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# **Banking Regulation and Financial Development**

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## Résumé

La crise financière mondiale de 2007-2009 a souligné le besoin de reconsidérer le modèle de régulation du secteur bancaire jusqu'alors établi. Bien que de nombreuses réformes financières aient été menées pour rétablir les conditions d'une croissance économique et d'une stabilité financière soutenables, peu de travaux soulignent le rôle du développement financier à satisfaire ces conditions. Ce travail doctoral a pour objectif de nourrir cette discussion en tentant précisément d'établir le lien entre développement financier et régulation bancaire. En particulier, nous choisissons comme cas d'étude l'Union Européenne (UE) tant la mise en œuvre d'un modèle de régulation unique confronté à l'hétérogénéité des systèmes financiers des pays membres rend ce cas particulièrement adapté à notre question de recherche.

Au chapitre 2, nous étudions empiriquement la relation entre capitalisation, liquidité et développement bancaire au niveau macroéconomique dans l'objectif de mieux comprendre les implications que peut avoir le cadre réglementaire tel que défini au sein de l'Union Bancaire Européenne (UBE). Les résultats montrent que les niveaux de capitalisation et de liquidité ont un impact sur le développement bancaire et en conséquence, la politique de régulation constitue un instrument authentique de la stabilité financière en régulant la taille du système bancaire. Nous montrons aussi que la sensibilité du capital et de la liquidité au développement bancaire diffère selon la région économique auquel le système financier appartient. Ainsi, une régulation unique par les instruments de capital et de liquidité peut avoir des impacts différents sur le développement du système bancaire non négligeables pour les autorités de régulation soucieuses d'assurer la stabilité financière.

Dans la mesure où la capitalisation et la liquidité semblent constituer des déterminants importants du développement bancaire, il convient d'obtenir une compréhension fine de l'impact d'un cadre prudentiel à la fois articulé autour du capital et de la liquidité sur le comportement de prêt de la banque. Ceci dans l'objectif de comprendre les fondements de la production de crédit du système bancaire et donc du développement bancaire. Nous établissons au chapitre 3 une théorie positive du comportement bancaire dans une configuration réglementaire à la Bâle III. Nos résul-

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tats soulignent tout d'abord les implications communes des instruments de capital et de liquidité. Nous mettons aussi en avant le rôle que peut jouer la concurrence dans le comportement bancaire en déterminant à la fois l'offre de prêt et la structure du passif de la banque. En conclusion, nous soulignons le besoin de déterminer l'impact d'une telle régulation dans le but de ne pas générer de distorsions potentiellement dommageables à la fois pour la croissance économique et la stabilité financière.

Dans le chapitre 4, nous menons une étude empirique de la relation capital, liquidité et crédit au niveau micro, ceci dans le but de tester la théorie établie au chapitre 3. Tout d'abord, nous montrons qu'un instrument tel que le Net Stable Funding Ratio (NSFR) est complémentaire de l'instrument du capital car il renforce l'offre de prêt du système bancaire. Nos résultats suggèrent que cette offre de prêt est sensible à la qualité du capital non négligeable pour établir la conduite de la politique monétaire au sein de l'UE dont les enjeux de croissance économique et de stabilité financière sont communs à la politique de régulation. Les résultats montrent aussi que l'efficacité de règles en capital et de liquidité diminue lorsque le développement du système bancaire s'accroît.

En conclusion générale, nous montrons que régulation bancaire et développement financier n'apparaissent pas comme des concepts indépendants l'un de l'autre. Les travaux présentés dans ce travail doctoral soulignent donc la nécessité pour les autorités de régulation de prendre en compte la dimension de développement financier tant l'application d'un modèle de régulation peut avoir des conséquences en termes de développement financier et in fine, de stabilité financière. Nous montrons aussi que l'application seule de règles en capital et de liquidité ne semble pas suffire pour assurer la stabilité financière en particulier quand la taille du système bancaire se développe. Dans ce cadre, il apparaît opportun d'adopter un cadre couplant la fonction prudentielle et de supervision pour assurer la stabilité financière comme c'est le cas pour l'UE où des entités à risque systémique caractérisent le système financier. Définir la conception de cette architecture et de son efficacité à assurer la stabilité financière reste cependant une question ouverte tant les économies à l'échelle mondiale présentent des caractéristiques différentes.

**Mots-clefs :** Développement financier, régulation bancaire, régime prudentiel, Bâle III, offre de crédit, comportement bancaire, canal du capital bancaire, politique monétaire

# Abstract

The 2007-2009 Financial Crisis has shed some light on the need to reconsider the design of the post-crisis banking regulation. Although financial reforms have been led in the objective to restore sustainable economic growth and financial stability, few literature highlight the role of financial development in satisfying these conditions. In this dissertation, we contribute to the debate by establishing the relationship between financial development and banking regulation. We specifically focus on the European Union (EU). The implementation of a unique regulatory framework and the heterogeneity of European financial systems render the EU a perfect case study.

In chapter 2, we empirically assess the relationship between capitalization, liquidity and the development of the banking sector at the macroeconomic level in order to raise the implications of a unique regulatory framework as defined within the European Banking Union (EBU). Our results show that capitalization and liquidity have a significant impact on the development of the banking sector. We argue that regulatory policy is an authentic instrument of financial stability by regulating the size of the banking system. We also show that the capital and liquidity impact on the banking sector development differs widely depending on the economic region the financial system belongs to which raises concerns for financial stability.

Chapter 2 illustrates the role of capitalization and liquidity on the banking sector development. Consequently, we build a positive theory of bank behavior under a regulatory framework *à la* Basel III in order to deeply investigate the impact of a regime both capital and liquidity driven on the production of credits in chapter 3. Our results evidence the common implications of the capital and liquidity instruments. We also underline the role of competition in modifying the bank loan supply and the banking liability structure. Our conclusion highlights the need to consider the implications of such a framework in order to avoid regulatory distortions which might dampen the objectives of economic growth and financial stability.

We set an empirical investigation in chapter 4 focusing on the relationship between capital, liquidity and lending at the microeconomic level in order to test the theory

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presented in chapter 3. First, we show that the implementation of a funding ratio such as the NSFR complements the instrument on capital as it strengthens the credit structure of the banking system. Our results suggest that bank loan supply differs depending on the quality of bank capital which raises a particular concern for the lead of monetary policy. Our results also show that the efficacy of the capital and liquidity instruments decreases as the banking sector develops.

As a conclusion, we show that banking regulation and financial development are not independent concepts. Therefore, our work highlights the need to consider the level of financial development in the design of banking regulation as the application of the regulation might impact financial development and financial stability *in fine*. Our results tend to show that the application of capital and liquidity instruments appears not sufficient to ensure financial stability particularly during the banking sector development process. Complementing banking regulation with a supervisory framework appears essential to ensure financial stability as the EU features Systemically Important Institutions (SIIs). Defining the conception of this architecture and its efficacy to ensure financial stability constitute an avenue for future research as economies differ widely at the global level.

**Keywords:** Financial Development, Banking Regulation, Prudential Regime, Basel III, Credit Supply, Bank Behavior, Bank Capital Channel, Monetary Policy



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# List of Acronyms

**AASF** Available Amount of Stable Funding. 44, 79

**ALLOW** Loan Loss Allowance. 92

**ALM** Asset and Liability Management. 14, 80, 81, 90

**ASF** Available Stable Funding. 44, 78, 79

**AT1** Additional Tier 1 Capital. 76, 94

**BBIFD** Broad Based Index of Financial Development. 25, 26

**BCBS** Basel Committee on Banking Supervision. 22, 42, 44, 72

**BCC** Bank Capital Channel. 15, 72, 85, 90, 91

**BCE** Banque Centrale Européenne. 5, 9, 109, 116

**BIS** Bank for International Settlements. 46

**BLC** Bank Lending Channel. 15

**CD** Certificate of Deposit. 45

**CEE** Central and Eastern Europe. 24–27, 29–32, 34, 46, 48, 55, 60, 61, 69

**CET1** Common Equity Tier 1 Capital. 76, 94

**CMU** Capital Market Union. 28

**CPO** Conditions de Premier Ordre. 14, 15

**CRD IV** Capital Requirements Directive. 5, 9, 60

**CRR** Capital Requirement Ratio. 77

**D-SIBS** Domestic Systemically Important Banks. 57, 73, 89, 92

## List of Acronyms

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- DSGE** Dynamic Stochastic General Equilibrium. 116
- EBU** European Banking Union. vii, 22, 28
- EC** European Commission. 22
- ECB** European Central Bank. 27, 47
- EFS-27** European Financial Systems. 22–25, 31, 36, 68
- EMU** Economic and Monetary Union. 22, 68
- EONIA** Euro OverNight Index Average. 46, 54
- EU** European Union. vii, viii, xv, 22–33, 41, 49, 54–56, 58, 60, 61, 64, 69, 98
- FE** Fixed-Effects. 98
- FFCO** Financial Fragility Crowding Out. 35, 55, 61, 68, 72, 108
- G-10** Group of Ten. 42
- G-SIBS** Global Systemically Important Banks. 57, 89, 92
- GDP** Gross Domestic Product. 47–49, 96, 97, 100, 103
- GFC** Global Financial Crisis. 22, 23, 29, 41–44, 48, 56, 72, 84, 88
- GFDD** Global Financial Development Database. 25, 29, 37, 38, 43, 45, 46, 53, 56, 60
- GMM** Generalized Method of Moments. 98
- HQLA** High Quality Liquid Assets. 44
- IFRS** International Financial Reporting Standards. 91
- ILG** Individual Liquidity Guidance. 73, 89
- IMF** International Monetary Fund. 96
- IQR** Interquartile Range. 64
- LA** Liquid Assets. 75
- LCR** Liquidity Coverage Ratio. 18, 43, 44, 72, 73, 78, 88, 89, 100
- LR** Leverage Ratio. 29, 72

- LRR** Liquidity Requirement Ratio. 79
- M&As** Mergers and Acquisitions. 74, 93
- MNI** Marge Net d'Intérêt. 14, 15, 111
- MSU** Mécanisme de Supervision Unique. 9
- NBFI** Non bank financial institutions. 27, 37
- NE** Northern European countries. 25, 29, 30, 33, 60
- NIM** Net Interest Margin. 32, 33, 81, 83, 84
- NPL** Non Performing Loans. 45, 53, 92, 96, 98, 100
- NSFR** Net Stable Funding Ratio. vi, viii, 16, 18, 22, 27, 30, 32, 37, 43, 44, 53, 72, 73, 78–80, 88, 89, 91, 92, 110, 112, 113
- OECD** Organisation for Economic Co-operation and Development. 96
- OI** Organisation Industrielle. 13
- OLS** Ordinary Least Squares. 52
- Outside** Outside European countries. 25
- PIB** Produit Intérieur Brut. 5, 8, 17, 19, 109
- RAC** Risk Absorption Capacity. 36, 56, 72, 76
- RASF** Required Amount of Stable Funding. 44, 79
- ROA** Return on Assets. 7, 18, 93
- RSF** Required Stable Funding. 44, 78, 79
- RWA** Risk Weighted Assets. 29, 35, 47, 77, 94, 108
- S&L** Savings and Loan. 80
- SE** Southern European countries. 25, 27, 29, 30, 33
- SIIs** Systemically Important Institutions. viii
- T1** Tier 1 Capital Ratio. 94

## List of Acronyms

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**TCR** Total Capital Ratio. 76, 77, 93, 94

**TFE** Time Fixed-Effects. 52

**UB** Union Bancaire. 4, 5, 116

**UBE** Union Bancaire Européenne. v, 5, 9, 11, 110

**UE** Union Européenne. v, vi, 4–10, 12, 13, 16, 19, 46, 107, 108, 110, 112, 113, 115, 116

**UEM** Union Economique et Monétaire. 4–6, 109, 110, 114–117

**UK** United Kingdom. 25–27, 47, 73, 88, 89

**UMC** Union des Marchés des Capitaux. 8, 10

**UMP** Unconventional Monetary Policies. 30, 96

**US** United States. 45, 89, 90

**VaR** Value at Risk. 77, 79

**WB** World Bank. 25, 37, 47

**WE** Western European countries. 24–26, 29, 31, 34

**WEO** World Economic Outlook. 96

# 1 Introduction générale

## 1.1 Question de recherche : Régulation bancaire et développement financier

En 2013, la Banque Mondiale démarrait une série de rapports intitulés *Global Financial Development Report* dont l'objectif est de promouvoir une croissance économique durable par le développement des systèmes financiers. Les différentes publications de ces rapports- du premier "*Rethinking the Role of the State in Finance*" (2013) au dernier en date "*Bank Regulation and Supervision a Decade after the Global Financial Crisis*" (2019)- soulignent le besoin de fonder une nouvelle approche de la régulation bancaire. Ces travaux mettent l'accent sur l'importance du binôme développement financier et stabilité financière.<sup>1</sup> La crise financière mondiale de 2007-2009 et ses conséquences ont montré que le développement des systèmes financiers s'est réalisé aux dépends de la stabilité financière.

D'un point de vue normatif, cette crise a complètement bouleversé la manière avec laquelle les politiques de régulation et donc, les modalités d'intervention de l'Etat doivent-être pensées. L'objectif de développement économique d'un pays ne peut plus être défini par un ensemble de mesures financières favorisant l'augmentation de la profondeur des systèmes financiers uniquement. Cet objectif doit aujourd'hui

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<sup>1</sup>De manière simple, nous retiendrons que le développement financier correspond à l'ensemble des contributions des systèmes et instruments financiers visant à améliorer le financement de l'économie. Le lecteur peut se référer à Cihak et al. (2012) pour une définition large du développement financier. La stabilité financière peut se définir de deux manières. Premièrement, elle peut correspondre à la capacité des systèmes financiers à ne pas recontrer d'altération de leur fonction de financement. Deuxièmement, cette stabilité peut s'illustrer par la capacité de ces mêmes systèmes à absorber un choc de nature endogène ou exogène. On parle alors de "résilience" des systèmes financiers. Le lecteur pourra se référer également à la définition donnée de la Banque Mondiale sur <https://www.worldbank.org/en/publication/gfdr/gfdr-2016/background/financial-stability>.

## Chapter 1. Introduction générale

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être nourri d'une profonde réflexion tenant compte des désordres économiques et financiers que pourraient engendrer une telle augmentation.

La crise financière mondiale a montré que la stabilité des systèmes financiers ne va pas nécessairement de pair avec la profondeur financière.<sup>2</sup> Ainsi, la stabilité constituerait une dimension à part entière et le régulateur devrait l'intégrer comme paramètre supplémentaire autour de laquelle la politique de régulation s'articulerait.<sup>3</sup> Les réformes financières résulteraient d'un arbitrage tenant compte de l'instabilité financière induite par une augmentation de la taille des marchés.<sup>4</sup> Le régulateur fait face à un dilemme. Adopter un cadre de régulation plutôt qu'un autre correspond à un partage entre gain de croissance économique et perte de stabilité financière et la politique de régulation apparaît comme un instrument authentique de ce partage.<sup>5</sup> La régulation, insuffisante ou mal coordonnée, favoriserait certes la profondeur des systèmes financiers mais aussi l'adoption d'une prise de risque excessive des institutions financières menaçant ainsi la stabilité financière et économique d'un pays, comme on l'a observé en 2008. En revanche, des mesures trop contraignantes mettraient probablement à mal le rôle premier des institutions financières –financer l'économie réelle– et provoqueraient des effets délétères sur l'économie.<sup>6</sup>

Les enjeux de croissance économique et de stabilité financière ne peuvent être abordés sans tenir compte du rôle fondamental des institutions financières, en particulier des banques. Rappelons que l'activité première d'une banque consiste à collecter des dépôts et à octroyer des crédits, nécessaires au financement de l'économie réelle. Parmi les comportements ayant mis à mal la croissance économique et la stabilité financière en 2008, nous noterons la construction de modèles bancaires trop axés sur la ressource de marché de court-terme du marché interbancaire.<sup>7</sup> Ce cas est très problématique pour les banques, engagées traditionnellement dans un processus

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<sup>2</sup>La profondeur financière correspond à la taille des systèmes financiers. Le lecteur pourra se référer à Cihak et al. (2012) pour une définition plus exhaustive.

<sup>3</sup>Dans cette thèse, nous définissons la politique de régulation comme les modalités d'intervention de l'Etat dont le subtil objectif est de promouvoir la stabilité financière sans toutefois compromettre la fonction première des institutions financières: financer l'économie.

<sup>4</sup>La littérature académique s'est aussi orientée vers ce type de questionnement. Voir par exemple, Arcand et al. (2015)

<sup>5</sup>Concevoir la régulation est une tâche complexe pour le superviseur. Sous la contrainte de ne pouvoir connaître le meilleur modèle, i.e modèle pour lequel la stabilité financière et la croissance économique sont maximales, le régulateur se trouve contraint de choisir un second best parmi toutes les régulations possibles.

<sup>6</sup>Cette approche de la régulation et plus généralement de la politique financière n'est pas nouvelle. Les modèles de répression financière proposaient déjà un tel cadre de réflexion. Pour plus de détails, voir par exemple Darreau (2003).

<sup>7</sup>Le lecteur pourra se référer à Dewatripont et al. (2010) et Vives (2016) pour une contextualisation de la crise financière.



## 1.1. Question de recherche : Régulation bancaire et développement financier

de transformation des échéances et suscite l'intérêt du régulateur.<sup>8</sup> Les banques transforment des passifs de courte échéance en actifs de long-terme induisant ainsi un risque de maturité. Un des épisodes les plus marquants de la crise financière de 2008 a été le gel du marché interbancaire américain et des conséquences qui ont suivi. Cet épisode a illustré la nécessité de tenir compte de la liquidité d'un établissement bancaire et a souligné les limites du cadre de régulation alors mis en place.

Il apparaît que les modèles de régulation internationale d'avant crise étaient davantage structurés autour du concept de solvabilité de l'établissement bancaire que de sa liquidité. L'architecture Bâle III est en ce sens novatrice car elle légitime par la création de standards de liquidité la nécessité de prendre en compte à la fois la solvabilité et la liquidité d'un établissement bancaire. Notons que la liquidité telle que définie dans ce cadre prudentiel promeut la construction de modèles bancaires davantage tournés vers l'intermédiation, i.e. octroyer des crédits et collecter des dépôts, qui reste la fonction première d'une banque dans une économie.

La mise en oeuvre d'un régime réglementaire construit autour de standards de capital et de liquidité soulève de nombreuses questions quant à son impact à la fois en termes de croissance économique (offre de prêt des banques) et de stabilité financière (solvabilité et liquidité saines des institutions bancaires). A titre d'illustration, la matrice ci-dessous illustre la complexité de la relation entretenue entre solvabilité et liquidité et montre dans quelles configurations les différentes conceptions de régulation de Bâle s'inscrivent.

	Solvable	Insolvable
Liquide	Liquide et solvable Bâle III	Liquide et insolvable
Illiquide	Illiquide et solvable Bâle I et II Crise financière de 2008	Illiquide et insolvable

Bien que sous cet aspect, nous abordons une approche essentiellement microéconomique de la régulation du secteur bancaire, il faut toutefois en comprendre les enjeux macroéconomiques et très précisément à travers l'offre de crédit. Comme souligné précédemment, la première utilité économique d'une banque est de financer l'économie réelle. Compte tenu de la complexité de la relation capital-liquidité, l'adoption du régime Bâle III pose question quant à son impact sur le comportement bancaire et en particulier sur l'offre de prêt de la banque. La littérature traitant de

<sup>8</sup>Le risque de transformation de maturité compte à ce titre parmi les justifications de la régulation du secteur bancaire. Pour de plus amples détails, voir par exemple Freixas and Rochet (2008).

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l'impact des standards internationaux sur le comportement bancaire n'est pas nouvelle. Une importante production scientifique s'est établie déjà à l'instauration de Bâle I. Les contextes dans lesquels cette littérature s'est développée sont à ce titre tout à fait intéressants à étudier. L'instauration de Bâle I est intervenue peu avant la récession de l'économie américaine du début des années 90. Les conditions financières, et particulièrement l'hypothèse d'un rationnement des crédits "*Credit Crunch*" ont été parmi les facteurs avancés dans la littérature pouvant expliquer la sévérité de cette crise.<sup>9</sup> De manière analogue, ce type de question s'est aussi posée dans le contexte de 2008.<sup>10</sup> D'une part parce que les standards en capital sont plus importants. D'autre part, parce que l'adoption de standards de liquidité au niveau international est nouvelle et donc peu connue du secteur bancaire. Les chapitres 3 et 4 contribuent à nourrir ce débat en étudiant l'hypothèse d'un *credit crunch* pour le cas européen.

Notre lecture de ces enjeux de croissance économique et de stabilité financière est abordée sous l'angle du développement financier. En particulier, nous nous interrogeons sur la légitimité de prendre en compte le paramètre de développement financier dans la conception de la régulation. Nous étudions plus précisément la modalité selon laquelle le calibrage des instruments de capital et de liquidité est dépendant du niveau de développement financier d'une économie donnée. L'intuition suggère que plus un système bancaire est profond, plus les instruments de capital et de liquidité doivent être forts pour assurer la stabilité financière.

A ce titre, l'UE constitue un excellent sujet d'étude. Premièrement, son originalité tient en l'appartenance des pays membres à une Union Economique et Monétaire (UEM) et requiert de l'objectif de stabilité financière qu'il s'inscrive parmi ceux de convergence économique et financière déjà établis à la création de l'UEM. Dans ce contexte, on comprend tout le poids d'une bonne politique de régulation qui consiste à assurer la stabilité financière sans compromettre les objectifs d'une croissance économique et d'une intégration financière durables.

Deuxièmement, le modèle de régulation post-crise de l'UE fait partie intégrante d'un corpus de lois et de règles applicables à tout établissement de crédit de l'UE et a été institué à la création de l'Union Bancaire (UB). La mise en oeuvre de normes communes de fonds propres et de liquidité à l'ensemble des entités bancaires des pays membres de l'UE est comprise dans le premier pilier de l'UB. La définition de ces règles est en grande partie empruntée au dispositif Bâle III proposé par le Comité de Bâle et vise à promouvoir un système bancaire et financier plus résilient aux chocs tels qu'observés en 2008. Ces normes font l'objet d'une transposition en droit européen

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<sup>9</sup>Le lecteur pourra se référer à Berger and Udell (1994) pour une étude sur la relation du standard de Bâle et de l'hypothèse de *Credit Crunch*.

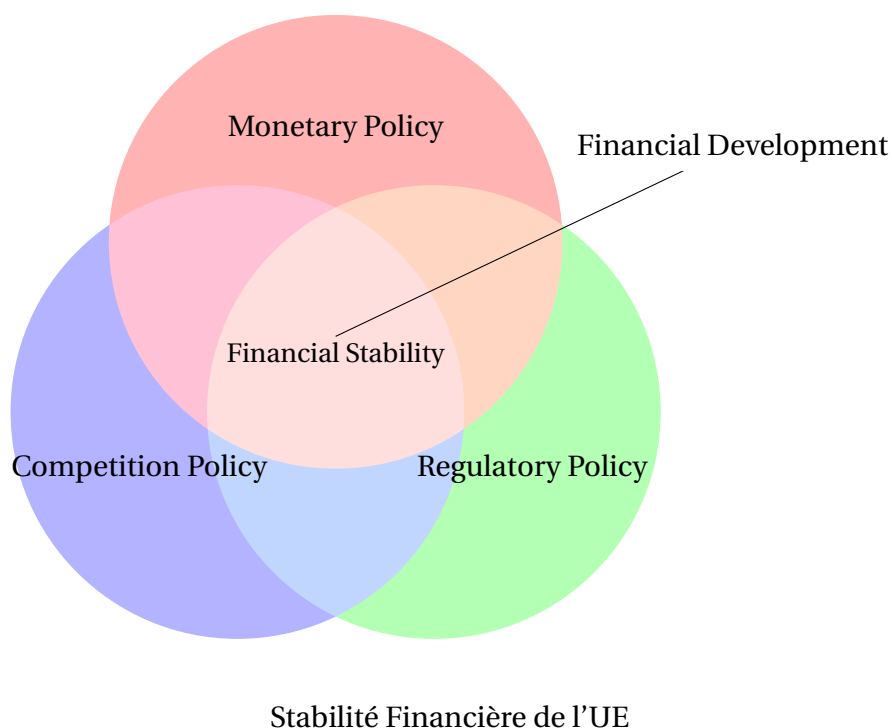
<sup>10</sup>Voir par exemple Mizen (2008).

## 1.1. Question de recherche : Régulation bancaire et développement financier

sous la directive Capital Requirements Directive (CRD IV).<sup>11</sup>

Troisièmement, les systèmes bancaires et de façon générale, les systèmes financiers des pays membres de l'UE sont très hétérogènes dans leur dimension transversale. Par exemple, la taille du secteur bancaire allemand, mesuré en % du Produit Intérieur Brut (PIB), représentait presque deux fois le secteur bancaire lituanien en 2017.

Le graphique ci-dessous présente la lecture donnée des enjeux de stabilité financière dans l'UE. Nous retenons trois politiques pouvant influencer sur la dynamique de la stabilité financière auxquelles s'ajoute la prise en compte du développement financier.



<sup>11</sup>Le projet d'UBE correspond à une réponse coordonnée des institutions européennes aux conséquences du choc économique et financier de 2008 en zone Euro. C'est en juin 2012, au sommet de la zone Euro et en étroite collaboration avec les Présidents de la Commission Européenne, de la Banque Centrale Européenne (BCE) et de l'Eurogroupe, que le Président du Conseil Européen, Herman Van Rompuy, publie un rapport intitulé "Towards a genuine economic and monetary union" dans lequel le projet d'UB née. En décembre 2012, le Conseil Européen établit une feuille de route en ligne avec les objectifs fixés dans le rapport de juin 2012 et dans laquelle l'existence de l'UB est matérialisée. La création de l'UBE est une innovation institutionnelle sans précédent et un exemple d'outil pour assurer la stabilité financière de l'UEM. L'architecture de cette UB se compose de trois piliers. A savoir, un mécanisme de supervision unifié, un schéma commun de résolution des crises et un dispositif européen de garantie des dépôts. Le lecteur pourra se référer à Chalmers et al. (2019) et Perrut (2012) pour une présentation de l'UBE.

Cette différence de taille des systèmes financiers, confrontée à la mise en oeuvre de standards en capital et liquidité uniques met en lumière les enjeux de croissance économique et de stabilité financière dans l'UE. Compte tenu de l'analyse que nous avons précédemment établie, la mise en oeuvre d'un ensemble de règles communes confrontées à des systèmes bancaires très diversifiés au sein d'une même UEM peut-il constituer la meilleure réponse des institutions européennes?

Cette problématique ainsi définie constitue le fil directeur de cette thèse. Nous tentons d'y répondre en trois chapitres. Nous évaluons au chapitre 2 l'impact de la capitalisation et de la liquidité des systèmes bancaires sur leur développement. Notre objectif est de soulever les principales implications de la mise en oeuvre d'un modèle de régulation unique à la fois articulé autour de règles en capital et de liquidité sur le développement bancaire. Cette étude nous paraît importante au regard des objectifs fixés de convergence économique et financière au niveau européen. Au chapitre 3, nous construisons une théorie positive du comportement bancaire sous un régime à la Bâle III. Dans la mesure où l'introduction de standards de liquidité à l'échelle internationale est relativement nouvelle, il convient de s'interroger sur la nature de ce régime prudentiel où coexistent standards de capital et de liquidité et de son impact sur le comportement de la firme bancaire. Enfin, au chapitre 4, nous testons la validité de cette théorie et mesurons l'importance que peut revêtir le développement financier sur le comportement bancaire particulièrement pour l'UE.

## 1.2 Chapitre 2: Does one rule fit all? Banking regulation in Europe

Dans ce chapitre, nous étudions de manière empirique l'impact de la capitalisation et de la liquidité des systèmes bancaires de l'UE sur leur développement. Premièrement, nous illustrons l'hétérogénéité des systèmes financiers des pays membres de l'UE pour la période 2000-2017. Ceci est rendu possible par les développements statistiques entrepris depuis les travaux de Cihak et al. (2012). Cette approche du développement financier est tout à fait intéressante car elle incite tant le chercheur que le régulateur à concevoir le développement financier sous sa forme multidimensionnelle (profondeur, accès, efficience et stabilité); cohérente avec la conception de la régulation que nous avons définie précédemment. La première partie (analyse descriptive) constitue les faits stylisés du secteur financier européen avec un regard particulier sur le système bancaire.<sup>12</sup> Nous montrons que l'hétérogénéité ne semble

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<sup>12</sup>Malgré l'émergence et le poids croissant d'institutions non-financières dans le financement de l'économie des pays membres, le système bancaire tient encore une place importante. Le lecteur trouvera dans Beck (2012) une lecture plus complète à ce sujet. De plus, à l'appui de l'étude sur le

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pas s'illustrer uniquement en matière de profondeur financière. En effet, l'efficacité et la stabilité sont autant de dimensions et donc de paramètres à prendre en compte pour définir le modèle de régulation des pays membres.<sup>13</sup>

Ces premiers résultats établis, nous utilisons l'outil économétrique pour évaluer dans quelle mesure cette hétérogénéité peut constituer un frein aux objectifs établis de convergence économique et de stabilité financière. Le modèle économétrique défini dans cette étude correspond à une équation d'offre de crédit dont les déterminants sont définis à la croisée de la littérature bancaire et du développement financier. Ces déterminants sont censés refléter les conditions d'offre des différents marchés de crédit des pays membres de l'UE. Le poids des banques, et donc du financement intermédié restant important en Europe, l'étude des déterminants ayant trait à l'offre de crédit permettra d'apprécier davantage la relation crédit-croissance économique entretenue en Europe.

Le modèle économétrique utilisé dans cette étude traduit une relation statistique au niveau agrégé et ne doit donc pas être confondu avec les modèles d'offre de crédit établis au niveau microéconomique qui correspondent à une équation d'offre comportementale.<sup>14</sup> En effet, le modèle retenu exprime la quantité de crédits produits par le système bancaire d'une économie compte tenu d'une part, des caractéristiques propres des banques et du secteur et d'autre part, de l'environnement économique donné.

Nous distinguons les déterminants en trois niveaux. Premièrement, nous les sélectionnons à l'échelle microéconomique. La littérature retient en particulier les niveaux de capitalisation et de liquidité -variables d'intérêt dans notre étude- les modèles de rentabilités des banques principalement mesurés par le *Return on Assets (ROA)* et la qualité des prêts bancaires (mesuré par le ratio de prêts non-performants).

Deuxièmement, nous retenons les variables ayant trait aux caractéristiques mésoéconomiques de la banque. La concentration bancaire et plus généralement la concurrence constitue un instrument de choix dans la politique d'intégration financière. De plus, comme illustré dans Vives (2016) et Fungáčová et al. (2014), la concentration et la concurrence sont des éléments clés de la stabilité financière et de l'efficacité de

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développement financier publié par le BCE en mars 2020, le système bancaire opère une restructuration importante justifiant ainsi son étude.

<sup>13</sup>L'efficacité et la stabilité sont deux dimensions qui ne sont pas indépendantes l'une de l'autre. Nous illustrons ce point dans le chapitre 3 en intégrant dans un modèle d'affaires les contraintes réglementaires Bâle III.

<sup>14</sup>Ces équations reflétant les conditions d'offre de crédit au niveau microéconomique sont tirées de modèles d'ajustement de bilan. Le lecteur pourra se référer à Jackson et al. (1999) et BCBS (2016) pour une excellente revue de la littérature.

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la politique monétaire de l'UE. Nous incluons aussi la taille des marchés financiers dans la mesure où celle-ci correspond à un outil stratégique d'intégration financière dans l'UE.<sup>15</sup> Nous tenons compte aussi du financement externe des économies dans la mesure où les économies d'Europe de l'Est membres de l'UE restent fortement dépendantes de cette composante.

Enfin, nous retenons deux déterminants d'ordre macroéconomique et financier. Tout d'abord, la conduite de la politique monétaire apparaît comme un facteur clé de la quantité de crédit disponible dans l'économie.<sup>16</sup> Deuxièmement, la prise en compte de la croissance économique, mesurée par le PIB permet usuellement de tenir compte de la demande de crédit, nous contrôlons cette dernière par une mesure du développement économique (PIB par tête).

Nos résultats sont multiples. Premièrement, les variables d'intérêt- le capital et la liquidité- sont des déterminants importants du développement bancaire et ce quelque soit la spécification proposée. Nous trouvons que la relation positive du capital au prêt (solidement ancrée dans la littérature micro empirique) n'est plus vérifiée au niveau agrégé. Au contraire, nous trouvons un impact négatif. Ce résultat n'est pas surprenant et peut s'expliquer par un ensemble d'hypothèses établies dans Berger and Bouwman (2009). En particulier, deux corps d'hypothèses s'opposent dans la littérature pour illustrer la relation du capital au prêt. La première se réfère à l'hypothèse "*financial fragility-crowding-out*" pour laquelle le capital peut limiter la création de liquidité bancaire soit par un mécanisme de fragilité financière intrinsèque à la banque, soit par un mécanisme d'éviction des dépôts.<sup>17</sup> Le second corps théorique se réfère à l'hypothèse "*risk absorption*". Les banques tenant une position forte en capital sont aussi celles présentant une capacité d'absorption des risques plus importante. Ainsi, de fortes positions en capital doivent être associées à une création de liquidité et donc une offre de crédit plus importante.

Dans son expression la plus simple, le modèle d'offre de crédit tend à soutenir l'hypothèse "*financial fragility-crowding-out*" pour les systèmes bancaires de l'UE. L'élaboration d'un modèle économétrique plus complexe incluant un terme d'interaction montre que capital et dépôts apparaissent plutôt comme substitués et non complé-

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<sup>15</sup>L'Union des Marchés des Capitaux (UMC) initiée par la Commission Juncker en est une parfaite illustration.

<sup>16</sup>Cette relation est établie à travers le canal du crédit bancaire. Le lecteur pourra se référer à Agénor (2019) pour de plus amples détails.

<sup>17</sup>Bien que la liquidité bancaire au sens de Berger and Bouwman (2009) ne corresponde pas à la liquidité telle que définie dans cette thèse, l'impact du capital sur le prêt reste négatif si l'on s'en tient à ce corps théorique. Le lecteur peut se référer à Kim and Sohn (2017) pour une justification. Pour une compréhension des mécanismes de fragilité financière et d'éviction des dépôts, le lecteur pourra se référer à Berger and Bouwman (2009), Diamond and Rajan (2000) et Gorton and Winton (2017).

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ments confortant plus précisément l'hypothèse d'éviction des dépôts par le capital en UE. Cependant, cette interprétation doit rester mesurée d'une part, parce-qu'elle est tirée d'un cadre de réflexion microéconomique et d'autre part parce que l'usage de la métrique du capital par les risques (*risk-based*) au niveau agrégé pose question.<sup>18</sup>

Ce résultat montre aussi que la relation du capital au prêt au niveau macroéconomique ne correspond pas à la simple agrégation des comportements microéconomiques. Ainsi, l'importance accordée à la dimension macroprudentielle dans le dispositif Bâle III et la directive CRD IV apparaît pleinement justifiée.

