set at a high level, in the sense that the conversion occurs well before the issuing bank finds itself in a bad position, coco bonds can act in a going-concern perspective. The idea is that conversions are in this case meant to strengthen the funding structure of the issuing bank to prevent difficulties from arising. If, on the contrary, the trigger is set at a low level, the conversion occurs only close to the point where the bank is actually defaulting. In this case, conversions are mostly meant to ensure an orderly resolution of the defaulting bank to protect taxpayers from a costly bailout.

5.2.2 The loss absorption mechanism

The loss absorption mechanism is the second key defining feature of coco bonds. When coco bonds are triggered, they can either be converted into equity or written down. In the first case, the main concern is to determine the price of the new share. The first solution is to define a price *a priori* (i.e. when the coco bond is issued) and to stick to this price when the conversion occurs. The second option consists in pricing the new share with regard to the market value of the bank at the conversion time.

The main concern associated with principal write-down coco bonds is that they may not provide managers with the incentives to reduce risk taking.

This kind of coco bonds indeed provide a loss-absorbing cushion to shareholders that may lessen their incentives to properly discipline managers. On the contrary, to avoid "death by dilution" (Huertas, 2011), shareholders are incentivized to prevent coco bonds from converting into equity. When coco bonds are designed in such a way that they convert into equity when the triggering mechanism is activated, it is indeed in shareholders' best interest to prevent conversions from happening, and thus to pressure banks to hold large capital buffers (Himmelberg and Tsyplakov, 2011).

5.3 Coco bonds: excessive complexity and high systemic risk

5.3.1 How to price coco bonds?

The main argument in favor of coco bonds is that, in normal times, they provide banks with a funding source that is less costly than equity while, in times of crisis, they display the same loss-absorbing capacity as equity. However, coco bonds are complex financial instruments and are thus hard to price. Multiple equilibria or absence of equilibrium are indeed characteristic of coco bonds' pricing (see chapter 6) and are a great source of uncertainty. Glasserman and Nouri (2012) manage however to derive closed-form expressions for the market value of coco bonds associated with a capital-ratio trigger when the firm's asset value is modeled as a geometric Brownian motion. Glasserman and Nouri (2016) show that for a pricing equilibrium to exist in the case of a stock price trigger, the conversion should be disadvantageous

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to shareholders. For coco bonds associated with a market trigger based on common equity price, Sundaresan and Wang (2015) show that the pricing equilibrium is not necessarily unique. For the equilibrium to be unique, the conversion must not transfer value from equity holders to coco bonds investors. Pennacchi and Tchisty (2019) however point out an error in the paper by Sundaresan and Wang (2015) that amends their results. Pennacchi and Tchisty (2019) indeed show that, this error once corrected, they obtain an equilibrium price very similar to that found by Glasserman and Nouri (2016).

Coco bonds are therefore hard to price. Even if Sundaresan and Wang (2015) made an error in their model, it is to be feared that "multiplicity or absence of equilibrium introduces the potential for price uncertainty, market manipulation, inefficient capital allocation, and frequent conversion errors." (Sundaresan and Wang, 2015, p.881). What is however even more to be feared is the potential systemic impact of coco bonds, which currently lies in the blind spot of the literature on coco bonds. This latter indeed mainly focuses on the expected micro impact of coco bonds, disregarding what could be their destabilizing effect from a macro perspective. It is therefore of the utmost importance to recall that the main mistake of pre-crisis banking regulation was to consider that ensuring the soundness of each bank individually would necessarily ensure that of the banking system as a whole. In the next section, we show that coco bonds could have a market-wide destabilizing impact. In other words, they could be a channel through which systematic risk spreads.

5.3.2 Taking the systemic risk into account

The vast majority of papers on coco bonds focus on their impact on banks taken individually (Goodhart, 2010). The main questions addressed are thus those of the incentive scheme put in place by coco bonds and of the pricing of coco bonds. Few is indeed said concerning the impact of coco bonds on the financial system as a whole.

In this perspective, Allen (2012) shows how, because of the conversion risk, coco bonds could constitute a market-wide threat. Since the conversion risk is likely to be low, investors are likely to disregard it and to focus only on the high yields associated with coco bonds. However, if the conversion risk materialized, panic sales would likely occur (see chapter 6), which would furthermore increase the probability of conversion and thus the incentives for panic selling coco bonds. A self-fulfilling crisis could thus occur and it could furthermore spread to the whole financial system. Corcuera *et al.* (2014) describe another mechanism through which coco bonds could have a systemic destabilizing impact on financial markets. Because of the conversion risk, coco bonds exhibit a death-spiral effect. To hedge the conversion risk, coco bonds' holders may indeed short sell shares. Doing so they may find themselves in a position of selling shares whose price is decreasing and therefore they may contribute actively to the materialization of the conversion risk. By hedging the conversion risk, investors thus make it more likely. Hence the spiral effect. Bologna *et al.* (2018) provide empirical evidence that shows how a contagion can spread in the coco bonds market. Using two stressed episodes that have affected the European coco bonds market in 2016, the au-

thors show that there is a significant coco bonds-specific contagion that can be the consequence of the reassessment by investors of coco bonds' riskiness.

To summarize, if the coco bonds' market widened, investors would likely massively invest in it, allured by the high yields associated with coco bonds. To hedge the conversion risk, some investors might short sell shares and thus make conversions more likely to occur. As conversions would become more likely to occur, investors would get more and more incentivized to panic sell their coco bonds. A market-wide panic could then happen and it could eventually spread to the whole financial system, depending on the size of the coco bonds' market.

5.4 Private interest and political compromise: how not to regulate the banking sector

In this section, we discuss the regulatory consequences of the assessment of the micro and macro risks associated with coco bonds done in the previous section. We first (section 5.4.1) describe how coco bonds are currently included in the regulatory framework and then discuss (section 5.4.2) why other options, such as a sharp increase in equity requirement, have not been put in place instead.

5.4.1 Coco bonds and the regulatory framework

Coco bonds have entered the regulatory framework through two gates: they are eligible for the TLAC and the MREL and they can enter Tier 1 capital.

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Recall that the TLAC and the MREL aim at ensuring that taxpayers will not be in the frontline whenever a bank goes bankrupt. In other words, their purpose is to make sure that failing banks will be bailed in instead of bailed out. The implementation of those two standards rests on the definition of eligible liabilities, which are subordinated debt such as coco bonds. The TLAC and the MREL thus implicitly delegate market discipline to long-term subordinated debt's holders. This could eventually prove detrimental to market discipline since it could weaken the incentives of short-term investors to monitor and influence banks:

"In the wake of the financial crisis, the BCBS and FSB introduced new policies designed to make large banks resolvable without disrupting their competitors or financial markets. The availability of bail-in bonds should facilitate the resolution or recapitalization of large banks that encounter problems. In terms of market discipline, however, the "bail in" bond requirements have created a (relatively small) set of subordinated investors who have a strong incentive to monitor an issuing bank's condition. At the same time, bail-in bonds and improved resolution processes have increased the protection provided to short-term liability holders. Regulatory changes since the crisis have thus shifted monitoring incentives away from the large set of short-term claimants – depositors, short-term liability-holders, and derivatives counterparties – toward a much smaller group of bail-in bondholders, whose cumulative effect on a bank's funding costs may be insubstantial. We propose that this change has served to weaken market disci-

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pline, on net, whatever its other benefits to the financial system."

(Bliss and Flannery, 2019, p.27-28).

Bail in standards could thus eventually weaken market discipline instead of strengthening it.

After the crisis, the Basel Committee has decided to modify the definition of regulatory capital in order to focus more on equity. The first pillar of Basel III thus constrains banks to hold 4.5% of their risk-weighted assets in core capital CET1, while under Basel II this proportion was only 2%. In addition to this constraint, banks are obligated to constitute counter-cyclical capital cushions that raise core capital CET1 requirements up to 7% of their risk-weighted assets. What is striking is that, at the same time as the definition of regulatory capital is hardened, coco bonds are admitted as regulatory capital under certain conditions. More precisely, coco bonds can constitute up to 1.5% of Tier 1 capital requirements and up to 2% of Tier 2 capital requirements. The European transposition of Basel III, known as directive CRD IV, is more specific concerning coco bonds. To be included in Tier 1 capital, those need to be associated with a capital trigger higher than 5.125% of the risk-weighted assets. In other words, to be admitted as regulatory capital, coco bonds must convert into equity whenever the CET1 capital of the issuing bank falls below 5.125% of its risk-weighted assets. The way regulatory coco bonds have been designed is subject to criticisms, especially because the trigger mechanism is often considered as being too low. As noted by Cahn and Kenadjian (2014), coco bonds associated with a capital trigger of 5.125% are unlikely to be converted since regulators are very likely to intervene before the 5.125% threshold is crossed. The disciplinary

effect associated with the threat of conversion is thus expected to be weak in the case of regulatory coco bonds. Those are therefore less thought of as instruments whose aim is to implement a strong *ex ante* market discipline, but more as bail-in instruments whose purpose is to make sure *ex post* that taxpayers do not have to pay to bail out banks .

