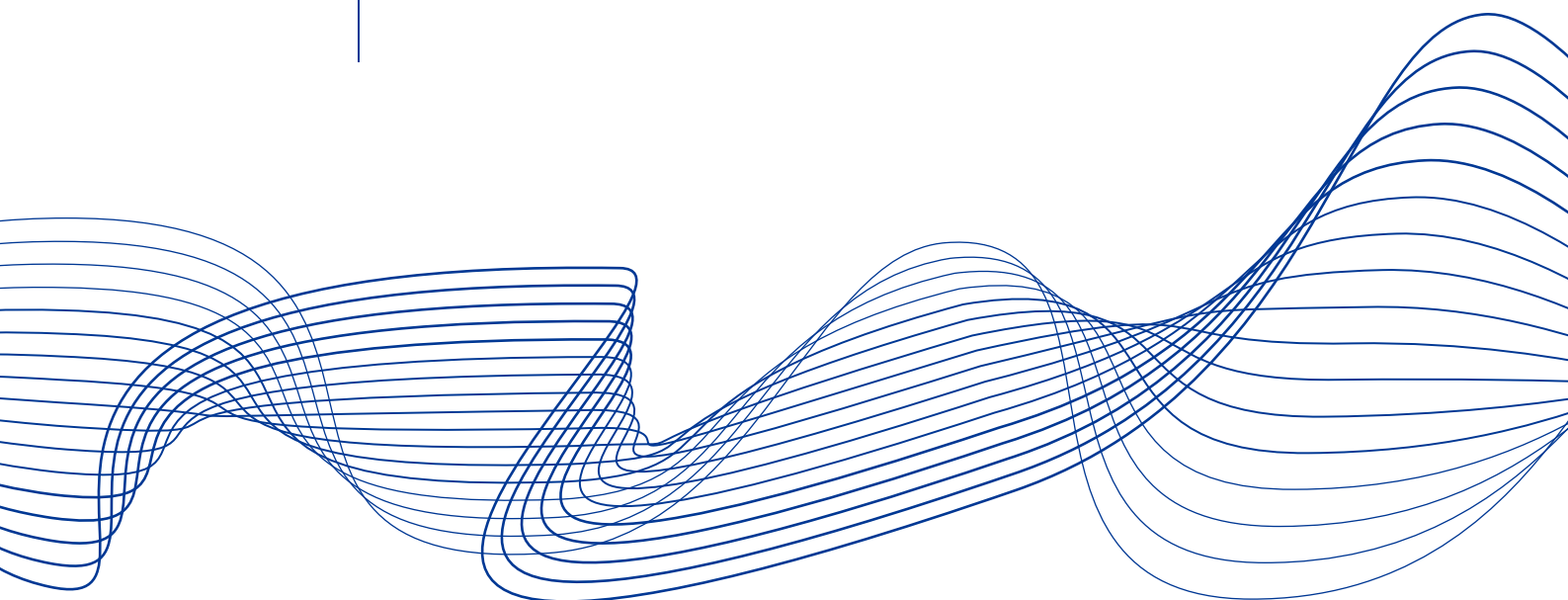


**Preliminary investigation
into the potential impact
of a leverage ratio
requirement on market
liquidity**

Technical input provided to the
European Banking Authority

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European Systemic Risk Board

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Section 1

Introduction

The leverage ratio is an important part of the post-crisis regulatory framework. It was initially proposed by the Basel Committee on Banking Supervision (BCBS) in December 2009 and is expected to be introduced as a Pillar 1 standard by 1 January 2018.¹ The ESRB considers the leverage ratio to be a potentially useful instrument as part of the overall regulatory toolkit. In its Recommendation on intermediate objectives and instruments of macroprudential policy,² the ESRB identified the prevention of excessive credit growth and leverage as one intermediate objective of macroprudential policy and noted that a macroprudential leverage ratio instrument could contribute to achieving this intermediate objective.³ In 2015 the ESRB published an addendum chapter to its 2014 Handbook on Operationalising Macro-prudential Policy in the Banking Sector which extended the analysis to discuss the potential use of the leverage ratio as a macroprudential instrument.⁴ The chapter discussed the intended benefits of introducing a leverage ratio requirement alongside risk-weighted capital requirements, such as the leverage ratio's simple and direct capacity to guard against the build-up of excessive leverage, an underlying cause of the global financial crisis.⁵ It also recognised certain potential unintended consequences of introducing the leverage ratio, including the possible incentive for banks to replace safer exposures with more risky ones to maintain their profit margins or reduce balance sheet-intensive activities if they are not sufficiently profitable.