La relation des dépôts aux crédits - d'intérêt particulier dans un dispositif de type Bâle III - est positive et toujours significative. Contrairement au capital, la relation apparaît robuste lors du passage au niveau macroéconomique. Comme attendu, nous trouvons que l'activité de collecte de dépôts impacte positivement le développement bancaire. Plus le secteur bancaire a une base solide en dépôts clients, plus sa taille est à même d'augmenter.

La concentration bancaire et la taille des marchés financiers apparaissent comme les mésodéterminants les plus importants. Les résultats montrent que plus un secteur bancaire est concentré, et plus l'offre de crédit augmente. Ce résultat est alertant en termes de stabilité financière. La relation statistique entre concentration et développement bancaire peut toutefois traduire une relation en niveau. La production de crédits bancaires dans l'UE serait ainsi essentiellement conduite par les grands groupes bancaires présents en Europe. Ce résultat ne serait pas surprenant dans la mesure où le système bancaire de l'UE est caractérisé par l'existence de grands groupes bancaires dont l'importance des bilans pose problème pour le régulateur.<sup>19</sup> Dans ce cadre, l'instabilité financière endogène à l'accroissement du système bancaire tiendrait à la qualité du portefeuille des actifs de ces institutions.<sup>20</sup> Ainsi, des mesures disciplinantes, incitant les institutions bancaires à réaliser pleinement leur fonction de monitoring et de screening apparaissent essentielles. Les mesures d'intégration financière visant à promouvoir une meilleure couverture des services financiers par la concurrence apparaissent aussi comme stratégiques pour diminuer ce risque. La taille des marchés impacte positivement le développement bancaire. L'adoption de structures financières beaucoup plus équilibrées tendrait à diversifier les sources de financement des agents en besoin de financement et constituerait une stratégie

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<sup>18</sup>Ce point sera discuté plus en détails dans le chapitre 2.

<sup>19</sup> Parmi les réformes post-crise dans UE et au sein du pilier de Mécanisme de Supervision Unique (MSU) de l'UBE, les banques totalisant un actif de plus de 30 milliards d'euros font l'objet d'une supervision de la BCE. Le lecteur pourra se référer à <https://www.bankingsupervision.europa.eu/banking/list/criteria/html/index.en.html> pour une explication détaillée.

<sup>20</sup>Nous trouvons dans nos tests de robustesse que le coefficient de ratio de prêts non performants est hautement significatif.

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intéressante pour accroître la stabilité financière. Ce résultat est en ligne avec les mesures justifiant l'UMC au sein de l'UE.

Enfin, les déterminants macroéconomiques (politique monétaire et développement économique) contribuent fortement au développement financier. Leurs impacts respectifs sont de signe attendu et correspondent à ceux trouvés dans la littérature bancaire. Comme montré dans les récents travaux d'économie monétaire, la politique monétaire couplée avec des mesures macroprudentielles peut constituer un instrument intéressant de promotion de la stabilité financière.<sup>21</sup>

Les faits stylisés étudiés en section 2.2 suggèrent de prendre en compte la dimension régionale de l'échantillon. Dans cette étude, nous ciblons en particulier les pays membres de l'UE appartenant à l'Europe de l'Est. Nous justifions ce choix à plusieurs titres. Premièrement, les pays membres d'Europe de l'Est ont fait l'objet du processus de convergence économique et financière et s'inscrivent pour la plupart dans la politique d'intégration financière menée par l'UE. Ainsi, nous étudions dans quelle mesure l'usage des instruments en capital et liquidité peut impacter leur développement bancaire et constituer une stratégie supplémentaire à la réussite des objectifs de convergence.<sup>22</sup> Deuxièmement, la stabilité financière a constitué et reste encore un enjeu de première importance pour ces économies.<sup>23</sup> De manière analogue au premier argument, il semble donc tout aussi important d'étudier les enjeux de la mise en oeuvre d'un cadre de régulation unique pour ces pays. Enfin, les différentes spécifications économétriques montrent que ce groupe de pays présente des caractéristiques bien spécifiques ayant trait aux enjeux de régulation bancaire et de développement financier.

Nos résultats tendent à confirmer le caractère hétérogène des systèmes financiers présentés dans la partie descriptive. Nous trouvons que la région économique est un facteur important du développement bancaire. Ainsi, un cadre réglementaire unique entraînerait un développement bancaire à plusieurs vitesses. Les pays membres de la région d'Europe Centrale et de l'Est présentent des spécificités particulières par rapport aux autres régions de l'UE et dont il faut tenir compte pour le développement bancaire. Ces spécificités tendent à freiner le développement bancaire qui combinées aux positions en capital et/ou dépôts accentuent ce ralentissement. En particulier, nous trouvons que pour cette région économique, l'effet d'éviction des dépôts par le capital serait renforcé et que la contribution positive des dépôts au développement bancaire est moindre.

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<sup>21</sup>Voir par exemple Agénor (2019).

<sup>22</sup>Une étude complétant ce sujet peut se retrouver dans IMF (2013).

<sup>23</sup>Le lecteur pourra se référer à l'initiative de Vienne pour une description très précise de cet enjeu: <https://www.ebrd.com/what-we-do/sectors-and-topics/vienna-initiative.html>.



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En conclusion de cette étude, nous trouvons que la capitalisation et la liquidité des systèmes bancaires importent quant à la détermination du niveau de développement bancaire.

Par conséquent, la construction de règles axées autour de la capitalisation et de la liquidité et telle que mise en oeuvre au sein du premier pilier de l'UBE constitue un instrument authentique de développement financier et de stabilité financière. Ces règles s'intègrent pleinement dans une stratégie globale visant à satisfaire les objectifs de convergence économique et financière.

En termes de recommandations de politique économique, une augmentation simple du ratio de capitalisation peut apparaître comme une première réponse pour freiner le développement bancaire suspecté d'instabilité financière. Cependant, cette mesure ne pourrait pas constituer la meilleure réponse des autorités prudentielles pour remplir l'objectif de stabilité financière et ce pour plusieurs raisons.

Premièrement, comme les résultats l'ont montré, cette augmentation produirait probablement des ralentissements du développement bancaire à plusieurs vitesses. Les résultats obtenus dans le chapitre 2 suggèrent que les effets produits par l'instrument de capitalisation sont plus importants pour les systèmes financiers d'Europe de l'Est. A un degré inférieur, il est de plus probable qu'une augmentation du ratio de capitalisation produise des effets multiples sur l'offre de crédit tant le tissu bancaire européen est diversifié. Nos résultats empiriques suggèrent que le mécanisme à l'oeuvre du ralentissement du développement bancaire pourrait être un effet d'éviction des dépôts par le capital au sein des systèmes financiers européens. Compte tenu de l'arbitrage croissance économique-stabilité financière que nous avons établi plus haut, cette modalité d'intervention apparaît comme contre-productive dans la mesure où les gains de croissance économique ne seraient pas assurés et l'instabilité financière probable de par le développement de structures bilancielle très déséquilibrées. Cette recommandation reste toutefois relative tant le mécanisme d'éviction reste à confirmer.

Deuxièmement, la mise en oeuvre d'instruments de régulation calibrés en fonction du niveau de développement bancaire ou financier peut aussi poser un problème technique et de politique économique. Si cette modalité de régulation peut sembler opportune pour freiner le développement bancaire lorsque celui-ci est générateur d'instabilité financière, il reste difficile de la légitimer dans la mesure où obtenir la taille optimale du système financier de ces économies est une tâche complexe pour le régulateur. De plus, renforcer les positions en capital et de liquidité d'un système vis-à-vis d'un autre peut apparaître non optimal au sens de Pareto. Ce type de politique semble ne pas rentrer non plus en cohérence avec la direction générale proposée par

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les politiques européennes "*the level playing field*".

Des corps de régulation différents peuvent provoquer des avantages comparatifs et induire des comportements non souhaités des agents économiques correspondant à des effets de distorsion de la politique de régulation pouvant compromettre la stabilité financière.

L'instabilité financière endogène à l'accroissement du système bancaire porterait bien plus sur la qualité du portefeuille d'actifs contenu au bilan des banques que sur l'adoption d'un modèle de régulation unique. La réponse des autorités européennes en vue de satisfaire à l'objectif de convergence économique et de stabilité financière des économies moins développées peut se trouver dans la littérature d'économie du développement.<sup>24</sup> Ainsi, la qualité de la construction institutionnelle (l'application de la loi bancaire par exemple) et la construction de normes incitant à générer des structures financières plus équilibrées peuvent constituer des pistes à une plus grande promotion du processus de convergence économique et de stabilité financière.

Nos contributions sont nombreuses. Premièrement, nous illustrons la complexité de la relation du capital à l'offre de prêts. Nos résultats soutiennent les études soulignant l'impact négatif de la capitalisation bancaire sur l'offre de crédit au contraire de la plupart des travaux micro empiriques. Cependant, ils doivent rester mesurés tant la mesure du capital au niveau agrégé peut poser problème comme souligné précédemment. La contribution porterait ainsi sur la nécessité de prendre en compte la dimension macroprudentielle car le comportement macroéconomique des entités bancaires ne semble pas correspondre à la simple somme des comportements microéconomiques. Ainsi, l'adoption du dispositif Bâle III en vue de satisfaire aux objectifs de stabilité financière et de croissance économique apparaît pleinement justifié pour l'UE.

Deuxièmement, nous trouvons que la région économique est un déterminant important du développement bancaire. Les économies des pays membres de l'UE présentent donc des spécificités particulières selon la région à laquelle ils appartiennent. Ce paramètre paraît important à prendre en compte pour assurer l'objectif de développement bancaire. Au regard de l'importance du binôme développement financier et stabilité financière que nous avons établie précédemment, la prise en compte de la région économique dans la politique de régulation apparaît comme une réponse aux objectifs fixés de convergence économique et de stabilité financière mais difficile à mettre en oeuvre. Cependant, la promotion d'une plus grande qualité institutionnelle pour les pays membres de l'Europe de l'Est semble constituer une

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<sup>24</sup>Le lecteur pourra à ce titre se référer à Laffont et al. (2005).

### 1.3. Chapitre 3: Assessing the impact of Basel III on bank behavior: A micro-founded approach

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stratégie intéressante pour satisfaire ces objectifs.

Les instruments de régulation tels que les règles en capital et de liquidité restent de première importance pour assurer la stabilité financière. Si l'adoption du modèle de régulation consistant à adapter ces normes en fonction du niveau de développement financier peut apparaître comme le modèle de régulation de premier rang, sa mise en oeuvre s'avère complexe. Ainsi, le cadre d'adoption visant à établir un ensemble de règles communes apparaît comme un "*second-best*".

L'adoption du cadre Bâle III en Europe reste unique en ce sens où la cohabitation de règles en capital et de liquidité reste nouvelle dans l'histoire de la régulation bancaire. De manière générale, il semble donc important d'en étudier son impact sur le comportement bancaire. Ce sujet fait l'objet des chapitres 3 et 4.

### 1.3 Chapitre 3: Assessing the impact of Basel III on bank behavior: A micro-founded approach

Dans ce chapitre, nous construisons une théorie positive du comportement bancaire. Notre objectif est de comprendre les implications d'une réglementation à la fois articulée autour de règles en capital et de liquidité au niveau de la firme bancaire. Nous empruntons l'approche de l'Organisation Industrielle (OI) pour traiter cette problématique. Cette approche permet de tenir compte d'une part, de la pression induite par le marché (pression concurrentielle). Ceci nous paraît fondamental dans la mesure où la concurrence constitue un outil authentique d'intégration financière au sein de l'UE et occupe une place importante parmi les politiques européennes qui n'est pas sans conséquence pour la stabilité financière<sup>25</sup>. D'autre part, ce cadre nous permet aussi de tenir compte de la pression induite par la régulation. Nous dérivons très précisément notre modèle du cadre monopolistique tel que présenté dans Freixas and Rochet (2008).

La littérature empirique analysant l'impact de la régulation sur le comportement bancaire est très prolifique depuis l'adoption des premiers accords de Bâle en 1988. Un important corps empirique s'est établi autour de ce sujet mais peu d'études proposent un cadre théorique<sup>26</sup>. Les travaux intégrant le rôle de la liquidité restent en

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<sup>25</sup>Le lecteur pourra se référer à Vives (2016) pour apprécier les enjeux d'une telle relation.

<sup>26</sup>La littérature traitant de ce sujet restait balbutiante avant l'adoption des premiers standards internationaux. Elle se construisait autour de mesures prises au niveau national essentiellement. Les premiers accords de Bâle, dont l'objectif était de promouvoir la stabilité financière et limiter le jeu de concurrence réglementaire des différents pays par l'harmonisation de standards bancaires, ont donné lieu à l'intérêt d'étudier l'impact de la réglementation sur le comportement bancaire.

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comparaison peu développés, probablement du à l'adoption récente de standards internationaux sur la liquidité. Nous contribuons donc à cette littérature en proposant une théorie micro-fondée du comportement de la banque dans un environnement à la Bâle III.

Une des difficultés sur le plan théorique consiste à définir de quelle manière nous intégrons la réglementation prudentielle dans notre modèle. Nous adoptons la régulation par les coûts telle que développée dans Ito and Sasaki (1998). Le régulateur a deux approches pour atteindre l'objectif de stabilité financière. Premièrement, il peut assigner une quantité de crédits produits par le système bancaire. C'est l'approche par les quantités. Elle apparaît cependant limitée en ce sens où le régulateur doit connaître toute l'information disponible pour déterminer avec précision la quantité de crédit optimale du système bancaire. Deuxièmement, le régulateur ne peut fonder un tel modèle et les contraintes réglementaires apparaissent comme des coûts que la banque doit intégrer. C'est l'approche de la régulation par les coûts. Nous stipulons que la banque y répond précisément par des mécanismes d'ajustement de bilan. Les contraintes réglementaires prendront donc la forme de coûts dépendant eux-mêmes des ratios (capital et liquidité) que la banque doit respecter. L'orientation de la politique prudentielle est en effet reflétée par le niveau des ratios fixé par le régulateur. Ces coûts peuvent prendre différentes formes pour la banque. Il peut s'agir de la mise en place de services au sein de l'entité telle que l'activité de *compliance*, de *reporting* etc... Dans ce cas, la banque subit des coûts d'ajustement de bilan.

L'intégration de la réglementation étant ainsi définie, nous réduisons le processus de décision de la banque à un problème d'optimisation. L'objectif de la banque est de maximiser les profits sous contrainte d'égalité de bilan. Cette approche à deux avantages. Premièrement, les Conditions de Premier Ordre (CPO) nous permettent de déterminer le modèle de rentabilité bancaire sous Bâle III. Nous donnons au problème d'optimisation la forme très précise d'un modèle de gestion *Asset and Liability Management (ALM)*.

La première CPO indique que la Marge Net d'Intérêt (MNI) correspond à la somme des coûts marginaux de gestion sur les prêts et le capital net de la rentabilité marginale de marché de ces mêmes composantes. Dans ce problème d'optimisation, nous notons que les dépôts des agents non financiers induisent une pression supplémentaire sur la MNI de part la mise en oeuvre d'un ratio de liquidité. Ceci est attendu car nous endogénéisons la contrainte dans la mesure où la réglementation, par la mise en oeuvre d'un ratio de transformation, génère une incitation à collecter des dépôts. Ainsi, les dépôts ne constituent plus une constante dans le modèle mais bien une variable de choix dont la banque tient compte dans son processus de décision.

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La deuxième CPO indique que l'arbitrage de financement de la banque sous Bâle III correspond à la différence des coûts marginaux induits par la régulation sur le capital et les dépôts et de celle induite des marchés de ces mêmes composantes. Dans cette configuration, nous notons que l'arbitrage de financement correspond à la différence entre autre, de leurs coûts marginaux ce qui n'apparaissait pas dans une réglementation uniquement axée sur le capital.

Le deuxième avantage d'une telle approche est de pouvoir obtenir les élasticités de la firme bancaire sous certaines hypothèses. La première élasticité doit établir la relation entretenue entre le capital et le crédit. Nous souhaitons établir la manière avec laquelle le canal du capital bancaire -*Bank Capital Channel (BCC)*- opère dans un cadre réglementaire à la Bâle III. Ceci est d'importance pour la conduite de la politique monétaire. Gambacorta and Marques-Ibanez (2011) soulignent en effet le besoin de prendre en compte les caractéristiques des banques dans l'identification du canal de prêt de la banque *Bank Lending Channel (BLC)*<sup>27</sup>. La deuxième élasticité doit clairement établir la relation entre les dépôts et le capital. Un des objectifs définis sous Bâle III est en effet de renforcer les positions en capital et le modèle de transformation des banques. Ainsi, le modèle doit nous renseigner sous quelle(s) condition(s) une réglementation à la Bâle III permet de renforcer à la fois la structure en capital et le modèle de transformation des banques.

Dans les deux cas, nous trouvons que la régulation peut engendrer des effets croisés pouvant modifier le comportement de la banque. Deux configurations sont possibles, dépendantes de la forme de la fonction de coût. Premièrement, en l'absence de coût de second ordre, nous trouvons que la régulation a uniquement un impact sur la MNI et l'arbitrage de financement de la banque. En revanche, si cette absence de coût est levée, la régulation peut avoir un impact supplémentaire sur le comportement de la banque en infléchissant ou dynamisant la MNI, la relation du capital au prêt et l'arbitrage de financement.

En conclusion, nous dénombrons plusieurs résultats de notre modèle. Premièrement, nous montrons par transposition que les ratios de capital et de liquidité ne sont pas indépendants l'un de l'autre. Ce résultat est cohérent avec Tirole (2011) qui illustre la complexité de la relation entretenue entre le capital et la liquidité. Nous trouvons que l'instauration unique d'un ratio de capital incite l'institution financière à satisfaire un certain profil de liquidité. Néanmoins, une telle incitation peut s'avérer insuffisante et

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<sup>27</sup>Notons que suite à la crise financière de 2007-2009, les travaux d'économie monétaire ont connu un regain d'intérêt pour la compréhension des mécanismes de transmission de la politique monétaire. Que ce soit par le mécanisme du canal du capital ou bien le nouveau canal de prêt bancaire tel que défini dans Gambacorta and Marques-Ibanez (2011), les chercheurs ont attribué au capital bancaire un rôle indiscutable dans ces mécanismes de transmission.

dans cette mesure, l'adoption d'un second ratio de liquidité de type NSFR renforcerait l'incitation de la banque à construire un profil de liquidité plus solide. Ce premier résultat met en évidence les implications communes que peuvent entretenir les ratios de capital et de transformation.

Deuxièmement, nous montrons que Bâle III signe le retour et l'attrait des dépôts clients et redéfinit les contours d'un modèle bancaire beaucoup plus traditionnel : collecter des dépôts et distribuer des crédits. Cette importance des dépôts se retrouve d'une part dans la définition du modèle de rentabilité de la banque et de l'arbitrage de financement. D'autre part, nous notons que ce nouveau type de régulation peut engendrer des effets croisés pouvant modifier plus profondément le comportement bancaire où les dépôts constituent pour le régulateur une variable de choix pour modifier le comportement de la banque.

Nous dressons deux recommandations essentielles de politique économique. Tout d'abord, le modèle théorique souligne l'importance d'identifier la nature des coûts mis en oeuvre par la régulation. Nous montrons qu'une réglementation en capital et liquidité peut engendrer des effets croisés dont l'impact sur le comportement de la banque peut s'avérer non négligeable. Ainsi, une bonne politique de régulation doit anticiper les implications d'une telle réglementation en vue de ne pas générer de comportement économique indésirable pouvant compromettre l'objectif premier de stabilité financière. Nous proposons de tester une telle implication sur le comportement bancaire au chapitre suivant. Notre seconde recommandation porte sur la nécessité d'identifier la nature de la concurrence à laquelle la banque est soumise. Cette concurrence définit en bonne partie le comportement bancaire et comme souligné dans la littérature<sup>28</sup>, a aussi des implications communes de stabilité financière avec la politique de régulation.

### **1.4 Chapitre 4: Assessing the impact of Basel III on bank behavior: An empirical approach**

Le chapitre 4 a pour objectif de tester la théorie décrite précédemment. Nous nous concentrons en particulier sur le canal du capital bancaire identifié au chapitre précédent. Nous justifions un tel choix étant donné le poids important du financement intermédié dans l'UE. Dans ce contexte, analyser l'impact de la régulation sur le comportement de prêt de la banque apparaît comme crucial pour apprécier les implications de croissance économique et de stabilité financière.

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<sup>28</sup>Voir Vives (2016).

#### 1.4. Chapitre 4: Assessing the impact of Basel III on bank behavior: An empirical approach

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La littérature traitant de l'impact de la mise en oeuvre de standards internationaux sur le comportement bancaire est bien établie depuis les premiers accords de Bâle. Un important corps empirique s'est développé autour de quatre thématiques que l'on peut retrouver dans Jackson et al. (1999), à savoir, "*The effects of capital requirements on banks' balance sheets*", "*Regulatory capital arbitrage*", "*The effects of capital requirements on the macroeconomy*" et "*The effects of capital requirements on the long-run competitiveness of banks*". Dans ce chapitre, la spécification économétrique est tirée du modèle théorique présenté précédemment et a l'avantage de s'inscrire parmi les travaux économétriques adoptant une approche par les ajustements de bilan. A la différence du chapitre 2, cette spécification est définie comme une équation comportementale d'offre de crédit bancaire et est la résultante du modèle théorique du comportement bancaire présenté au chapitre 3.

Nous choisissons les déterminants ayant trait uniquement au processus décisionnel de la banque. Ils sont de trois types. Tout d'abord, nous définissons les variables d'intérêt, les ratios de capital (capital de régulation rapportés aux actifs pondérés des risques) et de transformation (dépôts rapportés aux prêts nets) qui sont justifiés théoriquement. Deuxièmement, la littérature récente met en avant l'importance de tenir compte des caractéristiques du modèle d'affaires des banques dans l'offre de prêt. Gambacorta and Marques-Ibanez (2011) incluent entre autre la capitalisation, la liquidité, la taille et le financement de marché pour identifier les caractéristiques déterminantes du canal de prêt. Nous trouvons des déterminants similaires dans Brei et al. (2013). Enfin, Kim and Sohn (2017) ajoutent la qualité du portefeuille et la rentabilité du modèle bancaire comme déterminants supplémentaires de l'offre de crédits. Dans ce chapitre, nous retiendrons très précisément la liquidité de court-terme, la taille de la banque, le modèle de rentabilité et la qualité du portefeuille de crédit en plus des ratios de capitalisation et de transformation. Enfin, l'environnement macroéconomique, en particulier la croissance économique et la politique monétaire permettent de contrôler respectivement la demande établie pour le crédit bancaire et le coût de refinancement induit par la politique monétaire. Nous définissons ainsi le taux de croissance du PIB réel et la différence de rendement des taux longs et courts pour rendre compte de l'impact de la croissance économique et de la conduite de la politique monétaire.

Nos résultats sont cohérents avec la littérature. Premièrement, nous trouvons que l'impact du coefficient de capital sur la croissance de prêts bancaires est positif favorisant ainsi l'hypothèse d'absorption des risques et non celle d'éviction des dépôts au niveau microéconomique. Une entité bancaire mieux capitalisée est à même de mieux distribuer des crédits dans la mesure où sa capacité à absorber un choc négatif est plus importante. La sensibilité du capital au prêt, et donc la capacité d'absorption

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des risques est meilleure lorsque la mesure du capital Tier 1 est choisie. Ce résultat suggère que la construction d'un ensemble de réformes incitant les banques à collecter ce type de capital est souhaitable. D'une part, cela permet de rendre l'offre de crédits des banques plus résiliente aux chocs. D'autre part, cette mesure permettrait d'améliorer la qualité du canal du capital bancaire et donc, l'efficacité de la transmission de la politique monétaire.

Deuxièmement, nous trouvons que le coefficient du ratio de transformation est positif mais de moindre amplitude que le ratio de capital. Ce résultat n'est cependant pas surprenant dans la mesure où nous montrons dans le chapitre 3 que l'effet induit par un ratio de type *NSFR* correspond à la somme du ratio de capital et de dépôts rapportés aux prêts. Ainsi, l'amplitude moindre du coefficient de transformation par rapport au capital tendrait à montrer qu'une partie de l'effet du standard de transformation passe par le ratio de capital. Une mesure telle que l'instauration d'un ratio de transformation semble aller de pair avec la mise en oeuvre du ratio de capital car ces deux ratios sont complémentaires. L'incitation à développer des modèles bancaires mieux capitalisés et plus axés sur l'activité de transformation tend à favoriser l'offre de prêts des banques.

Les variables tenant compte des caractéristiques du modèle bancaire sont de signes attendus. Le coefficient de liquidité est lui aussi positif et légitime l'instauration d'un ratio de type *Liquidity Coverage Ratio (LCR)* montrant que des banques avec des profils de liquidité sains tendent à accroître l'offre de prêts. Le coefficient mesurant la taille de la banque est positif et tend à encourager l'hypothèse "*too big to fail*" pour les banques européennes. Cet effet peut, en grande partie être induit par l'existence d'entités bancaires à risque systémique dans l'échantillon. Ce résultat ne semble pas pour autant remettre en cause l'existence de dispositifs macroprudentiels et de supervision visant à mieux encadrer ces entités pour en limiter le risque systémique. La profitabilité, mesurée par l'indicateur de ROA, a un impact négatif sur l'offre de crédits. Ce résultat tendrait à montrer que les banques affichant une profitabilité importante sont aussi celles qui prennent le plus de risque du côté de leurs actifs. Elles offriraient ceteris paribus moins de prêts en vue de restaurer la qualité de ceux-ci. Ceci peut aussi se traduire comme un signal de meilleure gestion de bilan face à des investisseurs adverses au risque. Enfin, le signe du ratio de prêts non performants, mesurant la qualité du portefeuille de la banque est lui aussi de signe attendu. Seul le ratio de provisions affiche un signe contraire.

Les déterminants macroéconomiques montrent qu'ils sont tout aussi importants pour la période sélectionnée. Premièrement, la pente de la courbe des taux a un impact positif sur l'offre de prêt. Une augmentation de la pente des taux tend ainsi à favoriser



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l'augmentation de prêts dans la mesure où le coût de générer un actif de ce type diminue. Enfin, l'environnement économique, mesuré par la croissance du PIB réel et permettant de contrôler pour la demande de crédit est déterminant et positivement associé à l'offre de prêt.

Un développement supplémentaire est proposé en lien avec le développement financier. Une estimation simple incluant le développement financier suggère que l'impact du capital sur l'offre de crédit est marginal. Cependant, une spécification plus avancée suggère qu'une relation capital-développement financier existe et est déterminante de l'offre de crédit. En particulier, les résultats suggèrent que plus les systèmes bancaires sont complexes, et moins la règle en capital contribue positivement à l'offre de crédit. La qualité du capital importe et suggère que le recours à d'autres instruments de régulation est d'autant plus important que l'instrument de capital perd en efficacité pour soutenir l'offre de crédit. Une combinaison tenant compte du lien développement financier et transformation bancaire fournit en revanche des résultats insuffisants.

En conclusion de cette étude, les réformes sur le capital et le modèle de transformation des banques apparaissent souhaitables dans la mesure où elles encouragent l'activité de crédit. Tout comme les résultats présentés au chapitre 2, la qualité du portefeuille de crédit des banques apparaît comme un déterminant du crédit. En l'occurrence, ces résultats suggèrent que les réformes incitant à produire des bilans bancaires de bonne qualité sont essentielles pour assurer les enjeux de croissance économique et de stabilité financière au sein de l'UE, comme présenté en début d'introduction. L'interrogation portée sur un possible scénario de type *credit crunch* suggère que celui-ci aurait été induit non pas par un cadre de régulation plus contraignant mais par la dégradation des portefeuilles de prêt des banques.

De plus, les résultats de l'étude microéconomique suggèrent qu'une attention particulière doit être apportée sur le paramètre de la taille. Le système bancaire des pays membres étant constitué de banques à risque systémique, il est en effet important de porter un regard particulier sur ce type d'entité pour assurer la stabilité financière. La réponse des autorités peut ne pas se traduire par des mesures plus contraignantes vis-à-vis de ce type d'entité, au risque de pénaliser la croissance économique et de générer des opportunités d'arbitrage vecteur d'instabilité financière. Cependant, les modalités d'intervention de la régulation peuvent se justifier par le choix stratégique d'instruments à disposition des autorités de l'UE. Ainsi, compléter le dispositif prudentiel par une fonction de supervision apparaît légitime.

Notre étude montre aussi que plus les systèmes financiers sont complexes et plus la pression mise sur la politique de régulation est importante dans la mesure où les outils

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de capitalisation et de transformation seuls, perdent de leur efficacité. Ce couplage du dispositif prudentiel et de supervision semble ainsi constituer la meilleure option des autorités en vue de pérenniser une croissance économique et une stabilité financière durables.

## **2 Does one rule fit all? Banking regulation in Europe**

"When it comes to regulation, one size does not fit all" (World Bank, 2019)

*This chapter is joint work with Michael Goujon (CERDI, Université Clermont Auvergne, France) and Benjamin Williams (CleRMA, Université Clermont Auvergne, France)*

### 2.1 Introduction

The origins of financial regulation in Europe stem from the need to accompany the Single Market Initiative by a deeper integration of financial markets within the Economic and Monetary Union (EMU). However, the integration and the deepening of capital financial markets has rapidly urged European Authorities to consider its implications in terms of financial stability. In recognition of the prominence of the banking sector, the European Commission (EC) has embodied the regulation of the banking sector in a succession of directives starting as early as 1977. A significant part of these directives has focused on the harmonization of prudential policies derived from the international regulatory standards set by the Basel Committee on Banking Supervision (BCBS). The main challenge of the EC was to design a capital market integration policy aiming at creating a single playing field by which all credit institutions could compete and ensure an efficient coverage of financial services supply.

The 2008 financial crisis and its aftermaths have questioned the design of this policy and to a larger extent the role of European institutions in ensuring financial integration without impeding financial stability. In recognition of the need to better supervise financial systems in Europe, the EC urged the de Larosière group to propose a set of recommendations for the design of the post-crisis supervisory framework in the EU.<sup>1</sup> The progressive adoption of the Basel III reforms in the 2010s had become a key element to promote financial stability. It is part of the first pillar of the EBU covered under the single rulebook initiative stating that all financial institutions in the Single Market have to comply with regulatory standards.<sup>2</sup>

In addition to the implementation of more stringent rules on capital, the new aspect of this regulatory regime is the introduction of liquidity standards and specifically the NSFR to address the excessive transformation activity of the banking sector observed prior to the 2008 Global Financial Crisis (GFC). One should note that some European countries already adopted liquidity standards but their application remained at the national level essentially (for further details, see BCBS (2016)). However, the application of a unique, and hence homogeneous, regulatory framework does not per se take into account differences in financial conditions within the 27 European Financial Systems (EFS-27) and then would question its implications in terms of financial stability at an aggregated or at a macroeconomic level.

The financial heterogeneity of the European system is recognized by European institu-

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<sup>1</sup> Report of “The high level group on financial supervision in the EU” chaired by Jacques de Larosière.

<sup>2</sup> Regulation 575/2013/EU : “This Regulation would entail that all institutions follow the same rules in all the Union, which would also boost confidence in the stability of institutions, especially in times of stress.”

tions.<sup>3</sup>

It may be observed that, beyond the distinction between the 19 Eurozone members and the 8 non-members, different sub-groups of countries are characterized by different levels and different evolutions in terms of financial development. Despite convergence criteria for accessions, and under the hypothesis of slow or partial convergence after accessions, EU countries typically present different levels of economic development (West versus East and North versus South). They would then logically have different levels of financial development or performances considering the conjunction between economic and financial conditions. Specifically, the Emerging East-European economies remain bank-based essentially and foreign-oriented, while the term structure of funding is generally short compared to other countries.<sup>4</sup> Furthermore, according to some classifications, some members of the EFS-27 are close to be, or are, tax/financial havens, with specific and outlying financial characteristics.<sup>5 6</sup> In this chapter, we question the role of these characteristics and more generally, the role of financial development in the design of banking regulation in order to ensure the goal of financial stability.

Moreover, considering the development of financial systems in the design of banking regulation might be important for the lead of the European monetary policy.<sup>7</sup> As underlined in Gambacorta and Marques-Ibanez (2011) and Gambacorta and Shin (2018), bank specific characteristics such as business model, capital and funding structures are of primary importance for the aggregate supply of credits. Thus, an optimal financial integration policy in a monetary union should be able to ensure the coverage of financial services without impeding the purpose of financial stability and the efficacy of the transmission of monetary policy. In this chapter, we analyze at the macroeconomic level the sensitivity of credit supply to the capital and funding

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<sup>3</sup>The directive No 575/2013 noted that “macro prudential risks may however differ in a number of ways with a range of national specificities resulting in variances being observed for example with regard to the structure and size of the banking sector compared to the wider economy and the credit cycle.” This view is confirmed in Lehmann et al. (2011) who present an overview of the main issues of the application of Basel III in Emerging Europe.

<sup>4</sup>See European Bank Coordination Vienna Initiative and others (2012) for more details.

<sup>5</sup>The current list of non-cooperative third countries produced by the EU does not include any of the EU-27 members or associated States, while Oxfam notes that five EU member states - Cyprus, Ireland, Luxembourg, Malta and the Netherlands – “have economic indicators typical of tax havens”, <https://www.oxfam.orgconsultedFeb.2021>.

<sup>6</sup>See European Bank Coordination Vienna Initiative and others (2012) for more details.

<sup>7</sup>The academic literature has renewed the interest for the understanding of the conduct of monetary policy following the 2008 GFC. In particular, financial stability had become a central issue for academics and policy makers. The literature establishes common implications of monetary and macro-prudential policies. Note that this issue also questions the role and the organization of the institutions in charge of the objective of economic growth and financial stability.

## Chapter 2. Does one rule fit all? Banking regulation in Europe

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structures in order to draw the implications for the conduct of monetary policy.

To our knowledge, no papers examine the importance of financial development in the design of banking regulation in Europe, specifically for the EFS-27, and at the macroeconomic level. A large body of literature studying the impact of capital and liquidity rules on bank lending has emerged since the adoption of the first international regulatory standards in 1988.<sup>8</sup> These studies are performed at the microeconomic level and does not consider the impact of the capital and liquidity rules on the development of the banking sector per se. Thus, no policy implications are drawn as to the impact of these rules on financial development. In addition, no studies explore the importance of regional heterogeneity for the design of financial regulation in the EU.

The main contributions of this chapter are as follows: (i) We assess the influence of the capitalization and funding structures on the development of the EFS-27 banking sector. (ii) We establish the relationship between the financial conditions and development at the macroeconomic level while the majority of the papers focus on micro-evidences at the bank-level. (iii) We bring the empirical evidence that economic conditions affect the lending behavior of banks at the country level. The macro behavior of banks located in Eastern countries is specifically not similar to that of other countries. (iv) We highlight that financial heterogeneity in the EFS-27 might be a determinant of financial stability and thus an additional parameter in the design of financial regulation. Our results have clear economic policy implications and question the implementation of a unique regulatory framework among European countries.