5.4.2 The political economy of the implementation of coco bonds

Coco bonds are not the best funding instruments to implement bail-in. Indeed, as mentioned in section 5.3, they could act as a great transmission channel of systemic risk. For instance, if a bank buys coco bonds issued by another bank, the former would likely face great difficulties if the latter went bankrupt (because in this case coco bonds would be converted into equity). A safer way to ensure an orderly resolution of failing banks is to strongly increase equity requirements. This is the point made by Admati *et al.* (2013) when they show that a sharp increase in equity requirements would not lead to higher funding costs. Their idea is that since increasing equity requirements decreases the risk associated with banks, they can issue bonds at a lower cost and therefore the total cost associated with their liabilities could decrease instead of increasing as is often argued. Gambacorta and Shin (2018) provide empirical evidence that an increase of 1 percentage point in the ratio of equity over total asset yields a decrease of 4 basis points in the cost of debt for a sample of banks located in the G10 countries. It may therefore be preferable to raise equity requirements instead of implementing

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coco bonds requirements. This is what Persaud says when he compares coco bonds to fool's gold:

"In this regard, fool's gold is an apt description. Fool's gold has a metallic lustre that gives it a superficial resemblance to gold. However, it is an iron sulphide, one of the ancient uses of which was to spark fires. Either we need real gold – more equity capital – or not. Fool's gold is no alternative." (Persaud, 2014, p.2).

What is striking is that coco bonds are alluring for basically the same reason that explains the success of securitization before the crisis: they are complex financial products that give the false impression that risk can be suppressed thanks to financial innovation. Coco bonds are highly systemic and could therefore prove as dangerous as securitized products. The interest currently given to coco bonds therefore appears as the sign that the lessons that should have been drawn from the financial crisis are partly being ignored. Minsky's (1986) analysis on how financial innovation can act as an endogenous driver of financial instability is therefore strongly up-to-date. Why are coco bonds however still being promoted? The answer to this question may be found in political economy. Admati *et al.* (2013) clearly state that resistance toward a sharp increase in equity requirements is based on fallacious arguments motivated by the private interest of the banking industry very prompt to mix private and social costs:

"Most importantly, the cost to shareholders is entirely a private cost based on being able to benefit at the expense of creditors or taxpayers when there is less equity in the mix. Thus, it does

not establish any social cost to increased equity requirements."

(Admati *et al.*, 2013, p.36).

Enforcing bail-in through coco bonds instead of increasing equity requirements thus appears as a compromise in favor of the banking industry that could eventually prove detrimental to society. The implementation of real macroprudential tools (countercyclical capital cushions or liquidity ratios for instance) alongside with old instruments that, even though they proved ineffective at addressing the specific issues of the banking system, are promoted as new solutions (coco bonds for instance) echoes the conclusions of Baker (2013) concerning the political economy of the macroprudential ideational shift:

"What is clear is that the macroprudential agenda has to overcome considerable procyclical political obstacles, and it will continue to coexist with some of the old risk management practices."

(Baker, 2013, p.134).

5.5 Conclusion

At first sight, coco bonds appear as a panacea: less costly than equity, they however provide banks with the same loss-absorbing capacity. In this chapter, we argue that this statement has to be qualified. Coco bonds are indeed complex financial instruments that could eventually act as a channel through which systematic risk propagates. Expectations of conversions could indeed nourish self-fulfilling panic sales of coco bonds and thus precipitate a market-wide panic that could spread to the whole financial system. The empirical

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evidence recently provided by Bologna *et al.* (2018) is the sign that such a self-fulfilling crisis could actually unfold.

It is of the utmost importance to keep in mind that one of the reasons why the global financial crisis was so severe was because the systemic risk associated with securitized products had been largely overlooked. The current will to ensure financial stability through complex financial instrument, such as coco bonds, thus appears as a dangerous oversight of history.

Chapter 6

Mind the conversion risk: contingent convertible bonds as a transmission channel of systemic risk

Abstract: We develop a model to assess the systemic risk associated with contingent convertible (coco) bonds. When their conversion is related to changes in their market price, coco bonds can act as a transmission channel of systemic risk. In this case, a self-fulfilling crisis can indeed occur because of panic sales of coco bonds motivated by the expectation of conversion by coco bonds' holders. In addition, when the bank mainly relies on funding instruments other than capital, we show that increasing the precision of the information disclosed by the bank through its financial statements decreases the probability that such a crisis happens. On the contrary, increasing the

precision of the information privately held by coco bonds' holders has the opposite effect. This paper therefore calls for cautiousness when it comes to discussing coco bonds as an instrument to implement market discipline.

6.1 Introduction

In this chapter, we develop a theoretical model to assess the systemic risk associated with coco bonds. We model a bank that relies on three different funding sources: equity, deposits and coco bonds. Coco bonds are assumed to be mechanically written off whenever the CET1 capital of the bank falls below a pre-defined threshold. In addition, they are discretionarily written off by the central bank whenever the market value of the Tier 1 regulatory capital of the bank falls below a certain threshold. This second risk of conversion captures the idea of indirect market discipline. Recall that Bliss and Flannery (2001) indeed define market discipline as a two-step process. Market participants first *monitor* banks' activities in the sense that they observe the risk associated with those activities. Then, an *influence* can be exerted over the behavior of those banks based on the information produced through the monitoring process. If the influence is exerted indirectly by a third party (a regulatory institution reacting to changes in market prices for instance), market discipline is said to be indirect. In this context, there is a game between the central bank and coco bonds' holders since the latter are incentivized to sell their coco bonds when the probability of conversion increases, while the former is more likely to force this conversion as panic sales of coco bonds are more likely to happen (since those sales are expected to have a negative impact on the market value of regulatory capital).

We assume that coco bonds' holders do not know the true financial situation of the bank. They are granted a public signal that accounts for the information displayed by the bank in its financial statements. Additionally,

we assume that each investor has its own assessment of the situation of the bank. This assessment is based on elements that are not found in the financial statements but relies on the "sophistication" of investors, in the sense of their ability to collect information on their own. This second source of information is referred to as the private signal. Investors therefore base their decisions on two noisy signals that are informative of the financial situation of the bank.

Using the global game technique (Carlsson and Van Damme, 1993; Morris and Shin, 1998; Metz, 2002; Morris and Shin, 2003; Morris and Shin, 2004), we exhibit situations where a self-fulfilling crisis occurs. In those situations, coco bonds could act as a transmission channel of systemic risk since they could eventually spread a market-wide panic. More precisely, when the bank relies strongly on funding instruments other than capital, which is the case in reality, we show that such a crisis is more likely to occur when coco bonds' holders are sophisticated investors. On the contrary, the more the information found in the financial statements of the bank is precise, the less likely a crisis is to occur.

The next section presents the general framework of the model. Section 6.3 introduces coco bonds and develops a simple pricing model. Section 6.4 describes a game that allows us to study how a panic can materialize in the coco bonds' market. In section 6.5, we study the impact of information precision on the probability that a crisis happens. Section 6.6 discusses policy implications. Section 6.7 concludes.

6.2 General framework

There are three periods.

In $t = 0$, the bank invests in an asset portfolio that yields a random return θ . This portfolio is funded thanks to equity in proportion E , deposits in proportion y_1 and coco bonds in proportion y_2 . We assume that $E + y_1 + y_2 = 1$ and that funding structure of the bank is exogenous. Depositors are in all cases assumed to be risk-neutral. Let us denote by r_2 the return associated with coco bonds. We assume that deposits pay the riskless return 1. Coco bonds enter regulatory capital. More precisely, we make a distinction between common equity Tier 1 (CET1) capital and additional Tier 1 (AT1) capital. CET1 capital is made of equity – it thus amounts to E – and AT1 capital is made of coco bonds – it thus amounts to y_2 . In $t = 0$, the book value of total Tier 1 capital therefore amounts to $E + y_2$.

In $t = 1$, coco bonds' holders can sell their coco bonds. Coco bonds are long-term bonds and are associated with a liquidity risk in the short-run. To take this liquidity risk into account, we assume that the $t = 1$ market price of coco bonds is equal to:

$$p(r_2) = r_2 - \gamma s, \tag{6.1}$$

where $s \in [0, 1]$ is the proportion of coco bonds' holders that decide to sell. $\gamma \geq 0$ is thus a parameter that accounts for the liquidity (more precisely the depth) of the coco bonds' market. The higher γ is, the more illiquid this market is. The linear demand function described in equation (6.1) can, for instance, be thought of as that of a potential representative buyer characterized by an exponential utility function and a normal distribution with mean

r_2 over the return associated with coco bonds. Coco bonds' holders do not know the true distribution of θ . They are granted a public signal through the financial statements of the bank that allows them to know that θ is normally distributed with mean μ and variance $\frac{1}{\alpha}$. α is thus the precision of the information disclosed by the bank: an increase in α – because of regulatory requirements such as the third pillar of Basel III – consists in an increase in the precision of the public signal. The public signal is common knowledge to all coco bonds' holders. Each investor also has its own assessment of the financial situation of the bank. This assessment is summarized in a private signal $v_i = \theta + \varepsilon_i$ with $\varepsilon_i \hookrightarrow \mathcal{N}(0, \frac{1}{\beta})$. β is here the precision of the private signal. When β is large, i.e. when private signals are very accurate, investors are sophisticated in the sense that they are able to assess precisely the financial situation of the bank on their own. We assume that the noises associated with the private signals are independent of each other (i.e. $\mathbb{E}(\varepsilon_i \varepsilon_j) = 0$ for $i \neq j$) and of θ (i.e. $\mathbb{E}(\varepsilon_i \theta) = 0$). At the same time as coco bonds' holders can sell their bonds, the central bank can discretionarily decide to write them off.

