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Interactions of bank capital and liquidity standards within the Basel 3 framework: A literature Review

Note du Comité scientifique de l'ACPR

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INTERACTIONS OF BANK CAPITAL AND LIQUIDITY STANDARDS
WITHIN THE BASEL 3 FRAMEWORK:

A LITERATURE REVIEW

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Interactions of bank capital and liquidity standards within the Basel 3 framework: A literature review

Abstract: this paper questions the expected outcome for bank stability and economic performance of adding liquidity rules to capital rules in the Basel 3 regulatory environment. We discuss the various channels and mechanisms highlighted in the academic literature on how liquidity and capital interact and how bank behavior is affected by such interaction. Whether liquidity and capital standards need to be jointly implemented (complementarity) or not (substitutability) has not reached a consensus in the literature and depends on the specific transmission channel considered by each study. Whereas one strand of the literature focuses on banks' risk-taking behavior under the joint capital-liquidity constraint, other papers emphasize the implication for lending and economic performance. Drawing from this lack of consensus, we highlight directions for future research in this area which is at its burgeoning stage and make some recommendations.

Keywords: Bank Capital Regulation, Bank Liquidity Regulation, Basel III

JEL Classification: G28, G21

Les interactions entre les normes de capital et de liquidité bancaires dans le cadre de Bâle 3 : Une revue de la littérature

Résumé : ce papier étudie la question du résultat attendu de l'ajout de contraintes de liquidités aux règles sur le capital dans le cadre réglementaire de Bâle 3, en termes de stabilité financière et de performance économique. Nous présentons les divers canaux et mécanismes mis en avant dans la littérature sur la manière dont la liquidité et le capital bancaires interagissent et la manière dont le comportement des banques est affecté par cette interaction. Le point de savoir si les règles de liquidité et de capital doivent être mises en œuvre de façon conjointe (complémentarité) ou non (substituabilité) n'a pas fait l'objet d'un consensus dans la littérature et dépend du canal de transmission spécifique considéré par chaque étude. Tandis qu'un segment de la littérature se concentre sur le comportement des banques en termes de prise de risque dans le cadre de contraintes de liquidité et de capital appliquées conjointement, d'autres papiers soulignent les implications sur l'offre de prêt et la performance économique. Partant de ce manque de consensus, nous esquissons des pistes pour de futures recherches dans ce domaine, qui reste à un état embryonnaire, et proposons plusieurs recommandations.

Mots-clés : Réglementation du capital bancaire, réglementation de la liquidité bancaire, Bâle 3,

JEL Classification : G28, G21

“With capital regulation there is a huge literature but little agreement on the optimal level of requirements. With liquidity regulation, we do not even know what to argue about.” Allen and Gale (2017)

Introduction: what to expect from combining capital and liquidity rules?

The global financial crisis of 2007-09 (GFC) uncovered many inadequacies in existing banking system regulations. In response the Basel Committee on Banking Supervision (BCBS) redesigned prudential rules. Specifically, the new framework, Basel 3, has introduced minimum liquidity requirements by adding them to the existing capital requirements which were also tightened. These new liquidity rules, the LCR (Liquidity coverage ratio) and the NSFR (Net Stable Funding Ratio)⁶, mean to ensure that banks hold enough liquid assets to withstand creditor runs during financial crises (LCR), and also that banks avoid, to some extent, using short-term funds to finance long-term loans (NSFR).⁷

The resulting package of reforms is thus characterized by its reliance on multiple regulatory requirements to deliver both the safety and soundness of individual banks as well as the stability of the financial system.

Assessing the outcome of these reforms is crucial to guarantee that they reach their intended goals without being economically and socially too costly. Regulators indeed need to make sure that capital and liquidity standards are adequately calibrated. Furthermore, as the acceptance of stricter regulatory rules tends to decline as the effects of the crisis fade, their effectiveness and accuracy need to be challenged on a regular basis.