Specifically, the main findings are as follows. The stylized facts show that the EFS-27 is heterogeneous both in terms of level in financial variables and in terms of relationship, or sensitivity, between financial variables. The distinction between Western European countries (WE) and Central and Eastern Europe (CEE) seems particularly relevant in both univariate and bivariate stylized facts. Econometric tests also suggest that we can reject the null hypothesis that a unique set of regulatory ratios have a homogeneous effect on the issuance of credit in the EFS-27, in favor of the alternative hypothesis of at least two different regimes. We can then conclude that “one rule does not fit all”.

The remainder of the paper is organized as follows: Section 2.2 depicts the main stylized facts in the EFS-27. Section 2.3 presents the data and descriptive statistics. Section 2.4 explains the econometric methodology. Section 2.5 details the results. Section 2.6 presents the robustness checks. Section 2.7 concludes.

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<sup>8</sup>For a complete review on the effects of capital and liquidity rules on bank behavior, see BCBS (2016).

## 2.2 Stylized facts

We explore stylized facts of the EFS-27 according to a specific country regional classification, keeping in mind that given the small sample size, results would be sensible to selection, exclusion and grouping. We use the classification of the EU regular Economic Report from the World Bank (WB). The report uses four sub-groups that share broadly similar development patterns: CEE comprises Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Slovak Republic and Slovenia; Northern European countries (NE) includes Denmark, Estonia, Finland, Latvia, Lithuania and Sweden; Southern European countries (SE) comprises Cyprus, Greece, Italy, Portugal and Spain; and WE comprises Austria, Belgium, France, Germany, Ireland, Luxembourg, the Netherlands. In the following, we add a group Outside European countries (Outside) for Switzerland and the United Kingdom (UK).<sup>9 10 11 12</sup>

We look for stylized facts based on usual measures of financial development and banking sector performance. Data come from the WB's Global Financial Development Database (GFDD).<sup>13 14</sup>

<sup>9</sup>The EU has progressively enlarged (through "accessions") from the 1958 six core states, Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany; in 1973 Denmark, Ireland, United Kingdom; in 1981 Greece; in 1986 Portugal, Spain; in 1995 Austria, Finland, Sweden; in 2004 Cyprus, Czechia, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia; in 2007 Bulgaria, Romania; in 2013 Croatia and from EU-28 to EU 27 with the Brexit. The United Nations considers two regional groups (Western that groups members and accession till the 1990s, vs Eastern); Cyprus remains neutral between the two European Groups but is usually viewed as belonging to the Western European group.

<sup>10</sup>The EU Regular Economic Report is a bi-annual publication of the World Bank Group and covers economic developments, prospects, and economic policies in the EU. While the report covers the EU, it provides additional information on European countries which had historically a stronger operational engagement with the World Bank Group, in particular, Bulgaria, Croatia, Poland and Romania. For further details, see <https://www.worldbank.org/en/region/eca/publication/eurer>.

<sup>11</sup>The Eurozone is transregional and gathers countries that show different level of (financial) development. It is the monetary union of 19 of the EU member states which have adopted the euro as their common currency and sole legal tender, with the monetary authority of the Eurozone being the Eurosystem. It consists of 14 Western European countries Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, plus Malta and Cyprus, and 5 Eastern European Estonia, Latvia, Lithuania, Slovakia, Slovenia.

<sup>12</sup>Switzerland is associated with the Union through bilateral treaties in which it has adopted various provisions of EU law in order to participate in the Union's single market, without joining as a member state.

<sup>13</sup><https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database>.

<sup>14</sup>Svirydenka (2016) characterizes financial systems using a composite indicator of financial development, the Broad Based Index of Financial Development (BBIFD) (BBIFD: <https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Introducing-a-New-Broad-based-Index-of-Financial-Development-43621>). It contains additional information on financial development compared to standards indicators of the GFDD developed by the WB. The use of this index and its sub-index components allows the assessment of the degree of financial development in its multiple dimensions. However, indicators of depth, access and efficiency

We first explore the heterogeneity at two levels: (i) country heterogeneity in level using variables measuring financial depth and performances, and over time for some of them (section 2.2.1), and (ii) regional heterogeneity in correlation (section 2.2.2). We assess the level of financial development following the main indicators presented in Cihak et al. (2012). It is based on a 4x2 matrix measuring 4 indicators in 2 dimensions that are financial institutions and financial markets. The 4 indicators account for depth, access, efficiency, and stability. They are described in section 2.3.1.

### 2.2.1 Country heterogeneity

In this section, we provide *prima facie* evidence of the heterogeneity of the EU financial systems focusing particularly on depth, efficiency and stability. Figure 2.1a provides evidence of the heterogeneity of financial depth in banking (measured by the credit-to-GDP ratio) and financial markets (measured by the stock market capitalization-to-GDP ratio) by countries grouped by regions, for the year 2017. We note excessive values of the bank credit and stock market ratios for countries which are defined as financial centers, e.g. Switzerland and the UK suggesting that the deepening of these financial systems are not in line with the fundamentals of the economy.

As illustrated in Enoch et al. (2013), The bank funding of the EU financial systems is large. Figure 2.1a shows that the bank credit-to-GDP ratio is heterogeneous within each group, but is significantly lower in the CEE group. While the structure of financial systems appears relatively balanced between banking and financial markets in the WE, there is a clear dominance of the banking sector in others (with Cyprus being an outlier). This result is consistent with Freixas and Rochet (2008) that explain that the banking sector dominates in countries with low levels of financial development. Yet, as outlined by the authors, the structure of financial systems might be a key determinant to foster economic growth.

As discussed in Freixas and Rochet (2008), this difference suggests that financial structures are determined depending on the economic environment of the regions and specifically the legal enforcement environment. Žuk and Savelin (2018) show that the quality of institutions varied over time depending on the accession to the EU suggesting that the banking system function performs better as the quality of institutions rises. We suggest that more balanced financial structures tend to mitigate financial risk and thus promote financial stability. Yet, this intuition must be nuanced as the emergence of other financial institutions might represent an additional pressure

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are not documented at a disaggregated level and stability is not included in the dimensions of the BBIFD.



on financial stability.<sup>15</sup>

Figure 2.1b illustrates the depth of the EU banking systems (measured by the the asset-to-GDP and the credit-to-GDP ratios) by countries grouped by regions, for the year 2017. It shows that the banking book (i.e. the activity of granting loans) remains an important part of banking assets in Europe, e.g. Denmark, Sweden.<sup>16</sup> The banking book appears relatively smaller particularly for the CEE and SE regions which might reflect the dynamic of the cross-border lending activity. This decrease in the banking book might also be driven by the development of other sources of funding. The emergence of Non bank financial institutions (NBFI) as outlined in Beck (2012) has raised specific concerns for financial stability. In addition, the banking books appear heterogeneous at the country and regional dimension suggesting that the resilience of the EU credit markets would be different at both the country and regional levels.

Figure 2.1c compares the ratios of credit-to-GDP and deposit-to-GDP. Luxembourg appears as an outlier suggesting that financial centers are also reflected via the use of the deposit-to-credit ratio. It illustrates the financial service industry notably.<sup>17</sup> The CEE region features the lowest deposit-to-credit ratios. As shown in the graph, these ratios are different across regions and a country difference within each group emerges. This illustrates that the underlying mechanisms of the deposit collection process might be different at both the country and regional levels questioning thus the impact of a unique deposit standard such as the NSFR on the development of the EU banking systems. The figure also suggests that the transformation process of the banking systems operates differently. This is particularly true for Denmark, Finland and Sweden. Overall, different dynamics are observed across the country and regional levels which call for a better understanding of the credit origination and deposit collection processes. These differences might result in the construction of different banking business models which might be a determinant of the EU financial stability.

Figure 2.1d depicts the development of the banking sector in 2008 and 2017. It shows that the volume of loans (in % of GDP) decreased in most of the EU countries which lends support for a credit crunch scenario. The decrease in the size of the banking sector might also be related to the expansion of other NBFI as documented in the report on Financial Integration and structure published in March 2020 by the European Central Bank (ECB) showing that the dominance of the banking sector has slowed down in the euro. An additional dynamic to the decrease in the size of the

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<sup>15</sup>See for example Muller et al. (2012).

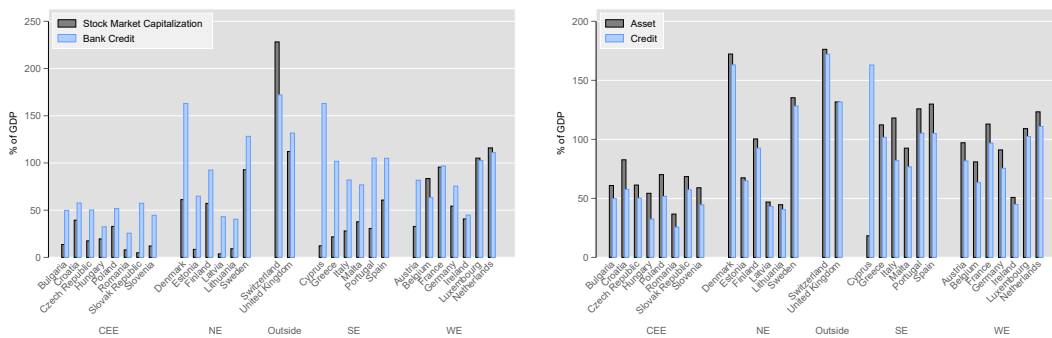
<sup>16</sup>Cyprus and Switzerland being considered as outliers.

<sup>17</sup>This is also the case for Belgium, Ireland Malta, Switzerland and the UK when removing Luxembourg. See appendix A.1.

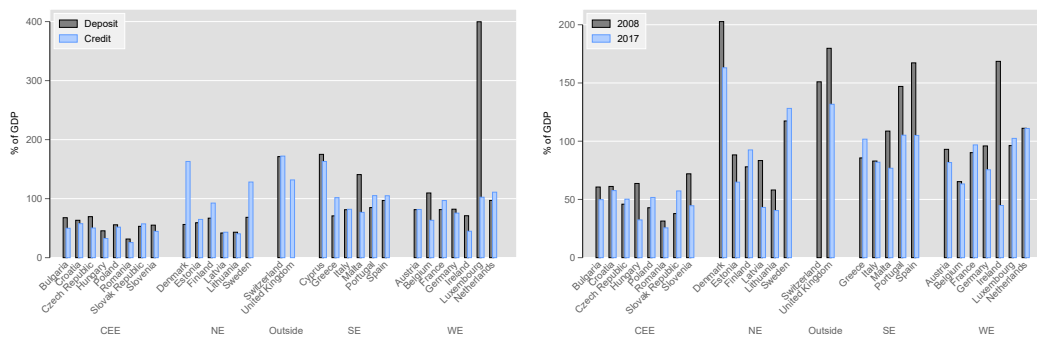
## Chapter 2. Does one rule fit all? Banking regulation in Europe

banking sector might be the operation of a restructuring process by banks in the Euro Area. As underlined in the report, the banking sector operated a restructuring process in the aftermath of the crisis including the search for new business models, the adjustment to the revised regulatory regime, consolidation and the resolution of non-performing assets. One question arises from these stylized facts is to determine whether the slowdown in bank loan supply might be caused by the implementation of tighter regulatory standards. Chapters 3 and 4 are particularly designed to address this question.

The changing nature of funding in the euro area, the dynamic of the restructuring process of the euro area banking sector and the heterogeneity of the EU banking systems raise particular concerns on the EU financial stability and the coverage of financial services which make the conduct of the EBU and the Capital Market Union (CMU) particularly challenging.



(a) Bank Credit and Stock Market Capitalization (2017, in percent of GDP) (b) Banking System Assets and Credits (2017, in percent of GDP)



(c) Banking System Credits and Deposits (2017, in percent of GDP) (d) Bank Credit (in percent of GDP)

Figure 2.1. Depth of the EU financial systems

Figure 2.2 documents the stability of the EU banking sectors. The distribution of the risk-sensitive ratio across countries and regions in the EU differs (see figure 2.2a). Overall, capital ratios are higher than they were in 2008. As underlined in Cohen and Scatigna (2016), the increase of the Risk Weighted Assets (RWA) ratio may reflect two different bank strategies. First, banks were able to rise their capital positions by raising capital. The RWA ratio revalues the capital position of banks upwards (one cannot exclude the idea that the leverage ratio gives a more accurate measure of the capital position and that the RWA underweight the degree of risk of the banking systems as it did in times of crisis). They show that banking capital ratios have raised since the 2008 GFC, reflecting a deleveraging process already noted in Enoch et al. (2013). The levels in the ratios of both the CEE and WE countries are medium while SE countries show lower levels and NE higher levels.

Second, the increase of the ratio might also be due to the decrease of the balance-sheet risks, i.e credit, market and operational risks. Although the outcome of these strategies is common at the microeconomic level, i.e an improvement of the capital position, its consequences on the macroeconomy might differ. In particular, a decrease in the denominator might reflect a downsizing dynamic, i.e. a loan reduction with detrimental effects on the economy. However, Cohen and Scatigna (2016) suggest that European banks maintained credit supply following the financial crisis which suggests that the implementation of tighter regulatory standards on capital hasn't caused a credit crunch scenario.

Figure 2.2a also documents that the distribution of the capital ratios are heterogeneous across countries and regions meaning that capital ratios might be driven by economic specificities. This heterogeneity might also reflect accounting standard differences and the harmonization of a unique regulatory framework might thus represent a strategic instrument to limit this heterogeneity. We complement evidence of the balance-sheet adjustment mechanisms of the EU banking sector by documenting the evolution of the leverage ratio for the same period. Similar to figure 2.2a, leverage ratios improved for the period 2008-2017 (see figure 2.2b) suggesting that risks were not underestimated as they were prior the GFC. The challenge for European authorities might stem from this heterogeneity in the determination of these ratios rather than the evaluation of risks.<sup>18</sup>

Figure 2.2c depicts the liquidity profile of the EU banking sectors for 2008 and 2017 respectively.<sup>19</sup> Figure 2.2c indicates that the level of the liquidity ratios in 2017 are closed

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<sup>18</sup>The post-crisis banking regulation includes the use of the Leverage Ratio (LR) for comparison purposes which was not the case before.

<sup>19</sup>The liquidity ratio available in the GFDD defines the ratio of the value of liquid assets to short-term funding plus total deposits. Details are available in section 2.3.

## Chapter 2. Does one rule fit all? Banking regulation in Europe

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to the ones in 2008. Data suggest that liquidity ratios haven't improved significantly and are driven by different economic decisions compared to the dynamic of capital buffers. Differences exist for countries in the CEE and the SE regions. This is not consistent with the literature studying the relationship between liquidity and lending which establishes a strong positive relationship between liquidity and lending.<sup>20</sup> The liquidity ratios are also heterogeneous across countries and regions. However, we remain cautious as to the interpretation of figure 2.2c as liquidity ratios are computed on unconsolidated data.

Figure 2.2d shows the transformation ratios of the EU banking systems by countries grouped by regions, for the year 2017.<sup>21</sup> While the levels are heterogeneous, with a higher ratio in NE countries, the transformation activity decreases over 2008- 2017 for most of European countries. This might be the result of different dynamics. First, the quality of bank loans worsens drastically as the financial shock experienced in 2008 was consequent. Second, the design of the post-crisis banking regulation encourages banks to adopt sound funding practices by collecting customer deposits via the implementation of the NSFR. One challenging research question is to determine whether these adjustments were induced by the implementation of tighter regulatory standards or the worsening of the loan quality portfolio. This question is further investigated in chapters 3 and 4. Yet, figure 2.2d illustrates the heterogeneity of the transformation models at the country and regional levels which highlights the need to understand the implications of a unique set of liquidity instruments on funding.

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<sup>20</sup>Chapter 4 is consistent with the view that a positive relationship exists between liquidity and lending for the EU banking sector.

<sup>21</sup> The transformation ratio is measured by the ratio of credit-to-GDP to deposit-to-GDP and expressed in percent. We disentangle the transformation activity of the banking sector induced by the monetary and regulatory policies. The transformation activity induced by monetary policy is not presented because it is beyond the scope of the chapter. However, the period covered in this chapter suggests that this transformation operated via the interest rate (cost of funds) and the lead of Unconventional Monetary Policies (UMP).

## 2.2. Stylized facts

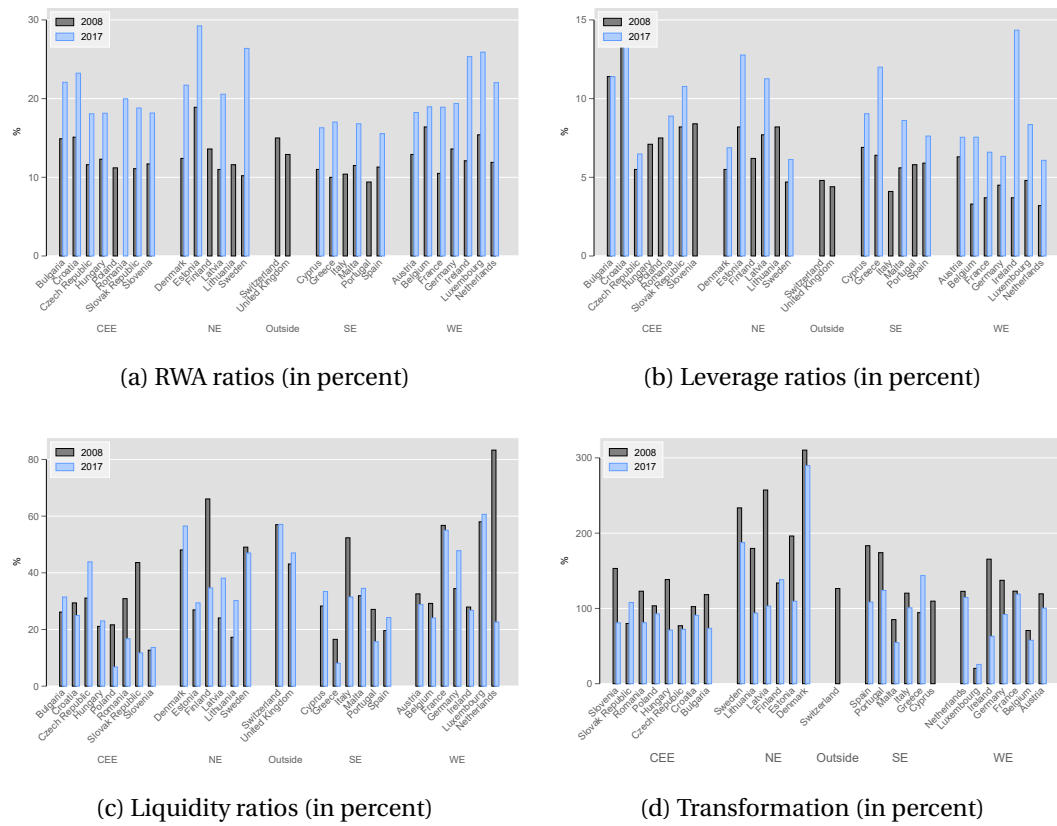
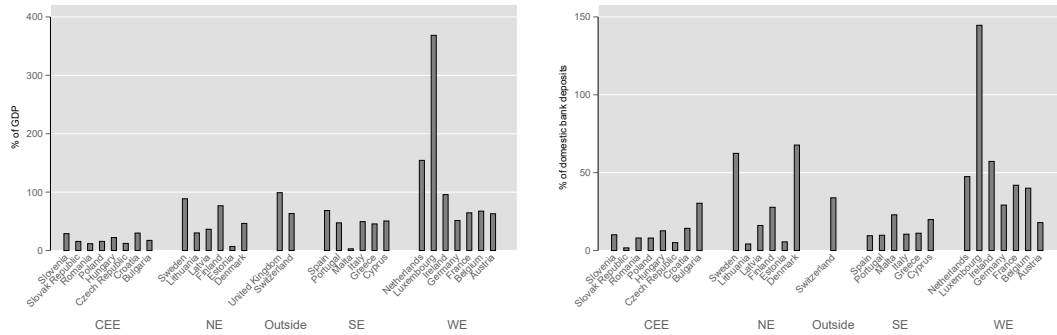


Figure 2.2. Stability of the EU financial systems

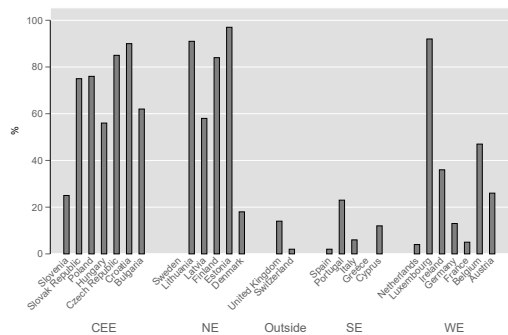
As a marker of financial integration, cross-border lending is typically high in the EFS-27, with a strong presence of Western European banks in the CEE (see for example Enoch et al. (2013)). As outlined in Beck (2012), the cross-border lending activity would promote financial and economic development. However, the financial crisis has also showed that cross-border lending might entail deleterious effects on the stability of financial systems by raising the volatility of financial flows. Figure 2.4a shows that WE countries are characterized by an important activity of cross-border lending, while the CEE is dependent from external funding. This is associated with the structure of the banking industry in these countries where a significant share of banks are subsidies and branches of major Western banks.

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(a) Loans from non-resident banks (2017, in percent of GDP)

(b) External loans and deposits of reporting banks vis-à-vis the banking sector (2017, in percent of domestic bank deposits)

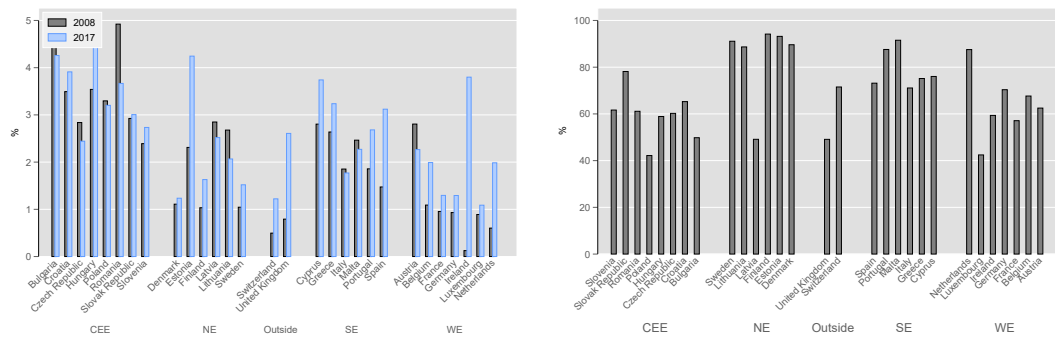


(c) Ratio of foreign bank assets to total bank assets (2017, in percent)

Figure 2.3. Cross-border activity of the EU banking systems

Regarding efficiency and specifically bank profitability, we use the Net Interest Margin (NIM) computed as the banking net interest to average total earning assets. We find that the heterogeneity observed above for the transformation activity is more pronounced for the NIM. In particular, we find that smaller banking sectors in the CEE tend to show a higher NIM (figure 2.4a). This heterogeneity in the transformation activity and the NIM questions the impact of both the monetary and financial policies in the EU. First, a low-interest-rate environment might impact the bank business model in different manners. Second, the design of the NSFR aims to limit this transformation but the question on its impact on the bank business model of banks remains. Third, a higher ex-ante credit risk in the CEE may explain a higher level of the NIM. Fourth, the lower level of competitiveness in that region, compared with that of Western European countries, may also contribute to a higher level of the NIM.

The degree of concentration (the share of assets held by the three largest banks in the total assets of the country's banking sector) is high in the EU, suggesting that the level of competition is low, but with significant differences that can be observed at the regional and country level. We notice that the NE and the SE countries show the highest levels of concentration. The degree of competition is considered as a usual determinant of the credit supply of a banking system. It is also an important element of the financial integration policy in Europe with the objective of ensuring an efficient supply of financial services within the EU. Petersen and Rajan (1995) and Vives (2016) show that concentration fosters the credit supply of banks. However, a sharp competition might have deleterious effects on financial stability when generating risky behavior for the financial system.



(a) NIM for the European banking systems (in percent) (b) Concentration of the European banking systems (2017, in percent)

Figure 2.4. Efficiency of the EU banking systems

### 2.2.2 Regional heterogeneity

In this section, we investigate the heterogeneity in correlations between credits, the capital and funding positions at the regional level. The correlations are set upon country-year pair observations for the 27 European member countries over the period 2000-2017 (see section 2.3 for a description of the data).

Figure 2.5 depicts the correlations between bank credits and deposits, which is extremely high for the Eastern and Northern regions, less pronounced for the Southern and Western regions.<sup>22</sup> Figures 2.5a and 2.5b show that the correlations between

<sup>22</sup>Luxembourg shows excessive banking deposits to the rest of the group. In accordance with the literature, these data suggest that Luxembourg is a financial center. However, the correlation remains low after removing Luxembourg.

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deposits and credits are 0.73 and 0.68 which are significantly positive for the Eastern and Northern regions respectively. On the other hand, we observe lower levels of correlation within both Southern (2.5c) and Western (2.5d) countries. The latter exhibiting the lowest level of correlation ( $\rho = .18$ ). These differences can be viewed as a consequence of the heterogeneity in the banking models. More (less) complex banking models in WE (in CEE) may explain the low (high) correlation between bank deposit and credit.

Moreover, a non linear relationship might exist as banking systems tend to be more complex. Figure 2.5 features non linear dynamics especially for the Northern, Southern and Western regions suggesting that the relationship between credits and deposits might vary depending on the level of financial development. In all cases, the correlation is positive which is generally observed at the micro level.<sup>23</sup> This is also in line with the perspective proposed in chapter 3, which predicts a positive elasticity between loans and deposits under specific conditions discussed later on.

Overall, these correlations suggest a heterogeneity of credits to deposits at the regional level and, to a broader extent a different sensitivity of the banking systems to the level of deposits which, questions the impact of a unique set of regulatory rules on the development of banking systems.

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<sup>23</sup>See for example, Brei et al. (2013) and Kim and Sohn (2017).



## 2.2. Stylized facts

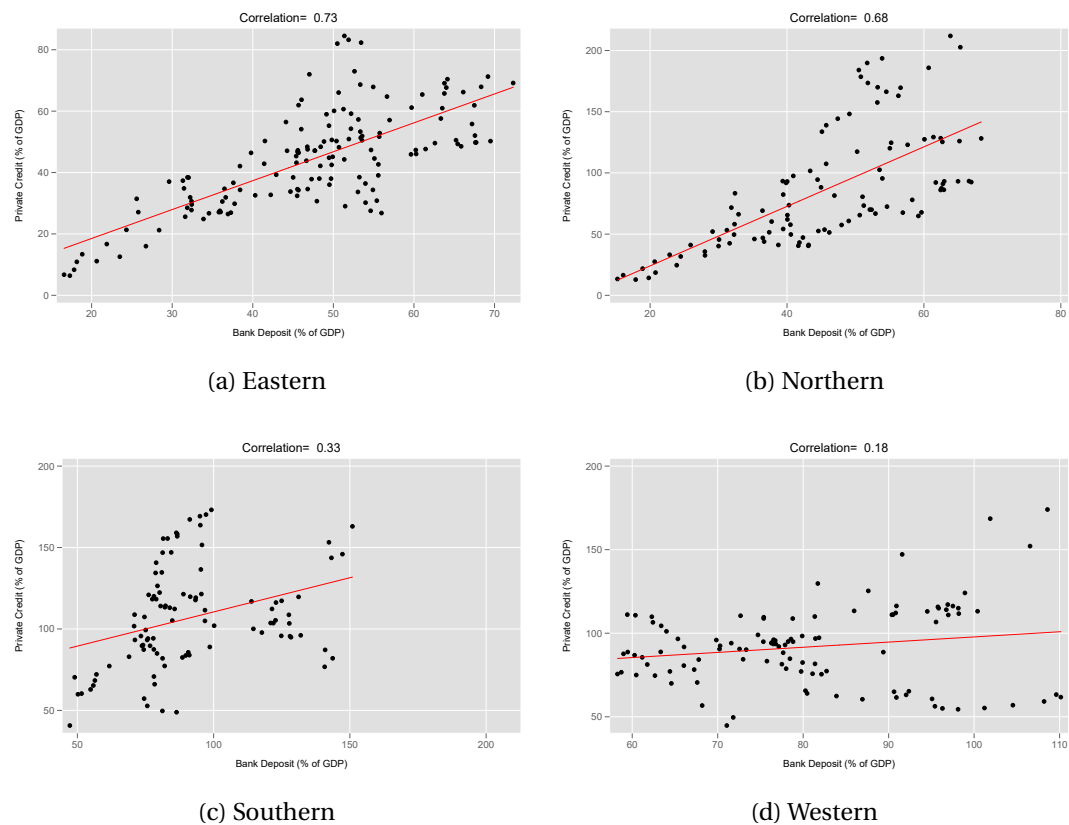


Figure 2.5. Correlation between bank deposits and credits

Figure 2.6 details the four regional correlation diagrams representing the relationship between the capital ratios<sup>24</sup> and credits. We find a negative correlation for three regions: Eastern Europe (2.5a), Southern Europe (2.5c), and Western Europe (2.5d). In Northern Europe, we find a positive correlation that is close to zero ( $\rho = .08$ ). Overall, we find a common feature of the European banking systems at the regional level. The correlations between capital and credits are weak which begs the question to consider the impact of capital rules on the banking sector development.

This observation is however inconsistent with most of the literature on the impact of capital on lending. Berger and Bouwman (2009) establish two competing hypotheses on the relationship between capital and credit. First, the Financial Fragility Crowding Out (FFCO) hypothesis illustrates the negative relationship between capital and lending by the financial fragility of banks and the possible crowding-out effect of capital on deposits. On the other hand, most of empirical studies using bank balance-sheet data

<sup>24</sup>The capital ratio is measured via the RWA Capital ratio aggregated at the country level (see Box 2.1 for a detailed presentation of the RWA capital ratio).

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highlight the positive impact of bank capital on lending under the Risk Absorption Capacity (RAC) hypothesis. Evidence contained in empirical studies using bank-balance data establish a strong positive relationship between capital and lending justified under the RAC hypothesis. Therefore, we remain cautious as to the interpretation of these correlations which might also reflect the issues set for aggregating the capital positions at the country and regional levels.<sup>25</sup>

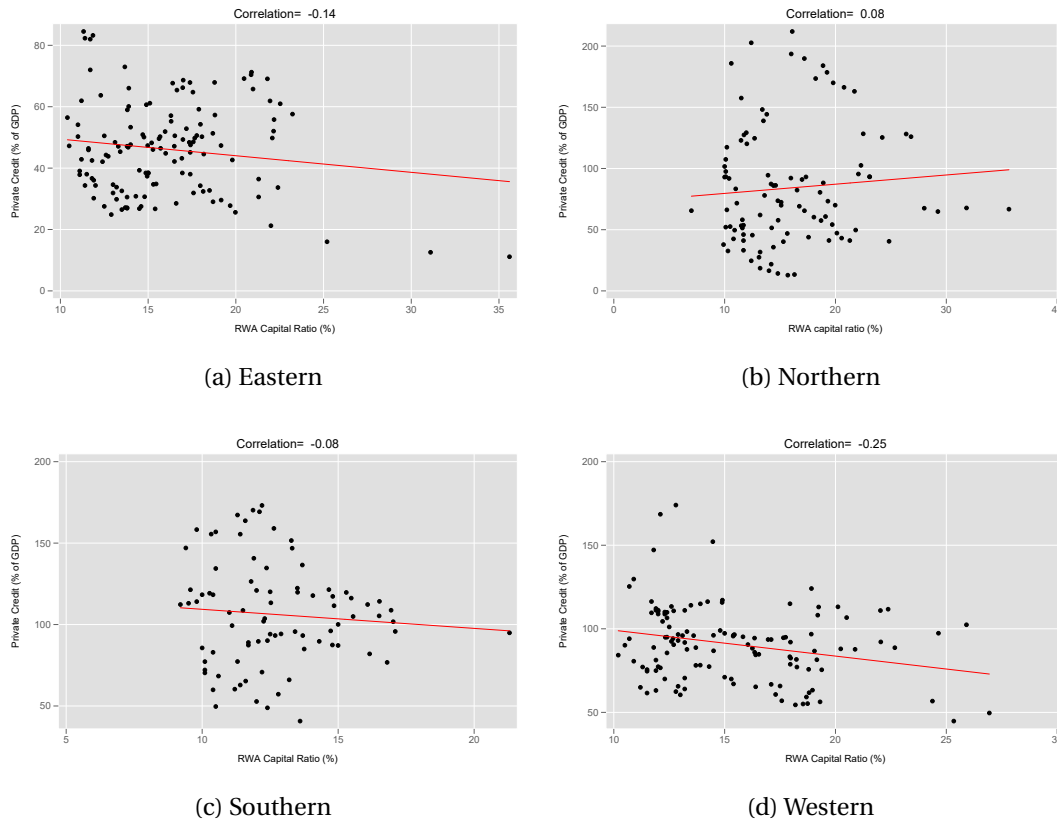


Figure 2.6. Correlation between capital ratio and credits

As an intermediary conclusion, we observe *prima facie* evidence of a heterogeneity within the EFS-27. This analysis is made through the lens of financial development. First, we document a regional heterogeneity in levels of financial variables. This heterogeneity concerns financial depth, efficiency and stability of the banking industry. Second, we find a regional heterogeneity in correlations between variables in the light of the credit-deposit relationship notably. However, the correlation between capital and credits remains uncertain at the macroeconomic level. As outlined above, stylized

<sup>25</sup>See section 2.3 for a discussion on this topic.

facts suggest a heterogeneity of the sensitivity of credit to deposit for the European banking systems which questions the impact of the implementation of a funding ratio such as the NSFR. Although the data do not lend support for a strong relationship between capital and credit at the macroeconomic level for the European banking systems, the study of the impact of capital rules on the banking sector development remains a question of interest. We also observe a low correlation between bank deposit and credit in Western countries and a high correlation for Eastern countries, where banking models appear simpler. These first elements shed light on the particular dynamics found in Central and Eastern Europe and to a broader perspective on the importance of financial development. These stylized facts are explored and investigated using econometric tests in the next sections.

## 2.3 Data and descriptive statistics

### 2.3.1 Data

We investigate the relationship between the capital and funding positions and the development of the banking sector at the macroeconomic level. Our dataset thus consists of pair observations (country-year) for the 27 European member countries over the period 2000-2017. The sample starts in 2000, one year after the Euro currency came into existence, and because a significant number of observations is not available for the 1997-1999 period.

Data are mainly retrieved from the GFDD, which is maintained by the WB and made publicly available.<sup>26</sup> This database has been introduced by Cihak et al. (2012) and is designed for a deeper understanding of the functioning of financial systems. It also aims at providing metrics for financial development. Statistical indicators' definitions are based on the financial literature and gathered under four dimensions: depth, access, efficiency and stability. The construction of the database is derived from the four dimensions mentioned above and leads to a 4x2 matrix of financial system representation. The second dimension accounts for the nature of funding. First, financial institutions correspond to entities collecting funds from agents with surpluses and channeling them to agents in need for financing. These institutions are mainly compound of various types of banks.<sup>27</sup> Second, financial markets correspond to entities where agents meet directly to fund their activity.