In $t = 2$, the asset portfolio pays and depositors are paid. Table 6.1 summarizes the timing of the model.

$t = 0$	$t = 1$	$t = 2$
The bank invests in an asset portfolio that yields a random return θ	The central bank can write coco bonds off and coco bonds' holders can decide to sell them	The asset pays and depositors are paid

Table 6.1: Timing of the model

6.3 A first glimpse into coco bonds

6.3.1 Definition

Coco bonds are associated with both a mechanical and a discretionary trigger.¹ The mechanical trigger is a capital trigger that forces coco bonds to be written off whenever the CET1 capital of the bank falls below a certain threshold. We assume that coco bonds are written off whenever the $t = 2$ equity value of the bank is below a threshold $\chi_1 \geq 0$. That is when:

$$\underbrace{\theta - y_1 - y_2 r_2}_{\text{CET1}} \leq \chi_1 \iff \theta \leq \theta^* \equiv y_1 + y_2 r_2 + \chi_1. \quad (6.2)$$

Coco bonds can also be discretionarily written off by the central bank. More precisely, we assume that the central bank takes information from market prices and decide to write coco bonds off when the market value of the Tier 1 capital falls below a threshold $\chi_2 \geq 0$. That is when the following inequality holds true:

$$\underbrace{\underbrace{\theta - y_1 - y_2 r_2}_{\text{CET1}} + \underbrace{y_2(r_2 - \gamma s)}_{\text{AT1}}}_{\text{Tier 1}} \leq \chi_2 \quad (6.3)$$

$$\iff \theta \leq \theta^{**} \equiv y_1 + y_2 \gamma s + \chi_2.$$

The central bank exerts an indirect market discipline over the bank in the sense of Bliss and Flannery (2001). Coco bonds' holders monitor the bank and decide to sell under certain circumstances. Doing so, they produce information (through prices) based on which the central bank may decide to

¹According to CRD IV, to be included in AT1 capital, coco bonds need to be associated with both a mechanical and a discretionary trigger.

exert an influence over the bank. Since coco bonds enter the regulatory capital of the bank, sales of coco bonds deplete the market value of this capital. Observing market prices, the central bank notices this depletion and may decide to write coco bonds off to prevent the bank from going insolvent. In this case, the probability with which coco bonds are written off is an increasing function in the expected proportion s of coco bonds' holders that decide to sell. According to equation (6.3), θ^{**} is indeed an increasing function in s . In other words, when s increases, coco bonds are more likely to be written off and depositors are thus more inclined to sell them. In this sense, selling decisions are strategic complements since depositor i is more incentivized to sell if depositor j does so and *vice versa*. This is in line with the empirical evidence provided by Bologna *et al.* (2018) according to which coco bonds markets are subject to self-fulfilling behaviors.

Regulatory coco bonds are associated with a "low" mechanical trigger that makes their conversion before the point of non-viability unlikely (Cahn and Kenadjian, 2014). In the terms of our model, this means that χ_1 is low so that coco bonds are written off only when the bank is close to insolvency. We assume that the mechanical trigger is indeed low so that conversions, if they occur, are always discretionary. A sufficient condition for conversions to be always discretionary is $\chi_2 \geq \chi_1 + y_2 r_2$. In this case, the central bank is determined to act in a going-concern perspective and to write coco bonds off before the point of non-viability is reached.

6.3.2 Pricing

We assume that only the mechanical conversion risk is taken into consideration when pricing coco bonds. In reality, coco bonds associated with both a mechanical trigger and a discretionary trigger are likely to be priced this way since it is *ex ante* virtually impossible to assess the probability of a discretionary conversion. Since depositors are risk-neutral, the expected return associated with coco bonds should be equal to the riskless return 1. Let us denote by r_2^* the equilibrium value of r_2 . r_2^* is thus the solution of the following equation:

$$\int_{\theta^*}^{+\infty} r_2 f(\theta) d\theta = 1 \iff [1 - F(\theta^*)] r_2 = 1, \quad (6.4)$$

where $f(\cdot)$ is the probability density function of θ and $F(\cdot)$ its cumulative distribution function. We assume that θ is normally distributed with mean μ and variance σ^2 . Equations (6.2) and (6.4) allow us to compute the equilibrium value of r_2 . We show that such an equilibrium does not always exist. In other words, the bank is not always able to issue coco bonds.

Proposition 1. *There does not necessarily exist an equilibrium value r_2^* . For such an equilibrium to exist, E needs to be larger than a threshold E_{min} defined as the minimum on \mathbb{R}_+^* of the function $1 + y_2(x - 1) + \chi_1 - \frac{1}{x} F^{-1}\left(1 - \frac{1}{x}\right)$. E_{min} is a decreasing function in μ .*

Proof. See Appendix 6.A. □

Figure 6.1 plots E_{min} as a function of μ . When E is below the curve E_{min} , no equilibrium value of r_2 can be found. In this case, the bank

cannot issue coco bonds. In accordance with Proposition 1, we notice that E_{min} is a decreasing function in μ . In particular, for values of μ larger than approximately 1.2, we have $E_{min} < 0$ and thus E is always greater than E_{min} . In that case, the bank is always able to issue coco bonds.

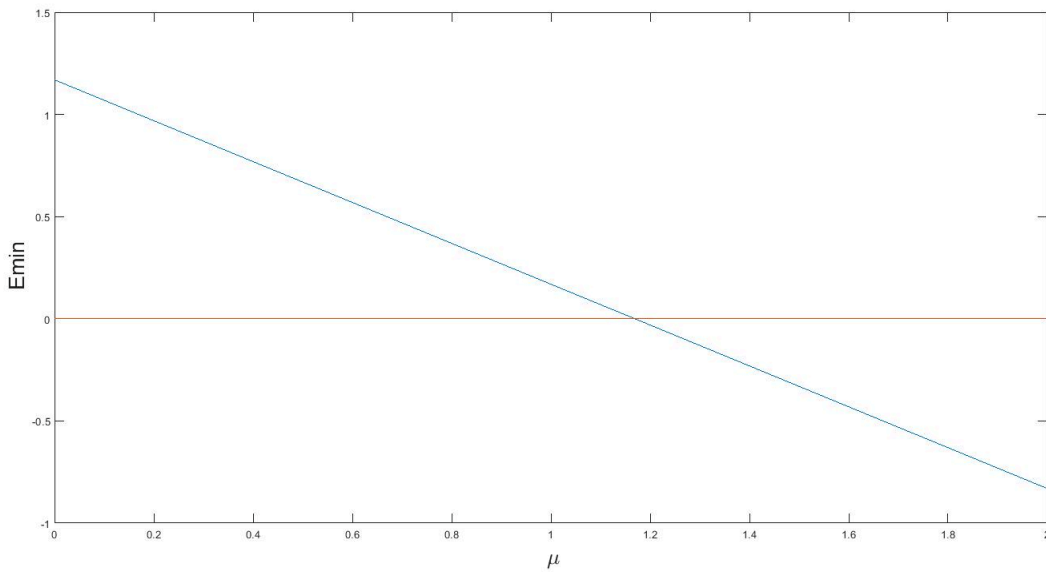


Figure 6.1: E_{min} as a function of μ ($y_2 = 0.3$ and $\chi_1 = 0$)

Proposition 1 states that weakly-capitalized banks can find themselves unable to issue coco bonds. This is a theoretical rationale for the empirical evidence according to which larger and stronger banks were among the first wave of coco bonds issuers (Avdjiev *et al.*, 2017). Figure 6.2 plots r_2^* as a function of μ for some values of E . When r_2^* does not exist, we arbitrarily define $r_2^* = 0$. In accordance with Proposition 1, we notice that for the smallest value of E (0.05), the bank is not able to issue coco bonds when μ is below approximately 1.4. When the value of E is larger (0.2), the bank is always able to issue coco bonds when μ is greater than 1.

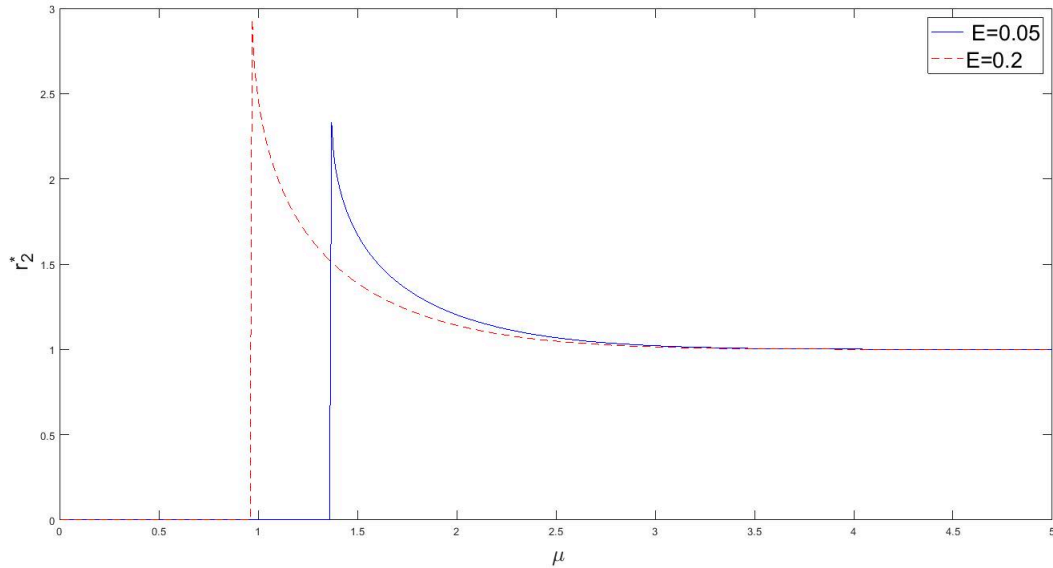


Figure 6.2: The equilibrium return r_2^* as a function of μ for some values of E ($y_1 = 0.5$ and $\chi_1 = 0$)