Assessing the new rules is nevertheless difficult given the lack of historical depth combined to a high degree of uncertainty regarding the measure of liquidity and its optimal level. This assessment is even more challenging when considering the interactions between liquidity and capital standards. One needs to understand how these different requirements interact as their compounded effect might differ from the individual effects of each rule taken separately. History also tells us that banks are adept at regulatory arbitrage and innovating their way around regulatory constraints and, as such, the

⁶ Some countries had already implemented or experimented such liquidity rules individually before Basel 3. These requirements were relatively close to the LCR but not the NSFR (for example the French Liquidity Coefficient dating to 1988 or the Dutch Liquidity Balance Rule of 2003).

⁷ These liquidity rules are imposed on banks in addition to a set of solvency rules, such as the Common Equity Tier 1, the Tier 1 and the total capital ratios as well as the leverage ratio. The first three solvency rules require banks to hold a minimum amount of own funds in proportion of their risk-weighted assets. By contrast, the leverage ratio is used as a backstop measure and is an unweighted ratio relating the amount of Tier 1 capital to total assets. Finally, an output floor was introduced by the Basel Committee in 2017 to ensure that banks hold a minimum amount of capital when they use sophisticated internal models to assess their risks. Specifically, it sets a floor in capital requirements calculated with internal models at 72.5 percent of those required under standardized approaches.

new rules may lead to unexpected behavioral responses by banks. For example, some studies show that banks might already have bypassed the new liquidity rules by increasing their long-term borrowing (to “artificially” improve their NSFR) from non-regulated entities that borrow short at a lower cost (Sundaesan and Xiao, 2020).

The current paper focuses on the interactions of capital and liquidity requirements. Conceptually, **three types of potential interactions can be distinguished: i) complementarity; ii) substitutability; and iii) independence.** The literature has started providing some elements on what complementarity and substitutability between the two requirements mean as well as their implications in terms of actual effectiveness or redundancy of combining the two rules (see among others DeYoung et al. (2018) and Vo (2020)).

The two rules are indeed related. Risk-based capital ratios compare equity to asset mix whereas liquidity ratios compare funding mix to asset mix and hence both constraints are linked. It is therefore important to go beyond the mechanical link between the two and draw actual changes in bank behavior.

On the one hand, the overall Basel 3 framework would be validated if one finds that liquidity and capital standards are complementary, addressing different types of externalities or sources of risk. For example, if holding more capital is costly, banks can have incentives to take on higher liquidity risk and reduce lower-yielding liquid assets holdings. In such a case, adding liquidity requirements to capital requirements could be necessary to avoid banks from taking too much liquidity risk. Note that complementarity could also work the other way around. For example, a liquidity constraint that would reduce bank profitability could encourage banks to take higher risk to limit the negative impact on profits. In that case, capital requirements would be complementary to liquidity requirements: adding a capital rule to a liquidity rule would be necessary. Moreover, complementarity could also only work one way round. Adding rule A to rule B could be necessary but adding rule B to rule A might not be.

On the other hand, the opponents of adding liquidity rules to capital rules in the Basel framework consider that liquidity regulation and capital regulation are substitutes. Substitutability between standards is more of an issue for the overall assessment as this would mean that costs are additive to banks, but that benefits in terms of stability are not. Some argue that the most important dimension is capital and not liquidity (Admati and Hellwig, 2013). If capital regulation is risk-weighted, banks will have incentives to hold low-risk assets which are generally more liquid. Hence, if they are required to hold more capital, banks will comply with the capital rule by also improving their liquidity. If they do not hold enough capital banks could also have incentives to improve their liquidity. Indeed, if they hold enough capital, banks can easily and cheaply access liquidity from the market or from the central bank and they will be less subject to runs. But, if they do not hold enough capital, banks will have incentives to hold more precautionary liquidity because the cost of raising new funds is higher (because of their lower solvency) or to make depositors more confident.