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<sup>26</sup><https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database>.

<sup>27</sup>The recent literature has highlighted the emergence of a new type of monetary institutions with a similar structure: NBFIs. The role of these institutions and the implications of their activity on financial stability is a debate of current research. See for example Muller et al. (2012).

## **Chapter 2. Does one rule fit all? Banking regulation in Europe**

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The GFDD has the main advantage to characterize complex and multifaceted financial systems by the use of standard financial indicators. It offers a broad coverage of countries' financial systems at a yearly frequency starting from 1960. Financial data are collected from various primary dataset, e.g. Bureau Van Dijk, IMF International Financial statistics, etc. Indicators available in the GFDD present several properties for computational purposes, which allows to deeper examine the functioning of financial systems.

Table 2.1 below refers to the stylized matrix as presented in Cihak et al. (2012)

## 2.3. Data and descriptive statistics

Table 2.1. The 4x2 Matrix of Financial System Characteristics

	Financial Institutions	Financial Markets
<b>Depth</b>	Private sector credit to GDP Financial institutions' assets to GDP M2 to GDP Deposits to GDP Gross value-added of the financial sector to GDP	Stock market capitalization Outstanding domestic private debt securities to GDP Private debt securities to GDP Public debt securities to GDP International debt securities to GDP Stock market capitalization to GDP Stock traded to GDP
<b>Access</b>	Accounts per thousand adults (commercial banks) Branches per 100,000 adults (commercial banks) % of people with a bank account % of firms with line of credit (all firms) % of firms with line of credit (small firms)	Percent of market capitalization outside of top 10 largest companies Percent of value traded outside of top 10 traded companies Government bond yields (3 month and 10 years) Ratio of domestic to total debt securities Ratio of private to total debt securities (domestic) Ratio of new corporate bond issues to GDP
<b>Efficiency</b>	Net interest margin Lending-deposits spread Non-interest income to total income Overhead costs (% of total assets) Profitability (return on assets, return on equity) Boone indicator (or Herfindahl or H-statistics)	Turnover ratio (turnover/capitalization) for stock market Price synchronicity (co-movement) Private information trading Price impact Liquidity/transaction costs Quoted bid-ask spread for government bonds Turnover of bonds (private, public) on securities exchange Settlement efficiency
<b>Stability</b>	Z-score (or distance to default) capital adequacy ratios asset quality ratios liquidity ratios other (net foreign exchange position to capital etc)	Volatility (standard deviation/ average) of stock price index, sovereign bond index Skewness of the index (stock price, sovereign bond) Vulnerability to earnings manipulation Price/earnings ratio Duration Ratio of short-term to total bonds (domestic, int'l) Correlation with major bond returns (German, US)

### 2.3.2 Variables

In this study, we choose the determinants of bank credit in light of the bank lending channel and financial development literature.<sup>28</sup>

#### The bank lending activity

The dependent variable is the credit-to-GDP ratio expressed in percent which measures the size of the banking sector and is a common proxy for the depth or the level of financial development. It defines the financial resources provided to the private sector by domestic money banks as a share of GDP. This measure contrasts with most of empirical studies using bank level data. A direct aggregation of banks' data at the macroeconomic level would lead to a metric at the industry level for country  $j$ :

$$\frac{L_j}{TA_j} = \frac{\sum_{i=1}^m L_{i,j}}{\sum_{i=1}^m TA_{i,j}}$$

Where  $L_{i,j}$  is the loan issued by bank  $i$  ( $i = 1 \dots m$ ) operating in country  $j$ , and  $TA_{i,j}$ , the total assets of bank  $i$  operating in country  $j$ . Our dependent variable replaces the sum of banks' total assets  $\sum_{i=1}^m TA_{i,j}$  by GDP in country  $j$ :

$$\frac{L_j}{GDP_j} = \frac{\sum_{i=1}^m L_{i,j}}{GDP_j} \cong \frac{Credit_j}{GDP_j}$$

The sum of the loans issued by banks operating in country  $j$  is proxied by the private credit measured at the macroeconomic level.

We split the determinants of bank credit into three categories: (i) capital and funding positions that are our variables of interest, (ii) bank-specific characteristics, (iii) banking sector-specific characteristics, and (iv) macroeconomic controls.

#### The Capital and funding positions

The capital and liquidity regulatory requirements are designed to modify the capital and liquidity positions of the banking sector. The capital regulatory requirement was introduced in Basel I but has evolved since the initial version. The liquidity requirement was introduced in Basel III in order to provide guidelines to address

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<sup>28</sup>See for example Gambacorta and Marques-Ibanez (2011) and Allen et al. (2012) for a selection of the determinants.

the liquidity issues that appeared after the triggering of the 2008 GFC. As shown in BCBS (2016) and Gambacorta and Shin (2018), the capital and liquidity requirements have common implications for bank behavior. The main challenge for regulatory authorities is to deeply understand these implications for ensuring financial stability.

- Capital regulatory requirements

The literature on the relationship between bank capital and lending has been extensively documented since the adoption of the first Basel Capital Accords in 1988. The use of the equity-to-asset ratio presented several drawbacks due to the specificity of the banking industry, which called for a deeper understanding of the capitalization process of banks.<sup>29</sup> The adoption of Basel I accompanied the introduction of a newly method for assessing the capital position of banks. The novel aspect of the metric accounted for a capital measure that is sensitive to the banking credit risk. Due to the evolution of the complexity of financial systems, this measure included additional types of risk, namely, the market and operational risks in the next Basel II regime adopted in 2006 in the EU. The risk sensitive measure corresponds to the amount of regulatory capital the bank disposes of to countervail the risk inherent to its investment activities (For further details, see Box 2.1). This measure has become the standard to analyze the impact of the capital regulatory requirement on bank behavior in the literature. However, the role of bank capital in the economy remains a debate of on-going research.<sup>30</sup> The adoption of liquidity standards since the 2008 financial crisis has raised further concerns on the understanding of such a debate. In addition, the design of risk sensitive measures such as the risk-based capital ratio raises several issues at the aggregate level. First, as outlined in IMF (2019), comparison across countries might be difficult due to differences in national accounting, taxation, and supervisory regimes. Although European Authorities promotes the harmonization of prudential rules, the heterogeneity of tax regimes remains.<sup>31</sup>

Second, the definition of regulatory capital might not be time consistent as several versions of regulatory standards at the international level have been published since the first adoption of the Accords.

Third, the internal ratings-based approach has been adopted since the implementation of Basel II. Banks are allowed to use their own model to determine the amount of regulatory capital to cover the credit risk. The aggregation rule established in the guideline proposes to sum the denominator of the ratio, i.e. the

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<sup>29</sup>For a deeper understanding of these specificities, see Freixas and Rochet (2008).

<sup>30</sup>For a discussion on this topic, see Gorton and Winton (2017).

<sup>31</sup>For further details, see Enoch et al. (2013)

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risk-weighted assets, although the measure of credit risk remains bank driven mainly. This raises an additional issue at the aggregated level.

### Box 2.1. The Basel Capital Standard

The Latin American Debt crisis in the 80s urged the BCBS to design a global regulatory framework to prevent internationally active banks from capital shortage related to their activities and allowing them to play on the same level playing field.

The initiative supported by the Group of Ten (G-10) countries, gave rise to the first Basel Capital Accords, a consultative paper defining the newly global regulatory framework to which international active banks had to comply with. This approach has introduced novel aspects of regulatory practices at the international level. First, banks had to comply with a target standard capital ratio in order to build adequate capital risk coverage. This newly introduced capital ratio defined the portion of eligible capital that banks were required to hold to cover the risk induced by their credit activities mainly. The capital ratio under Basel I was defined as follows:

$$\text{Basel I capital ratio} = \frac{\text{Capital}}{\text{Risk Weighted Assets}} \geq 8\% \quad (2.1)$$

The numerator (capital) is split into two components denominated "Tier". First, Tier 1 defines the core capital or the basic equity. It corresponds to equities and disclosed reserves issued by banks. Tier 1 has the main advantage to be common to all countries' banking systems and ensures transparency to investors as it is freely available in banks' published accounts. Tier 2 or supplementary capital consists of diverse financial instruments, e.g undisclosed and revaluation reserves, hybrid capital debt instruments etc... These instruments are subject to private disclosure. Thus, they are defined with lower risk-absorption capacity relative to Tier 1.

The denominator (risk weighted assets) is the second innovation in Basel I. In addition to standard gearing ratios applied in the banking industry, risk weighted assets allow for a measure sensitive to the degree of asset riskiness. Thus, bank capital is allocated according to different categories of asset or off-balance-sheet exposure. Assets were categorized using five weights - 0, 10, 20, 50 and 100% - under Basel I.

Source: Author

- Liquidity regulatory requirements

Following the 2008 GFC, banks suffered from massive liquidity disruptions which called for the need of consequent public support in most developed financial systems.<sup>32</sup>

In recognition of the need to lead newly designed financial reforms, the Basel Committee introduced in December 2010 a global regulatory framework known as Basel III. One of the novel aspects of this regulatory regime is the introduc-

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<sup>32</sup>Financial systems in the world have showed different resilience in response to the 2008 financial shock. See for example World Bank (2012) and Brei et al. (2013) for the topic on public support.



tion of liquidity standards aiming at encouraging sound liquidity management practices. The 2008 GFC has shown that liquidity should not be underestimated as the financial stress experienced during the crisis has necessitated the intervention of central banks and changed the conduct of monetary policy in the post-crisis period. Liquidity is however complex as it covers multidimensional aspects and represents an additional challenge for the design of banking regulation.

First, over-reliance on short funding during the financial crisis raised the rationale for improving the resilience of the banking sector in the short-term.<sup>33</sup> The LCR is designed to avoid massive liquidity disruptions on this type of funding.

Second, the build-up of unbalanced funding structures on a longer time horizon leads to the adoption of the NSFR.<sup>34</sup> As illustrated during the 2008 GFC and its aftermath, the insufficient holdings of liquidity buffers of the banking sector at the short and longer terms represents a common macroeconomic risk. This risk can significantly affect the real economy when economies remain bank-based essentially.

A growing body of literature has emerged since the post-crisis period to understand the impact of liquidity ratios on banks' behavior and their implications for the real economy.<sup>35</sup> Similar to the literature assessing the impact of banking capital regulation, two strands have developed using a microeconomic and macroeconomic approaches to understand the impact of liquidity standards on bank behavior and the macroeconomy. Studies at the microeconomic level show that banks have adopted different balance-sheet adjustment processes to comply with regulatory standards.<sup>36</sup> These strategies were very similar to the ones adopted under the application of the first Basel capital standards.

- Measurement of the funding structure

We measure the funding position of the banking sector using the deposit-to-GDP ratio available from the GFDD. Deposits correspond to the sum of the total value of demand, time and saving deposits at domestic deposit money banks relative to the GDP. In our model, this indicator aims at measuring the sensitivity of credits to deposits. This metric is in line with the scope of the chapter, which adopts a financial development approach to assess the impact of banking regulation on the development of the banking sector.

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<sup>33</sup>See for example Huang and Ratnovski (2011).

<sup>34</sup>For further details on the ratios, see Box 2.2.

<sup>35</sup>See BCBS (2016) for a complete review of literature.

<sup>36</sup>A complete review of these strategies can be found in King (2013).

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### Box 2.2. Basel Liquidity Standards

The GFC has called for the implementation and integration of liquidity standards at the international level. In response to the inability of the banking sector to build up sufficient liquidity buffers, the BCBS had designed a liquidity regulatory framework aiming at promoting sound practices in liquidity management. Similar to the adoption of capital standards, the Basel Committee defined two metrics to which banks have to comply with. First, the LCR requires banks to hold sufficient High Quality Liquid Assets (HQLA) to limit excessive liquidity needs at short-notice (30 days). The LCR is defined as follows:

$$\text{LCR} = \frac{\text{Stock of High Quality Liquid Assets}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\% \quad (2.2)$$

The numerator corresponds to cash or bank assets that can be sold on financial markets at insignificant losses in order to fund liquidity needs for a 30-day period. The denominator defines the total net cash outflows that banks must cover in case of liquidity stress.

The second metric, i.e. the NSFR, corresponds to the Available Amount of Stable Funding (AASF) that banks are able to allocate to face liquidity shortages at a longer time horizon (one year).

$$\text{NSFR} = \frac{\text{Available Amount of Stable Funding}}{\text{Required Amount of Stable Funding}} \geq 100\% \quad (2.3)$$

The AASF represents the sources of funding the bank collects to manage the liquidity gap induced by its investment activity. An Available Stable Funding (ASF) factor is applied to each liability or equity component determining thus the available structure of funding the bank disposes of.

The Required Amount of Stable Funding (RASF) defines the amount of stable funding the bank has to mobilize for its investment activities. Similar to the construction of the AASF, a Required Stable Funding (RSF) factor is applied to each asset component in order to determine the funding risk profile of the banking institution.

The adoption of international regulatory standards on liquidity gave rise to a recent body of research focusing on their impact on bank behavior. Similar to the studies assessing the impact of the first Basel capital accords, the literature highlights the strategies that banks adopted to comply with these liquidity standards.

Source: Author

### Control variables: Bank specific characteristics

The recent literature studying the determinants of bank loan supply highlights the need to consider the business model of the bank.<sup>37</sup> In addition to take into account the funding structure, we use other indicators of the bank business model related

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<sup>37</sup>See for example, Gambacorta and Marques-Ibanez (2011).

### 2.3. Data and descriptive statistics

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specifically to its liquidity, profitability and loan quality. All of these measures are taken from the GFDD and thus aggregated at the country level.

Liquidity is an important determinant of bank lending.<sup>38</sup> The standard indicator of liquidity is the ratio of liquid assets to total assets. This measure is not available in the GFDD. We choose a metric (*LIQ*) close to this indicator named "Liquid assets to deposits and short term funding" expressed in percent. Following the definition available in the GFDD, liquid assets correspond to "cash and due from banks, trading securities and at fair value through income, loans and advances to banks, reverse repos and cash collaterals". Deposits and short term funding cover the total amount of customer deposits available in the banking sector which includes current, savings and term deposits. Short-term borrowings are money market instruments, Certificate of Deposit (CD)s and other deposits.

Kim and Sohn (2017) highlight the role of bank profitability in determining bank loan supply for United States (US) commercial banks. The impact of profitability on bank lending remains a topic of on-going research. First, bank profitability is positively associated with bank lending as it reflects the quality of the bank balance-sheet and thus, the capital ratio. On the other hand, bank profitability might negatively impact bank loan supply. A higher level of profitability might be perceived as a riskier bank investment strategy. In order to improve the quality of assets, banks reduce thus the amount of loans. We measure the profitability of the banking sector using the Return on Assets ratio (*ROA*). It corresponds to the commercial banks' after-tax net income relative to yearly averaged total assets and expressed in percent.

It is also important to take into account the quality of the loan portfolio. Several indicators are considered in the literature to proxy the loan quality of the banking portfolio. We use the non-performing loan ratio (*NPL*), which defines the ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio). As outlined in Kim and Sohn (2017), this variable is a backward measure of the quality of the loan portfolio. The ratio of loan loss allowance to total loans would complement this measure to obtain a forward view of loan quality, but it is not available from the GFDD. The inclusion of the Non Performing Loans (NPL) ratio is twofold. First, as underlined in Mesnard et al. (2016), non-performing loans constitute an important issue in Europe both for the financial stability and economic growth prospects. In addition, the inclusion of the NPL ratio would shed some light on the origins of a possible credit crunch scenario in Europe as questioned in section 2.2. In particular, a credit crunch, if any, would occur if non-performing loans worsens significantly the quality of bank balance-sheets.

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<sup>38</sup>See for example Kim and Sohn (2017).

### Control variables: Banking sector characteristics

In addition, we also consider other determinants of the banking development at the sectoral level. First, Allen et al. (2012) highlight the importance of the financial structure in the economy. They consider the development of financial markets (i.e. stock and bond markets) to account for the development of the banking sector. We use the stock market capitalization ratio (in percent of GDP) to control for the size of market funding (*STOCK*).<sup>39</sup>

Competition is central to the strategy of the financial integration policy in Europe. The recent literature shows that competition has common implications with the objective of financial stability (see for example Vives (2016)). We use the bank concentration index (*BC*) available in the GFDD to control for concentration (the higher the concentration, the lower the competition). This index is measured as the portion of assets holds by the three largest commercial banks in the sector relative to the total of commercial banking assets.

Finally, section 2.2 suggests to control for external funding to account for the development of the banking sector in the UE. Our sample covers the period 2000-2017 during which the CEE economies benefited from this type of funding.<sup>40</sup> We specifically control for the banking cross-border activity (*CLAIM*). Cross-border banking in Europe has raised concerns for financial stability since the 2008 financial crisis. We use the ratio of consolidated financial claims relative to GDP developed by the Bank for International Settlements (BIS) and available in the GFDD.

### Macroeconomic controls

Economic and monetary conditions are important for the credit activity. We control for economic conditions using the GDP per capita. Monetary conditions rely on the conduct of monetary policy. We control for monetary conditions using the Euro OverNight Index Average (EONIA) rate that prevails on the interbank market. This standard measures the cost of refinancing when banks create money by issuing loans. This control variable allows us to control for a shift overtime, common to all countries.

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<sup>39</sup>Another determinant of the banking sector development is the bond market ratio which reflects the importance of debt funding in an economy. However, due to a lack of data, we are not able to control for this type of funding.

<sup>40</sup>For a review on this topic, see for example Berger et al. (2014).

## 2.3. Data and descriptive statistics

Table 2.2. Definition of main variables and data sources

Variable	Definition	Source
<i>Banking sector development</i>		
<i>CREDIT</i>	Private credit by deposit money banks to Gross Domestic Product (GDP) (%)	WB
<i>Bank-specific characteristics</i>		
<i>CAP</i>	Bank regulatory capital to RWA (%)	WB
<i>FUND</i>	Bank deposits to GDP (%)	WB
<i>LIQ</i>	Liquid assets to deposits and short term funding (%)	WB
<i>ROA</i>	Bank return on assets (% , after tax)	WB
<i>NPL</i>	Bank nonperforming loans to gross loans (%)	WB
<i>Banking sector characteristics</i>		
<i>STOCK</i>	Stock market capitalization to GDP (%)	WB
<i>BC</i>	Bank concentration (%)	WB
<i>CLAIM</i>	Consolidated foreign claims of BIS reporting banks to GDP (%)	WB
<i>Macroeconomic controls</i>		
<i>MP</i>	EONIA rate (%)	ECB
<i>GDP</i>	GDP per capita (Constant 2005 USD)	WB

### 2.3.3 Descriptive statistics

Table 2.3 and 2.4 refer to the descriptive statistics and cross-correlation tables.

The mean value for the variable *CREDIT* equals 84% with a standard deviation of 42%. As outlined in section 2.2, the heterogeneity among European countries is particularly high (see figure 2.1). While the ratio is lower for the Eastern region with a homogeneous distribution, the distributions are relatively heterogeneous within the Northern, Western and Southern regions.

High values of credit are found for Cyprus, Denmark, Ireland, Portugal, Spain, Switzerland and the UK, which are financial centers for most of them. The minimum value

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(6.4) is observed for Romania in 2000, and the maximum (212) for Denmark in 2009.

This heterogeneity is mainly explained by the between variance (0.51 for the log of *CREDIT*), which is slightly above the within variance (0.29 for the log of *CREDIT*).<sup>41</sup> That would mean that the variability of credit would be mainly driven by the country economic heterogeneity and less by a common trend over the period which is confirmed in the robustness checks (see section 2.6).

The mean value for *CAP* equals 15.1 with a standard deviation of 4.1, while the mean value for *FUND* equals 79.5 with a standard deviation of 64.8, signaling a higher heterogeneity of the variable *FUND*. The coefficient of variation for *FUND* (0.82) is three times that of *CAP*. One explanation might stem from the early implementation of capital standards at the international level relative to liquidity ones. It probably promotes the harmonization of the capital positions across countries. These two variables show different sources of variability, country heterogeneity for *FUND*, time variability for *CAP* where within variance dominates (see appendix A.2).

Other bank specific characteristics also show a high level of heterogeneity with high coefficients of variation: 2.286 for the variable *ROA* and 1.203 for the variable *NPL*. The minimum value of *ROA* (-10.47) is observed for Slovenia in 2013. The variability would be mainly driven by the 2008 GFC as the within variance is twice the between variance. The heterogeneity in the variable *NPL* shows that banking sectors are heterogeneous, probably in terms of credit screening capacities. This heterogeneity in the banking sector efficiency underlines from another perspective the importance of financial development.

Regarding the level of the stock market capitalization index (*STOCK*), Finland, Luxembourg and Switzerland show the highest values contrasting with the CEE region which shows weak degrees of stock market capitalization. This shows once again the heterogeneity in financial development among European countries.

The correlation between bank capital and credit is significantly negative ( $p < .05$ ) with an estimated coefficient of -0.135, while, usually, most of empirical studies at the microeconomic level establish a positive relationship. This might be due to the existence of a nonlinear relationship at the aggregate level and/or the choice of GDP as the denominator of the ratio.

Second, the relationship between the funding structure and credit is significantly positive ( $p < .01$ ) with an estimated coefficient of 0.301. We can also notice that the relationship between *FUND* and *CREDIT* appears to be stronger than the one between

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<sup>41</sup> See appendix A.2 for further details.

### 2.3. Data and descriptive statistics

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*CAP* and *CREDIT* as both the magnitude of the coefficient and the significance are greater. The capital and funding positions are weakly correlated with an estimated coefficient of 0.094, which is significant at 10%.

Third, the relationship between liquidity and credit is positive, which is consistent with the existing literature.<sup>42</sup> It suggests that a better liquidity profile of the banking sector tends to favor its development. Finally, we also find a negative relationship between the profitability (*ROA*) and bank lending (*CREDIT*).

All banking sector characteristics show a positive correlation with bank lending. The correlations remain relatively strong for the indicator of stock market (*STOCK*) and concentration (*BC*). It suggests that the market structure is a complement to bank-based systems. The positive correlation between bank concentration and credit suggests that bank loan supply in the EU might be driven by major banks featuring concentrated banking systems.

Finally, macroeconomic determinants have a strong relationship with the development of the banking sector. The correlations with the GDP per capita (*GDP*) and the monetary policy index (*MP*) are 0.54 and -0.13 respectively.

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<sup>42</sup>See for example Brei et al. (2013) and Kim and Sohn (2017).

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Table 2.3. Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
<i>Banking sector development</i>					
CREDIT	509	83.60	41.82	6.39	211.92
<i>Bank-specific characteristics</i>					
CAP	489	15.13	4.05	7.00	35.65
FUND	500	79.50	64.78	15.23	472.05
LIQ	522	37.46	17.19	5.26	130.63
ROA	522	0.56	1.28	-10.47	4.24
NPL	474	6.01	7.23	0.10	48.68
<i>Banking sector characteristics</i>					
STOCK	462	55.83	49.95	0.74	263.75
BC	519	69.59	17.02	30.62	100.00
CLAIM	522	121.06	193.06	9.87	1,330.98
<i>Macroeconomic controls</i>					
MP	540	1.68	1.68	-0.746	5.97
GDP	522	33,127.05	21,827.41	3,955.28	111,968.00



Table 2.4. Correlation Matrix

	CREDIT	CAP	FUND	LIQ	ROA	NPL	STOCK	BC	CLAIM	GDP	MP	CEE
CREDIT	1.000											
CAP	-0.135** (0.003)	1.000										
FUND	0.301*** (0.000)	0.094* (0.042)	1.000									
LIQ	0.136** (0.002)	0.137** (0.002)	0.219*** (0.000)	1.000								
ROA	-0.293*** (0.000)	0.109* (0.016)	-0.131** (0.003)	0.139** (0.001)	1.000							
NPL	-0.148** (0.001)	0.130** (0.005)	-0.078 (0.098)	-0.320*** (0.000)	-0.330*** (0.000)	1.000						
STOCK	0.504*** (0.000)	-0.071 (0.140)	0.511*** (0.000)	0.407*** (0.000)	-0.039 (0.404)	-0.364*** (0.000)	1.000					
BC	0.265*** (0.000)	-0.046 (0.310)	-0.217*** (0.000)	0.059 (0.179)	-0.024 (0.585)	-0.093* (0.043)	0.104* (0.025)	1.000				
CLAIM	0.111* (0.012)	0.125** (0.006)	0.905*** (0.000)	0.224*** (0.000)	-0.028 (0.518)	-0.134** (0.003)	0.375*** (0.000)	-0.305*** (0.000)	1.000			
GDP	0.536*** (0.000)	0.045 (0.323)	0.709*** (0.000)	0.444*** (0.000)	-0.134** (0.002)	-0.316*** (0.000)	0.735*** (0.000)	0.061 (0.168)	0.635*** (0.000)	1.000		
MP	-0.135** (0.002)	-0.548*** (0.000)	-0.113* (0.012)	0.167*** (0.000)	0.198*** (0.000)	-0.306*** (0.000)	-0.022 (0.634)	0.019 (0.673)	-0.002 (0.969)	-0.113** (0.010)	1.000	
CEE	-0.592*** (0.000)	0.131** (0.004)	-0.317*** (0.000)	-0.219*** (0.000)	0.178*** (0.000)	0.174*** (0.000)	-0.430*** (0.000)	-0.433*** (0.000)	-0.181*** (0.000)	-0.549*** (0.000)	0.009 (0.831)	1.000

*p*-values in parentheses

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

## 2.4 Econometric methodology

Our objective is to assess whether the heterogeneity observed at the regional level is a determinant of the development of the banking sector and should therefore be considered for the design of banking regulation.

Our empirical specification corresponds to a model of bank loan supply. This type of model has long been established in the microeconomic literature motivated by the implementation of international regulatory standards. The seminal contribution on the impact of international regulatory standards on bank lending can be found in Jackson et al. (1999) and BCBS (2016). However, we propose a new perspective at the macroeconomic level with bank lending activity being measured by the private credit-to-GDP ratio. Therefore, our model is not a direct transposition of bank loan supply set in most of micro empirical studies. Rather, our model corresponds to the production of credits in an economy and does not reflect the behavior of banks per se.

The econometric specification presented in this study represents a convenient frame-

work for analyzing the impact of different banking determinants on the banking sector development. Our contribution is to shed light on the debate on financial stability by showing that banking regulation, financial and economic development are interrelated concepts.

The stylized facts show that European financial systems are heterogeneous in terms of financial depth, and that the relationships between the development of the banking sector and its capital and funding positions are different across European countries. The distinction between Western and Eastern Europe seems particularly relevant from both a univariate and bivariate perspective.

Considering that the use of regulatory instruments is not neutral on bank loan supply and thus the banking sector development, we state that, under the null hypothesis, regulatory ratios have the same effect on the issuance of private credit measured as the ratio of credit-to-GDP. In this case, a unique credit equation can summarize a common relationship for all the sample and the answer to the question is “yes, one rule fits all”. However, the stylized facts suggest the opposite.

### 2.4.1 Baseline model

Under the null hypothesis, the relationship between capitalization and funding and credit is common for all regions. In order to test this hypothesis, we set the following econometric model. Results are presented in table 2.5.

$$CREDIT_{i,t} = \alpha + \beta_1 CAP_{i,t-1} + \beta_2 FUND_{i,t-1} + \theta Z_{i,t-1} + \epsilon_{i,t-1}, \quad (2.4)$$

Where  $CREDIT_{i,t}$  denotes the credit-to-GDP ratio for country  $i$  at year  $t$ ;  $CAP_{i,t-1}$  defines the capital position of the banking sector;  $FUND_{i,t-1}$  corresponds to the funding position measured as the deposit-to-GDP ratio; and  $Z_{i,t-1}$  is a set of control variables encompassing bank specific characteristics, banking sector characteristics and macroeconomic controls presented in previous sections. The parameters  $(\alpha, \beta_1, \beta_2, \theta)$  is a vector of estimated coefficients with Ordinary Least Squares (OLS) regressions based on a pooled sample. Robustness checks account for Time Fixed-Effects (TFE) and outliers.

All variables are expressed in logs.<sup>43</sup> Our objective is to assess the elasticity (sensitivity) of the depth of the financial sector to the capital and funding positions. Moreover, we

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<sup>43</sup>The transformation of the variables  $ROA$  and  $MP$  are expressed as  $\ln(1 + X)$ .

lag them once to avoid a source of endogeneity.<sup>44</sup>

*CAP* and *FUND* measure the capital and funding positions of the banking sector respectively. We use the risk-sensitive approach to measure the capital position of the banking sector. The variable *CAP* is the ratio of regulatory capital to risk-weighted-assets expressed in percent. This ratio is regulatory driven since the implementation of the capital standards in 1988. Therefore, we have a direct measure of the impact of capital regulation on the banking sector development.

We measure the funding position of the banking sector using the deposit-to-GDP ratio (*FUND*), expressed in percent. This measure differs from the capital one to the extent that the implementation of standards on deposits has remained at the national level before the implementation of Basel III. We consider that the funding position is therefore banking driven mainly. This variable has the advantage to be calculated over the entire period, which would not be possible with a funding measure such as the NSFR.

The coefficient  $\beta_1$  measures the elasticity of credit to capital and  $\beta_2$  measures the elasticity of credit to deposit. These two coefficients are used to assess the relationship that does exist between the credit activity and the capital and funding positions.

Other bank specific characteristics include indicators of efficiency and stability. The profitability of the bank reflects its business model which is an important determinant of bank lending at the macroeconomic level.<sup>45</sup> In this study, we measure the profitability of the bank using the variable *ROA* available in the GFDD. It corresponds to the after-tax net income of the bank to yearly averaged total assets also expressed in percent. The relationship between profitability and bank lending remains uncertain. On the one hand, high levels of profitability might reflect better bank balance-sheet management. Banks with high profitability tend to show high levels of capital ratios. Thus, we expect a positive relationship between profitability and bank lending. On the other hand, profitability is a proxy of the risk the bank incurs on its assets. Banks might decrease the volume of loans (i.e. downsizing) to improve the quality of assets.

The quality of the loan portfolio is also important for bank lending. We choose the non-performing loan ratio (*NPL*) as a proxy for the quality of banks' loan portfolio. The literature establishes a negative relationship between *NPL* and bank lending. Banks tend to reduce lending as the quality of the portfolio worsens. This adjustment is necessary as the deterioration in loan quality increases credit risk, which in turn deteriorates capitalization ratios.

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<sup>44</sup>For a justification, see Brei et al. (2013) and Kim and Sohn (2017).

<sup>45</sup>See for example Gambacorta and Marques-Ibanez (2011).

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Banking sector characteristics include the size of the stock market (*STOCK*), the concentration of the banking sector (*BC*) and the external funding (*CLAIM*) as presented in section 2.3. Allen et al. (2012) argue that banking sectors and financial markets are complementary instrument for economic development. This argument is particularly relevant for the European case because the development of other sources of funding such as financial markets is an additional instrument to complement the role of the banking sector and ensuring the capital market integration in the EU.<sup>46</sup>

Following Fungáčová et al. (2014), competition appears as an important determinant of bank lending as it might impact the bank lending channel especially in the euro area. We proxy competition in the EU via the concentration index (*BC*) previously defined.

Economic and monetary conditions might impact the bank credit activity. In particular, monetary policy and economic development are key drivers of bank loan supply. We choose to control for the conduct of monetary policy (*MP*) using the EONIA and the GDP per capita to account for the level of economic development (*GDP*).

We introduce an interaction term (cross-effect) in equation 2.4 between *CAP* and *FUND* in order to deeply investigate the relationship between capital and deposits and to measure its potential impact on the banking sector development.

$$CREDIT_{i,t} = \alpha + \beta_1 CAP_{i,t-1} + \beta_2 FUND_{i,t-1} + \beta_3 CAP_{i,t-1} * FUND_{i,t-1} + \theta Z_{i,t-1} + \epsilon_{i,t-1}, \quad (2.5)$$

The elasticity of credit to capital is obtained by deriving equation 2.5 with respect to the variable *CAP*. The amplitude of the coefficient is given by  $\beta_1 + \beta_3 FUND_{i,t-1}$ . We find that the sign and the amplitude of the elasticity depends on the sign and the size of  $\beta_1$  and  $\beta_3$  and on the level of *FUND* because the variable is expressed in log. Similarly, the elasticity of credit to deposit is given by  $\beta_2 + \beta_3 CAP$ .

### 2.4.2 Alternative models

In this section, we define additional econometric specifications to capture the regional heterogeneity in the capital, funding and banking sector development relationship.

The econometric model is defined as follows:

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<sup>46</sup>See the Juncker Commission's ten priorities for an illustration.

$$CREDIT_{i,t} = \alpha + \beta_1 CAP_{i,t-1} + \beta_2 FUND_{i,t-1} + \theta Z_{i,t-1} + \delta_{FC} FC_i + \delta_E CEE_i + \epsilon_{i,t-1}, \quad (2.6)$$

We show in sections 2.2 and 2.3 high values of banking system deposits for countries that are financial hubs or tax havens, which collect a significant amount of deposits not aligned with the fundamentals of the economy. In this study, we consider financial centers because our sample covers the period 2000-2017 featuring differences in tax regimes and regulatory requirements among EU countries. We define the dummy variable  $FC_i$  taking the value 1 if the country is a financial center or tax havens following the classification from Zoromé (2007) and Enoch et al. (2013). The variable  $CEE_i$  is a dummy variable taking the value 1 if the country belongs to the CEE region and 0 otherwise.

We include two additional variables in equation 2.6 in order to deeply investigate the heterogeneity of the EU financial systems. In particular, we study the statistical relationship in the light of the capitalization and funding structures of the CEE. The specification is as follows:

$$CREDIT_{i,t} = \alpha + \beta_1 CAP_{i,t-1} + \beta_{1,E} CEE * CAP_{i,t-1} + \beta_2 FUND_{i,t-1} + \beta_{2,E} CEE * FUND_{i,t-1} + \beta_{3,E} CEE * CAP_{i,t-1} * FUND_{i,t-1} + \theta Z_{i,t-1} + \epsilon_{i,t-1}, \quad (2.7)$$

The relationship between credit and capitalization is defined by  $\beta_1$  for non-CEE and by  $\beta_1 + \beta_{1,E} + \beta_{3,E} * FUND_{i,t-1}$  for CEE. Under the null hypothesis (i.e. “one rule fits all”), we have  $\beta_1 = \beta_1 + \beta_{1,E} + \beta_{3,E} * FUND_{i,t-1} = 0$ . Similarly, the relationship between credit and deposit is defined by  $\beta_2$  for non-CEE and by  $\beta_2 + \beta_{2,E} + \beta_{3,E} * FUND_{i,t-1} = 0$  for CEE. Under the null hypothesis (i.e. “one rule fits all”), we have  $\beta_{2,E} = \beta_2 + \beta_{2,E} + \beta_{3,E} * CAP_{i,t-1} = 0$ .

## 2.5 Results

### 2.5.1 Baseline model

Table 2.5 presents the results of the baseline specification.