6.4 Panic in the coco bonds' market

6.4.1 The central bank

The central bank observes the market value of the regulatory capital (CET1 plus AT1) of the bank and decides to write coco bonds off whenever the capital is below a threshold χ_2 . There therefore is a threshold value θ^{**} of θ (see equation (6.3)) for which the central bank is indifferent between writing coco bonds off or not:

$$\theta^{**} \equiv y_1 + y_2\gamma s + \chi_2. \quad (6.5)$$

We assume that depositors follow a threshold strategy, meaning that depositor i decides to sell when the private signal v_i he observes is smaller than

or equal to a threshold v^* . Since ε_i is independent of ε_j and of θ , we know that s is given by the probability with which a depositor i observes a private signal below v^* :

$$s = \Pr[v_i \leq v^* | \theta^{**}] = \Phi\left(\sqrt{\beta}(v^* - \theta^{**})\right), \quad (6.6)$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. Combining equations (6.5) and (6.6), we can derive the indifference curve of the central bank:

$$\begin{aligned} \theta^{**} &= y_1 + y_2 \gamma \Phi\left(\sqrt{\beta}(v^* - \theta^{**})\right) + \chi_2 \\ \iff v_{CB}^* &= \frac{1}{\sqrt{\beta}} \Phi^{-1}\left[\frac{\theta^{**} - y_1 - \chi_2}{y_2 \gamma}\right] + \theta^{**}. \end{aligned} \quad (6.7)$$

v_{CB}^* is the threshold value of the private signal derived from the objective function of the central bank.

6.4.2 Coco bonds' holders

Coco bonds' holders decide to sell when they expect coco bonds to be written off. Since they do not know the true distribution of θ , coco bonds' holders can only base their estimation of the probability of conversion on the noisy information they possess. More precisely, depositor i decides to sell its coco bonds whenever the probability that coco bonds are not written off times the return associated with coco bonds is smaller than their market price. That

is when the following inequality holds true:

$$\underbrace{\Pr [\{\theta \geq \theta^*\} \cup \{\theta \geq \theta^{**}\} | \mu, v_i]}_{\text{Probability of no conversion conditional on the signals}} \quad r_2^* \leq r_2^* - \gamma s. \quad (6.8)$$

Since we assumed that $\theta^{**} \geq \theta^*$, condition (6.8) can therefore be rewritten as follows:

$$\Pr [\theta \geq \theta^{**} | \mu, v_i] r_2^* \leq r_2^* - \gamma s. \quad (6.9)$$

As we assumed that the noise parameters ε_i are normally distributed, we know that the distribution of θ conditional on μ and v_i is normal as well. The expected value of θ conditional on μ and v_i is thus:

$$\mathbb{E}[\theta | \mu, v_i] = \frac{\alpha\mu + \beta v_i}{\alpha + \beta}, \quad (6.10)$$

and its variance is

$$\text{Var}[\theta | \mu, v_i] = \frac{1}{\alpha + \beta}. \quad (6.11)$$

Since depositors are assumed to follow a threshold strategy, we have:

$$s|v_i = \Pr[v_j \leq v^* | v_i] = \Phi \left[\sqrt{\frac{\beta}{2}}(v^* - v_i) \right]. \quad (6.12)$$

We can therefore rewrite (6.9) as follows:

$$1 - \Phi \left[\sqrt{\alpha + \beta} \left(\theta^{**} - \frac{\alpha\mu + \beta v_i}{\alpha + \beta} \right) \right] r_2^* \leq r_2^* - \gamma \Phi \left[\sqrt{\frac{\beta}{2}}(v^* - v_i) \right]. \quad (6.13)$$

Coco bonds' holders are thus indifferent between selling or holding their coco bonds when:

$$\begin{aligned} 1 - \Phi \left[\sqrt{\alpha + \beta} \left(\theta^{**} - \frac{\alpha\mu + \beta v^*}{\alpha + \beta} \right) \right] r_2^* &= r_2^* - \frac{\gamma}{2} \\ \iff v_{coco}^* &= \frac{\alpha + \beta}{\beta} \theta^{**} - \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(\frac{1 - r_2^* + \frac{\gamma}{2}}{r_2^*} \right) - \frac{\alpha\mu}{\beta}. \end{aligned} \quad (6.14)$$

v_{coco}^* is therefore the threshold value of the private signal below which depositors decide to sell their coco bonds. A depositor i that would observe a private signal v_i below v_{coco}^* would sell its coco bonds, while it would hold them otherwise. According to equation (6.14), we notice that for v_{coco}^* to exist and to be finite we need to have $r_2^* \in]\frac{1}{2} \left(1 + \frac{\gamma}{2} \right), 1 + \frac{\gamma}{2}[$. When $r_2^* \leq \underline{r}_2^* \equiv \frac{1}{2} \left(1 + \frac{\gamma}{2} \right)$, equation (6.14) is never verified, sales of coco bonds never occur in this case because the market is too illiquid (i.e. γ is too large) and coco bonds' holders always prefer to keep holding their bonds. On the contrary, when $r_2^* \geq \bar{r}_2^* \equiv 1 + \frac{\gamma}{2}$, coco bonds are always sold.

6.4.3 The equilibrium

Equations (6.7) and (6.14) allow us to find the equilibrium value of θ :

$$\begin{aligned} \frac{1}{\sqrt{\beta}} \Phi^{-1} \left[\frac{\theta^{**} - y_1 - \chi_2}{y_2 \gamma} \right] + \theta^{**} &= \frac{\alpha + \beta}{\beta} \theta^{**} - \frac{\sqrt{\alpha + \beta}}{\beta} \Phi^{-1} \left(\frac{1 - r_2 + \frac{\gamma}{2}}{r_2} \right) - \frac{\alpha\mu}{\beta} \\ \iff \theta^{**} &= y_1 + y_2 \gamma \Phi \left[\frac{\alpha}{\sqrt{\beta}} \theta^{**} - \frac{\alpha}{\sqrt{\beta}} \mu - \sqrt{\frac{\alpha + \beta}{\beta}} \Phi^{-1} \left(\frac{1 - r_2 + \frac{\gamma}{2}}{r_2} \right) \right] + \chi_2. \end{aligned} \quad (6.15)$$

Proposition 2. *Provided that $r_2^* \in]\underline{r}_2^*, \bar{r}_2^*[$ and if $\beta > \frac{\alpha^2}{2\pi}$ (sufficient condition), there exists a unique equilibrium value of θ that satisfies (6.15).*

Proof. For the equilibrium value of θ to be unique, v_{CB}^* and v_{coco}^* need to

cross only once. This is the case if $\frac{\partial v_{CB}^*}{\partial \theta} > \frac{\partial v_{coco}^*}{\partial \theta}$ for all θ . We have:

$$\begin{aligned} \frac{\partial v_{CB}^*}{\partial \theta} &= \frac{1}{\sqrt{\beta}} \frac{\partial \Phi^{-1}(\cdot)}{\partial \theta} + 1, \\ \frac{\partial v_{coco}^*}{\partial \theta} &= \frac{\alpha + \beta}{\beta}. \end{aligned} \tag{6.16}$$

As $\min \left\{ \frac{\partial \Phi^{-1}(\cdot)}{\partial \theta} \right\} = \frac{1}{\max\{\phi(\cdot)\}} = \sqrt{2\pi}$ with $\phi(\cdot)$ the probability density function of the standard normal distribution, a sufficient condition for $\frac{\partial v_{CB}^*}{\partial \theta} > \frac{\partial v_{coco}^*}{\partial \theta}$ is $\beta > \frac{\alpha^2}{2\pi}$. \square

For a panic equilibrium to exist, three conditions are finally required:

1. r_2^* must exist,
2. $r_2^* \in]r_2^*, \bar{r}_2^*[$,
3. $\beta > \frac{\alpha^2}{2\pi}$.

Assuming that r_2^* exists and that $\beta > \frac{\alpha^2}{2\pi}$, Table 6.2 summarizes the situations where a panic occurs in the coco bonds' market.

$r_2^* \leq \underline{r}_2^*$	$r_2^* \in]\underline{r}_2^*, \bar{r}_2^*[$	$\bar{r}_2^* \leq r_2^*$
Sales of coco bonds never occur	Panic sales of coco bonds occur when θ is below θ^{**}	Coco bonds are always sold

Table 6.2: Panic sales of coco bonds

From now on, panic sales refer to sales that occur when $r_2^* \in]\underline{r}_2^*, \bar{r}_2^*[$. Since we cannot compute r_2^* analytically, we resort to simulations to exhibit situations where such panic sales arise. The values of exogenous parameters are set as follows: $y_1 = 0.9$, $E = 0.05$, $\chi_1 = 0$, $\chi_2 = 0.1$, $\alpha = 1$ and

$\beta = 2$. The bank therefore funds 5% of its total asset through equity E , 90% through deposits y_1 and 5% through coco bonds y_2 . In $t = 0$, CET1 capital amounts to 5% and Tier 1 capital to 10% of the total asset. Coco bonds are mechanically converted whenever the point of non-viability is reached ($\chi_1 = 0$) and the central bank discretionarily writes coco bonds off whenever the market value of Tier 1 capital falls below 0.1. We run simulations to compute the probability of crisis as a function of μ and γ . Results are presented in Figure 6.3.