It could also be argued that when one constraint tightens, the other one could be unaffected, in which case capital and liquidity would be considered as independent. In that case, it is not clear whether the two constraints need to be implemented at the same time. The two rules might have the same objective i.e. limit risk-taking or follow different objectives. Hence, it could be necessary and effective to implement them jointly. However, the rationale behind introducing either of them is not driven by the need to offset the undesired effect that one of the two rules could have on bank behavior

necessitating the introduction of the other rule. On the whole, complementarity and substitutability are a matter of degree and can either operate partially or fully. Therefore, the extent to which a rule might need to be added to another rule will depend on how weakly or strongly they interact.

However, because there is no clear understanding of how bank behavior changes in the presence of a single constraint (capital rule), adding a second constraint (liquidity rule) makes it extremely complex to predict how banks will behave.

This paper analyses the interactions between capital and liquidity rules from three perspectives. It first discusses (section 1) the possible outcomes of such interactions in terms of banks' default risk and the implications for financial stability. It then analyses the impact of such interactions on bank lending behavior and the potential net benefits of the joint regulation of capital and liquidity (section 2). Finally, section 3 sketches areas for future research and draws some recommendations.

1. Capital - liquidity interactions: from banks' risk-taking behavior to financial (in)stability

Along the lines of the Basel Committee on Banking Supervision comprehensive study (BCBS 2016), the literature has identified four conceptual channels through which liquidity and capital requirements could interact: (i) quality of assets, (ii) fire sales, (iii) bank profitability, and (iv) bank solvency. Regarding the first channel (quality of assets), banks could respond to an increase in liquidity and risk-weighted capital requirements by improving the quality of their short-term assets as higher quality assets enable banks to simultaneously reduce their risk weights under the solvency ratio, increase their liquidity buffer under the Liquidity Coverage Ratio and improve their Net Stable Funding Ratio. Regarding the second channel (fire sales), increasing liquidity requirements may reduce the occurrence of fire sales when banks are facing liquidity problems and therefore reduce the threat to banks' solvency. With regard to bank profitability (third channel), the adjustments banks make to meet liquidity and capital requirements may affect their profits, and in particular, their interest margin through changes in funding costs and banks' earnings. With respect to bank solvency (fourth channel), liquidity and capital requirements could both help to protect a bank from different forms of risks that may threaten its solvency.

There is no consensus in the literature on how capital and liquidity rules interact and on whether banks treat capital and liquidity as substitutes or complements. Indeed, the four channels through which capital and liquidity requirements operate suggest that these two types of requirements have both elements of substitutability and complementarity.

In general, the proponents of the substitutability hypothesis argue that regulating liquidity is not necessary as long as capital is set to sufficiently high levels, as capital is a more important regulatory dimension than liquidity (Admati and Hellwig (2013), Thakor (2018)). A higher level of capital reduces the need for liquidity buffers if it boosts depositors' and investors' confidence and entails a decline in funding costs.

Recent contributions to the literature do find that the two requirements act as **substitutes** in reducing the probability of crisis through the first two channels identified in BCBS (2016). Regarding the first channel (quality of assets), DeYoung et al. (2018), using data on US banks, Acosta-Smith et al. (2019), using data on UK banks, and Gomez and Vo (2019) on the basis of a theoretical model find that banks engage in less maturity transformation when their capital increases. This adjustment is made either because the average maturity of liabilities mechanically increases, with the increase in capital, and banks thus have a more stable liability structure, or because banks voluntarily increase the liquidity of their assets which in turn improves their regulatory (risk-weighted) capital ratios. This implies that properly designed capital requirements could also incentivize banks to refrain from excessive liquidity transformation through a "skin in the game effect", which is the goal of liquidity requirements. This substitutability might be hard to interpret and even misleading as it might result from mechanical balance sheet effects or actual changes in bank behavior. On the second channel (fire sales), Vives (2014), Walther (2016) and Carletti et al. (2020) broadly find that bank capital and bank liquidity are substitutable in reducing the probability of runs. From a financial stability perspective, Aldasoro et al. (2017) conclude that both an increase in capital and liquidity requirements can induce banks to reduce interbank loans, which helps to lessen the scope of contagion via interconnectedness.