Regression R1 corresponds to the basic relationship between the development of the banking sector and the capital and funding positions. The two coefficients are highly significant ( $p < .01$ ). The capital ratio has a negative impact on the development of the banking sector suggesting that the FFCO hypothesis set in Berger and Bouwman

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(2009) prevails for the case of the EU. This result is consistent with most of the literature studying the impact of capitalization on the macroeconomy. However, it is inconsistent with most of micro empirical studies using micro-data where the RAC hypothesis prevails. This does suggest that the financial fragility crowding out hypothesis holds at the macroeconomic level but not at the microeconomic one. This finding shows that the aggregated data do not exhibit the same pattern than those observed at the microeconomic level. The design of a regulatory framework should thus consider this new result as banking regulation target macroeconomic objectives. All things being equals this finding brings the empirical evidence that an increase in the capital regulatory ratio decreases the size of the banking sector at the macroeconomic level .

Second, we find that customer deposits exert a significant and positive impact on the development of the banking sector. Unlike capital, the impact of funding on bank lending appears to hold at the macroeconomic level. Usually, the basic argument in the microeconomic literature suggests that bank lending tends to expand as the funding structure of the bank strengthens. This result is important for the lead of the European regulatory policy. It shows that the construction of standard business models, i.e collecting customer deposits and granting loans, contributes to the development of the banking sector. While other business models relying on short-term wholesale funding notably might produce financial instability as observed in the aftermath of the 2008 GFC. In addition, this type of business model would alter the traditional function of financial institutions, i.e. funding the real economy. Thus, adopting financial reforms promoting standard business models would favor the development of the banking sector and contributes to economic development.

Regression R2 includes other microeconomic determinants related to the bank specific characteristics. The estimates of the coefficients on capital and funding remain stable. Liquidity has no effect on the development of the banking sector. This result is also inconsistent with microeconomic studies which argue for a positive impact of liquidity on bank lending.<sup>47</sup> However, we find that liquidity has a negative impact on bank lending in R3, R4 and R5. These different results might be due to the definition and calculation of the liquidity ratio available in the GFDD. Liquidity defines the ratio of liquidity assets to total assets and is expressed in percent in microeconomic studies while the indicator of liquidity available in the GFDD corresponds to liquid assets to deposit and short-term funding also expressed in percent. In addition, this ratio is computed on an unconsolidated format and the definition of the ratio might vary across time depending on the evolution of accounting standards.

The profitability of the bank has a negative impact suggesting that the asset quality

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<sup>47</sup>See for example, Brei et al. (2013) and Kim and Sohn (2017).

channel hypothesis prevails. A higher profitability can imply a greater risk on assets. As a result, banks with higher profitability might offer fewer loans to improve the quality of assets. Finally, consistent with the literature, the quality of the loan portfolio has a negative impact on credit. A rise of one unit of the change in loan quality leads to a decrease of 0.1% in lending.

The third set of regressions (R3) includes banking sector characteristics. The introduction of these determinants increases R-squared from .443 to .624. The estimates of the coefficients associated to the capital and funding positions remain stable compared to R1 and R2. We find that banking concentration (*BC*) has a significant and positive impact on credit. A rise in the concentration ratio increases the development of the banking sector by nearly 0.5%. This result is inconsistent with most of the empirical literature justifying the promotion of banking competition to favor bank lending. We suggest that the model reflects a statistical relationship and that bank credit in Europe is mainly driven by large banks including Domestic Systemically Important Banks (D-SIBS) and Global Systemically Important Banks (G-SIBS). This finding illustrates the challenge for the competition and regulatory policies in setting the right incentive mechanisms to favor the development of the banking sector without causing deleterious effects on financial stability.

The stock market index (*STOCK*) which controls for the size of the stock market, shows a positive and significant influence on the development of the banking sector meaning that an increase in the size of the stock market tends to favor the depth of the banking sector. This result shows that the two funding structures are complement rather than substitute as we could expect. It also suggests that the stock and banking markets move in the same way likely due to the changing business model of European banks which raised their importance on financial markets.<sup>48</sup> This result illustrates the need to take into account the relationship of the different funding structures. Although the development of other sources of funding represents an additional strategy for risk diversification, measuring the risk of the financial institution activity on financial markets appears essential for insuring the goal of financial stability as the banking and investment activities might be closely related.

The indicator of the cross-border activity (*CLAIM*) shows no significant impact on the development of the banking sector. This results is inconsistent with most of the literature evidencing a strong role of cross-border funding in financial and economic development. In particular, cross-border lending has been essential for the development of Eastern European economies as outlined in Beck (2012) and in European Bank

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<sup>48</sup>For a review of the transformation of the European financial systems and its implications, see for example ECB (2003) and Berger et al. (2014).

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Coordination Vienna Initiative and others (2012). The results presented in section 2.6 confirms this view. External funding had a positive and statistically significant impact on the development of the banking sector for the period 2000-2017 in the EU. However, as outlined in Beck (2012), the cross-border activity might represent an issue for financial stability due to the volatility of capital flows with a significant impact on the duration of crises. The statistically and significant impact of the cross-border activity on the banking sector development shows that cross-border activity is an additional aspect to consider for the design of banking regulation. It supports the view presented in European Bank Coordination Vienna Initiative and others (2012) for the design of a unique model of bank supervision in the EU.

We include the main macro determinants in regressions R4 and R5 which only marginally improves the explanatory power of the model with an increase of the R-squared coefficient from .624 to .660. The estimates of the coefficients  $\beta_1$  and  $\beta_2$  remain stable. The impact of the coefficient of GDP per capita is significantly positive ( $p < .01$ ) as expected. The impact of monetary policy (*MP*) is significantly negative, which is also expected (an increase in the cost of funds lowers credit activity).

Regression R5 introduces the interaction term between capital *CAP* and funding *FUND*. The estimated coefficient of the variable *CAP* becomes positive, but the coefficient of the cross-term *CAP \* FUND* is significantly negative ( $p < .01$ ).

It brings the empirical evidence that the statistical relationship between capital, deposits and lending is complex featuring conditional threshold effects:

$$\frac{\partial CREDIT}{\partial CAP} = 1.77 - 0.60 * FUND \quad (2.8)$$

$$\frac{\partial CREDIT}{\partial FUND} = 1.85 - 0.60 * CAP \quad (2.9)$$

Based on equations 2.8 and 2.9, we obtain the thresholds for the elasticities of credit to capital and credit to deposit. We find that the elasticity of credit to capital is negative when the log of *FUND* is above 2.93 ( $1.770/0.604$ ), that is when the variable *FUND* is above 18.74. Similarly, we find that the elasticity of credit to funding is positive when the variable *CAP* is below 21.53.

The distribution of the variable *FUND* suggests that the elasticity of credit to capital is negative for almost all the country-year pairs as the threshold is close to the minimum value of *FUND*, which is equal to 15.23. Using the mean value of the variable *FUND* (79.5), we find the mean elasticity of credit to capital is -0.874.



Similarly, the distribution of the variable  $CAP$  suggests that the elasticity of credit to deposit is positive for almost all the country-year pairs as the threshold is significantly above the mean value for  $CAP$ , which is equal to 15.13. Using the mean value of the variable  $CAP$ , we find that the mean elasticity of credit to deposit is 0.213.

Regression model R5 confirms the findings in R1 to R4. The capital ratio has a negative impact on bank lending suggesting that the financial fragility crowding out hypothesis prevails. On the other hand, the funding structure of the banking industry tends to foster banks' loan supply has the coefficient remains significantly positive.

Table 2.5. Regression Results- Baseline Regressions

Dependent variable: Credit	R1	R2	R3	R4	R5
<i>Bank-specific characteristics</i>					
$CAP_{t-1}$	-0.594*** (0.0793)	-0.490*** (0.0861)	-0.426*** (0.0889)	-0.667*** (0.102)	1.770*** (0.594)
$FUND_{t-1}$	0.561*** (0.0359)	0.472*** (0.0402)	0.430*** (0.0582)	0.286*** (0.0638)	1.854*** (0.382)
$CAP_{t-1} * FUND_{t-1}$					-0.604*** (0.145)
$LIQ_{t-1}$		-0.0340 (0.0440)	-0.137*** (0.0405)	-0.0941** (0.0422)	-0.0963** (0.0413)
$ROA_{t-1}$		-0.165*** (0.0398)	-0.113*** (0.0386)	-0.0530 (0.0385)	-0.0460 (0.0376)
$NPL_{t-1}$		-0.0952*** (0.0214)	-0.0180 (0.0216)	-0.00979 (0.0215)	-0.0215 (0.0212)
<i>Banking sector characteristics</i>					
$BC_{t-1}$			0.497*** (0.0664)	0.427*** (0.0656)	0.367*** (0.0657)
$STOCK_{t-1}$			0.172*** (0.0270)	0.113*** (0.0285)	0.121*** (0.0279)
$CLAIM_{t-1}$			-0.0471 (0.0377)	-0.00999 (0.0365)	0.0314 (0.0371)
<i>Macroeconomic controls</i>					
$GDP_{t-1}$				0.146*** (0.0481)	0.164*** (0.0472)
$MP_{t-1}$				-0.160*** (0.0351)	-0.202*** (0.0357)
<i>Summary Statistics</i>					
Observations	437	390	353	353	353
R-squared	0.397	0.443	0.624	0.660	0.676

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

### 2.5.2 Alternative specifications

In this section, we present the estimates of model 2.6 in table 2.6. The financial activity measured by the dummy variable (*FC*) is negatively associated with the development of the banking sector ( $p < .10$ ). This result is as expected. We argue that the existence of financial centers might be an obstacle to the integration of the capital market in the EU and would not favor the financial and economic development. This result is consistent with Enoch et al. (2013). Financial centers are characterized by an intensive financial service activity including financial asset management, foreign exchange trading, loan syndication etc... This might be reflected in the statistical indicators available in the GFDD. For example, deposits in Luxembourg represent nearly 400% of GDP in 2017 which is not in line with the fundamentals of the economy. The existence of financial centers in Europe has been characterized by differences in tax regimes and regulatory requirements as outlined in Enoch et al. (2013). The harmonization of regulatory standards as proposed in the CRD IV directive represents a strategy to decrease the influence of financial centers.

The regional dummy (*CEE*) indicates that the economic region is also an important determinant of the banking sector development.<sup>49</sup> It exerts a statistically and negative impact on credit ( $p < .05$ ). This results probably reflects the low level of financial development relative to more advanced economies in the EU. In addition, CEE might present additional characteristics which impacts the statistical relationship between credit, capital and funding. These determinants might be related to the financial development literature. For example, the literature highlights the role of the quality of institutions in the development of financial markets.<sup>50</sup> As illustrated in Žuk and Savelin (2018), the quality of institutions remains heterogeneous among CEE and improvements in this area have slowdown for countries accessing the EU suggesting a negative impact on the development of the banking sector.

Considering financial centers and the regional dimension in the capital, funding and credit relationship shows that the sign and significance of the capital and funding coefficients are comparable (see regressions R6 and R7). In addition, the interaction term remains negative and significant with an amplitude close to the one obtained in regression R5. The elasticity of credit to capitalization is negative when the variable *FUND* is above 21.66,<sup>51</sup> and the elasticity of credit to deposit is also negative when

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<sup>49</sup>We specify other regional dummies based on the classification set in the Regular Economic Report. All coefficients related to the NE and other regions appear not significant.

<sup>50</sup>See for example Haselmann et al. (2016).

<sup>51</sup>Where  $21.66 = e^{-\frac{\beta_1}{\beta_3}} = e^{\frac{-1.913}{-0.622}}$ .

$CAP$  is above 6.80.<sup>52</sup> This result means that the relationship between credit and deposit is always negative as the threshold is below the minimum value for the variable  $CAP$ .

We deeply investigate the relationship between capitalization, funding and credit in the light of the characteristics of the CEE region. The results are presented in regressions R8, R9 and R10 in table 2.6. The relationship between credit and capital is defined by the coefficients  $\beta_1$  for non CEE and  $(\beta_1 + \beta_{1,E})$  for CEE respectively. We find that the coefficient of the capital ratio is negative and significant for CEE allowing us to reject the null hypothesis “one rule fits all”. The elasticity of credit to capitalization equals -0.648 in CEE and -0.578 for non CEE countries, meaning that capitalization has a stronger negative impact on credit for CEE countries.

The relationship between credit and deposit is defined by  $\beta_2$  for non CEE and by  $(\beta_2 + \beta_{2,E})$  for CEE. We find that the coefficient of deposits for CEE is negative and significant in regression R9, rejecting the null hypothesis “one rule fits all”. However, the elasticity of credit to deposit is 0.258, which is lower than for non CEE ( $\beta_2 = 0.311$ ), meaning that funding has a lower positive impact on credit in CEE.

Regression R10 includes all possible heterogeneity depending on the capital and funding characteristics of the banking sectors and the regional dimension. The estimates indicate that all interaction terms are significant except the variable  $CEE * CAP_{t-1}$ . The results suggest that the mechanisms related to the FFCO hypothesis appear strong for the EU banking systems and particularly for the CEE region.

Overall, the results contained in regressions R6 to R10 indicate that the impact of a unique set of capital and funding regulatory instruments on the development of the banking sector would probably differ across European regions. This can be explained by the heterogeneity in the level of financial development and on the sensitivity of credit to capital and funding. These findings shed some light on the need to consider the characteristics of CEE for the design of banking regulation as the relationship between capital, funding and credit appears different compared to other economic regions. We suggest that the quality of institutions might be one of the determinants influencing this relationship. Thus, pursuing efforts in the harmonization of the institutional quality appears essential for promoting the integration of capital markets.

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<sup>52</sup>Where  $6.80 = e^{-\frac{\beta_2}{\beta_3}} = e^{-\frac{-1.924}{-0.622}}$ .

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Table 2.6. Regression Results- Alternative Regressions

Dependent variable:	R6	R7	R8	R9	R10
Credit					
<i>Bank-specific characteristics</i>					
$CAP_{t-1}$	-0.598*** (0.100)	1.913*** (0.579)	-0.578*** (0.102)	-0.603*** (0.100)	1.583** (0.710)
$FUND_{t-1}$	0.310*** (0.0646)	1.924*** (0.372)	0.314*** (0.0650)	0.311*** (0.0647)	1.767*** (0.435)
$CAP_{t-1} * FUND_{t-1}$		-0.622*** (0.141)			-0.568*** (0.165)
$CEE * CAP_{t-1}$			-0.0697*** (0.0198)		-0.284 (0.217)
$CEE * FUND_{t-1}$				-0.0528*** (0.0133)	-0.302** (0.128)
$CEE * CAP_{t-1} * FUND_{t-1}$					-0.402** (0.175)
$LIQ_{t-1}$	-0.0952** (0.0417)	-0.0976** (0.0406)	-0.0939** (0.0419)	-0.0957** (0.0417)	-0.0944** (0.0405)
$ROA_{t-1}$	-0.0419 (0.0377)	-0.0345 (0.0368)	-0.0433 (0.0379)	-0.0414 (0.0377)	-0.0318 (0.0366)
$NPL_{t-1}$	-0.00341 (0.0210)	-0.0153 (0.0207)	-0.00430 (0.0211)	-0.00216 (0.0211)	-0.0184 (0.0213)
<i>Banking sector characteristics</i>					
$BC_{t-1}$	0.345*** (0.0706)	0.281*** (0.0703)	0.359*** (0.0707)	0.352*** (0.0700)	0.258*** (0.0740)
$STOCK_{t-1}$	0.111*** (0.0279)	0.119*** (0.0273)	0.111*** (0.0281)	0.112*** (0.0279)	0.110*** (0.0274)
$CLAIM_{t-1}$	0.0164 (0.0385)	0.0596 (0.0388)	0.0137 (0.0387)	0.0205 (0.0385)	0.0506 (0.0399)
<i>Macroeconomic controls</i>					
$GDP_{t-1}$	0.0785 (0.0496)	0.0947* (0.0484)	0.0819 (0.0501)	0.0798 (0.0495)	0.108** (0.0488)
$MP_{t-1}$	-0.156*** (0.0343)	-0.199*** (0.0348)	-0.153*** (0.0345)	-0.158*** (0.0343)	-0.201*** (0.0349)
<i>Other controls</i>					
Financial Centers	YES	YES	YES	YES	YES
$\delta_T$	-0.120* (0.0662)	-0.122* (0.0645)	-0.120* (0.0666)	-0.126* (0.0663)	-0.0939 (0.0667)
Eastern dummy	YES	YES	YES	YES	YES
$\delta_E$	-0.209*** (0.0526)	-0.215*** (0.0513)			
<i>Summary Statistics</i>					
Observations	353	353	353	353	353
R-squared	0.677	0.695	0.674	0.677	0.700

Standard errors in parentheses

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

## 2.6 Robustness checks

In this section, we perform various robustness checks using sample selection and estimation techniques. First, we control for the potential effect of outliers in the credit, capital and funding relationship, by excluding Luxembourg, which is a financial center, and more systematically extreme outliers.

Table 2.7 below presents estimates of model 2.5 excluding Luxembourg.

Table 2.7. Regression Results- Robustness 1

Dependent variable: Credit	R11	R12	R13	R14	R15
<i>Bank-specific characteristics</i>					
$CAP_{t-1}$	-0.504*** (0.0716)	-0.325*** (0.0727)	-0.407*** (0.0833)	-0.537*** (0.0965)	1.982*** (0.666)
$FUND_{t-1}$	0.869*** (0.0417)	0.804*** (0.0409)	0.615*** (0.0581)	0.461*** (0.0635)	2.084*** (0.429)
$CAP_{t-1} * FUND_{t-1}$					-0.633*** (0.166)
$LIQ_{t-1}$		-0.00560 (0.0363)	-0.0528 (0.0387)	-0.0465 (0.0398)	-0.0550 (0.0391)
$ROA_{t-1}$		-0.149*** (0.0328)	-0.147*** (0.0360)	-0.0913** (0.0363)	-0.0808** (0.0356)
$NPL_{t-1}$		-0.165*** (0.0184)	-0.0998*** (0.0224)	-0.0809*** (0.0221)	-0.0818*** (0.0216)
<i>Banking sector characteristics</i>					
$BC_{t-1}$			0.0947 (0.0788)	0.0428 (0.0789)	0.0375 (0.0773)
$STOCK_{t-1}$			0.102*** (0.0263)	0.0488* (0.0278)	0.0666** (0.0276)
$CLAIM_{t-1}$			0.0747** (0.0378)	0.0987*** (0.0368)	0.127*** (0.0368)
<i>Macroeconomic controls</i>					
$GDP_{t-1}$				0.175*** (0.0451)	0.187*** (0.0443)
$MP_{t-1}$				-0.0943*** (0.0342)	-0.137*** (0.0353)
<i>Summary Statistics</i>					
Observations	420	375	338	338	338
R-squared	0.542	0.636	0.692	0.716	0.728

Standard errors in parentheses

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

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The signs of the capital and funding variables remain unchanged in regression R11 to R15. The coefficients are still highly significant ( $p < .01$ ). The *ROA* and *NPL* control variables that are bank specific characteristics are now significant in all the regressions. It was not the case in regression models R1 to R6.

The significant and negative impact of the *NPL* ratio lends support for a credit crunch scenario, if any, caused by impaired loan portfolios in the EU for the post-crisis period. It is however difficult to argue that the downsizing of the banking sector might be due to the implementation of tighter regulatory standards. The negative relationship between capital and lending is fragile due to the issues to determine the capital position at the macroeconomic level. On the contrary, the variable *LIQ* which was negative and significant in models R3 to R5 is not significant anymore.

Regarding the banking sector characteristics, the bank concentration variable (*BC*) is found insignificant while *CLAIM* becomes significant. This latter finding brings the empirical evidence that the emergence of cross-border lending (*CLAIM*) has an effect on the development of the banking sector. This result is consistent with the main literature on cross-border lending. Finally, the effect of macroeconomic controls (R14 and R15) are stable compared with that obtained in R4 and R5.

The explanatory power of our model is also increased when dropping Luxembourg out of the sample, from a R-squared of 0.676 in R5 to 0.728 in R15 for instance. The models fitted without Luxembourg thus confirm the baseline results and provide us with a stronger model.

### Trimming

In this section, we present the estimates of model 2.5 using the data trimming technique. We exclude country-year observations from the sample considering extreme values of the credit-to-GDP ratio. We identify outliers using the Interquartile Range (IQR) method. We define the IQR as the difference between the third and first quartiles ( $Q3 - Q1$ ), where  $Q1$  and  $Q3$  are the first quartile and the third quartile respectively. All observations above  $Q3 + (3 * IQR)$  and below  $Q1 - (3 * IQR)$  are excluded.

Overall, we find that the results are consistent with the estimates of the baseline regression presented in section 2.5. The capital and funding positions present similar impacts on the development of the banking sector.

## 2.6. Robustness checks

Table 2.8. Regression Results- Robustness 2

Dependent variable:	R16	R17	R18	R19	R20
Credit					
<i>Bank-specific characteristics</i>					
$CAP_{t-1}$	-0.560*** (0.0800)	-0.466*** (0.0861)	-0.400*** (0.0881)	-0.641*** (0.102)	2.080*** (0.629)
$FUND_{t-1}$	0.534*** (0.0363)	0.441*** (0.0407)	0.380*** (0.0580)	0.251*** (0.0632)	1.983*** (0.400)
$CAP_{t-1} * FUND_{t-1}$					-0.666*** (0.152)
$LIQ_{t-1}$		-0.00918 (0.0441)	-0.113*** (0.0401)	-0.0780* (0.0417)	-0.0770* (0.0406)
$ROA_{t-1}$		-0.172*** (0.0395)	-0.129*** (0.0380)	-0.0720* (0.0381)	-0.0606 (0.0372)
$NPL_{t-1}$		-0.0905*** (0.0212)	-0.0105 (0.0211)	-0.00394 (0.0211)	-0.0164 (0.0208)
<i>Banking sector characteristics</i>					
$BC_{t-1}$			0.506*** (0.0648)	0.440*** (0.0645)	0.376*** (0.0645)
$STOCK_{t-1}$			0.178*** (0.0266)	0.124*** (0.0282)	0.130*** (0.0275)
$CLAIM_{t-1}$			-0.0350 (0.0371)	0.000335 (0.0361)	0.0396 (0.0363)
<i>Macroeconomic controls</i>					
$GDP_{t-1}$				0.135*** (0.0473)	0.156*** (0.0463)
$MP_{t-1}$				-0.152*** (0.0349)	-0.190*** (0.0351)
<i>Summary Statistics</i>					
Observations	434	387	350	350	350
R-squared	0.365	0.412	0.608	0.642	0.661

Standard errors in parentheses

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

### Trend and time fixed effects

In this section, we control for a trend and time fixed effects that may alter the main findings. Table 2.9 and 2.10 report the results. Including the time trend allows us to capture a linear trend in the credit-to-GDP ratio while yearly time dummies allow us to capture a common non-linear trend. We have checked the robustness of the results found in the alternative specifications (R6 to R10) by adding first a time trend and second, a yearly time dummy.

## Chapter 2. Does one rule fit all? Banking regulation in Europe

Table 2.9. Regression Results- Robustness 3

Dependent variable: Credit	R21	R22	R23	R24	R25
<i>Bank-specific characteristics</i>					
<i>CAP</i>	-0.622*** (0.0982)	1.846*** (0.565)	-0.889*** (0.115)	-0.624*** (0.0993)	1.241* (0.693)
<i>FUND</i>	0.308*** (0.0631)	1.894*** (0.363)	0.274*** (0.0621)	0.309*** (0.0632)	1.589*** (0.424)
<i>CAP * FUND</i>		-0.611*** (0.138)			-0.502*** (0.160)
<i>CEE * CAP</i>			0.688*** (0.163)		-0.211 (0.211)
<i>CEE * FUND</i>				-0.0218 (0.151)	-0.383*** (0.126)
<i>CEE * CAP * FUND</i>					-0.324* (0.171)
<i>LIQ</i>	-0.0657 (0.0413)	-0.0686* (0.0402)	-0.0632 (0.0403)	-0.0659 (0.0414)	-0.0636 (0.0399)
<i>ROA</i>	-0.0326 (0.0369)	-0.0255 (0.0359)	-0.0238 (0.0361)	-0.0324 (0.0370)	-0.0209 (0.0357)
<i>NPL</i>	-0.00555 (0.0205)	-0.0171 (0.0202)	-0.00384 (0.0201)	-0.00502 (0.0209)	-0.0180 (0.0207)
<i>Banking sector characteristics</i>					
<i>BC</i>	0.369*** (0.0691)	0.305*** (0.0688)	0.356*** (0.0675)	0.372*** (0.0716)	0.292*** (0.0722)
<i>STOCK</i>	0.108*** (0.0273)	0.116*** (0.0266)	0.107*** (0.0266)	0.109*** (0.0275)	0.108*** (0.0267)
<i>CLAIM</i>	-0.0238 (0.0387)	0.0194 (0.0390)	-0.00464 (0.0381)	-0.0222 (0.0405)	0.0110 (0.0397)
<i>Macroeconomic controls</i>					
<i>GDP</i>	0.0794 (0.0484)	0.0954** (0.0472)	0.113** (0.0479)	0.0797 (0.0485)	0.114** (0.0474)
<i>MP</i>	0.0232 (0.0537)	-0.0227 (0.0533)	0.0146 (0.0525)	0.0226 (0.0540)	-0.0136 (0.0529)
<i>Other controls</i>					
<i>TREND</i>	0.0309*** (0.00726)	0.0303*** (0.00707)	0.0342*** (0.00713)	0.0309*** (0.00728)	0.0327*** (0.00708)
Financial Centers $\delta_T$	YES -0.0424 (0.0671)	YES -0.0464 (0.0654)	YES -0.0218 (0.0657)	YES -0.0448 (0.0693)	YES -0.0148 (0.0670)
Eastern dummy $\delta_E$	YES -0.201*** (0.0514)	YES -0.207*** (0.05)	YES -2.021*** (0.4332)	YES -0.115 (0.5948)	YES
<i>Summary Statistics</i>					
Observations	353	353	353	353	353
R-squared	0.693	0.710	0.709	0.694	0.718

Standard errors in parentheses

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



## 2.6. Robustness checks

Table 2.10. Regression Results- Robustness 4

Dependent variable:	R26	R27	R28	R29	R30
Credit					
<i>Bank-specific characteristics</i>					
$CAP_{t-1}$	-0.399*** (0.101)	1.314** (0.559)	-0.677*** (0.114)	-0.397*** (0.102)	0.276 (0.685)
$FUND_{t-1}$	0.324*** (0.0605)	1.437*** (0.363)	0.287*** (0.0592)	0.324*** (0.0606)	0.883** (0.423)
$CAP_{t-1} * FUND_{t-1}$		-0.430*** (0.138)			-0.227 (0.160)
$CEE * CAP_{t-1}$			0.726*** (0.155)		-0.143 (0.203)
$CEE * FUND_{t-1}$				0.0154 (0.145)	-0.522*** (0.122)
$CEE * CAP_{t-1} * FUND_{t-1}$					-0.0186 (0.171)
$LIQ_{t-1}$	-0.129*** (0.0407)	-0.123*** (0.0402)	-0.126*** (0.0394)	-0.129*** (0.0407)	-0.121*** (0.0394)
$ROA_{t-1}$	-0.00683 (0.0370)	-0.00380 (0.0365)	0.00464 (0.0359)	-0.00705 (0.0371)	0.00561 (0.0359)
$NPL_{t-1}$	0.00486 (0.0199)	-0.00387 (0.0198)	0.00641 (0.0193)	0.00448 (0.0202)	-0.00141 (0.0201)
<i>Banking sector characteristics</i>					
$BC_{t-1}$	0.308*** (0.0666)	0.270*** (0.0668)	0.295*** (0.0646)	0.306*** (0.0690)	0.267*** (0.0692)
$STOCK_{t-1}$	0.107*** (0.0270)	0.115*** (0.0267)	0.108*** (0.0261)	0.106*** (0.0273)	0.106*** (0.0265)
$CLAIM_{t-1}$	-0.0717* (0.0405)	-0.0391 (0.0413)	-0.0561 (0.0393)	-0.0729* (0.0422)	-0.0518 (0.0415)
<i>Macroeconomic controls</i>					
$GDP_{t-1}$	0.103** (0.0463)	0.111** (0.0457)	0.139*** (0.0455)	0.103** (0.0464)	0.140*** (0.0455)
$MP_{t-1}$	-0.431*** (0.134)	-0.392*** (0.133)	-0.407*** (0.130)	-0.431*** (0.134)	-0.386*** (0.130)
<i>Other controls</i>					
Financial Centers	YES	YES	YES	YES	YES
$\delta_T$	-0.0706 (0.0707)	-0.0634 (0.0698)	-0.0390 (0.0689)	-0.0689 (0.0728)	-0.0264 (0.0708)
Eastern dummy	YES	YES	YES	YES	YES
$\delta_E$	-0.259*** (0.0502)	-0.256*** (0.0496)	-2.177*** (0.412)	-0.320 (0.570)	
<i>Summary Statistics</i>					
Observations	353	353	353	353	353
R-squared	0.735	0.743	0.752	0.735	0.755

Standard errors in parentheses

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

All the robustness tests we have conducted show that the effects of the variables *CAP* and *FUND* are stable. First, we find a significant negative effect of the capital position on the development of the banking sector at the country level lending support for the FFCO hypothesis. However, we are cautious about this conclusion as the aggregate measure of the capital position raises several issues. Second, we find that deposits exert a statistically and significant impact on bank lending at the country level suggesting that better funded banking systems raise the development of the banking sector.

### 2.7 Conclusion and policy implications

In this chapter, we investigate the role of the capital and funding structures on the development of the banking sector. This topic is of particular interest as banking systems in Europe remain relatively heterogeneous which raises considerations for economic development and financial stability. The implementation of a unique regulatory framework such as covered under the single rulebook initiative raises the question to consider the development of the banking sector in the design of banking regulation aiming at promoting financial stability. In other words, do regulatory authorities need to consider financial development in their policy to satisfy the objective of financial stability? This question is particularly relevant as this purpose is coupled with the additional objective of ensuring the optimal coverage of financial services within the EMU.

Using macroeconomic data on the EFS-27 for the period 2000-2017, we find that both the capital and funding structures are key determinants of the development of the banking sector. The negative impact of bank capital on credit lends support for the FFCO hypothesis. It is however difficult to argue that this hypothesis holds at the macroeconomic level. First, the FFCO hypothesis as presented in Berger and Bouwman (2009) covers two different mechanisms which are difficult to disentangle using a set of macroeconomic data only. In addition, the measure of the capital position at the aggregated level raises several issues presented in sections 2.3 and 2.5.

We also find that the funding ratio has a significant and positive impact on bank lending. Unlike the capital ratio, this finding is consistent with most of micro-empirical studies suggesting that lending tends to expand as the funding structure of banks improves. The implementation of the liquidity standard on funding appears strategic both for financial stability and economic development. A rise in the size of the banking sector would however raise concerns for financial stability. We believe that it raises an additional pressure on financial stability particularly for financial systems featured

## 2.7. Conclusion and policy implications

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by consequent loan impediments. In addition, our results support the view that the financial integration policy has to promote other sources of funding and thus adopt more balanced financial systems in order to mitigate financial risks and encouraging sustainable economic growth.

Our results also show that the CEE economies present specific characteristics impacting bank loan supply. The regional dimension appears essential to take into account for the development of the banking sector. This result is consistent with the literature highlighting that the bank business model of these economies is specific in Europe and should be considered for financial stability purposes. Thus, focusing on the enforcement of sustainable bank business models in this region appears determinant for European Authorities.

The implementation of capital and liquidity standards in the EU is unique and raises concerns as to its impact on both economic development and financial stability. In this paper, we study the relationship between capital, liquidity and credit in order to raise the implications of such a regime on the development of the banking sector. Our main contribution is to show that financial systems in the EU are characterized by a heterogeneity at the regional level which might be important to consider for the design of banking regulation.

It appears essential that European institutions consider this heterogeneity to satisfy the objectives of financial stability and economic convergence. However, this response should be expressed not necessarily in more stringent rules on capital and liquidity but rather on the harmonization of the competition, monetary and regulatory policies notably. The promotion of the quality of institutions should not be undermined as it remains an important determinant to satisfy these objectives particularly for Eastern European members.



### **3 Assessing the impact of Basel III on bank behavior: A micro-founded approach**

"Banking operations may be varied and complex, but a simple operational definition of a bank is available: *a bank is an institution whose current operations consist in granting loans and receiving deposits from the public.*" (Freixas and Rochet, 2008)

*This chapter is joint work with Benjamin Williams (CLERMA, Université Clermont Auvergne, France)*

### **3.1 Introduction**

In response to the excessive build-up of risk leverage and the insufficient holdings of liquidity buffer of the banking sector prior to the GFC, the BCBS had designed a package of reforms under the amendment Basel III. Based on the three-pillar approach of Basel II,<sup>1</sup> Basel III includes tighter rules on capital and liquidity. As underlined in Walter (2011) "the Basel III reforms are central to promoting financial stability". Among the reforms, the Basel Committee strengthens the quantity and quality of the capital base, complements risk-sensitive measures implemented under Basel I and Basel II with a LR. In addition, one of the novel aspect of this regulatory regime is the introduction of two liquidity standards, namely the LCR and the NSFR. In this chapter, we investigate the main implications of such a regulatory regime on bank behavior.

Our objective is twofold. First, we examine how the introduction of a liquidity requirement modifies the lending behavior of the bank. This topic appears essential as the literature following the 2008 GFC has renewed the interest for understanding the impact of banking regulation on banks' balance sheet adjustments. The mechanism by which banks' balance sheet affects the conduct of monetary policy is referred as the BCC and underscores the potential role of banking regulation in affecting the transmission mechanism. Therefore, analyzing the behavior of the bank under a regulatory configuration *à la* Basel III appears crucial as it highlights the common implications of macroprudential and monetary policies.

Second, as underlined in Kim and Sohn (2017), two competing sets of theories establish the relationship between bank capital and lending. The first one refers to the FFCO hypothesis. In particular, we are interested in this chapter to determine under which conditions capital "crowds out" deposits and establishes a negative relationship between bank capital and lending. The second body of theories refers to the RAC hypothesis for which a positive relationship between capital and lending is set. Banks with higher capital ratios tend to show greater risk-absorption capacities and are able to lend more. We design the capital-lending relationship in the light of the Basel III configuration and establish under which conditions this relationship is negative or positive illustrating thus the different mechanisms set in the literature.

Analyzing the impact of International Regulatory Standards on bank lending is not new. A large stream of literature supporting the effectiveness of the 1988 Basel Capital Accord shows that banks adopted different strategies to comply with the so-called "Cooke ratio".<sup>2</sup> Cohen and Scatigna (2016) show that banks from advanced economies

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<sup>1</sup>Basel II, fully effective in 2008, adopted a three-pillar approach to promote financial stability. These three pillars were "Capital Requirements", "Supervisory Review", and "Market Discipline".