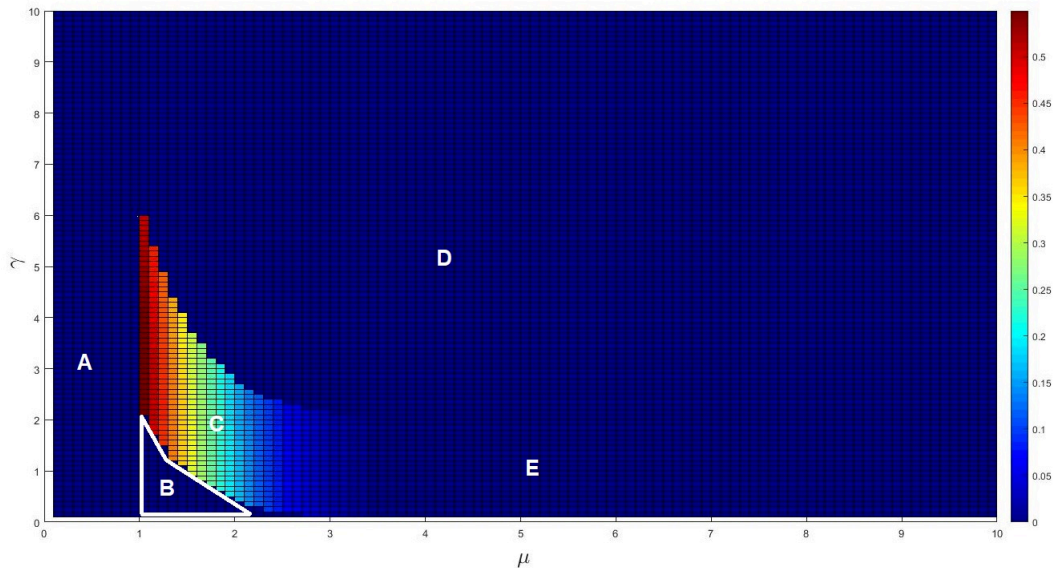


Figure 6.3: The probability of a panic-driven crisis as a function of μ and γ

The probability that a panic-driven crisis occurs is the probability that θ is below θ^{**} . When θ^{**} does not exist, because at least one of the conditions does not hold, this probability thus equals 0. Five situations are worth distinguishing:

- Situation A: μ is smaller than the riskless return 1, the bank does not invest in the asset.

- Situation B: when γ and μ are such that $r_2^* \geq \bar{r}_2^*$, coco bonds are always sold no matter the behavior of the central bank. In this case, θ^{**} does not exist and the probability of a panic-driven crisis is therefore 0.
- Situation C: θ^{**} exists and the probability that a crisis happens is given by the probability that θ is below θ^{**} . When μ is small, the probability that the bank ends up insolvent is large and so is the probability that coco bonds are written off. In this case, coco bonds' holders are very likely to sell. Notice however that, even for the smallest values of μ , panic sales of coco bonds only occur provided that γ is under a certain value (6 here). Above this value of γ , the market is so illiquid that coco bonds' holders never find it interesting to sell.
- Situation D: when γ and μ are such that $r_2^* \leq \underline{r}_2^*$, the market is too illiquid and coco bonds are never sold no matter the behavior of the central bank.
- Situation E: θ^{**} exists but the expected return μ associated with the asset is large so that the probability that the bank ends up insolvent is close to 0, and so is consequently the probability that a crisis happens.

6.5 Information precision and the probability of crisis

In this section, we study the impact of information precision on the probability of crisis. We thus assume that θ^{**} exists and is unique.

6.5.1 Comparative statics

Proposition 3. *Increasing the precision of the public signal has an ambiguous impact on the probability of crisis:*

- when $\gamma \leq \bar{\gamma}$, we have $\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$ when $\theta^{**} \geq \bar{\theta}_\alpha^{**}$, while we have $\frac{\partial \theta^{**}}{\partial \alpha} < 0$ otherwise,
- when $\gamma > \bar{\gamma}$, we have $\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$ when $\theta^{**} \leq \bar{\theta}_\alpha^{**}$, while we have $\frac{\partial \theta^{**}}{\partial \alpha} < 0$ otherwise.

Proof. We differentiate θ^{**} with respect to α :

$$\frac{\partial \theta^{**}}{\partial \alpha} = \frac{\frac{\gamma y_2}{\sqrt{\beta}} \left[\theta^{**} - \mu - \frac{1}{2\sqrt{\alpha+\beta}} \Phi^{-1} \left(\frac{1-r_2^* + \frac{\gamma}{2}}{r_2^*} \right) \right] \phi(\cdot)}{1 - \gamma \frac{y_2 \alpha}{\sqrt{\beta}} \phi(\cdot)}. \quad (6.17)$$

When $\gamma \leq \bar{\gamma} \equiv \frac{1}{y_2 \frac{\alpha}{\sqrt{\beta}} \phi(\cdot)}$, we indeed have $\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$ when $\theta^{**} \geq \bar{\theta}_\alpha^{**} \equiv \mu + \frac{\Phi^{-1} \left(\frac{1-r_2^* + \frac{\gamma}{2}}{r_2^*} \right)}{2\sqrt{\alpha+\beta}}$ and $\frac{\partial \theta^{**}}{\partial \alpha} < 0$ otherwise. On the contrary, when $\gamma > \bar{\gamma}$, we indeed have $\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$ when $\theta^{**} \leq \bar{\theta}_\alpha^{**}$ and $\frac{\partial \theta^{**}}{\partial \alpha} < 0$ otherwise. \square

The impact of an increase in the precision α of the public signal on the probability of crisis thus depends both on the liquidity γ of the market and on the value of θ^{**} . On the contrary, when the market is rather liquid ($\gamma \leq \bar{\gamma}$), public information should not be too precise when the probability of crisis is high.

Proposition 4. *Increasing the precision of the private signal has an ambiguous impact on the probability of crisis:*

- when $\gamma \leq \bar{\gamma}$, we have $\frac{\partial \theta^{**}}{\partial \beta} \geq 0$ when $\theta^{**} \leq \bar{\theta}_\beta^{**}$, while we have $\frac{\partial \theta^{**}}{\partial \beta} < 0$ otherwise,
- when $\gamma > \bar{\gamma}$, we have $\frac{\partial \theta^{**}}{\partial \beta} \geq 0$ when $\theta^{**} \geq \bar{\theta}_\beta^{**}$, while we have $\frac{\partial \theta^{**}}{\partial \beta} < 0$ otherwise.

Proof. We differentiate θ^{**} with respect to β :

$$\frac{\partial \theta^{**}}{\partial \beta} = \frac{\frac{\gamma y_2 \alpha}{2\beta \sqrt{\beta}} \left[-\theta^{**} + \mu + \frac{1}{\sqrt{\alpha+\beta}} \Phi^{-1} \left(\frac{1-r_2^* + \frac{\gamma}{2}}{r_2^*} \right) \right] \phi(\cdot)}{1 - \gamma \frac{y_2 \alpha}{\sqrt{\beta}} \phi(\cdot)}. \quad (6.18)$$

When $\gamma \leq \bar{\gamma} \equiv \frac{1}{y_2 \frac{\alpha}{\sqrt{\beta}} \phi(\cdot)}$, we indeed have $\frac{\partial \theta^{**}}{\partial \beta} \geq 0$ when $\theta^{**} \leq \bar{\theta}_\beta^{**} \equiv \mu + \frac{\Phi^{-1} \left(\frac{1-r_2^* + \frac{\gamma}{2}}{r_2^*} \right)}{\sqrt{\alpha+\beta}}$ and $\frac{\partial \theta^{**}}{\partial \beta} < 0$ otherwise. On the contrary, when $\gamma > \bar{\gamma}$, we indeed have $\frac{\partial \theta^{**}}{\partial \beta} \geq 0$ when $\theta^{**} \geq \bar{\theta}_\beta^{**}$ and $\frac{\partial \theta^{**}}{\partial \beta} < 0$ otherwise. \square

Similarly, the impact of an increase in the precision of the private signal depends on the values of γ and θ^{**} . Tables 6.3 and 6.4 summarize the results presented in Propositions 3 and 4.