The question of substitutability can also be addressed through the analysis of the joint bindingness of regulatory standards, i.e., whether each regulatory standard will bind at the same time or not. Theory

predicts that not all regulations will bind at the same time (Cecchetti and Kashyap, 2018), implying that some standards might be redundant. Moreover, one more stringent requirement might change the relative price of holding capital buffers and liquidity buffers (Fecht, Nyborg and Rocholl, 2011, Fecht and Wedow, 2014). Another difficulty comes from the fact that we do not know how banks target their liquidity ratios and how they adjust their balance sheets once the minimum liquidity rules become binding. Such a question is complicated because theoretical and empirical literatures show a two-way relationship between capital and liquidity: a causal impact of capital on liquidity (Diamond and Rajan, 2000, 2001; Gorton and Winton, 2000; Bhattacharya and Thakor, 1993; Repullo, 2004; Von Thadden, 2004) and vice-versa (Distinguin et al. 2013).

By contrast to the substitutability hypothesis, interactions through the last two channels (bank profitability and bank solvency) highlight the **complementarity** between capital and liquidity requirements. In particular, the literature suggests that liquidity requirements are more efficient than capital requirements in dealing with liquidity-driven runs. Eisenbach et al. (2014) and Koenig (2015) suggest that since liquid assets have lower returns than illiquid assets, higher liquidity requirements could undermine banks' solvency by reducing banks' profitability. This, therefore, indicates that bank capital is a complement to bank liquidity since an increase in liquid assets requires an increase in capital for banks to maintain the same level of resilience. However, this does not imply that a liquidity rule is a complement to a capital rule, which is what Basel 3 assumes by adding liquidity rules to long-existing capital constraints. Nevertheless, De Bandt et al. (2021) based on data on liquidity requirements implemented in France before the Global Financial Crisis, confirming the DSGE predictions of De Bandt and Chahad (2016), do conclude that liquidity and capital requirements are complementary, in the sense that liquidity buffers protect banks against runs in crisis times. Such findings highlight that liquidity rules can effectively complement capital rules but by possibly targeting a different objective i.e. avoiding runs in distressed periods whereas capital rules taken solely would protect from failure during normal times. Finally, capital requirements were introduced to limit moral hazard resulting from the establishment of deposit guarantee schemes (Diamond and Dybvig, 1983).

Empirical papers using Quantitative Impact Studies data provide mixed results. The preliminary results found by the BCBS Research Task Force's Micro Data work stream (unpublished document) from the analysis of the impact of Basel III reforms on banks' capital and liquidity suggest that imposing both capital and liquidity ratios can lead to an overall increase in the quality of assets (lower risk-weighted assets and higher liquidity ratio). Birn et al. (2017) conclude that capital and liquidity requirements are complementary while the Liquidity Coverage Ratio LCR and the Net Stable Funding Ratio NSFR are substitutable. This might appear surprising given they were designed to be complementary, with the LCR having a thirty-day horizon and aimed at ensuring short-term resilience while the NSFR was meant to be more structural, with a one-year horizon and the objective of limiting banks' maturity transformation.

2. Capital - Liquidity ratios: from bank lending to growth

As mentioned previously, when assessing banks' behavior in reaction to balance sheet restrictions, it is crucial to understand that restrictions placed on one portion of the balance sheet may lead to compensating changes elsewhere. By reducing banks' balance sheet flexibility, tougher capital and liquidity requirements might encourage banks to grant fewer loans, thus offsetting some of the desired benefits in terms of economic performance and growth. Or banks could respond by making riskier loans (optimizing the risk buckets for RWA calculations) or by increasing lending rates (for a given risk).