<sup>2</sup>The Cooke-ratio, named after one of the past Chairs of the Basel Committee Peter Cooke, defines

comply with the Basel III capital requirements through the accumulation of retained earnings and to a lesser extent, shifting to assets with lower risk weights. Cosimano and Hakura (2011) examine the impact of the Basel III capital standards on lending rates and growth. They find that a tightening of capital requirements gives incentives to banks to increase lending rates causing a slowdown in credit supply. This stream of literature remains focused on the effects of capital requirements on bank lending behavior. However, as documented in BCBS (2016): "Liquidity requirements can affect banks through several channels". For example, King (2013) disentangles the different banks' strategies to meet the NSFR. Among these strategies, the bank is able to shrink the size of the portfolio of loans (downsizing) or substitute them for more liquid assets (portfolio-shifts) modifying thus the composition of their assets and lending.

Gobat et al. (2014) examine the impact and issues raised by the implementation of such a ratio for a large panel of banking systems. They also highlight the potential adverse effect of the NSFR on bank lending especially for large D-SIBS. Using banks' balance-sheet data, Banerjee and Mio (2018) study the impact of the Individual Liquidity Guidance (ILG)- a liquidity ratio close to the LCR- on the UK banking sector. They find that banks did not shrink the size of their balance-sheet but rather modify its composition without causing deleterious effects on bank lending.

These type of adjustments were already performed under Basel I when no liquidity standards were set-up suggesting that capital and liquidity requirements may produce similar bank balance-sheet adjustments and thus, have common implications on bank behavior. One rationale for implementing liquidity standards was the effective inability of banks to raise additional funds on the wholesale market. As a result, the Basel Committee adopted two metrics to encourage banks to adopt sound liquidity management practices. First, banks have to comply with the LCR designed to incentivize banks to respond to liquidity shortages under 30 days. Second, banks are encouraged to collect stable sources of funding such as retail deposits by the application of the NSFR. The literature examining the effects of liquidity standards on bank behavior remains relatively sparse likely due to the fact that liquidity standards set at the international level has been mainly motivated since the implementation of Basel III.<sup>3</sup>

We contribute to this emerging literature by developing a theoretical model of bank behavior subject to capital and liquidity constraints. Our objective is to examine the

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the first international capital-adequacy standard. Banks were required to hold a minimum capital-to-risk-weighted-asset ratio of 8%. For a complete review on bank strategies, see Jackson et al. (1999) and BCBS (2016).

<sup>3</sup>Note that the Basel Committee published "Sound Practices for Managing Liquidity in Banking organisations" in 2000. However, the unprecedented liquidity crisis experienced by the banking sector in 2008 urged for its application.

## **Chapter 3. Assessing the impact of Basel III on bank behavior: A micro-founded approach**

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key implications of a regulatory framework *à la* Basel III, i.e. a regulatory framework both capital and liquidity driven on bank behavior. Our model is derived from Ito and Sasaki (1998). These authors investigate the impact of the adoption of the first Basel Capital Accord on Japanese banks' behavior for the period 1990-1993. In particular, they find that banks tended to issue more subordinated debts and to reduce lending following the decrease of the Nikkei index in order to comply with the Basel capital ratio. However, as international liquidity requirements were not in place at that time, the model does not provide further implications on bank behavior when implementing an additional regulatory tool such as liquidity requirements. Nevertheless, the role of these last should not be undermined as an emerging body of literature shows that liquidity requirements modify the composition of banks' balance-sheet and thus, have effects on bank behavior. Further investigation on a regulatory framework both capital and liquidity driven on bank behavior is therefore needed.

The remainder of this paper is as follows: Section 3.2 describes the model and section 3.3 concludes.

### **3.2 The model**

We develop a theoretical model of banks' behavior drawn upon Ito and Sasaki (1998). Their model is suitable to depict and understand banks' behavior under Basel I and Basel II as the prudential structure of these two regulatory regimes is capital driven. However, the introduction of liquidity requirements under Basel III questions the implications of a prudential regulatory structure both capital and liquidity driven. Our contribution is adding liquidity requirements to the model in order to assess the effects of such a regulatory structure on bank behavior.

#### **3.2.1 The bank business model**

We assume that the bank buys credits to households and firms whether retail, commercial, wholesale or universal.<sup>4</sup> Investment banks are not considered as they do not distribute credits and are involved in financial activities such as trading and Mergers and Acquisitions (M&As). We depict these credits as mortgage, credit cards or commercial loans which are defined through a unique loan portfolio held by the bank. The credit risk related to these loans plays a central role in the model as we focus on the credit activity of the bank. For the sake of simplicity, we consider the

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<sup>4</sup>Following Freixas and Rochet (2008), we define the bank as a financial intermediary buying and selling financial claims. In particular, we consider the bank funds its lending and market activities through the selling of financial liabilities.



bank is government-bond buyer on the bond market. Thus, the market risk is nil because government bonds are risk-free assets in our model. We propose this simple bank investment decision problem for two reasons. First, as one of our objective is to study the impact of capital and liquidity rules on the asset composition of the bank, we reduce the bank investment decision problem to two dual assets, one risky asset (loans) for which the bank has to provide sufficient capital and liquidity coverages and one risk-free asset (government bonds) requiring neither capital nor liquidity coverage. Second, defining a risky market portfolio induces introducing additional hypotheses in the model while our research question remains the same. We choose to keep this simplified version following somewhat Ockham's razor spirit even if a more general specification including market risky securities could be developed in our model.

The economic model of the bank is as follows: We assume that capital  $K$  and customer deposits  $D$  fund loans  $L$  and government bonds  $B$ . We suppose that the maturity of  $K$  is infinite and  $D$  is a resource comprising both *non-maturity deposit and term deposit*. In sum, the activity of the bank consists of buying a portfolio of loans  $L$  and government bonds  $B$ , selling capital  $K$  and customer deposits  $D$ .

We depict the balance-sheet of the bank as follows:

Assets		Liabilities	
L	Loans	Capital	K
B	Government Bonds	Customer Deposits	D

We consider the loan activity of the bank as the main source of illiquidity. The portfolio of government bonds defines the total amount of Liquid Assets (LA) the bank buys. Finally,  $K$  and  $D$  define the sources of available funding the bank disposes of for covering the funding risk induced by the credit activity.

The loan decision process is characterized by the parameter  $0 < \theta \leq 1$  which is the risk default on loan and the return  $r_L$  at which the bank charges the loan. Therefore, the product  $\theta L$  defines the credit risk the bank is willing to bear on the loan activity. Assuming a competitive loan market environment, the bank has to decrease the loan interest rate in order to raise the volume of loans bought by one unit setting  $r'_L(L) < 0$ .<sup>5</sup>

The introduction of the parameter  $\theta$  allows us to better account for the aggregate risk related to the bank lending activity. An exogenous shock may indeed increase the

<sup>5</sup>Assumptions on the second derivative of the interest rates will be discussed later on.

### Chapter 3. Assessing the impact of Basel III on bank behavior: A micro-founded approach

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overall credit risk as it has been the case in 2008. This risk parameter is necessary to measure the credit risk assessed in the requirement ratios. The market activity of the bank consists of buying a risk-free portfolio of bonds, typically high-graded government bonds excluded from the regulatory risk-asset base given a risk-free rate  $r_B$ . Thus, the portfolio of loans defines the total asset risk-exposure of the bank since the market risk is nil in the model. We suppose the bank is able to fund its activities through the rise of  $K$  or  $D$ . The rate  $r_K$  corresponds to the market cost at which the bank is able to fund its activities on capital markets. All things being equal, banks have to offer a higher return on capital to raise their funds setting  $r'_K(K) > 0$ . The bank is also able to increase its funding base by raising  $D$ . We assume the bank sells more deposits as it raises its attractiveness via  $r_D$  implying  $r'_D(D) > 0$ .

#### 3.2.2 Regulatory requirements

The Basel III measures aim at providing a “global regulatory framework for more resilient banks and banking systems” BCBS (2011). Reforming the Basel II Accords was about “strengthening the global capital framework” and “introducing a global liquidity standard” (*ibid.*). The introduction of liquidity requirements is the most significant change in the regulatory framework and a direct consequence of the liquidity crisis faced by the banking industry in 2008 when the subprime mortgage crisis triggered. The theoretical approach we use underlines the impact of these new liquidity requirements on bank lending and the funding structure. In view of this, we propose to transpose the Basel III regulatory ratios.

#### The capital requirement ratio (CRR)

Due to the insufficient build-up of capital coverage during the financial crisis, the Basel Committee proposed to tighten the definition of capital under Basel III. The bank regulatory capital base has been classified into two categories denominated “Tier”. The best-quality capital includes Common Equity Tier 1 Capital (CET1) and Additional Tier 1 Capital (AT1).<sup>6</sup> The capital of the bank is also compound by Tier 2 with a lower RAC. We define  $K$  as the sum of Tier 1 and Tier 2 in the model. The regulatory capital of the bank is thus equal to  $K$ . The Total Capital Ratio (TCR) as defined in Basel III is the sum of Tier 1 and Tier 2 and complemented regarding the bank asset risk-exposure:

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<sup>6</sup>Tier 3 aiming at covering the market risk under Basel II has been removed in Basel III.

$$\text{TCR} = \frac{\text{Regulatory capital}}{\text{Risk-weighted assets}}$$

The RWA are the sum of the risks incurred by the bank. They consist in credit, market and operational risks. The TCR can be rewritten as follows since both market and operational risks are nil in the model:

$$\text{CRR} = \frac{K}{\theta L} \quad (3.1)$$

The Capital Requirement Ratio (CRR) defines the total amount of capital available to the bank to cover the credit risk and corresponds to the TCR in Basel III. The CRR differs from the capital ratio standard developed by Ito and Sasaki (1998) to the extent that we introduce the parameter  $\theta$ . However, the two regulatory ratios are similar for  $\theta = 1$ .<sup>7</sup> The credit risk  $\theta L$  is a positive linear function of  $L$  and is measured in units of currency as it is the case for the Value at Risk (VaR) which is used to assess the RWA under Basel II and Basel III. This metric is consistent with the underlying logic of the VaR “which is a lower tail percentile for the distribution of profit and loss (P&L)” (Berkowitz and O’Brien (2002)). All things being equal, the higher the aggregate risk related to the bank lending activity, the higher the credit risk. Similarly, the higher the volume of loans bought by the bank, the higher the credit risk.<sup>8</sup> This phenomenon complies with the “fallacy of large numbers” by Samuelson (1963) since the “maximum loss” increases with the size of the portfolio of loans.

#### The liquidity requirement ratio (LRR)

In addition to strengthening the global capital framework, the Basel Committee designed a new liquidity framework as the banking sector failed to enter the financial crisis with adequate liquidity buffers. More specifically, the Basel Committee emphasized on the need for a better liquidity risk management and published in 2008 “Principles for Sound Liquidity Risk Management and Supervision” which has been complemented by the introduction of two minimum liquidity regulatory standards under “Basel III: International framework for liquidity risk measurement, standards and monitoring” in 2010.

<sup>7</sup>Ito and Sasaki (1998) add the term *fukumi* to the book value of shareholders’ equity which is equivalent to mark-to-market valuation.

<sup>8</sup>If the aggregate risk for loans was nil, the VaR would equal zero and thus  $\theta = 0$ . The market risk is nil in the model as the bank buys risk-free bonds which is equivalent to a VaR equals to 0 within the Basel framework.

### Chapter 3. Assessing the impact of Basel III on bank behavior: A micro-founded approach

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While the LCR is designed to improve the short-term resilience of the banking sector to meeting liquidity obligations for 30 days, the NSFR requires to meet funding obligations under a time horizon of one year. This last is designed to promote sustainable sources of funding when banks perform maturity transformation activities such as credit origination. As a result, we choose to model a liquidity ratio close to the NSFR because “Maturity transformation performed by banks is a crucial part of financial intermediation that contributes to efficient resource allocation and credit creation.” BCBS (2014). Moreover, we choose to characterise the liquidity aspect of our regulatory environment with the quality of the funding stability the banking sector might produce because as referenced in EBA (2015), the NSFR “is needed in addition to the solvency requirements (capital and leverage ratio) and LCR, because these existing requirements miss important aspects of structural funding stability.” Finally, it is more convenient to distinguish stock measures from flow ones. Therefore, we characterize the regulatory environment with stock measures only.

We contribute to the emerging literature by modeling a funding requirement close to the NSFR. As defined in (BCBS (2014), p.2): “The NSFR is defined as the amount of available stable funding relative [AASF] to the amount of required stable funding [RSF]. This ratio should be equal to at least 100 % on an on-going basis. “Available stable funding” is defined as the portion of capital and liabilities expected to be reliable over the time horizon considered by the NSFR, which extends to one year. The amount of stable funding required is function of the liquidity characteristics and residual maturities of the various assets held by the bank as well as those of its off-balance sheet (OBS) exposures”.

The liabilities taken into account to assess the ASF are weighted using an ASF factor which is between 100 % (e.g. for Tier 1 liabilities and Tier 2 liabilities with a maturity above one year) and 0 %. Symmetrically, the assets taken into account to assess the RSF are weighted using a RSF factor which is between 0 % (e.g. for central bank reserves and risk free securities) and 100 % e.g. for “all assets that are encumbered for a period of one year or more” (BCBS (2014), p.11). The NSFR can thus be defined as follows:

$$NSFR = \sum_i \frac{L_i \times ASF_i}{A_i \times RSF_i}$$

Where:  $L_i$  is the total amount of liabilities which belongs to the category  $i$  defining an ASF factor of  $ASF_i$ , and  $A_i$  is the total amount of assets belonging to the category  $i$  defining a RSF factor of  $RSF_i$ . Based on this definition, we can write the equivalent of the NSFR in the model.  $K$  which is equal to Tier 1 plus Tier 2 receive an ASF factor of

100 %. Deposits which are composed of term and non-maturity customer deposits define an ASF factor of 95 % or 90 % under the Basel III framework. For the sake of simplicity we also consider an ASF factor of 100 % for  $D$ . As a consequence, the AASF equals  $(K + D)$  in the model. The RASF induced by the banking activity is related to each asset held by the bank. Since the market risk is nil for the government bonds  $B$ , they define a 0% RSF factor. Loans have a credit risk parameter equals to  $\theta$ . Following the Basel III principle that the higher the risk, the higher the RSF factor we assume that loans  $L$  receive a RSF factor of  $\theta$ . The assets with the highest VaR also have a high level of RSF: such as the unencumbered residential mortgages (65 % RSF factor) and the other unencumbered performing loans (85 % RSF factor).<sup>9</sup> This symmetry is respected in the model where the credit risk is set equal to the RASF for loans.

Applying the NSFR formula to the model, we obtain the following Liquidity Requirement Ratio (LRR):

$$LRR = \frac{(K \times 1) + (D \times 1)}{(L \times \theta) + (B \times 0)}$$

$LRR$  measures the total amount of available funding (capital plus deposits) the bank disposes of to cover the funding risk induced by the credit activity and can be rewritten as follows:

$$LRR = \frac{(K + D)}{\theta L} = CRR + \frac{D}{\theta L} \quad (3.2)$$

Equation 3.2 states that  $CRR$  and  $LRR$  are not orthogonal by construction. We note the asymmetry of the two ratios: a rise in  $CRR$  implies a rise in  $LRR$  while a rise in  $LRR$  does not necessarily entail a rise in  $CRR$ . Raising  $CRR$  implies an increase in  $LRR$ . Satisfying a capital regulatory standard allows the bank to adopt a certain funding profile as outlined in Tirole (2011). This result is also consistent with most of the empirical literature showing that banks with strong capital ratios tend to strengthen their funding profile.<sup>10</sup> The implementation of a standard on funding such as the NSFR appears as a complement to the capital one and not an independent requirement.

#### 3.2.3 Bank behavior under a regulatory regime à la Basel III

To analyze the behavior of the banking firm under Basel III, we consider a representative bank seeking to maximize its profits under a capital and liquidity constrained environment. The constraints the regulatory authorities implement take the form of

<sup>9</sup>BCBS (2014), p.11

<sup>10</sup>See for example Dietrich et al. (2014).

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incentives that the bank is willing to comply with.

We define the cost function  $C(L, K, D)$  which measures the restriction and opportunity costs a bank may incur for its activity.<sup>11</sup> Ito and Sasaki (1998) assume that “the cost of the [regulatory capital] ratio is reduced as the ratio increases while its rate of change is diminished or constant; ( $C' < 0$ ,  $C'' \geq 0$ ). It means that banks with a low [regulatory capital] ratio can improve profit more by raising the ratio than banks with a high [regulatory capital] ratio” (Ito and Sasaki (1998), p.15).

The cost function also measures the ALM quality of the management related to the intermediation activity of the bank. In particular, the bank incurs a structural funding risk when funding illiquid assets with liquid liabilities as shown during the 2008 financial crisis.<sup>12</sup> The quality of the management of the funding risk can be assessed through the ALM activity which plays a prominent role under Basel III as the NSFR is designed to limit the over-reliance on short-term wholesale funding.<sup>13</sup> Thus, we are able to measure the effects of the liquidity regulation through the cost function  $C(L, K, D)$ . We consider that a bank with a low capital ratio incurs an opportunity cost not expanding its business activities as a strong capital base is necessary to support lending.<sup>14</sup> We set a similar hypothesis for liquidity. Following Spierdijk et al. (2017), note that “Deposits are used to fund loans and other earning assets”. A strong funding base appears essential to increase lending. High ratios are a signal for good bank business opportunities and the bank is thus able to improve its profitability. A high qualitative liquidity regulation should promote an efficient ALM activity which minimizes the funding risk the bank bears and limits the incentive to increase the liquidity gap.

We define  $L$  and  $K$  among the bank decision variables of the profit maximisation problem as in Ito and Sasaki (1998). However, deposits  $D$  becomes central within our bank decision problem because the NSFR is designed to give incentives to the bank to fund its business activities with stable sources of funding such as customer deposits. Indeed: “The second objective is to promote resilience over a longer time horizon by creating additional incentives for a bank to fund its activities with more stable sources of funding on an ongoing structural basis. The NSFR has a time horizon of

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<sup>11</sup>A bank satisfying no regulatory standards incurs restriction costs as regulatory authorities monitor certain credit activities of the bank. If there is no regulation,  $C(L, K, D) = 0$  by definition.

<sup>12</sup>The funding liquidity risk the bank is willing to bear is different from the aggregate credit risk it takes on its loan portfolio. We define the funding liquidity risk as the inability of the bank “to meet its obligations as they fall due” BCBS (2014).

<sup>13</sup>ALM covers other types of risk which turned out to be significant during banking crises. For example, the Savings and Loan (S&L) crisis of the US banking sector experienced at the end of the 80s was related to the mismanagement of the repricing gap of the banking sector.

<sup>14</sup>For example, see Berger and Bouwman (2009) for a set of hypotheses on this topic.

one year and has been developed to provide a sustainable maturity structure of assets and liabilities” (BCBS (2011), p.9). As a result, we define the deposit endogeneity of our bank decision problem as regulatory-induced. To picture the importance of collecting deposits, we set the following assumption on customer deposits:  $r'_D(D) > 0$ , meaning the bank raises more customer deposits when increasing its return.

We define the profits of the bank, denoted  $\Pi$  as the sum of its revenues on credit and market activities net of the costs induced by first the capital and deposit markets and second by the regulation. Increasing the volume of loans bought is costly  $C'_L > 0$  as the regulatory ratios of the bank are lower reducing thus its ability to cover capital and liquidity losses. On the other hand, raising the volume of capital and deposits decreases the costs  $C'_K < 0$  and  $C'_D < 0$  as the lending capacity of the bank rises:

$$\Pi = r_L(L) \cdot L + r_B \cdot B - r_K(K) \cdot K - r_D(D) \cdot D - C(L, K, D)$$

#### The bank profit maximisation problem

$$\max_{L, K, D} \Pi = r_L(L) \cdot L + r_B \cdot B - r_K(K) \cdot K - r_D(D) \cdot D - C(L, K, D)$$

$$\text{s.t. } L + B = K + D$$

Solving this profit-maximisation problem with the Lagrangian method gives the following first-order economic conditions:

$$r_L(L) - r_K(K) = C'_L + C'_K - (r'_L(L) \cdot L - r'_K(K) \cdot K), \quad (3.3)$$

$$r_K(K) - r_D(D) = C'_D - C'_K + r'_D(D) \cdot D - r'_K(K) \cdot K, \quad (3.4)$$

$$K + D - (L + B) = 0. \quad (3.5)$$

Eq. 3.3 means that the difference between the loan and capital rate -the NIM- equals the sum of the marginal regulatory costs on loans and capital ( $C'_L + C'_K$ ) net of the marginal profit derived from the intermediation activity ( $r'_L(L) \cdot L - r'_K(K) \cdot K$ ). Raising the portfolio of loans bought  $L$  entails an increase in the NIM ( $r_L(L) - r_K(K)$ ) as managing a higher illiquid portfolio of loans is costly. Other things being equal, the bank has to pay a higher price ( $C'_L - r'_L$ ) for its ALM activity.

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Eq. 3.4 states that the funding arbitrage of the bank – the difference between the capital and deposit rate – equals the marginal regulatory cost difference between deposits and capital ( $C'_D - C'_K$ ) plus the marginal market funding cost on these same liability components ( $r'_D(D) \cdot D - r'_K(K) \cdot K$ ). Assuming the funding arbitrage is positive, the bank has an incentive to raise deposits  $D$  at the expense of capital  $K$ . However, selling more deposits is costly at the margin. Thus, the bank issues deposits to the extent that the marginal cost of issuing it equals the marginal cost of issuing capital. The implementation of the additional liquidity ratio  $LRR$  shows that the bank funding arbitrage is both capital and deposit driven while it is only capital driven under a regulatory environment capital constrained such as Basel I and Basel II. This contribution is new in the academic literature.

Eq. 3.5 simply refers to the balance-sheet equilibrium constraint.

We assume  $d\theta = 0$  which means that the bank implements the right screening mechanism and is therefore able to perfectly assess the credit risk of the borrower in the short-run.<sup>15</sup> We obtain the following elasticities by totally differentiating eq. 3.3 and eq. 3.4 at the third order:<sup>16</sup>

$$dL = \frac{\delta_2 \cdot dK + \delta_3 \cdot dD}{\delta_1}; \quad (3.6)$$

$$dD = \frac{\delta_4 \cdot dK + \delta_6 \cdot dL}{\delta_5}; \quad (3.7)$$

where the coefficients are given by:

$$\delta_1 = r''_L(L) \cdot L + 2 \cdot r'_L(L) - \left( \frac{\partial^2 C}{\partial L^2} + \frac{\partial^2 C}{\partial L \partial K} \right);$$

$$\delta_2 = r''_K(K) \cdot K + 2 \cdot r'_K(K) + \frac{\partial^2 C}{\partial K^2} + \frac{\partial^2 C}{\partial K \partial L};$$

$$\delta_3 = \frac{\partial^2 C}{\partial D \partial L} + \frac{\partial^2 C}{\partial D \partial K};$$

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<sup>15</sup>This hypothesis also states that the credit risk is stable in the model.

<sup>16</sup>Note that developing the model at further order is possible. However, we do not do so because the economic interpretation would not be straightforward.



$$\delta_4 = r''_K(K) \cdot K + 2 \cdot r'_K(K) + \frac{\partial^2 C}{\partial K^2} - \frac{\partial^2 C}{\partial K \partial D};$$

$$\delta_5 = r''_D(D) \cdot D + 2 \cdot r'_D(D) + \frac{\partial^2 C}{\partial D^2} - \frac{\partial^2 C}{\partial D \partial K};$$

$$\delta_6 = \frac{\partial^2 C}{\partial L \partial K} - \frac{\partial^2 C}{\partial L \partial D};$$

$$\frac{dL}{dK} = \frac{\left( \delta_2 + \frac{\delta_3 \cdot \delta_4}{\delta_5} \right)}{\left( \delta_1 - \frac{\delta_3 \cdot \delta_6}{\delta_5} \right)}; \quad (3.8)$$

$$\frac{dK}{dD} = \frac{\left( \delta_5 - \frac{\delta_6 \cdot \delta_3}{\delta_1} \right)}{\left( \delta_4 + \frac{\delta_6 \cdot \delta_2}{\delta_1} \right)}. \quad (3.9)$$

Totally differentiating eq. 3.3 and eq. 3.4 stresses three important results. First, we see in eq. 3.8 and eq. 3.9 that the elasticities are market driven via the conduct of the first and second derivatives of the interest rates  $r'(\cdot)$  and  $r''(\cdot)$  obtained in  $\delta_1, \delta_2, \delta_4$  and  $\delta_5$ .

Second, we note that these elasticities are also regulatory driven. In addition to introducing banking adjustment and marginal regulatory costs as we have seen so far, capital and liquidity requirements adds secondary costs  $\left( \frac{\partial^2 C}{\partial (\cdot)^2} \right)$  and cross-effects  $\left( \frac{\partial^2 C}{\partial (\cdot) \partial (\cdot)} \right)$  potentially. The nature of these secondary costs and cross-effects may modify the structure of the elasticities of the bank and thus its behavior. As stated in Freixas and Rochet (2008), if costs are separable, then cross-effects are nil. If cross-effects are not nil then the elasticities are modified and determined depending on the functional form of the cost function. It is therefore crucial to determine the nature of these costs because they may affect the profitability (NIM), the funding arbitrage and the elasticities of the bank. The regulation may not be neutral.

Third, as in (Ito and Sasaki (1998), p.18) the signs of these elasticities “may not be uniquely determined.” We find that they depend on the costs that the regulation entails and second, on the structure of the competition the bank faces on the market.

For small enough  $C''$ , the signs of the elasticities depend on the structure of the com-

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petition and the regulation has only effects on the profitability (NIM) and on the funding arbitrage of the bank:

$$\frac{dL}{dK} \simeq \frac{\delta_2}{\delta_1} \simeq \frac{r_K''(K) \cdot K + 2 \cdot r_K'(K)}{r_L''(L) \cdot L + 2 \cdot r_L'(L)}; \quad (3.10)$$

$$\frac{dK}{dD} \simeq \frac{\delta_5}{\delta_4} \simeq \frac{r_D''(D) \cdot D + 2 \cdot r_D'(D)}{r_K''(K) \cdot K + 2 \cdot r_K'(K)}. \quad (3.11)$$

The sign of the loan-to-capital elasticity depends on the condition set on  $\delta_1$  and  $\delta_2$ . Assuming the cost of screening is decreasing, we set  $r_L'' > 0$ , “the rate of increase accelerates as more subordinated debts being issued” Ito and Sasaki (1998)<sup>17</sup> and the deposit interest rate follows the same pattern than capital ( $r_D'' > 0$ ), it follows that for  $L$  large:

$$\frac{dL}{dK} > 0; \quad (3.12)$$

$$\frac{dK}{dD} > 0. \quad (3.13)$$

Equation 3.12 shows that in the absence of secondary costs, the bank capital channel is effective. The credit activity appears bolstered under a regulatory framework *à la Basel III* and a stimulus from the monetary policy might amplify this effect since the bank capital channel is effective.

Equation 3.13 states the relationship between the capital and deposits of the bank. In particular, it shows that the “financial fragility-crowding out” does not hold at the micro level under the same conditions (absence of secondary costs).

### 3.3 Conclusion

The insufficient build-up of capital and liquidity buffers of the banking sector prior to the 2008 GFC has raised the rationale for implementing the regulatory regime Basel III.

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<sup>17</sup>This implies that  $r_K'' > 0$ .

One of the novel aspect of this regulation is the introduction of liquidity requirements aiming at counteracting the massive liquidity disruptions experienced by the banking sector. In this chapter, we draw a micro-founded theory of bank behavior subject to capital and liquidity constraints in order to deeply investigate the impact of this regulation on the conduct of the monetary policy and to shed some light on the capital-lending relationship. To our knowledge, this is the first body of research presenting a theoretical approach of bank behavior under a regulatory regime *à la* Basel III.

Evidence contained in this paper points to two major results. First, we show that implementing a capital and liquidity ratios has common implications for the bank. We show that the capital and funding ratios are not independent. Complying with the capital ratio allows to satisfy a certain funding profile which might not be sufficient though for financial stability purposes. We highlight the need to consider the design of a regulatory regime which is both capital and liquidity driven. In particular, we show that cross-effects might appear under this regulatory regime which might dampen or bolster the behavior of the bank.

Second, we point to the cross-effects induced by the introduction of a liquidity requirement to the capital one. Our theory illustrates the role of banking regulation in determining banks' balance sheet adjustments and modifying its composition. This result shows that banking regulation might be effective under the BCC and illustrates the common implications of the monetary and macroprudential policies which is a topic of on-going research in monetary economics. In addition, we find that banking regulation might be essential for determining the capital-lending relationship which is a concern of primary interest for prudential authorities.

There is avenue for future research in this chapter. In particular, one aspect which appears crucial in this chapter is to determine the costs incurred by the bank. It is of primary importance to identify the costs induced by the competitive nature of the market and the regulation as the right incentives of the bank might depend on. This question is particularly challenging to the extent that the literature in banking economics highlights that the behavior of banks might be different depending on its size. This chapter also questions the need to clarify the hierarchy (primary or secondary) of the objectives as well as their nature (complements or substitutes) in the design of banking regulation. As outlined in (Fisher (2014), p.2-3): "A necessary condition is that there should be at least as many independent and effective policy instruments as there are independent policy targets."



## **4 Assessing the impact of Basel III on bank behavior: An empirical approach**

## **4.1 Introduction**

The 2008 GFC and its aftermath had shed some light on the need to reconsider the design of banking regulation in order to promote the resilience of the international banking system. In recognition of the need to strengthen the capital base and support sustainable liquidity management practices, the Basel Committee designed a new set of financial reforms known as Basel III. One of the novel aspect of this regulation lies at the heart of the structure of the prudential regime. In addition to more stringent rules on capital, Basel III introduces two liquidity standards, namely the LCR and the NSFR.<sup>1</sup>

The novel aspect of this structure questions its impact on bank behavior. Analyzing the impact of international regulatory standards on bank behavior is not new. A large stream of literature supporting the effectiveness of the 1988 Basel Capital Accord shows that banks adopted different strategies to comply with the first international standard on capital. Among these strategies, banks were able to adjust their balance-sheets including restructuring their lending activity.<sup>2</sup> The implementation of tighter capital standards under Basel III has revived the interest for this topic and questioned the possibility of such an impact at the macroeconomic level illustrated under the *credit crunch* hypothesis during the implementation of Basel I.

Based on a sample of 148 UK banks for the period 1996-2007, Francis et al. (2009) analyze the impact of capital requirements on bank behavior. Their methodology has the main advantage to provide an analytical framework by which they assess this impact on the choice of capital dotation and lending. They find that the implementation of capital standards is positively associated with the banks' targeted capital ratios and lending. Cosimano and Hakura (2011) examine the impact of the Basel III capital standards on lending rates and growth. They find that a tightening of capital requirements gives incentives to banks to increase lending rates causing a slowdown in credit supply. Cohen and Scatigna (2016) show that banks from advanced economies comply with the Basel III capital requirements through the accumulation of retained earnings and to a lesser extent, shifting to assets with lower risk weights without detrimental effects on lending. Gropp et al. (2019) question the impact of higher capital requirements on bank lending and to a large extent on the real economy. Using a quasi-natural experiment, the authors find that banks reduced their level of

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<sup>1</sup>An important body of literature has urged for the design of a counter-cyclical prudential regulation since the implementation of the first Basel Capital Accords. Analyzing such aspect of banking regulation is however beyond the scope of this chapter.

<sup>2</sup>The literature shows that other balance-sheet adjustments were possible. Banks were able to reduce the size of their balance-sheet "downsizing" or modify the composition of their assets illustrated under the "portfolio-shift". For a complete review of these studies, see Jackson et al. (1999) and BCBS (2016).

risk-weighted-assets when subject to Basel III standards. In addition, banks facing higher capital requirements tend to lend less questioning thus the strategy to adopt for clearing the ratio.

This stream of literature remains focused on the effects of capital requirements on bank lending. However, an emerging body highlights the role of liquidity on lending and its consequences for the real economy.<sup>3</sup> King (2013) disentangles the different banks' strategies to meet the NSFR. Among these strategies, the bank is able to shrink the size of the portfolio of loans (downsizing) or substitute them for more liquid assets (portfolio-shift) modifying thus the composition of their assets and bank lending. Gobat et al. (2014) examine the impact and issues raised by the implementation of such a ratio for a large panel of banking systems. They also highlight the potential adverse effect of the NSFR on bank lending especially for large Domestic Systemically Important Banks D-SIBS. Kapan and Minoiu (2018) show that the funding structure may impact the lending activity of banks and the real activity as a whole. Using banks' balance-sheet data, Banerjee and Mio (2018) study the impact of the ILG– a liquidity ratio close to the LCR<sup>4</sup>– on the UK banking sector. They find that banks did not shrink the size of their balance-sheet but rather modify its composition without causing deleterious effects on bank lending. The implementation of liquidity standards suggests similar balance-sheet adjustments than those observed under Basel I and Basel II.

The adjustments induced by the capital and liquidity ratios suggest that the two ratios might have common implications for bank behavior and therefore financial stability. For example, Tirole (2011) shows that the definition of capital requirements under Basel I lends considerations for liquidity through the emission of capital. Using a sample of 11,000 banks across the US and Europe, Dietrich et al. (2014) analyze the relationship between bank funding structures, capital leverage and failures with a particular focus on G-SIBS and D-SIBS. Overall, the authors find that banks with weak liquidity structures and leverage tend to be more subject to failures. In addition, they show that the nature of bank failures are different across bank types. Small banks are more sensitive to failure when subject to liquidity issues while the failure of large banks occurs on the holding of insufficient capital base. Ben Naceur et al. (2017) study the impact of capital and liquidity indicators on bank lending in order to draw the main implications of a regime *à la* Basel III for US and European commercial banks. They find that the impact of the capital and liquidity structures of the bank may differ depending on heterogeneous bank specific characteristics. Kim and Sohn (2017)

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<sup>3</sup>As argued in Tirole (2011), liquidity covers different aspects. In this chapter, we define the concept of liquidity as the funding structure of the bank.

<sup>4</sup>The LCR corresponds to the liquidity standard requiring from banks to hold highly liquid assets to cover short-term liquidity needs. For more details, see BCBS (2011).

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underline the role of liquidity in the standard relationship between bank capital and lending. Overall, they find a significant impact of liquidity on the bank capital-lending relationship. They show that the relationship differs depending on the size of the bank. The effect of an increase in bank capital on credit growth is positively associated with the liquidity level for large banks while this relationship is non-existent for medium and small banks. Kapan and Minoiu (2018) outline the importance of bank capital in the relationship between the bank funding structure and lending. The authors find that weak balance-sheet structures, i.e. banks relying heavily on market funding, were less able to provide credits to the economy. However, better capitalized banks tend to slow down the volume of credits less than other banks. DeYoung et al. (2018), using a sample of US banks, investigate the liquidity behavior of banks under negative capital shocks. The authors emphasize on the need to take into account the size of the banks for the design of banking regulation. They show that small U.S. bank holding companies adopt sufficiently sound liquidity management practices before and after the crisis and present no risk for financial stability. On the other hand, they find no similar behavior for large commercial banks.