$\theta^{**} < \theta_\alpha^{**}$	$\theta^{**} \in [\theta_\alpha^{**}; \theta_\beta^{**}]$	$\theta_\beta^{**} < \theta^{**}$
$\frac{\partial \theta^{**}}{\partial \alpha} < 0$	$\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$	$\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$
$\frac{\partial \theta^{**}}{\partial \beta} \geq 0$	$\frac{\partial \theta^{**}}{\partial \beta} \geq 0$	$\frac{\partial \theta^{**}}{\partial \beta} < 0$

Table 6.3: Precision of information and risk of crisis when the market is liquid ($\gamma \leq \bar{\gamma}$)

$\theta^{**} \leq \theta_{\alpha}^{**}$	$\theta^{**} \in]\theta_{\alpha}^{**}; \theta_{\beta}^{**}[$	$\theta_{\beta}^{**} \leq \theta^{**}$
$\frac{\partial \theta^{**}}{\partial \alpha} \geq 0$	$\frac{\partial \theta^{**}}{\partial \alpha} < 0$	$\frac{\partial \theta^{**}}{\partial \alpha} < 0$
$\frac{\partial \theta^{**}}{\partial \beta} < 0$	$\frac{\partial \theta^{**}}{\partial \beta} < 0$	$\frac{\partial \theta^{**}}{\partial \beta} \geq 0$

Table 6.4: Precision of information and risk of crisis when the market is illiquid ($\gamma > \bar{\gamma}$)

Depending on the liquidity of the coco bonds' market and on the initial probability of crisis, the impact of an increase in the precision of the signals is not the same. In particular the nature of the information has to be taken into consideration.

6.5.2 Simulations

According to Propositions 3 and 4, the impact of an increase in the precision of information (either private or public) depends on the initial values of α and β . Conclusions on the impact of information disclosure on the probability that a crisis occurs cannot therefore be formulated solely from those two propositions. We resort to simulations to disentangle the impact of information precision on the probability of crisis. To do so, we compute $\frac{\partial \theta^{**}}{\partial \alpha}$ and $\frac{\partial \theta^{**}}{\partial \beta}$ for different values of μ , γ , α and β . Exogenous parameters are as follows: $y_1 = 0.9$, $E = 0.05$, $\chi_1 = 0$ and $\chi_2 = 0.1$. In this case, Figure 6.3 shows that the probability that a crisis happens is equal to 0 for all μ above 4 and for all γ above 6. Simulations are thus run for values of μ below 4 and values of γ below 6. More precisely, we proceed in two steps:

1. we first compute the values of $\frac{\partial \theta^{**}}{\partial \alpha}$ and $\frac{\partial \theta^{**}}{\partial \beta}$ for α and β ranging from 1 to 1000 for all couples (γ, μ) ,

2. for each couple (γ, μ) , we then sum the values of, on the one hand, all the $\frac{\partial \theta^{**}}{\partial \alpha}$ (meaning for all α and β) and, on the other hand, all the $\frac{\partial \theta^{**}}{\partial \beta}$ to determine the impact of an increase in information precision for every couple (γ, μ) .

Results are presented in Figure 6.4. At each crossing between μ and γ , Figure 6.4 provides the value of the sum of all the $\frac{\partial \theta^{**}}{\partial \alpha}$ (upper plot) and all the $\frac{\partial \theta^{**}}{\partial \beta}$ (lower plot) for α and β ranging from 1 to 1000. A positive value, as is for instance the case in situation A in the upper plot, is therefore indicative of an average positive impact of an increase in the precision of the public signal on θ^{**} . In this case, increasing the precision of the public signal increases the probability that a crisis happens.

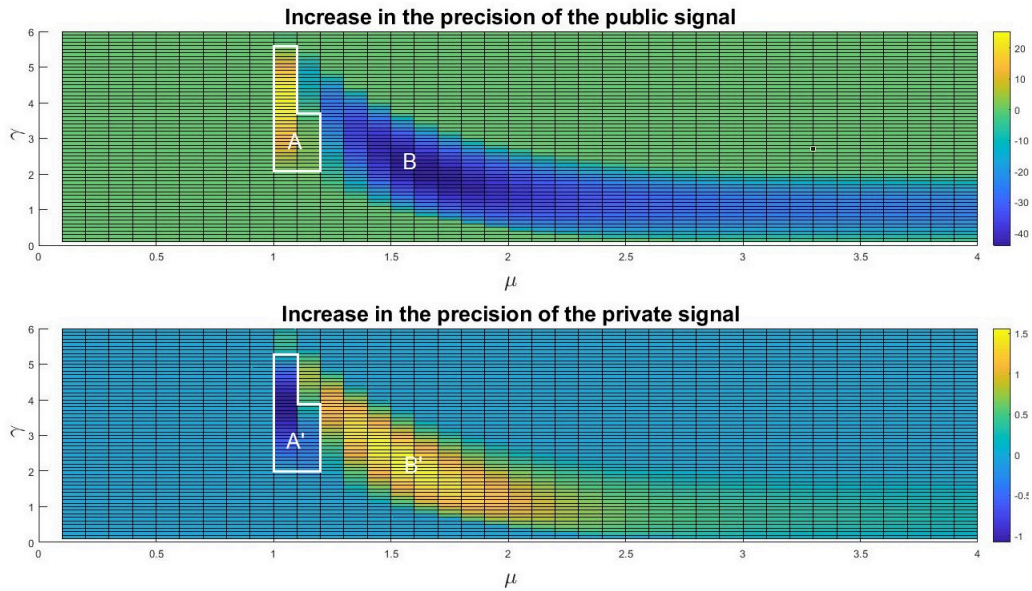


Figure 6.4: The impact of an increase in information precision on the probability of crisis as a function of μ and γ

In both plots, two situations are worth distinguishing:

- Situations A and A': for the smallest values of μ , we have $\sum \frac{\partial \theta^{**}}{\partial \alpha} > 0$ and $\sum \frac{\partial \theta^{**}}{\partial \beta} < 0$. In this situation, increasing the precision of the public signal increases the probability of crisis, while increasing the precision of the private signal decreases this probability.
- Situations B and B': for a sufficiently large value of μ , we have $\sum \frac{\partial \theta^{**}}{\partial \alpha} < 0$ and $\sum \frac{\partial \theta^{**}}{\partial \beta} > 0$. In this situation, increasing the precision of the public signal decreases the probability of crisis, while increasing the precision of the private signal increases this probability.

We demonstrated in section 6.5.1 that the impact of an increase in the precision of the signals rests on the value of θ^{**} and on three thresholds:

$$\bar{\gamma} = \frac{1}{y_2 \frac{\alpha}{\sqrt{\beta}} \phi(\cdot)}, \quad (6.19)$$

$$\theta_{\alpha}^{**} = \mu + \frac{\Phi^{-1}\left(\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*}\right)}{2\sqrt{\alpha+\beta}}, \quad (6.20)$$

$$\theta_{\beta}^{**} = \mu + \frac{\Phi^{-1}\left(\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*}\right)}{\sqrt{\alpha+\beta}}. \quad (6.21)$$

Because of the uniqueness condition stated in Proposition 2, we know that $\frac{\alpha}{\sqrt{\beta}}\phi(\cdot) \leq 1$. Therefore, $\bar{\gamma}$ is greater than $\frac{1}{y_2 \frac{\alpha}{\sqrt{\beta}} \phi(\cdot)} \geq \frac{1}{0.05} = 20$. All the values of γ for which θ^{**} exists are thus below $\bar{\gamma}$ and we are consequently in the situation described in Table 6.3.

When $\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*} \geq \frac{1}{2}$, we know that $\Phi^{-1}\left(\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*}\right) \geq 0$ and we thus have both θ_{α}^{**} and θ_{β}^{**} greater than μ . Since $\max\{\theta^{**}\} = y_1 + \gamma y_2 + \chi_2$, we have $\frac{\partial \theta^{**}}{\partial \alpha} < 0$ and $\frac{\partial \theta^{**}}{\partial \beta} > 0$ provided that $y_1 + \gamma y_2 + \chi_2 < \mu$ (see Table 6.3). This

is what happens in situations B and B'.

On the contrary, when $\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*} < \frac{1}{2}$, we have $\Phi^{-1}\left(\frac{1-r_2^*+\frac{\gamma}{2}}{r_2^*}\right) < 0$. We thus always have $\theta_\alpha^{**} < \theta^{**}$ and $\theta_\beta^{**} < \theta^{**}$ for sufficiently small values of μ . In this situation, according to Table 6.3, we indeed have $\frac{\partial \theta^{**}}{\partial \alpha} > 0$ and $\frac{\partial \theta^{**}}{\partial \beta} < 0$. This is what happens in situations A and A'.

On average, when the funding structure of the bank is such that it strongly relies on funding instruments other than capital ($y_1 = 0.9$), which is the case in reality, increasing the precision of the public signal decreases the probability of a panic-driven crisis, while increasing the precision of the private signal increases the probability of such a crisis. To conclude, apart from the situation where μ is very close to the riskless return, increasing the precision of the public signal has a negative impact on the probability that a crisis happens, while increasing the precision of the private signal has a positive impact on this probability.

6.6 Discussion and policy implications

After the crisis, banking regulation has narrowed the definition of regulatory capital. Under Basel III, banks are indeed constrained to hold 4.5% of their risk-weighted assets (RWA) in CET1 capital, which is more than twice the constraint under Basel II. In addition, counter-cyclical buffers have been added to the main framework and raised to 7% of the RWA the constraint in CET1 capital. Simultaneously, Basel III allows a certain proportion of AT1 capital to be made of coco bonds.² To be included in regulatory capital, coco

²Precisely 1.5% of the RWA.

bonds have however to be designed in a specific way. According to CRD IV – the European transposition of the Basel III framework – regulatory coco bonds have indeed to be associated with both a discretionary and a mechanical trigger and the latter has to be capital-based with a threshold greater than or equal to 5.125% of the RWA.