DeNicolò et al. (2014), Behn et al. (2019) and Covas and Driscoll (2014) are three main contributions that combine both capital and liquidity requirements to assess their joint impact on lending. All of these papers find that adding liquidity requirements to capital requirements leads to a larger reduction in lending to non-financial agents, in particular for the least liquid and least capitalized institutions. Nevertheless, stylized facts show that private debt has not subdued since the implementation of these new rules. Indeed, the BCBS Research Task Force's Micro Data work stream (mimeo) has not found any significant evidence that the interplay of regulatory requirements has led to conflicting effects on loan growth, beyond the effects of each regulatory requirement taken separately, meaning that all effects on loan growth point to the same direction.

These papers, however, do not assess the compounded effect of both requirements as compared to the sum of the effects when each requirement is considered individually. Xing et al. (2020) state that, among multiple regulations, which one binds for credit creation depends on banks' balance sheet structure and business models. The latter could influence banks' reliance on relatively more stable liabilities such as customer deposits and on more unstable shorter-term funding such as money market funding. One should also keep in mind that the impact will differ between bank-based and market-based financial systems.

Van den Heuvel (2019) has quantified the effects of the two requirements on the liquidity provisions of banks. This exercise provides a useful indication of the relative macroeconomic costs of these two requirements, although they are taken separately rather than in interaction. The paper concludes that in general capital requirements generate higher costs than liquidity requirements because the former reduces liquidity creation by banks much more than the latter: capital requirements limit the fraction of bank assets that can be financed by issuing deposit-type liabilities. Using US data, the welfare cost of a 10 percent liquidity requirement is found to be equivalent to a permanent loss in consumption of about 0.03 percent. The cost of a similarly-sized increase in the capital requirement is found to be about five times as large.

In terms of net effects and broad welfare effects, all the studies investigating the co-existence of capital and liquidity requirements (Boissay and Collard (2016), Adrian and Boyarchenko (2018), Ikeda (2018) as well as Kara and Ozsoy (2019)) suggest that using both regulations would help to achieve the highest attainable level of welfare. The reason is that using both requirements helps to attain a level of stability with the lowest long-term cost to the real economy, where the latter is measured in terms of foregone economic activities due to reduced financial intermediation. According to Boissay

and Collard (2016), the net welfare gain in the optimally-regulated economy compared to the unregulated economy corresponds to an increase in permanent annual consumption of 0.66 percent.

3. Additional important uncovered issues

There has been a growing interest in the interaction between capital and liquidity requirements and its implications for bank intermediation and stability. Nevertheless, several important research questions are still unanswered.

Although the literature has investigated the impact of such interactions on the probability of crisis and has highlighted different channels of substitutability between the two requirements, there is still no clear quantitative assessment of the rate of substitution between the requirements. This is an important gap if one seeks to evaluate the joint calibration of the two requirements. Moreover, two important sources of systemic risk for financial stability - correlated investments and herding behavior – have not been examined yet to our knowledge. It is thus important to evaluate how the co-existence of both capital and liquidity requirements affects the similarity of banks' balance sheets.

Also, conversely to capital rules that are risk-weighted, these new liquidity requirements are uniformly set across all banks and ignore that banks are more or less strongly interconnected with their peers and hence more or less dependent in terms of liquidity. Depending on their position (strong or weak) and role played in interbank networks (major hub, lender or borrower...) banks may need to hold more or less liquidity combined with more or less regulatory capital as dictated by their risk-weighted assets. Therefore, an important issue is how the new liquidity rules combined with the existing capital rules are going to affect bank behavior depending on their position in interbank networks and how bank lending will be affected overall. Some studies show that depending on their interconnectedness and position and strength in the network banks set their liquidity ratios, including their NSFR, at either lower or higher levels (Mahdavi Ardekani et al., 2020). Accounting for bank connections within a network is therefore important and the one-size fits all doctrine is once again challenged. Although such requirements cannot be tailored internationally to account for each bank's situation due to institutional differences and the rapidly changing nature of networks, supervisors (pillar II) might need to more closely monitor such connections and possibly impose more stringent requirements to given banks. On the same line, national and institutional differences such as maturity of financial markets, type of financial system (bank-based or market-based) and banks' business models could also influence the cost of compliance specifically in terms of access to relatively more stable liabilities such as customer deposits or reliance on more unstable shorter-term funding such as money market funding.