As underlined above, the macroeconomic implications of banking regulation has been revived particularly in the light of the conduct of monetary policy. Financial intermediaries are at the core of the transmission of monetary policy through bank loan supply. Based on a dynamic model of ALM, Van den Heuvel et al. (2002) provide the premise of the role of bank capital in the transmission of monetary policy. They show that monetary policy might be non-neutral on bank lending especially through the emission of bank capital. This mechanism, illustrated under the BCC shows that bank capital is an important transmission mechanism of monetary policy. Gambacorta and Marques-Ibanez (2011) show that bank-specific characteristics such as capitalization and funding are important determinants of monetary transmission mechanisms in Europe and the US. Gambacorta and Shin (2018) evidence the role of bank capitalization on the conduct of monetary policy. They find that weakly capitalized banking systems are associated with high bank funding costs reducing thus the lending capacity of the banking system. This mechanism has detrimental effects on the objective of monetary policy which is boosting sustainable lending following a negative shock.

We contribute to the literature as the implementation of liquidity ratios suggests that banks adopt similar strategies to capital compliance. To our knowledge, the literature examining the effects of capital and liquidity standards on bank behavior is still developing likely due to the fact that liquidity standards set at the international level has been mainly motivated since the implementation of Basel III.<sup>5</sup> We contribute to the

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<sup>5</sup>Note that the Basel Committee published "Sound Practices for Managing Liquidity in Banking Organisations" in 2000. However the unprecedented liquidity crisis experienced by the banking sector



literature in two areas. First, drawn upon the theoretical framework we presented in chapter 3, we construct a metric close to the NSFR in order to investigate the impact of both capital and liquidity standards on bank lending. This contribution should shed some light on the understanding of the BCC and thus the lead of monetary policy in Europe. Our second contribution is related to the role of financial development in the design of banking regulation. We motivate the interest for studying the impact of banking standards in Europe because this region features an important heterogeneity in financial development as shown in chapter 2. This characteristic might be essential for the conduct of monetary and prudential policies. The level of financial development appears as an additional parameter to take into account for financial stability purposes as it impacts bank behavior.

The remainder of this paper is organized as follows: Section 4.2 presents the data and methodology. Sections 4.3 and 4.4 present the main results and robustness checks respectively. Finally, section 4.5 concludes.

## 4.2 Data and methodology

### 4.2.1 Data treatment

We obtain the data based on the availability of bank balance-sheets and income statements in Moodys' Bank Focus, a commercial database maintained by Moody's. It has the main advantage to benefit from a large coverage of European banks. We present financial statements under a standardized and consolidated format disclosed in International Financial Reporting Standards (IFRS). We cover the period 2011-2019 characterizing the Basel III phase-in arrangements starting from 2013 to 2019. Balance-sheets and income statements are obtained annually and in Euro. Our objective is to assess the behavior of commercial banks under a regulatory regime *à la* Basel III. Thus, we cover banks implied in the intermediation activity only, i.e banks granting loans to non financial agents which includes commercial, cooperative and savings banks. We exclude entities such as central and investment banks and banks granting loans for predetermined sectoral activities.<sup>6</sup>

We select bank entities at the group level and under the IFRS consolidated format only. First, it allows us to avoid double counting issues by removing subsidiaries from the sample. Second, the literature shows that using data under the consolidated format

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in 2008 urged for an effective liquidity regulatory framework.

<sup>6</sup>For instance, this is the case for the automotive sector.

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allows to truly reflect the behavior of the bank.<sup>7</sup> Moreover, capitalization is usually measured at the group level. The adoption of liquidity standards is also subject to this type of adjustment. Thus, measuring at the group level allows to measure the exact capital and liquidity positions of the entity. In addition, as illustrated in Kim and Sohn (2017), banks might be constrained by various mandatory and discretionary supervisory actions. Including banks satisfying no regulatory standards could bias our estimations as it might not potentially reflect the true lending behavior of the bank. Following these criteria, our final sample is mainly composed of major banks in the Western European region comprising G-SIBS and D-SIBS.<sup>8</sup>

Table 4.1 below provides the summary statistics of the sample. Loan growth appears low for Cyprus and Luxembourg especially. These results do not necessarily reflect the economic-induced lending activity as these two countries are considered as financial centers.<sup>9</sup> The size of banking systems remains heterogeneous across countries. However, due to the small number of banks per country (e.g. Luxembourg and Malta), it is difficult to argue for comparability purposes. Capitalization is relatively homogeneous in the sample ranging from 10.45 for Luxembourg (N=1) to 23.64 for Sweden (N=5) and might reflect the ability of banks to comply with the requirement. It is less costly for banks to adjust to this ratio because the implementation of such a standard is well established since the first implementation in 1988. Banking staff is highly qualified and well organized to clear the hurdle. On the other hand, the funding of banks differs widely across countries ranging from 10.45 for Ireland (N=1) to 199.77 for Malta (N=1).<sup>10</sup>

As for the NSFR requirement, banks have to train highly qualified staff to optimize the management of their balance sheet. Due to the novel aspect of this regulation, banking adjustments remain relatively costly for this period as banks experiment different optimization strategies. This result might also be due to the bank reporting process. An identical pattern seems to operate for the short-term liquidity requirement. European banks are not featured by high levels of profitability. This might be due to the macroeconomic context characterized by weak economic growth. Finally, the ratios of Loan Loss Allowance (ALLOW) and NPL show that the screening function of banks is different across countries. Greece and Cyprus appear as the most impaired systems. We also find high NPL ratios for Ireland and Italy. This result is consistent with what was observed during the crisis. The heterogeneity of the loan quality indicators might represent an additional pressure on financial stability at the European level.

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<sup>7</sup>For a detailed explanation, see for example Brei et al. (2013).

<sup>8</sup>See for example EBA (2020) for a list of systemic banks.

<sup>9</sup>For a classification of financial centers, see for example Lane and Milesi-Ferretti (2011).

<sup>10</sup>The range remains important after removing financial centers (73.6).

## 4.2. Data and methodology

Table 4.1. Average bank features, by country (2011-2019)

Country	No. of banks	Loan Growth (%)	Size	Capitalization (%)	Funding (%)	Liquidity (%)	Profitability (%)	Loan quality (allowances, %)	Loan quality (non-performing loans, %)
Austria	9	4.02	13.05	15.86	86.93	18.73	0.43	3.46	5.68
Belgium	1	2.17	12.50	18.50	107.26	21.62	0.66	3.54	8.08
Cyprus	2	-7.10	10.48	14.58	128.36	26.85	-1.07	18.00	51.05
Germany	11	0.65	14.86	16.62	97.13	15.34	0.17	0.88	1.90
Denmark	5	5.01	14.07	19.04	95.94	34.71	0.62	3.86	4.65
Spain	9	2.90	14.81	14.64	100.98	14.19	0.48	3.96	7.20
Finland	5	-0.19	13.55	17.89	116.16	14.41	0.45	0.34	1.08
France	4	1.35	15.55	15.42	91.35	38.12	0.23	3.09	5.35
United-Kingdom	9	1.77	15.54	19.90	107.52	19.63	0.62	0.97	2.43
Greece	4	-2.47	12.60	14.06	89.79	11.13	-1.40	18.01	38.64
Ireland	1	-3.83	11.79	15.91	10.45	28.74	0.19	5.10	12.90
Italy	19	1.59	14.63	14.65	90.05	14.94	0.07	5.49	13.49
Luxembourg	1	-7.48	8.88	10.45	116.23	9.87	0.28	1.80	2.88
Malta	1	2.18	9.14	17.21	199.77	24.22	0.81	3.39	5.39
Netherlands	3	-0.66	14.52	20.31	79.91	18.14	0.39	1.30	2.49
Portugal	2	-3.40	11.47	13.52	116.15	6.94	0.16	6.74	6.67
Sweden	5	3.43	13.62	23.64	42.56	17.18	0.72	0.29	0.47

Note: Loan growth corresponds to the sum of the lending growth rates of individual banks per country and is averaged for the period 2011-2019.

Size is calculated by computing the log of the total assets of the country (sum of the total assets of each bank of the country) and averaged for the period 2011-2019.

Capitalization corresponds to the sum of the TCRs of individual banks per country and is averaged for the period 2011-2019.

Funding corresponds to the sum of the funding ratios (customer deposits to net loans expressed in %) of individual banks and is averaged for the period 2011-2019.

Liquidity corresponds to the sum of the liquidity ratios (sum of cash, trading securities and interbank lending of maturities less than three months, divided by total assets, expressed in %) of individual banks and is averaged for the period 2011-2019.

Profitability corresponds to the sum of the ROA (% , after tax) of individual banks and is averaged for the period 2011-2019. Allowances corresponds to the sum of the allowance ratios (allowance for credit losses to gross loans) of individual banks and is averaged for the period 2011-2019.

Non-performing loans corresponds to the sum of the NPL ratios (non-performing loans to gross loans) of individual banks and is averaged for the period 2011-2019.

We adjust our sample for potential outliers. The sample shows that outliers appear for capital and funding ratios above 30% and 300% respectively. Banks above these thresholds are likely to reflect M&As.<sup>11</sup> We remove observations with capital and

<sup>11</sup>The literature shows that other criteria are used to control for the M&As activity. However, these studies use large dataset mainly including non European banks. Regarding the size of our sample, we do not employ these types of adjustments.

## Chapter 4. Assessing the impact of Basel III on bank behavior: An empirical approach

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funding ratios higher than 30% and 300% respectively in order to avoid spurious lending behavior.<sup>12</sup> Our final sample consists of 84 banks over the period 2011-2019.

### 4.2.2 Econometric methodology

In this section, we investigate the impact of the capital and liquidity requirements on the volume of loans granted by the bank. A simplistic method to check the effects of the ratios on lending is to regress lending growth  $\Delta L_{i,j,t}$  on  $CRR$  and  $LRR$ .<sup>13</sup> The baseline specification of the econometric model to estimate is the following:

$$\Delta L_{i,j,t} = \beta_{CRR} CRR_{i,j,t} + \beta_{LRR} LRR_{i,j,t} + \epsilon_{i,j,t}, \quad (4.1)$$

where  $i$  denotes the bank,  $j$  the country the bank is incorporated in and  $t$  the period. For instance, BNP Paribas is incorporated in France and operates mainly in this country.

We define the dependent variable  $\Delta L_{i,j,t}$  as the growth of the loan-to-total-asset ratio. The capital and liquidity ratios are denoted  $CRR_{i,j,t}$  and  $LRR_{i,j,t}$ . They correspond to the capital and liquidity positions of bank  $i$  in country  $j$  at time  $t$  respectively. In this study, we use two indicators for measuring the capital position of the bank. We employ the TCR in the baseline regressions while using the Tier 1 Capital Ratio (T1) in robustness checks.<sup>14</sup>

The liquidity ratio  $LRR$  is defined as in chapter 3. We showed in this chapter that the liquidity ratio corresponds to the ratio of capital plus the deposit-to-credit ratio. Complying with the capital ratio allows to satisfy a certain funding profile. However this might not be sufficient and the implementation of a funding ratio bolsters the funding profile by giving incentives to collect customer deposits.

Estimating model (4.1) would be misleading because the proper impact of the capital and liquidity ratios on lending is not fully identified. Substituting  $LRR$  into eq. (4.1) suggests to estimate the following model:

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<sup>12</sup>Regressing the capital and funding positions on lending suggests that abnormal behavior appears for these values. For further details, see appendix B.1.

<sup>13</sup>Note that different expressions of the model is possible (in levels, first-difference etc...). In this study, we constrain the endogenous variable to be expressed in difference at least to account for bank lending behavior and not merely express a statistical relationship in level. We test different econometric specifications and retain the one presented in Ito and Sasaki (1998) due to the best econometric performance of this model.

<sup>14</sup>TCR corresponds to the total amount of regulatory capital (Tier 1+ Tier 2) divided by RWA. The T1 ratio includes CET1 and AT1 reported to RWA. For further details, see chapter 3 and BCBS (2011).

$$\Delta L_{i,j,t} = (\beta_{CRR} + \beta_{LRR}) CRR_{i,j,t} + \beta_{LRR} \frac{D_{i,j,t}}{\theta_{i,j,t} L_{i,j,t}} + \epsilon_{i,j,t}, \quad (4.2)$$

Eq.(4.2) shows that the magnitude of  $CRR$  is capital and liquidity induced. The proper impact related to the funding ratio is measured by the deposit-to-credit ratio  $\frac{D_{i,j,t}}{\theta_{i,j,t} L_{i,j,t}}$ , i.e a proxy for the ratio of transformation. In more details, we precisely estimate the impact of the funding ratio taking into account the volume of net loans to the denominator and not gross loans. This allows us to account for the function of screening measured by  $\theta$  in the theoretical model and in eq.(4.1) and eq.(4.2).

Eq. (4.2) can be rewritten as follows:

$$\Delta L_{i,j,t} = \beta_1 CRR_{i,j,t} + \beta_2 CFUND_{i,j,t} + \epsilon_{i,j,t}, \quad (4.3)$$

where:

$$CFUND_{i,j,t} = \frac{D_{i,j,t}}{L_{i,j,t}};$$

$$\beta_1 = \beta_{CRR} + \beta_{LRR};$$

$$\beta_2 = \frac{\beta_{LRR}}{\theta} \Rightarrow \beta_{LRR} = \theta * \beta_2;$$

We deduce:  $\beta_1 = \beta_{CRR} + \theta * \beta_2$

Assuming that  $\beta_{CRR} > 0$ ,  $\beta_2 > 0$  and  $\theta > 0$ , we obtain  $\beta_1 > \beta_2$ .

In addition to account for the impact of the capital and liquidity requirements on bank lending, we consider other determinants of bank loan supply. Usually, the literature related to the impact of banking regulation on bank loan supply recognizes two types of determinants.

First, we include a set of determinants related to the specific characteristics of the bank, which are denoted  $X_{i,j,t-1}$  in the model. As argued in Kim and Sohn (2017), the liquidity profile of the bank is an important determinant of lending. We define the liquidity ratio ( $LIQ$ , %) as available from Moody's Bank Focus. It corresponds to the sum of cash, trading securities and interbank lending of maturities less than three months, divided by total assets. We expect a positive impact of liquidity on lending. The size of the bank is also an important determinant to bank lending. DeYoung et al.

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(2018) show that bank lending behavior might vary depending on the size of the bank. We compute the log of total assets for each bank in our sample to define the size of the bank (*SIZE*). The profitability of the bank is also a determinant of bank loan supply. We use the Return on Assets (*ROA*, %) which corresponds to the net income to total assets. Finally, we use two indicators of loan quality. First, the ratio of allowance for credit losses to gross loans (*ALLOW*, %) corresponds to a forward measure of the quality of the portfolio of banks while the second measure, the non-performing loan ratio (*NPL*, %) corresponds to a backward measure of loan quality. *NPL* corresponds to non-performing loans to net loans.

The second type of determinants relates to the economic and monetary conditions of the bank, denoted  $Z_{j,t-1}$  in the model. We employ the growth rate of real GDP ( $\Delta GDP$ , %) to account for economic conditions which usually controls for the demand of credits. Second, monetary conditions are also important as they reflect the cost of funding additional loans. In this empirical investigation, we define the term spread (*TERM*) as the difference between the long and short term interest rates, which also reflects the stance of monetary policy. Although the conduct of the monetary policy is common to all countries across the Eurozone, monetary conditions remain important at the country level. Therefore, this measure has the main advantage to take into account these conditions at the country level.<sup>15</sup> Macroeconomic data are retrieved from the World Economic Outlook (WEO) database by the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD) statistics.

Table 4.2 below describes the variables and summary statistics used in the study.

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<sup>15</sup>We run standard specifications including the Euribor and the growth rate of central bank assets over GDP as the period features the lead of UMP. However, the models perform poorly.

## 4.2. Data and methodology

Table 4.2. Definition and Summary Statistics

Variable	Definition	Observations	Mean	Std. Dev	Min	Max
<i>Dependent variable</i>						
$\Delta L_{i,t}$	Growth rate of Net Loans to Total Assets (%)	693	0.24	4.88	-27.27	31.76
<i>Bank-specific characteristics</i>						
$CRR_{i,j,t-1}$	Total capital ratio (%)	697	16.30	4.12	-5.00	29.54
$CFUND_{i,j,t-1}$	Customer funding ratio (%)	697	93.97	38.75	8.42	297.11
$LIQ_{i,j,t-1}$	Liquidity ratio (%)	697	18.28	12.43	1.04	61.57
$SIZE_{i,j,t-1}$	Logarithm of total assets	697	11.08	1.85	6.71	14.63
$ROA_{t-1}$	Return on Assets (%)	696	0.20	1.16	-13.41	4.43
$ALLOW_{t-1}$	Allowance for credit losses to gross loans (%)	696	4.27	5.13	-6.26	31.95
$NPL_{t-1}$	Non-Performing Loans to gross loans (%)	679	8.38	10.46	0.00	65.60
<i>Macroeconomic controls</i>						
$TERM_{t-1}$	Long and short term interest rate difference	673	2.30	2.51	0.08	21.93
$GDP_{t-1}$	Growth of real GDP (%)	697	1.17	2.30	-9.13	25.12

The capital ratio is negative for banks subject to recapitalization. However, this case remains insignificant in the sample.

The highest value for  $TERM$  corresponds to Greece.

We estimate the following econometric model:

$$\Delta L_{i,j,t} = \alpha_i + \beta_1 CRR_{i,j,t-1} + \beta_2 CFUND_{i,j,t-1} + \gamma X_{i,j,t-1} + \lambda Z_{j,t-1} + \epsilon_{i,j,t}. \quad (4.4)$$

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We employ the pooled OLS estimator due to the size of our sample.<sup>16</sup> As in Brei et al. (2013), we include fixed effects in our estimations in order to account for other determinants at the bank level. All variables are lagged once in order to avoid endogeneity issues.<sup>17</sup>

### 4.2.3 Working hypotheses

We defined the funding structure of the bank as the sum of the capital and deposit-to-credit ratios in chapter 3. We showed that implementing a capital ratio allows the bank to satisfy a certain funding profile. Our study highlights the need to disentangle the impact of the capital and funding standards in order to assess their proper impact on bank lending. Otherwise, regressing the two regulatory measures on bank lending would be misleading as the statistical relationship is not fully identified.

We make the assumption that the amplitude of the coefficient on capital is greater than the one related to the deposit-to-loan ratio taking into account the definition we set in chapter 3.

**Hypothesis 1.** *The sensitivity of loans to the funding structure, measured as the ratio of deposit-to-loans, is positive.*

**Hypothesis 2.** *The sensitivity of loans to capital is stronger than the one related to the funding structure of the bank.*

## 4.3 Baseline results

In this section, we discuss the results of the basic linear relationship between bank loan supply and its determinants. First, we estimate the relationship between the variables of interest, i.e the capital and funding ratios and the bank loan supply. Second, we include in the model the macrodeterminants and loan quality. We perform the regressions including these determinants both separately and jointly. One accounting for the statistical relationship of the variables at two different levels. Another to measure the importance of the bank loan quality in the Eurozone.<sup>18</sup> Moreover, estimating

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<sup>16</sup>We used different estimation techniques including the Generalized Method of Moments (GMM) and panel Fixed-Effects (FE). However, due to the poor estimation performance of these techniques, we do not include the estimations in this study.

<sup>17</sup>See Brei et al. (2013) and Kim and Sohn (2017) for a justification.

<sup>18</sup>The quality of the loan portfolio in the EU remains an issue of primary importance for the banking sector. NPL might be a significant determinant of the mechanisms of bank balance-sheet adjustments including loans. For a review of the issues of NPL in Europe, see Mesnard et al. (2016).



the model including the variables of interest, the macrodeterminants and the loan quality corresponds to the specification presented in Ito and Sasaki (1998). Finally, we include all bank specific characteristics to reflect the conditions of the loan markets in Europe regarding the relevant determinants highlighted in the last development of the literature.

Table 4.3 refers to the linear specification. In this first set of regressions, *CRR* is proxied by the Total Capital Ratio (*TCR*). First, we find that our variables of interest – the capital and funding ratios – exert a statistically and positive impact on bank lending. This result is found in models R1 to R3 especially. We find that the coefficient on capital is weakly significant for R4 (p-value=10.5%) when accounting for liquidity, size and profitability. The positive sign of the coefficient on capital tends to support the risk absorption capacity hypothesis which prevails in most empirical studies at the micro level. A one percentage point increase in the capital ratio is associated with an increase of loans by 0.2 % roughly.

To a lesser extent, the coefficient associated to the funding structure of the bank *LRR* and measured as the deposits-to-loan ratio is significant in models R1 to R4. It has a positive and significant impact meaning that banks strengthening their funding profile raise lending by less than 0.1%. This finding confirms the prediction set in H1, which states that the sensitivity the loan activity to the funding structure is positive. To our knowledge, our research is the first to document this relationship as the literature focuses on the *NSFR* to proxy the liquidity requirements.

We find that the coefficient on the funding ratio is weaker than the one on capital as predicted in H2. We showed in chapter 3 and eq. 4.2 that the effect of the funding ratio is partially measured through the amplitude of the capital coefficient. The sign and the amplitude of the coefficient on funding shows that implementing a regulatory ratio such as the *NSFR* complements the one on capital. This first set of results complies with our theoretical framework as the estimates of  $\beta_2$  is below that of  $\beta_1$  for the models R1 to R4.

Overall, these results suggest that the Basel III reforms are in line with the objective primary set by prudential authorities. The implementation of the capital and liquidity ratios allow banks to strengthen their capital and funding profiles while supporting the lending activity.

Second, R4 shows that all coefficients related to other bank-specific characteristics are generally significant with expected signs. European bank lending appears very sensitive to the liquidity ratio. Its impact is positive and the magnitude is as consistent as the capital ratio. This result is in line with Brei et al. (2013) and Kim and Sohn

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(2017) who highlight the importance of liquidity in the capital-lending relationship. Completing the capital and funding ratios under Basel III with a liquidity requirement such as the LCR appears essential for bolstering the lending activity in Europe. Size remains an important determinant of bank loan supply. The positive sign of the coefficient suggests that the effect of moral hazard behavior derived from the too-big-to fail theory prevails. Large banks tend to support lending. The quality of the loan portfolio of the bank is also an important determinant to consider for bank loan supply. The loan loss allowance ratio has a positive impact on bank loan supply and its magnitude is relatively large. The ratio of NPL is significant and negative. A one percentage point increase in the NPL ratio is associated with a decrease of loans by 0.2 % approximately.

Finally, macroeconomic determinants are both significant, which means that economic and monetary conditions matter for the post-Basel adjustment period. Consistent with Brei et al. (2013) and Kim and Sohn (2017), we find that the growth of real GDP has a positive impact on bank loan growth. The term spread, i.e. the difference between the long and short-term interest rates is significant and large in magnitude. The positive impact of the coefficient suggests that bank loans tend to grow as the term spread deepens. This result is not inconsistent due to the fact that the rise of the term spread might reflect a downward dynamic of the short-term interest rates.<sup>19</sup>

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<sup>19</sup>Other empirical specifications have been tested to model a non-linear relationship between capital, funding and lending. However, we do not find evidence of such statistical relationships. The deposit-to-loan ratio is orthogonal by construction and it is expected to find no cross-effects.

## 4.4. Robustness checks and alternative specifications

Table 4.3. Regression Results- Baseline Regressions

VARIABLES	R1	R2	R3	R4
$CRR_{t-1}$	0.251** (0.0984)	0.218** (0.108)	0.222** (0.109)	0.159 (0.0973)
$CFUND_{t-1}$	0.0536*** (0.0183)	0.0605*** (0.0213)	0.0568** (0.0220)	0.0500** (0.0246)
$LIQ_{t-1}$				0.152*** (0.0470)
$SIZE_{t-1}$				6.565*** (1.836)
$ROA_{t-1}$				-0.318 (0.282)
$ALLOW_{t-1}$			0.521*** (0.191)	0.647*** (0.187)
$NPL_{t-1}$			-0.131 (0.0892)	-0.147* (0.0837)
$TERM_{t-1}$		0.169 (0.198)	0.377* (0.226)	0.430* (0.222)
$GDP_{t-1}$		0.248 (0.152)	0.274* (0.158)	0.279* (0.158)
Observations	693	669	652	652
R-squared	0.176	0.177	0.192	0.260

Robust standard errors in parentheses

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

## 4.4 Robustness checks and alternative specifications

### 4.4.1 Impact of the quality of capital

In this section, we first discuss the results of the basic relationship between capital and lending when measuring the capital of banks by the Tier 1 capital ratio. The estimate presented in table 4.4 shows that bank lending in Europe is sensitive to the quality of capital. The magnitude of the coefficient on capital is more important than it is when including Tier 2 and the statistical significance raises. This result has important implications for the conduct of monetary policy. The quality of bank capital appears as a crucial determinant to the efficacy of the transmission mechanism of

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monetary policy. This result also highlights the common implication of monetary and prudential policies. Setting the right incentives on the quality of capital might help fulfilling the objective of financial stability by bolstering the efficacy of the transmission mechanism of monetary policy.

All other determinants are of expected signs and significant except the ratio of allowance.

Table 4.4. Regression Results- Robustness Checks

VARIABLES	R5
$T1_{t-1}$	0.216* (0.115)
$CFUND_{t-1}$	0.0507** (0.0244)
$LIQ_{t-1}$	0.149*** (0.0463)
$SIZE_{t-1}$	6.264*** (1.881)
$ROA_{t-1}$	-0.371 (0.285)
$ALLOW_{t-1}$	0.640*** (0.186)
$NPL_{t-1}$	-0.148* (0.0842)
$TERM_{t-1}$	0.455** (0.221)
$GDP_{t-1}$	0.280* (0.156)
Observations	652
R-squared	0.263

Robust standard errors in parentheses

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

### 4.4.2 Financial development and banking regulation

In this section, we discuss the importance of the relationship between financial development and banking regulation. Our idea is that the impact of banking regulation

#### 4.4. Robustness checks and alternative specifications

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on the structure of the bank credit supply might vary depending on the degree of the development of the banking sector. This alternative model builds on the findings of chapter 2, which investigates the relationship between the capital and funding positions on the banking sector development at the country level.

**Hypothesis 3.** *Bank lending behavior is affected by the level of financial development in the country the bank operates in.*

In order to test this hypothesis, we first measure and include in model R4 the development of the banking sector via the credit-to-GDP ratio. Our results are presented in model R6 in table 4.5 and show that capital has no impact on the bank loan supply. The funding structure of the bank remains an important determinant but its impact is less significant. All remaining variables remain significant except real GDP. Financial development appears not significant in this regression.

A deeper investigation suggests to interact a measure of banking regulation and financial development. We test the relationship between the structure of bank capital and financial development.<sup>20</sup> Results are reported under R7. We find that the influence of bank capital on lending is significant and the amplitude of the coefficient stronger. Although the coefficient of financial development appears insignificant, the interaction term is statistically negative and significant. The influence of the capital ratio on the bank lending activity weakens as the level of financial development increases in the country the bank operates in. This result suggests that the standard relationship set between bank capital and lending might be reconsidered in the light of financial development. The use of the capital ratio as an instrument of prudential policy appears less efficient for more advanced financial systems. This result suggests that prudential authorities have to adopt additional instruments and strategies to counteract the loss of the efficacy of capital regulatory systems. This result lends support for the adoption of liquidity ratios to the extent that these two instruments strengthen the lending structure of the economy.

We test the relationship using a more stringent measure of bank capital, namely the Tier 1 capital ratio. Results are reported in models R8 and R9. We find that the capital ratio is significant and positive in the standard linear relationship between bank capital and lending. Financial development remains insignificant. Including the interaction term yields interesting results. First, we find that all coefficient related to banking regulation and financial development are significant meaning that, as established in R7, capitalization appears less binding as financial systems develop. This result shows that the role of capitalization is less pronounced in determining

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<sup>20</sup>Other specifications on the structure of bank funding and financial development have been tested. However, estimates perform poorly.

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bank loan supply when financial systems develop whatever the quality of capital. This confirms that the use of other prudential instruments should prevail to favor lending rather than emphasizing on the capitalization of the banking system.

Table 4.5. Regression Results- Financial Development and Banking Regulation

VARIABLES	R6	R7	R8	R9
$CRR_{t-1}$	0.155 (0.0992)	0.770** (0.310)		
$FD_{t-1}$	-0.0261 (0.0269)	0.0501 (0.0508)	-0.0229 (0.0273)	0.0917* (0.0475)
$CRR_{t-1} * FD_{t-1}$		-0.00546* (0.00282)		
$T1_{t-1}$			0.207* (0.116)	1.323*** (0.345)
$T1_{t-1} * FD_{t-1}$				-0.00977*** (0.00288)
$CFUND_{t-1}$	0.0475* (0.0242)	0.0462* (0.0240)	0.0484** (0.0242)	0.0443* (0.0232)
$LIQ_{t-1}$	0.150*** (0.0471)	0.143*** (0.0456)	0.148*** (0.0462)	0.134*** (0.0434)
$SIZE_{t-1}$	6.376*** (1.931)	6.348*** (1.960)	6.116*** (1.959)	6.106*** (1.912)
$ROA_{t-1}$	-0.299 (0.284)	-0.299 (0.283)	-0.350 (0.287)	-0.337 (0.277)
$ALLOW_{t-1}$	0.685*** (0.195)	0.705*** (0.194)	0.674*** (0.194)	0.720*** (0.195)
$NPL_{t-1}$	-0.142* (0.0801)	-0.144* (0.0797)	-0.143* (0.0807)	-0.154* (0.0814)
$TERM_{t-1}$	0.498** (0.221)	0.522** (0.218)	0.514** (0.220)	0.570*** (0.211)
$GDP_{t-1}$	0.222 (0.156)	0.218 (0.153)	0.230 (0.155)	0.187 (0.134)
Observations	652	652	652	652
R-squared	0.262	0.268	0.265	0.281

Robust standard errors in parentheses

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

### 4.5 Conclusion and policy implications

In this chapter, we investigate the impact of a regime *à la* Basel III on European banks' lending. Our research question is of particular interest as banks remain the core of the funding of the real economy in Europe. Drawing a model of bank lending behavior and using a sample of 84 European banks, this chapter points to two major results.

First, the impact of the capital and funding standards are significant and positive on bank lending for the period 2011-2019 characterizing the Basel III phase-in arrangements. The lead of Basel III in Europe appears to cause no deleterious effects on bank lending. Rather, our study suggests that the fragility of European bank lending is highly dependent on the quality of loans. Thus, a credit crunch scenario might be due to a worsening of non-performing loans. We find that the implementation of capital and liquidity rules in Europe encourages the production of credits.

Second, we find that financial development, measured by the credit-to-GDP ratio, appears as an important determinant of bank lending. The efficacy of the capital instrument weakens as the development of financial systems rises. Thus, the use of additional tools such as liquidity standards are necessary to favor sustainable bank lending conducts for advanced financial systems. Thus, maintaining a solid banking credit structure in Europe would imply the use of a joint regulatory structure combining both capital and liquidity instruments.

This chapter underlines that monetary and prudential policies have common implications for financial stability. We highlight that European banks are sensitive to the quality of capital. In light of the bank capital channel literature, designing incentives to collect better quality capital improves the quality of the monetary policy transmission mechanisms. In addition, taking into account the role of financial development appears essential to ensure the goal of financial stability in Europe but renders the lead of the monetary and prudential policies more complex. Understanding the implications of financial development in the design of these two policies would favor the comprehension of the financial stability mechanisms in Europe and lets further areas of research.





## 5 Conclusion générale

Tout au long de ce travail doctoral, nous avons cherché à établir le lien entre développement financier et régulation bancaire. En particulier, nous avons cherché à savoir si les modèles de régulation d'après crise devaient davantage tenir compte du niveau de développement financier pour assurer l'objectif de stabilité financière. A ce titre, l'UE constitue un excellent sujet d'étude tant son originalité tient en l'inscription de l'objectif de stabilité financière parmi ceux d'intégration financière et économique. Dans ce contexte et d'après l'analyse établie en introduction, on comprend tout l'enjeu que peut constituer une bonne politique de régulation. Cette dernière doit assurer la stabilité financière sans compromettre le chemin vers une croissance économique soutenable des pays membres de l'UE.

Ces derniers présentent des systèmes financiers hétérogènes à la fois en termes de profondeur, d'efficience et de stabilité. Par exemple, il apparaît que les pays membres de l'UE présentent des structures financières (financement intermédié et de marché) propres à chaque économie. Alors que les économies les plus avancées présentent des structures relativement équilibrées, les économies sujettes aux objectifs de convergence économique et financière présentent un déséquilibre au profit du financement intermédié.

Compte tenu des objectifs fixés et de l'hétérogénéité financière des pays membres, nous nous sommes interrogés au chapitre 2 sur l'efficacité de la mise en oeuvre d'un ensemble de règles uniques à satisfaire l'objectif de stabilité financière et de croissance économique. Nous avons pour cela étudié empiriquement la relation entretenue par la capitalisation, la liquidité et le développement du système bancaire.

Tout d'abord, notre étude illustre la complexité de la relation entretenue entre le capital et le crédit bancaire au niveau agrégé. L'estimation de la relation simple entre capital et développement bancaire montre un impact négatif de la capitalisation sur

## Chapter 5. Conclusion générale

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le niveau de développement. Ce résultat est intéressant dans la mesure où il conforte le corps d'hypothèses FFCO établissant une relation négative du capital au prêt et va à l'encontre de la plupart des études microempiriques qui justifient solidement un impact positif.

Il convient cependant de relativiser ce résultat. Premièrement, celui-ci peut tout simplement traduire la complexité statistique à établir la relation capital-crédit au niveau macroéconomique. Le calcul du ratio de capital pondéré des risques est dépendant des normes comptables en vigueur et aussi des normes produites par le système de supervision alors mis en place<sup>1</sup>. De plus, la comparabilité des modèles internes d'évaluation du risque de crédit, composant du dénominateur du ratio de capital, pose aussi question.

Deuxièmement, il apparaît aussi difficile de trancher au niveau agrégé entre l'hypothèse de fragilité financière "*financial fragility*" et l'hypothèse d'éviction "*crowding-out*" car la première se fonde essentiellement sur un corpus microéconomique et théorique. Ce résultat montre toutefois que la relation agrégée du capital au prêt ne correspond pas nécessairement à la simple somme des comportements individuels justifiant ainsi une approche pleinement macroprudentielle de la régulation.

Les déterminants méso-économiques ont globalement un impact positif sur le développement bancaire. Tout d'abord, la structure de crédit au sein de l'UE apparaît conditionnée par des marchés bancaires très concentrés suggérant qu'une part importante du crédit est établie par des entités bancaires dont la taille est importante. Ce résultat est cohérent avec l'existence de banques à risque systémique dans les économies des pays membres les plus avancés qui représentent un enjeu pour la stabilité financière de l'UE. Les implications en termes de politique économique suggéreraient de prêter attention à la qualité des prêts offerts dans une telle situation. Cette configuration peut constituer un frein aux objectifs de développement financier et économique. L'usage de l'instrument de concurrence apparaît légitime dans ce cas pour favoriser l'accession à une meilleure couverture des services financiers. Cependant, l'impact de cet instrument sur la stabilité financière rend l'exercice de la politique concurrentielle subtil. Deuxièmement, la profondeur du marché des actions semble aussi favoriser l'offre de crédit dans l'économie. Ce résultat tend à soutenir les mesures de politique économique consistant à promouvoir davantage les structures financières équilibrées (banque et marché notamment) au sein d'une économie en vue d'une croissance économique soutenable.