Our model allows us to discuss the impact of the introduction of coco bonds in regulatory capital. The main result is that if the conversion of coco bonds is related to changes in their market value, self-fulfilling behaviors may arise and a panic-driven crisis may occur. As a tool meant to improve market discipline, coco bonds are thus a potential channel of systemic risk. If market discipline is thought of as a regulatory intervention triggered by market signals – this is what Bliss and Flannery (2001) referred to as *indirect* market discipline –, expected sales of coco bonds could indeed increase the likelihood of a conversion, which in turn could increase the likelihood of panic sales and so on. This is what is referred to as the "reflection problem" (Morris and Shin, 2018): when a policy is based on market prices and when those prices are influenced by this policy, there is a circularity that can impede its effectiveness (see chapter 1).

Section 6.5 raises another concern related to the identity of ideal coco bonds' buyers. In a macroprudential perspective, it does not make sense for banks to buy other banks' coco bonds since this would only consist in building new transmission channels that could eventually prove a great factor of systemic risk. Retail customers are not sophisticated enough and therefore have to be prevented from investing in coco bonds. Persaud (2014) strongly objects the idea according to which long-term investors should invest in coco

bonds. He argues that this would go against their business model and thus could be detrimental to the funding of long-term investments. Hedge funds remain potential investors. However, we showed that when the private information available to coco bonds' holders is very precise, the probability of a crisis happening increases. As well-informed traders, hedge funds could therefore be a potential factor of instability in the coco bonds' market.

It is therefore not clear whether or not coco bonds could possibly fulfill their objective of improving market discipline. In at least two respects, they appear as a fantastic transmission channel of systemic risk. On the one hand, if banks invest in other banks' coco bonds, conversions would automatically propagate a crisis from the defaulting bank to the rest of the banking sector. On the other hand, short-term buying/selling behaviors from sophisticated traders such as hedge funds could be a great factor of instability that could eventually lead to a crisis. It is therefore of the utmost importance to cautiously take the potential destabilizing impact of coco bonds into account before considering going further in the direction of regulatory requirements in coco bonds.

6.7 Conclusion

We develop a model where a bank relies on three funding sources: equity, deposits and coco bonds. Because of the conversion risk, pricing coco bonds is a tricky exercise. We indeed show that there does not necessarily exist an equilibrium return for coco bonds and therefore the bank is not always able to issue coco bonds. In particular, when the bank is too weakly capitalized

and/or when the expected return associated with its asset portfolio is too low, no equilibrium price for coco bonds can be found.

In section 6.4, we explore how the conversion risk associated with coco bonds gives rise to self-fulfilling behaviors that can lead to panics. In particular, when the conversion of coco bonds is related to changes in their market value, a self-fulfilling crisis can occur because of the interaction between the expectation of conversion by depositors and the expectation of panic sales by the central bank. Since panic sales are motivated by the risk of conversion and since a discretionary conversion is related to the proportion of coco bonds that is panic sold, self-fulfilling crises can occur.

In section 6.5, we study the impact of information disclosure on the probability that a crisis happens. Doing so, we show that when the funding structure of the bank relies strongly on funding instruments other than capital, increasing the precision of the information publicly disclosed by the bank through its financial statements decreases the probability that a panic-driven crisis occurs. On the contrary, increasing the precision of the information privately held by coco bonds' holders has the opposite effect.

Those results allow us to formulate policy implications that are discussed in section 6.6. What is finally worth pointing out is that coco bonds are complex financial instruments that could eventually act as a channel through which systematic risk could propagate. The expectation of conversion could indeed nourish self-fulfilling panic sales of coco bonds and thus precipitate a market-wide panic that could spread to the whole financial system. The empirical evidence recently provided by Bologna *et al.* (2018) is the sign that such a self-fulfilling crisis could actually unfold. It is therefore of the utmost

importance to keep in mind that one of the reasons why the global financial crisis was so severe was because the systemic risk associated with securitized products had been largely overlooked. Cocom bonds share a lot with those products and may therefore be used with great caution.

6.A Appendix: proof of Proposition 1

The equilibrium return of cocom bonds is defined as the first value of r_2 that satisfies the following equation:

$$[1 - F(\theta^*)]r_2 = 1, \tag{6.22}$$

where $\theta^* \equiv y_1 + r_2y_2 + \chi_1$. We denote the equilibrium value of r_2 by r_2^* . According to the balance sheet identity, when $E = 1$ we immediately have $r_2^* = \frac{1}{1 - F(\chi_1)}$. Equation (6.22) can be rewritten as follows:

$$E = 1 + y_2(r_2 - 1) + \chi_1 - F^{-1}\left(1 - \frac{1}{r_2}\right), \tag{6.23}$$

where $F^{-1}(\cdot)$ is the inverse function of $F(\cdot)$. For all $r_2 \in [1, +\infty[$, let us define the function $h(r_2)$ as $h(r_2) = 1 + y_2(r_2 - 1) + \chi_1 - \frac{1}{r_2}F^{-1}\left(1 - \frac{1}{r_2}\right)$. We notice that $\max\{h(r_2)\} = +\infty$. For every $E \in [0, 1[$, it is therefore possible to find one r_2 such that we have $E < h(r_2)$. However, for some values of μ (see Figure 6.5), we have $\min\{h(r_2)\} > 0$. It is therefore not possible to find one r_2 in $[1, +\infty[$ such that $E \geq h(r_2)$ for every $E \in [0, 1[$. In that case, there are situations where we always have $E < h(r_2)$ and equation (6.23) does not have a solution. In other words, r_2^* does not necessarily exist.

r_2^* exists if and only if $E \geq \min \{h(r_2)\}$ for $r_2 \in [1, +\infty[$. We can easily show that $F^{-1}(\cdot)$ is an increasing function in μ . Therefore $h(r_2)$ is a decreasing function in μ . Thus when μ increases, $\min \{h(r_2)\}$ decreases and r_2^* is more likely to exist. Similarly, according to equation (6.23), r_2^* is more likely to exist when y_2 and χ_1 are small.

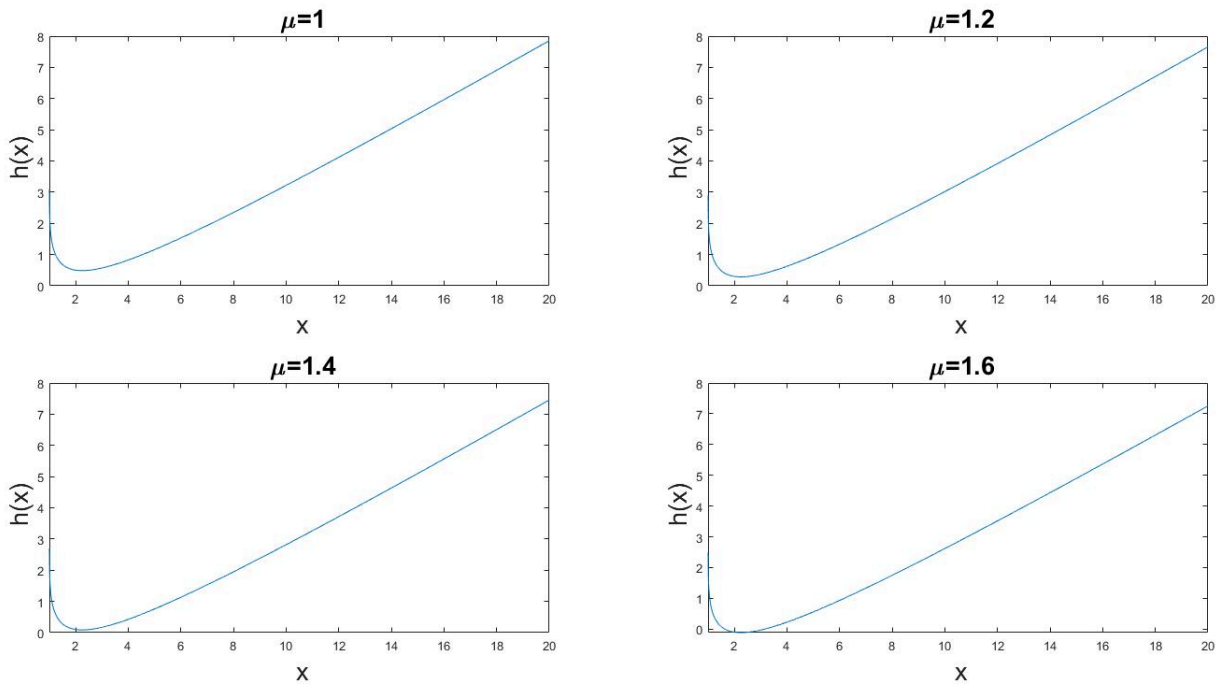


Figure 6.5: $h(x)$ as a function of x for some values of μ ($y_2 = 0.5$ and $\chi_1 = 0$)

To summarize, we showed that E and/or μ need to be large enough for r_2^* to exist.

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Qu'avons-nous appris ?