Moreover, the current debate on regulatory standards has neglected the role of managerial/shareholder behavior in response to the more stringent rules imposed on capital and liquidity by the Basel 3 regulatory framework. For instance, within pyramids, powerful shareholders with control rights in excess of cash-flow rights could refrain from increasing equity capital if they fear control dilution. Regulators also know little about how ownership structure and board designs to mitigate conflicts of interest among shareholders, managers and other stakeholders will affect the behavior of banks under a dual capital/liquidity constraint.

Very little has also been done in the literature regarding the implications of both constraints and their interaction in terms of cost of crises. Important questions for assessing such outcomes include how the co-existence of capital and liquidity requirements affects the propensity for banks to engage in deleveraging and the magnitude of any deleveraging.

The literature on the impact of such interactions on the opportunity cost for the real economy is also scarce. More research is needed to quantitatively assess the impact of the co-existence of the two requirements on the cost and volume of lending, especially as compared to the sum of the individual effects on lending from each requirement taken separately. Another unanswered question is the implications of the interactions for the degree of risk sharing in the economy.

In terms of evaluating the net benefits of the two requirements taken together, the main challenge is to develop a more comprehensive general equilibrium model that could incorporate all three main economic services – credit provision, liquidity provision and risk-sharing – that banks provide to society. Ideally, this model should include the main channels through which capital and liquidity requirements interact to determine the probability and costs of crises, and the opportunity costs for the real economy. This model would serve as a full economic evaluation of the interaction of the two requirements.

Moreover, it is important to investigate the way banks jointly target their liquidity and capital changes when regulatory restrictions on either capital or liquidity become more binding. Indeed, prior theoretical work shows how the interaction of different regulatory instruments can be complex (Schmaltz et al., 2014). This is important because it is unclear how bank behavior changes when they find themselves near or below their internal liquidity and/or capital targets and what adjustment mechanisms banks adopt in order to reach their target. Will banks lend less? Will they cherry pick borrowers? How will capital and liquidity constraints affect banks' incentives to lend to relatively riskier but critical sectors such as SMEs (Small and Medium Enterprises), which are vital in generating employment, in fostering innovation and in achieving inclusive growth.

Conclusion

There is no consensus in the academic literature on whether capital rules and liquidity rules need to be implemented alongside and specifically on whether liquidity rules should be added to capital rules. The outcome and lessons that can be drawn from the burgeoning literature are model specific and closely related to the transmission channel highlighted in each paper. There are still important uncovered issues which need to be addressed. Considering the behavior of the different stakeholders at play and corporate governance mechanisms is an important aspect. Introducing such a dual capital-liquidity constraint in a general equilibrium model of banking activities is another important way to assess the impact of such combined rules on the economy as a whole and on financial stability. The implications of the NSFR on the incentives created for banks to borrow from non-banking financial intermediaries (NBFi) on a long-term basis, while NBFi are funded on a short-term basis, would thus be worth analyzing. Also, whether these new rules have effectively improved the resiliency of banks to shocks is still an open question as their relatively good performance during the covid-19 pandemic is presumably, to a large extent, explained by massive government support to the economy.