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<sup>1</sup>La différence de norme peut s'établir aussi bien au niveau transversal que temporel. Le lecteur pourra trouver l'ensemble des facteurs influençant le calcul du ratio RWA dans IMF (2019). Notons que la question se pose aussi pour la mesure du ratio de levier (capital rapporté au total de l'actif) car il faut définir le capital dit réglementaire.

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Enfin, les environnements macroéconomiques et macro-financiers restent des déterminants importants de l'offre de crédit. Dans notre étude, nous utilisons le PIB par tête pour contrôler la demande de crédit dans l'économie. Bien que différente de la mesure du taux de croissance réel du PIB utilisée dans la plupart des études microéconomiques, nous trouvons que la mesure du développement économique a un signe positif et attendu. De même, la conduite de la politique monétaire, mesurée par le taux directeur de la BCE a elle aussi un impact conforme à ce que nous anticipions.

Nous montrons aussi que les pays membres de l'Europe de l'Est présentent des spécificités particulières dont la prise en compte semble nécessaire pour établir le régime de régulation. La réponse des politiques publiques européennes pourrait se trouver en l'usage de plusieurs instruments. Un ensemble de réformes incitant à construire des modèles sains de transformation bancaire et peut-être moins dépendants du financement externe pourrait constituer une stratégie viable de développement financier et économique.

Deuxièmement, la mise en oeuvre d'outils favorisant la qualité de la construction institutionnelle constitue un des déterminants usuellement mis en avant par la littérature de l'économie du développement pour accroître le développement économique et financier<sup>2</sup>. Le développement des marchés financiers, dynamique stratégique de l'intégration économique, légitime ainsi les efforts poursuivis vers une qualité institutionnelle meilleure. De plus, le développement des marchés financiers permettrait d'obtenir des structures de financement plus équilibrées pouvant diminuer le risque d'instabilité financière et permettrait de contribuer de manière plus importante au financement de l'économie en cas de choc.

En termes de politique économique, adapter les règles en capital et liquidité aux spécificités économiques semble une réponse séduisante pour assurer les objectifs d'intégration financière et de croissance économique. Cependant, cette modalité d'intervention de la régulation soulève de nombreuses questions pour les pays membres d'une UEM. Sur le plan prudentiel, le calibrage d'instruments en capital et de liquidité par le niveau de développement financier apparaît difficile à mettre en place pour plusieurs raisons. Premièrement, il faudrait déterminer techniquement la taille optimale du secteur bancaire et financier de l'économie. Sur le plan normatif, la mise en place de plusieurs régimes de régulation peut se heurter à une non-optimalité au sens de Pareto. Cette application pourrait aussi faire naître une concurrence des régimes de régulation probablement génératrice d'instabilité financière et allant à l'encontre de la conception des politiques européennes.

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<sup>2</sup>Le lecteur pourra à ce titre se référer à Freixas and Rochet (2008) pour une discussion de la relation développement financier-croissance économique.

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La réponse des autorités européennes aux objectifs de convergence économique et financière apparaît unique tant les pays membres présentent des caractéristiques bien particulières. Cette réponse doit apparaître globale, combinant l'usage de mesures prudentielles, de supervision et probablement institutionnelles. L'existence même d'une UEM légitime des mécanismes de solidarité tels qu'établis dans le modèle d'UBE pour palier aux difficultés du secteur bancaire en cas de choc et tel qu'observé lors de la crise de la dette en zone euro.

Dans le chapitre 3, nous construisons une théorie positive du comportement bancaire dans un environnement prudentiel axé sur le capital et la liquidité. Notre objectif est double. Premièrement, nous souhaitons analyser la manière avec laquelle le canal du capital bancaire opère pour mesurer les enjeux de politique monétaire lorsque le système bancaire est soumis à un régime de régulation à la Bâle III. Deuxièmement, dans une perspective purement prudentielle, nous souhaitons déterminer la nature de la relation entre capital et dépôts pour déterminer sous quelle(s) condition(s) les objectifs établis de structures de capital et de transformation plus résilientes sont atteints.

Nos résultats sont multiples. Premièrement, nous montrons que les ratios de capital et de liquidité (axé sur le modèle de financement des banques) ne sont pas indépendants l'un de l'autre. Cet enseignement rejoint en partie l'observation selon laquelle la mise en oeuvre d'un ratio de capital peut satisfaire à assurer un certain modèle de financement de la banque. Cependant, cette configuration peut s'avérer insuffisante et l'application de règles incitant les agents économiques à développer des modèles de financement plus sains peut s'avérer nécessaire. Dans cette optique, la construction d'un ratio de type NSFR est légitime. Le deuxième enseignement tiré du modèle théorique tient dans le processus de décision de la banque. L'implémentation d'une nouvelle contrainte engendre un coût supplémentaire pour la firme bancaire qui n'apparaissait pas dans un cadre de régulation uniquement axé sur le capital. La réponse des banques peut se traduire par un ajustement plus long à ce nouvel environnement réglementaire, par exemple, une offre de crédit moins importante à court-terme.

Notre modèle montre que la tâche de la politique de régulation au sein de l'UE peut s'avérer complexe. En effet, elle nécessite d'identifier de quelle manière les coûts de régulation se répercutent sur le modèle économique des banques. Celui-ci peut-être différent suivant la taille de l'entité bancaire. Le tissu bancaire en UE est marqué aussi bien par l'existence de grandes banques à risque systémique que de banques de taille moindre. Cette complexité s'illustre aussi à travers la dynamique concurrentielle à laquelle les banques font face. La politique de régulation peut infléchir

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le comportement des banques lorsque le cadre concurrentiel, vecteur d'instabilité financière incite à une prise de risque excessive. Une telle configuration de la régulation ne semble pas appropriée en revanche lorsque la banque fait face à une pression concurrentielle peu importante.

Le problème d'optimisation montre que la MNI et l'arbitrage de financement de la banque sont la somme d'une composante de régulation et de marché. La MNI et donc la rentabilité de la banque correspond à la somme des coûts marginaux minorée par la rentabilité des marchés des crédits et des capitaux. L'arbitrage de financement et donc la structure du passif répond à une dynamique légèrement différente. Elle correspond à la différence des coûts marginaux du dépôt et du capital majorée par l'arbitrage de marché de ces composantes. Les élasticités obtenues montrent que la structure concurrentielle à laquelle la banque est soumise conditionne son comportement. Une politique de régulation favorisant la concurrence semble être favorable. Cependant, une investigation empirique est nécessaire pour confirmer ce point dans la mesure où le lien entretenu entre concurrence bancaire et stabilité financière reste à déterminer dans la littérature.<sup>3</sup>

Enfin, nous montrons que la régulation peut engendrer des effets croisés modifiant les élasticités et plus généralement le comportement de la banque. Nous soulignons dans ce chapitre le besoin de déterminer la forme fonctionnelle de la fonction de coût. D'une part, nous montrons les implications communes de politique monétaire et macroprudentielle. La politique de régulation peut opérer à travers le canal du capital bancaire et donc impacter l'efficacité de la transmission de la politique monétaire. Notre seconde recommandation, en lien avec la première, porte sur l'identification de la concurrence à laquelle la firme bancaire est soumise. Nous avons montré dans le chapitre 3 que la concurrence de marché définit une part du comportement bancaire. Dans ce cadre, les autorités de régulation doivent intervenir de manière à ce que les interactions entre politique de régulation et politique concurrentielle agissent de concert pour favoriser la stabilité financière.

Nous avons complété ce travail théorique par une étude empirique présentée au chapitre 4. Notre objectif est de valider la qualité de la représentation du comportement économique que nous avons développée au chapitre 3. Ce travail s'inscrit de plus parmi les travaux précédemment établis de la littérature traitant de l'impact de la régulation sur le comportement bancaire. Un aspect important de l'étude empirique est notamment de déterminer sous quelle(s) condition(s) un scénario de type *credit crunch* a pu se former en Europe. Une contribution supplémentaire est l'étude de la relation régulation bancaire-développement financier sous l'angle microéconomique.

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<sup>3</sup>Voir à ce titre, l'ouvrage de Vives (2016) pour un état de l'art de la littérature.

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Tout d'abord, conformément à la littérature microéconomique et aux prédictions du modèle théorique, nous trouvons que l'impact du capital à l'offre de prêt est positif. Ce résultat soutient l'hypothèse d'absorption des risques et s'inscrit parmi les nombreuses études validant cette hypothèse. Nous trouvons que cette relation est renforcée lorsque nous utilisons une mesure plus fine du capital fondée sur le ratio Tier 1. Ce résultat suggère que la structure de crédit parmi les pays membres de l'UE apparaît plus résiliente lorsque les positions en capital sont de meilleure qualité.

Deuxièmement, nous trouvons que le coefficient du ratio de transformation est positif mais de moindre amplitude que le ratio de capital. Ce résultat est conforme aux prédictions du modèle théorique. Nous avons en effet montré que l'effet induit par un ratio de type NSFR correspond à la somme du ratio de capital et de dépôts rapportés aux prêts ajustés du risque. Ainsi, l'amplitude moindre du coefficient de transformation par rapport au capital tendrait à montrer qu'une partie de l'effet du standard de transformation passe par le ratio de capital. Une mesure telle que l'instauration d'un ratio de transformation semble aller de pair avec la mise en oeuvre du ratio de capital. Ces deux ratios apparaissent complémentaires. Ainsi, une structure de régulation à la fois axée autour du capital et de la liquidité permet d'une part de renforcer la capitalisation et le processus de transformation des banques mais aussi de soutenir l'offre de crédit. Cet impact est aussi de signe attendu et conforme à la littérature définissant la relation de la structure de financement aux prêts.

L'ensemble des autres déterminants sont de signe attendu excepté le ratio de provisions. L'impact positif des ratios de capitalisation et de liquidité confronté à l'impact négatif du ratio de prêts non-performants suggère qu'un scénario de type *credit crunch* est probable non par des ajustements de bilan causés par la mise en oeuvre de standards de régulation plus importants mais par la dégradation du portefeuille de prêt des banques.

L'introduction du terme de développement financier dans l'équation d'offre comportementale permet de mieux appréhender la compréhension de la relation régulation bancaire-développement financier sous l'angle microéconomique. Une estimation simple incluant le développement financier suggère que l'impact du capital sur l'offre de crédit est marginal. Cependant, une spécification plus avancée montre qu'une relation capital-développement financier existe et est déterminante de l'offre de crédit. En particulier, les résultats montrent que plus les systèmes financiers sont développés (complexes) et moins la contribution positive du capital à l'offre de prêt est importante. La qualité du capital importe et suggère que le recours à d'autres instruments de régulation est d'autant plus important que l'instrument de capital perd en efficacité pour soutenir l'offre de crédit.

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Nous dressons plusieurs recommandations de politique économique. Premièrement, un ensemble de réformes favorisant la collecte de capital de meilleure qualité paraît essentiel en ce sens où elles rendent les entités bancaires plus résilientes et à même de soutenir l'offre de crédit en cas de choc économique et financier. Le rôle déterminant de la qualité du capital est tout aussi intéressant pour l'établissement de la conduite de la politique monétaire au sein de l'UE et rend cette recommandation tout aussi valable. Le canal du capital bancaire, bien établi par les travaux d'économie monétaire d'après-crise, souligne les implications communes de politique monétaire et de régulation. En régissant un ensemble d'incitations à collecter du capital de meilleure qualité, la politique de régulation agirait de concert avec la politique monétaire en favorisant une structure de crédit plus solide. Ainsi, les objectifs fixés par les politiques de régulation et monétaire, à savoir croissance économique et stabilité financière, s'avèreraient mieux atteints.

Le ratio de liquidité établissant le modèle de financement de la banque montre un impact significatif et positif sur l'activité de prêt mais de moindre ampleur que le capital. Ce résultat soutient le rôle complémentaire joué par le ratio de type NSFR. Il souligne aussi l'opportunité que peut constituer ce modèle de régulation en ce sens où la cohabitation de ces deux ratios n'altère en rien la structure de crédit du marché du crédit bancaire en Europe.

Enfin, nous montrons que le développement financier est un paramètre clé de l'offre de prêt. En particulier, plus un système bancaire s'avère complexe et moins la contribution positive du capital au crédit semble importante. Dans ce cadre, l'adoption de stratégies supplémentaires par les autorités prudentielles telles que l'instauration de règles de liquidité peut s'avérer bénéfique à la fois pour soutenir la croissance de crédit et la stabilité financière.

Au regard de ces éclairages, nous illustrons aussi toute la complexité de satisfaire à bien les objectifs de la politique monétaire. D'une part, celle-ci doit tenir compte des effets induits par la politique de régulation dans la mesure où cette dernière peut affecter les mécanismes de transmission de la politique monétaire. D'autre part, ces mécanismes de transmission peuvent aussi être affectés par l'hétérogénéité des structures financières des pays membres les plus avancés.

En conclusion, nous avons montré que la régulation bancaire et le développement financier ne sont pas des concepts indépendants l'un de l'autre. Tenir compte du degré de complexité des systèmes bancaires apparaît comme essentiel pour les autorités de régulation. Un cadre de régulation mal adapté peut compromettre l'objectif de stabilité financière et de croissance économique. Par exemple, la mise en place d'une réglementation complexe pour des systèmes financiers peu développés peut poser

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problème compte tenu du partage entre gain économique et stabilité financière.

Si le calibrage d'instruments de régulation tels le capital et la liquidité apparaît comme une réponse attrayante pour freiner le développement bancaire ou financier lorsque ceux-ci sont générateurs d'instabilité financière, son adaptation au sein d'une UEM peut s'avérer complexe.

Premièrement, il apparaît très difficile techniquement de déterminer sous quel(s) critère(s) les ratios de capital et de liquidité sont optimaux. Cette modalité d'intervention peut donner naissance à plusieurs modèles de régulation où des avantages comparatifs et donc des distorsions induites par la régulation peuvent apparaître et générer de l'instabilité financière. Dans ce cadre, la mise en oeuvre d'un ensemble de règles uniques apparaît comme la meilleure réponse des autorités publiques bien que cette configuration apparaisse comme un "*second-best*". L'adoption du dispositif Bâle III apparaît comme une bonne mesure de politique économique. En particulier notre travail suggère que l'adoption de règles visant à promouvoir des modèles de financement bancaires plus sains est essentiel pour le développement du système bancaire et la convergence économique et financière. La lecture de l'impact du capital sur le développement bancaire est en revanche plus complexe et confronter différentes mesures de position en capital semble tout à fait légitime pour en faciliter la compréhension. De plus, l'adoption d'un cadre de supervision à cette configuration de la régulation apparaît comme la réponse souhaitable des autorités européennes. D'autant plus lorsque les systèmes bancaires sont marqués par l'existence de Léviathans bancaires tels qu'ils existent en Europe. Deuxièmement, adopter plusieurs régimes de régulation peut aller à l'encontre de la politique menée par les autorités européennes "*single playing field*" et créerait un problème d'incohérence temporelle.

Tenir compte de la structure financière pour des considérations de croissance économique et de stabilité financière est important. Cependant, le calibrage des instruments de régulation à ce paramètre n'apparaît pas comme la meilleure réponse des autorités européennes. Si l'adoption d'une approche macroprudentielle de la régulation est indispensable à la conception de la régulation aujourd'hui, l'instabilité financière endogène à l'accroissement des systèmes financiers en Europe porterait probablement en la qualité des prêts détenus au bilan des banques. A titre d'illustration, une étude du Parlement Européen de 2016 souligne l'hétérogénéité de la qualité des portefeuilles dans la dimension transversale des Etats Membres.<sup>4</sup> Notre échantillon de données présenté au chapitre 4 illustre aussi ce point. Ainsi, la stratégie selon laquelle un ensemble de réformes prudentielles visant à améliorer la capacité de screening et de monitoring des banques semble être une réponse souhaitable des autorités.

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<sup>4</sup>Voir Mesnard et al. (2016).



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De manière plus large, les interrogations portées à l'échelle européenne peuvent aussi se poser au niveau international. La mise en place de différents régimes de régulation pourrait matérialiser l'existence d'avantages comparatifs de systèmes de régulation. Or, dans l'histoire de la régulation, la mise en oeuvre des premiers standards internationaux avait pour objectif de réduire les distorsions engendrées par différents systèmes de régulation. La construction de plusieurs modèles de régulation matérialiserait un problème d'incohérence temporelle des autorités prudentielles. A l'instar des travaux de Lucas en politique monétaire, une politique de régulation transparente et unique apparaît aussi comme la meilleure réponse des autorités prudentielles.

Les apports de ce travail doctoral sont nombreux. Tout d'abord, nous éclairons les enjeux de stabilité financière à l'aune de la relation régulation bancaire-développement financier non établie dans la littérature. Cette nouvelle approche de la stabilité financière permet d'enrichir le cadre de l'analyse économique d'une part en économie monétaire et d'autre part en économie des unions monétaires.

Nous avons montré que si l'adaptation des normes prudentielles en fonction du niveau de développement financier peut s'avérer être une stratégie intéressante de stabilité financière, son application peut aussi s'avérer complexe au sein d'une UEM. La mise en oeuvre de plusieurs régimes de régulation peut faire naître différents comportements d'arbitrage pouvant induire des distorsions et générer de l'instabilité financière. Dans ce cadre, il semble que la meilleure réponse des autorités soit la mise en oeuvre d'un cadre réglementaire unique complété par un cadre de supervision visant à encadrer les banques menaçant la stabilité financière au plan macroéconomique.

Nous avons aussi illustré toute la complexité de mener à bien la politique monétaire au sein de l'UE dans la mesure où les autorités monétaires font face à deux difficultés majeures. Premièrement, il convient d'identifier les implications d'une politique de régulation à la Bâle III sur le comportement bancaire. Ceci dans la mesure où l'efficacité de la transmission de la politique monétaire s'en trouve affectée via le canal du capital bancaire. La diversité du tissu bancaire des économies membres en termes de taille des entités bancaires peut s'avérer déterminante. Deuxièmement, nous avons illustré l'hétérogénéité des structures financières pouvant constituer un frein supplémentaire au mécanisme de transmission de la politique monétaire.

Nous enrichissons de plus le cadre méthodologique en confrontant les approches microéconomiques et macroéconomiques. Nous avons pu ainsi illustrer toute la complexité de la relation capital-prêt pour l'UE. Notre étude micro empirique favorise l'hypothèse d'absorption des risques et non de fragilité financière et d'éviction.

Une contribution supplémentaire de ce travail doctoral est de croiser les travaux d'économie monétaire et bancaire. La littérature établissant la relation du capital au prêt est particulièrement dense à la fois en économie monétaire et bancaire. Nous avons en particulier attribuer un rôle central à l'offre de crédit permettant de souligner les implications communes de politique monétaire et macroprudentielle. La littérature à ce sujet est nouvelle et semble prometteuse pour approfondir la compréhension des problématiques de stabilité financière.

La question de la stabilité financière en UE reste complexe. La création de l'UB constitue une réponse institutionnelle sans précédent de la part des autorités européennes. La première interrogation porte sur le périmètre d'action de l'UB. A l'appartenance à une UEM, s'ajoute la compréhension de la stabilité financière des pays membres de la zone euro. Les derniers travaux en économie monétaire soulignent les implications communes de politique monétaire et macroprudentielle dans ce cadre. La réponse des autorités européennes consisterait ainsi en une articulation fine de la politique monétaire et macroprudentielle. L'évolution des missions et fonctions de la BCE en est une parfaite illustration et soulève deux questions majeures. Premièrement, comme souligné dans Beck (2012), l'UB doit-elle s'appliquer aux pays membres de l'UE ou bien aux pays membres de la zone euro? Deuxièmement, quelle pourrait être l'architecture optimale de politique monétaire et macroprudentielle assurant les missions de stabilité financière et de croissance économique ?

## Développements futurs

Nous proposons dans cette section un ensemble de développements futurs contribuant à répondre aux interrogations posées en conclusion et nourrir le débat sur la stabilité financière. Tout d'abord, cette thèse porte en grande partie sur la régulation bancaire. Or, comme souligné dans d'Avernas et al. (2020), considérer le poids des institutions financières non-bancaires pour l'objectif de stabilité financière s'avère important. L'orientation future de la régulation porte en grande partie sur l'émergence de ce type d'agents économiques. Il serait ainsi intéressant de prendre en compte ces institutions et d'en mesurer leur degré d'interconnexion avec les banques pour mieux apprécier l'impact de la régulation du secteur financier à la fois sur la stabilité financière et la croissance économique.

Une approche complémentaire par les modèles de type *Dynamic Stochastic General Equilibrium (DSGE)* permettrait de mieux apprécier la relation développement bancaire-croissance économique et d'inscrire ce travail dans le prolongement macro-empirique du chapitre 2. Le modèle économétrique utilisé dans ce chapitre est

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déterminé de façon ad-hoc. Il serait tout aussi intéressant de construire une théorie ayant trait à la question de recherche. Le chapitre 2 a illustré les implications communes de politique de régulation financière et de développement financier pour des économies inscrites au sein d'une UEM. Cette configuration rend d'autant plus complexe l'organisation des politiques économiques que le nombre d'objectifs s'accroît (stabilité monétaire, financière et budgétaire). Dans cette optique, la construction de théories normatives devrait permettre de fournir des recommandations de politique économique quant aux architectures et conduites des différentes politiques économiques à mener.

Au chapitre 3, nous construisons une théorie du comportement bancaire par une approche microéconomique et le modèle développé est un modèle d'équilibre partiel. Il n'intègre pas les conditions d'équilibre des autres marchés. Il serait intéressant d'inscrire ce travail dans une perspective macroéconomique au sein d'un modèle d'équilibre général. Ceci permettrait de mieux tenir compte du rôle de la politique monétaire et donc de mieux apprécier les implications communes de politique monétaire et prudentielle.

Dans le chapitre 4, le jeu de données utilisé est principalement constitué des grandes banques de l'Europe de l'Ouest, notamment celles à risque systémique domestique et global. Les banques de moindre taille ne sont pas incluses dans l'échantillon et l'on manque de juger de l'impact d'une régulation de type Bâle III pour ce type de banque. La construction d'un jeu de données plus riche permettrait de palier à cette difficulté d'autant plus que la taille reste un déterminant important de l'offre de prêt<sup>5</sup>. La compréhension de la relation développement financier-croissance économique en serait enrichie.

Nous avons accordé dans ce travail une place fondamentale à l'offre de crédit. Celle-ci est déterminée (entre autre) au niveau agrégé par la conduite de la politique monétaire et de régulation dont les mécanismes sont illustrés à travers les canaux de crédit et de capital bancaire. Comme souligné dans Agénor (2019), les canaux de prêts et de capital ne sont pas nécessairement indépendants l'un de l'autre. La compréhension des implications communes de politique monétaire et prudentielle éclaircissent les enjeux de stabilité financière et les travaux futurs semblent s'orienter en particulier vers une meilleure compréhension des canaux de transmission et de leur interdépendance.

Cette thèse a étudié l'impact des règles mises en place *de facto*. Or, la construction de normes bancaires peut découler de la relation entretenue entre régulateur et régulés. Ces normes peuvent ainsi résulter d'une activité de lobbying de la part du secteur

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<sup>5</sup>Voir par exemple DeYoung et al. (2018).

## Chapter 5. Conclusion générale

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bancaire.<sup>6</sup> Les objectifs des agents économiques régulés ne coïncident pas toujours avec ceux du régulateur. Avoir une meilleure compréhension de l'activité de lobbying par l'approche de la théorie des jeux permettrait de mieux apprécier son impact et de guider l'orientation des politiques futures de régulation.

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<sup>6</sup>L'adoption de la méthode d'évaluation interne des risques en est une illustration. Pour une discussion à ce sujet, voir Dewatripont et al. (2010).

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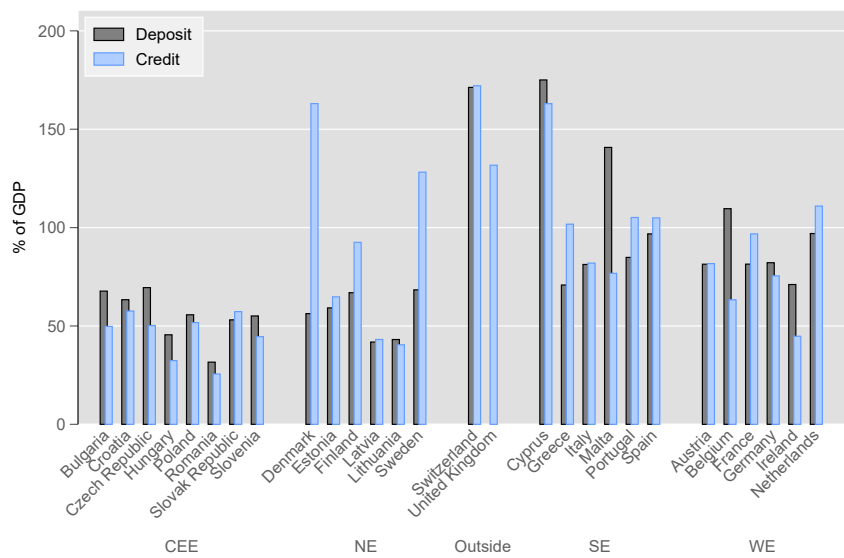


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# A Does one size fit all? Banking regulation in Europe

## A.1 Graphes



Banking System Credits and Deposits, 2017

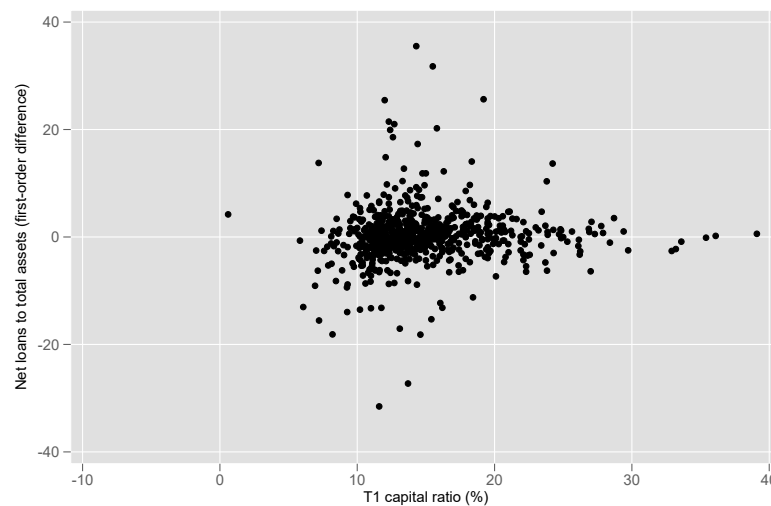
## A.2 Variance analysis

Table A.1. Overall, between and within variations

		Mean	Std. Dev.	Min	Max	N/n/T-bar
CREDIT	Overall	83.5956	41.82323	6.3921	211.922	509
	Between	.	38.32588	24.62023	166.2727	29
	Within	.	18.31755	-1.184406	153.6705	17.55172
CAP	Overall	15.13316	4.054188	7	35.6526	489
	Between	.	2.133655	11.06302	20.16165	29
	Within	.	3.454922	7.05042	31.20302	16.86207
FUND	Overall	79.50365	64.77514	15.2342	472.049	500
	Between	.	64.16683	26.18219	366.3245	28
	Within	.	14.75752	2.720147	185.2281	17.85714
LIQ	Overall	37.46267	17.19416	5.26372	130.63	522
	Between	.	12.05244	20.41173	60.90901	29
	Within	.	12.45462	-2.038472	119.8022	18
ROA	Overall	.5578566	1.277732	-10.4721	4.24146	522
	Between	.	.53265	-.9556266	1.746873	29
	Within	.	1.165393	-9.800032	3.140963	18
NPL	Overall	6.012484	7.229264	.1	48.6758	474
	Between	.	5.51187	.4238407	26.24089	29
	Within	.	5.360896	-16.6284	35.01208	16.34483
SMC	Overall	55.82631	49.94934	.737358	263.747	462
	Between	.	46.87032	4.366549	213.6782	29
	Within	.	18.1313	-8.221364	189.1227	15.93103
COMP	Overall	69.59382	17.01694	30.6151	100	519
	Between	.	15.47361	35.83358	94.53465	29
	Within	.	7.524337	41.22059	100.8062	17.89655
CLAIM	Overall	121.0636	193.0636	9.87485	1330.98	522
	Between	.	193.0821	44.09951	1097.72	29
	Within	.	34.77516	-97.17273	354.3233	18
GDP	Overall	33127.05	21827.41	3955.28	111968	522
	Between	.	22007.56	6309.015	103053.5	29
	Within	.	2811.882	23536.46	54225.28	18
MP	Overall	.7496385	.7265174	-1.370421	1.941041	540
	Between	.	.1317636	.117181	1.065646	30
	Within	.	.714852	-.7379635	2.13431	18

# B Assessing the impact of Basel III on bank behavior: An empirical approach

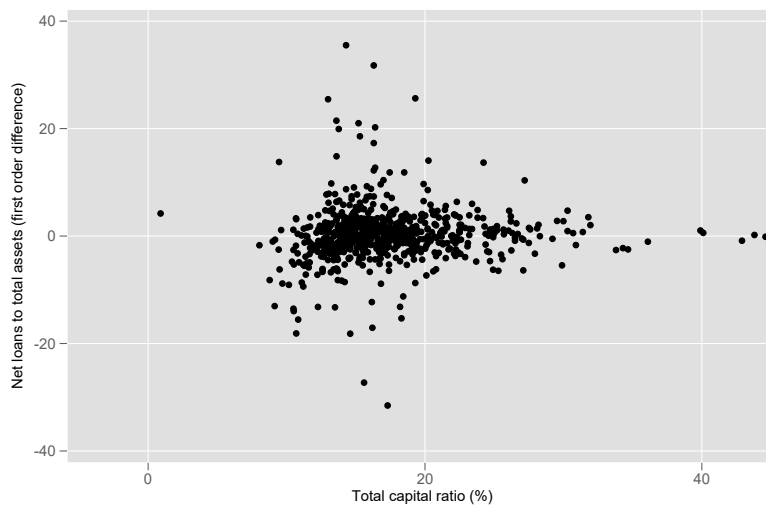
## B.1 Sample selection



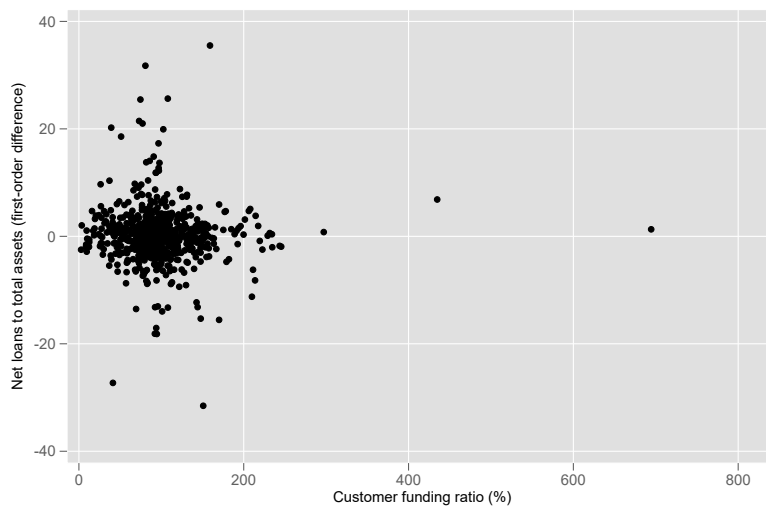
Cross-correlation between lending and capital (tier 1 capital ratio)

## Appendix B. Assessing the impact of Basel III on bank behavior: An empirical approach

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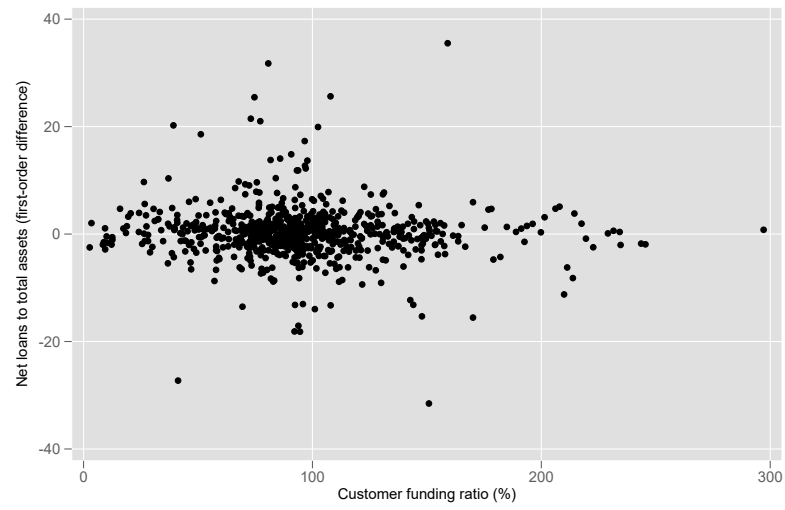
Cross-correlation between lending and capital (total capital ratio)



Cross-correlation between lending and funding (all sample)

## B.1. Sample selection

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Cross-correlation between lending and funding (threshold=300%)

## Appendix B. Assessing the impact of Basel III on bank behavior: An empirical approach

### B.2 Descriptive statistics

Variable	Definition	Observations	Mean	Std. Dev	Min	Max
<i>Dependent variable</i>						
$\Delta L_{i,t}$	Growth rate of Net Loans to Total Assets (%)	693	0.24	4.88	-27.27	31.76
<i>Bank-specific characteristics</i>						
$CRR_{i,j,t}$	Total capital ratio (%)	697	16.30	4.12	-5.00	29.54
$T1_{i,j,t}$	Tier 1 capital ratio (%)	697	13.90	3.96	-6.00	27.06
$CFUND_{i,j,t}$	Customer funding ratio (%)	697	93.97	38.75	8.42	297.11
$LIQ_{i,j,t}$	Liquidity ratio (%)	697	18.28	12.43	1.04	61.57
$SIZE_{i,j,t}$	Logarithm of total assets	697	11.08	1.85	6.71	14.63
$ROA_{t-1}$	Return on Assets (%)	696	0.20	1.16	-13.41	4.43
$ALLOW_{t-1}$	Allowance for credit losses to gross loans (%)	696	4.27	5.13	-6.26	31.95
$NPL_{t-1}$	Non-Performing Loans to gross loans (%)	679	8.38	10.46	0.00	65.60
<i>Banking-ector characteristics</i>						
$FD_{t-1}$	Private credit to GDP (%)	697	109.62	34.50	41.08	255.31
<i>Macroeconomic controls</i>						
$TERM_{t-1}$	Long and short term interest rate difference	673	2.30	2.51	0.08	21.93
$GDP_{t-1}$	Growth of real GDP (%)	697	1.17	2.30	-9.13	25.12

The highest value of financial development (255.31) corresponds to Cyprus.