La crise de la fin des années 2000 a donc motivé une modification en profondeur du corpus réglementaire qui encadre l'activité des banques. La nature endogène du risque est désormais prise en considération par un ensemble d'instruments qui se départissent souvent de l'idée que la régulation du système bancaire peut être déléguée aux seuls mécanismes du marché. La confiance en les prix, et donc en la discipline de marché, a, semble-t-il, été ébranlée par la crise. Cependant, en d'autres endroits, le corpus réglementaire fait la part belle à la régulation du système bancaire par les prix de marché. La transparence de l'information est, en effet, toujours promue comme un élément inséparable de la stabilité financière. Plus encore, l'inclusion de certaines innovations récentes dans le cadre réglementaire, s'agissant par exemple des obligations contingentes convertibles, révèle l'actualité de la discipline de marché. Si la qualité de l'information financière est indéniablement un pré-requis au bon fonctionnement du système bancaire, l'attention extrême accordée à la question de la transparence de l'information révèle la persistance d'une conception erronée de la manière dont fonctionnent les marchés financiers. La mise en place de contraintes réglementaires en instruments financiers complexes de type coco bonds (au travers du TLAC et du MREL) témoigne elle aussi d'une confiance placée en les mécanismes de marché qui ont pourtant participé à l'auto-déstabilisation du système bancaire pendant la crise.

Les marchés financiers ne sont pas une réalité au même titre que l'est le monde physique, mais bien plus une construction dont le propre est d'être

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affectée par la manière avec laquelle elle est envisagée. Dans cette perspective, la transparence est surtout un projet politique qui vise à assoir une certaine conception de la valeur en la faisant passer pour naturelle (chapitre 1). C'est ce que permet de saisir une approche pluridisciplinaire qui emprunte aussi bien à la sociologie (pensons par exemple aux approches qui invoquent l'idée de performativité) qu'à l'économie (pensons au *reflection problem*). En outre, la perspective pluridisciplinaire rappelle que la réglementation financière ne s'applique jamais dans le vide, mais qu'elle doit toujours faire avec un ensemble d'incitations pré-existantes qui peuvent infléchir ses effets dans une direction inattendue. Quand les créanciers disposent d'une information imparfaite et ne parviennent pas à se coordonner efficacement, un accroissement de la transparence de l'information publique peut ainsi, sous certaines hypothèses, encourager une banque à détenir moins de capital (chapitre 2).

L'étude des effets réels associés aux normes comptables consiste précisément à se demander de quelle manière des règles qui ont été pensées pour avoir un certain impact pourraient en avoir un autre du fait de la complexité de l'environnement dans lequel elles sont appliquées. Ainsi, l'élaboration des normes comptables devrait prendre en considération non seulement les effets directs attendus, mais également tous les effets indirects induits par la configuration particulière des marchés financiers.

En particulier, l'impact potentiellement très négatif des phénomènes de composition liés aux incitations associées à la comptabilité à la juste valeur doit être pris en compte. Ce faisant, il est possible de montrer que l'anticipation par l'ensemble des institutions financières de ventes inefficaces d'actifs, liées précisément à l'utilisation d'une telle comptabilité, aboutit à une al-

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location globale très éloignée de celle qui se produirait en situation de *first best*. En revanche, en reconnaissant la diversité des institutions financières qui interviennent sur les marchés financiers, c'est-à-dire en les soumettant à un régime comptable en accord avec leur modèle économique (coût amorti pour les institutions engagées dans des stratégies à long-terme, juste valeur pour des institutions plus court-termistes), il est possible de se rapprocher de l'allocation optimale (chapitre 3).

En outre, dans la mesure où toute règle comptable est sujette à interprétation, une marge de manoeuvre est laissée à quiconque entend utiliser un référentiel comptable. L'impact d'une telle marge de manoeuvre doit être pris en considération lorsqu'il s'agit de comparer les mérites de différentes options comptables. S'agissant, par exemple, du provisionnement pour pertes, il semble que les banques utilisent leur pouvoir discrétionnaire pour se soustraire à la discipline de marché. Ainsi, les banques les moins bien capitalisées ont tendance à répondre à un renforcement de la discipline de marché en augmentant leurs provisions discrétionnaires plutôt qu'en accroissant leur capital (chapitre 4). Le débat entre, d'un côté, un modèle de provisionnement basé sur la perte avérée et, de l'autre côté, un modèle prospectif jugé plus efficace, en partie parce qu'il est censé produire une information plus en adéquation avec le risque de crédit réel supporté par la banque, doit donc prendre en compte cet aspect. Dans la mesure où sa mise en oeuvre est moins évidente, notamment parce qu'il suppose le calcul d'une perte attendue dont les modalités sont sujettes à de nombreuses variations, le modèle de provisionnement prospectif accorde vraisemblablement plus de marge de manoeuvre aux banques. Il est donc potentiellement à craindre que ces dernières n'utilisent cette

liberté dans un sens qui affaiblirait la discipline de marché.

L'innovation financière constitue le corrélat naturel de l'hypothèse de discipline de marché au sens large. Il s'agit de rien de moins, en effet, avec l'innovation financière, que de construire des instruments en lesquels s'incarne l'idéal du marché auto-régulateur, c'est-à-dire l'idée d'une régulation endogène *via* la poursuite individuelle des intérêts. De fait, la titrisation devait permettre aux investisseurs qui le souhaitaient d'adopter des stratégies risquées permettant des rendements élevés (aspect poursuite individuelle des intérêts) tout en garantissant une répartition optimale des risques à même de garantir la stabilité du système (aspect auto-régulateur). La crise a montré à quel point le second aspect est, tout au plus, un voeu pieux. Pourtant, c'est exactement la même logique qui sous-tend aujourd'hui le développement des obligations contingentes convertibles (chapitre 5). Tout comme les produits issus de la titrisation et de la structuration, ces dernières pourraient ainsi servir de canal de transmission au risque systémique et participer à la propagation d'une crise bien plus qu'à son enrayement (chapitre 6).

Quelles conséquences en tirer ?

Comment expliquer que la discipline de marché ait été maintenue au sein d'un cadre réglementaire qui fait, à d'autres endroits, la part belle à des nouveautés radicales ? Il semble, en effet, y avoir une contradiction entre, d'un côté, les avancées majeures que constituent la réduction de la procyclicité du ratio de capital réglementaire, la mise en place d'un ratio de levier simple ou encore la mise en place de ratios de liquidité et, de l'autre côté,

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le maintien d'une discipline de marché promue au travers d'instruments qui n'ont rien de nouveau. Pour rendre compte de ce paradoxe, il est nécessaire de réintroduire le processus de révision réglementaire dans l'environnement social et politique dans lequel il prend nécessairement place. Loin d'être un vide qui n'attendrait qu'à être informé, le système financier est, en effet, un environnement complexe régi par des règles qui ne se limitent pas à celle de l'intérêt bien compris.

De fait, les acteurs qui interviennent sur les marchés financiers sont porteurs d'une certaine vision du monde qui s'incarne dans les "dispositifs de marché" qu'ils utilisent pour prendre leurs décisions. Par ailleurs, ces acteurs luttent, en continu, pour défendre leurs intérêts parfois aux dépens de ceux de la société dans son ensemble. Dans cette perspective, c'est toujours sous une double contrainte, à la fois cognitive (l'inertie associée à une vision du monde particulière) et politique (le jeu des intérêts privés), que le processus de révision réglementaire doit être mené. Ce que Walter (2016) désigne comme le *logos* financier renvoie bien à l'idée qu'il existe une inertie cognitive forte qui empêche de s'extraire des idées anciennes:

"Despite the 2008 financial crisis, the financial *logos* continues to 'talk' and continues to influence the ideas at work in attempts to overhaul the economic system." (Walter, 2016, p.598).

La contrainte politique est au moins aussi forte dans la mesure où elle permet à certains groupes d'intérêt de verrouiller le débat en faisant passer leurs intérêts privés pour l'intérêt de la société dans son ensemble. C'est particulièrement le cas concernant l'opposition du lobby bancaire à une hausse des

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contraintes en actions ordinaires comme le notent Admati *et al.* (2013):

"Most importantly, the cost to shareholders is entirely a private cost based on being able to benefit at the expense of creditors or taxpayers when there is less equity in the mix. Thus, it does not establish any social cost to increased equity requirements." (Admati *et al.*, 2013, p.36).

Dans cette perspective, le processus de révision réglementaire apparaît, tout à la fois, comme un défi intellectuel dont l'objet est de surmonter les défauts du cadre précédent et comme un combat contre l'inertie cognitive et les obstacles politiques. Le message principal de cette thèse est que cette lutte ne peut être laissée aux seuls experts qui sont susceptibles de rester englués dans la représentation qu'ils se font de la manière dont fonctionnent les marchés financiers. Dans la perspective de l'ouvrage de Callon *et al.* (2009), nous pensons qu'il est, en effet, nécessaire de faire participer l'ensemble des parties prenantes dès lors qu'il s'agit d'aborder des questions complexes. S'agissant, par exemple, du débat concernant les organismes génétiquement modifiés (OGM), il est tentant de ne laisser la parole qu'aux biologistes dans la mesure où ces derniers sont les seuls à même de saisir la complexité théorique de la question. Cependant, les OGM ont un impact direct sur l'activité des agriculteurs et, dans cette perspective, ces derniers sont en position d'exprimer un avis qui révélera peut-être un élément essentiel pourtant laissé dans l'angle mort de l'approche strictement théorique des biologistes. Callon *et al.* (2009) préconisent, ainsi, la constitution de "forums hybrides" où les questions complexes seraient abordées par des intervenants

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venant d'horizons différents et représentant l'ensemble des parties concernées par la question. Un tel *empowerment* de la société civile constitue peut-être effectivement la solution pour que le débat autour de la réglementation financière passe outre l'inertie cognitive et les pressions politiques exercées par les groupes d'intérêt privés.

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