References

- Acosta-Smith, J., G. Arnould, K. Milonas and Q. Vo (2019): “Bank capital and liquidity transformation”, *Bank of England Working Paper* No. 840.
- Admati A.R. and M.F. Hellwig (2013), “Does Debt Discipline Bankers? An Academic Myth About Bank Indebtedness”, *Rock Center for Corporate Governance at Stanford University Working Paper*, No. 132
- Adrian, T. and N. Boyarchenko (2018), “Liquidity policies and systemic risk”, *Journal of Financial Intermediation* 35, pp 45 – 60
- Aldasoro, I., D. D. Gatti and E. Faia (2017): “Bank networks: Contagion, systemic risk and prudential policy”, *Journal of Economic Behavior and Organisation* 142, pp 164 – 188.
- Allen, F. and D. M. Gale, How Should Bank Liquidity Be Regulated? (January 27, 2017). Available at SSRN: <https://ssrn.com/abstract=2956304> or <http://dx.doi.org/10.2139/ssrn.2956304>
- Basel Committee on Banking Supervision (2016), “Literature Review on integration of regulatory capital and liquidity instruments”, *Working Paper No 30*, March
- Behn, M., C. Daminato and C. Salleo (2019): “A dynamic model of bank behaviour under multiple regulatory constraints”, *ECB working paper* No. 2233.
- Bhattacharya, S. and A. Thakor (1993), “Contemporary Banking Theory”, *Journal of Financial Intermediation*, vol. 3, issue 1, 2-50
- Birn, M., M. Dietsch and D. Durand (2017), “How to reach all Basel requirements at the same time?”, Autorité de Contrôle Prudentiel et de Résolution, *Débats économiques et financiers* n°28, June
- Boissay, F and F. Collard (2016), “Macroeconomics of Bank Capital and Liquidity Regulations”, *BIS Working Paper* No. 596.
- Carletti, E., I. Goldstein and A. Leonello (2020): “*The interdependence of bank capital and liquidity*”, mimeo
- Cecchetti S.G. and A.K. Kashyap (2018), “What binds? Interactions between bank capital and liquidity regulations?” in *The Changing Fortunes of Central Banking*, pp 192-202
- Cont, R., A. Kotlicki and L. Valderrama (2020), “Liquidity at Risk: joint stress testing of solvency and liquidity”, *Journal of Banking and Finance*, 118
- Covas, F. and J.C. Driscoll (2014): “Bank liquidity and capital regulation in general equilibrium”, *Finance and Economics Discussion Series*, Federal Reserve Board
- De Bandt, O., S. Lecarpentier and C. Povel (2021), “Determinants of Banks’ Liquidity: A French Perspective on Interactions between Market and Regulatory Requirements”, *Journal of Banking and Finance*, vol 124, March
- de Bandt, O. and M. Chahad (2016), “A DGSE Model to Assess the Post-Crisis Regulation of Universal Banks”, *Banque de France Working Paper* No. 602, Available at SSRN: <https://ssrn.com/abstract=2838101> or <http://dx.doi.org/10.2139/ssrn.2838101>
- De Nicolo, G., A. Gamba and M. Lucchetta (2014), “Microprudential regulation in a dynamic model of banking”, *Review of Financial Studies* 27, pp 2097 – 2138
- DeYoung, R., I. Distinguin and A. Tarazi (2018), “The joint regulation of bank liquidity and bank capital”, *Journal of Financial Intermediation* 34, pp 32 – 46.

- Diamond D.W. and P. H. Dybvig (1983), "Bank runs, Deposit Insurance and Liquidity", *Journal of Political Economy*, vol. 91, no 3
- Diamond, D.W. and R. G. Rajan (2001), "Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking", *Journal of Political Economy*, vol. 109, No. 2, pp. 287-327
- Distinguin, I, C. Roulet and A. Tarazi (2013), "Bank Regulatory Capital and Liquidity: Evidence from U.S. and European Publicly Traded Banks", *Journal of Banking and Finance*, vol. 37(9), March
- Eisenbach, T., T. Keister, J. McAndrews and T. Yorulmazer (2014): "Stability of funding models: an analytical framework", *FRBNY Economic Policy Review*
- Farag, M. (2013), "Bank capital and liquidity", *Bank of England Quarterly Bulletin* Q3
- Fecht, F. and M. Wedow (2014), "The dark and the bright side of liquidity risks: Evidence from open-end real estate funds in Germany", *Journal of Financial Intermediation*, 2014, vol. 23, issue 3, 376-399
- Fecht, F., K. Nyborg and J. Rocholl (2011), "The price of liquidity: The effects of market conditions and bank characteristics", *Journal of Financial Economics*, 2011, vol. 102, issue 2, 344-362
- Gomez, F. and Q.-A. Vo (2020): "Liquidity management, fire sale and liquidity crises in banking: The role of leverage", *Bank of England Staff Working Paper* No. 894, 27 November
- Gorton, G. and A. Winton (2017), "Liquidity Provision, Bank Capital, and the Macroeconomy", *Working Paper*, University of Minnesota
- Horvath, B. and W. Wagner (2016), "Macroprudential Policies and the Lucas Critique", *BIS Paper* No. 86f, September
- Ikeda, D. (2018): "Bank Runs, Prudential Tools and Social Welfare in a Global Game General Equilibrium Model", *Bank of England Working Paper* No.732
- Kara, G. I. and S. M. Ozsoy (2019), "Bank regulation under fire sale externalities", *Review of Financial Studies*, forthcoming
- Koenig, P. J. (2015): "Liquidity Requirements: A Double-Edged Sword", *International Journal of Central Banking* 11, pp 129 – 167
- Mahadavi Ardekani A., Distinguin I., Tarazi A., 2020, "Do banks change their liquidity ratios based on network characteristics ?", *European Journal of Operational Research*, Volume 285, Issue 2, pp 789-803.
- Repullo, R. (2004), "Capital requirements, market power, and risk-taking in banking", *Journal of Financial Intermediation*, vol. 13, issue 2, 156-182
- Thakor, A. V. (2019), "Liquidity, Solvency and Stability" (Presentation Slides), Proceedings of the 4th Chapman Conference on Money & Finance on Liquidity: Pricing, Management and Financial Stability, Available at SSRN: <https://ssrn.com/abstract=3517670> or <http://dx.doi.org/10.2139/ssrn.3517670>
- Van den Heuvel, S. (2019), "The welfare effects of bank liquidity and capital requirements", *2019 Meeting Papers from Society for Economic Dynamics* No 325
- von Thadden, E.L. (2004), "Asymmetric information, bank lending and implicit contracts: the winner's curse", *Finance Research Letters*, vol. 1, issue 1, 11-23
- Vives, X. (2014): "Strategic complementarity, fragility, and regulations", *Review of Financial Studies* 27, pp 3547 – 3592.
- Vo, Q.A. (2020): "Interactions of capital and liquidity requirements: A literature review", *Bank of England Working Paper* forthcoming.

Walther, A. (2016): "Jointly optimal regulation of bank capital and liquidity", *Journal of Money Credit and Banking*, vol. 48, pp 415–448.

Xing, X., M. Wang, Y. Wang and H.E. Stanley (2020), "Credit creation under multiple banking regulations constraints: The impact of balance sheet diversity on money supply", *Economic Modelling*, vol. 91, pp 720-735

Débats Économiques et Financiers

1. M. Dietsch et H. Fraise, « De combien le capital réglementaire diffère-t-il du capital économique : le cas des prêts aux entreprises par les grands groupes en France », Février 2013.
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Economic and Financial Discussion Notes

1. M. Dietsch and H. Fraisse, "How different is the regulatory capital from the economic capital: the case of business loans portfolios held by major banking groups in France", February 2013.
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32. F. Borel-Mathurin, S. Loisel and J. Segers, "Reevaluation of the capital charge in insurance after a large shock: empirical and theoretical views" December 2017.
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38. L. Clerc, C. Lubochinsky, C. Pouvelle and A. Tarazi, « Interactions of bank capital and liquidity standards within the Basel 3 framework », March 2022.