Recent discussions on the introduction of a leverage ratio have focused on the topic of market liquidity: some industry participants and other observers have been investigating whether financial markets have become less liquid or more prone to episodes of severe illiquidity. Some of these participants and observers point to post-crisis regulatory reform as having affected the supply of liquidity and intermediation services by broker-dealers in a significant way. The leverage ratio, which has already been introduced in some key jurisdictions⁶, has come under particular criticism for constraining broker-dealers' balance sheets, particularly with respect to low-margin business such as securities financing transactions (SFTs).

The ESRB has publically stated that it considers the state of market liquidity to be relevant from a systemic risk perspective and has been investigating the topic since 2015. In the context of the international efforts to develop a harmonised leverage ratio requirement to which the European Banking Authority (EBA) contributed with its report on the leverage ratio in August 2016, the ESRB

¹ Basel Committee on Banking Supervision (2009), "**Strengthening the resilience of the banking sector**", consultative document, December.

² Recommendation **ESRB/2013/1** issued on 4 April 2013.

³ The ultimate objective of macroprudential policy is specified in Recommendation ESRB/2013/1 as "to contribute to the safeguard of the financial system as a whole, including by strengthening the resilience of the financial system and decreasing the build-up of systemic risks, thereby ensuring a sustainable contribution of the financial sector to economic growth".

⁴ Chapter available here: http://www.esrb.europa.eu/pub/pdf/other/150625_esrb_handbook_addendum.en.pdf?505d0ec919dc8e05fb98bbd40e2e286c.

⁵ Basel Committee on Banking Supervision (2014), **Basel III leverage ratio framework and disclosure requirements**, January.

⁶ A Basel III-style leverage ratio has been introduced into the domestic legislation in Switzerland, the United Kingdom and the United States as a current or future requirement.



considers it very important to investigate the concerns that the leverage ratio could reduce liquidity in some financial markets.⁷

The ESRB has prepared some preliminary further analysis – beyond what has already been done for the ESRB Handbook chapter – to investigate the potential positive and negative effects of the leverage ratio requirement on market liquidity. This paper summarises the findings. An important source of data for this analysis is the ESRB's 2015 data collection exercise. This exercise collected both quantitative and qualitative data from a number of bank market-makers in the EU. The quantitative data collected includes market-makers' held-for-trading inventories, average trade size and volume of market-making activity. The qualitative survey requested information on a range of topics including the effects of regulatory change and recent market disruptions. The banks covered by the qualitative survey trade a substantial share of bonds in major fixed income markets: aggregating banks' own estimated market shares gives the respondents a combined market share that ranges from 64% in high-yield corporate bond markets to 85% in covered bond markets. The survey can therefore be viewed as representative of market-makers in Europe.

It is important to remember that the analysis in this paper is necessarily limited at this time for three key reasons. First, several factors may have been influencing the state of market liquidity in recent years (including a range of regulations and non-regulatory factors). It is therefore difficult to empirically attribute certain developments to an individual factor, such as the leverage ratio. Second, the scope for empirical investigation is limited because at present the leverage ratio is not yet a capital requirement for the majority of EU banks. While it is true that the global banking system has been anticipating a leverage ratio requirement for some time, most EU banks are currently only subject to a leverage ratio disclosure requirement.⁸ Further, market liquidity in the EU will also be influenced by the activities of dealers from non-EU jurisdictions, which are not within the scope of this analysis. Third, there is no agreed theoretical framework that includes market liquidity, market-making and regulation to model the impact of introducing a leverage ratio requirement.⁹ For these reasons, the focus of this work has been to (1) set out the conceptual channels by which regulation, in particular the leverage ratio, may affect banks and their role in facilitating liquid markets, and (2) to investigate whether there is any empirical evidence of an impact owing to the *anticipation* of a leverage ratio requirement.

Although preliminary, the ESRB hopes that these findings will be useful to the EBA and the European Commission when they come to consider the costs and benefits of introducing a leverage ratio requirement in the EU.

The rest of this paper is structured as follows:

- Section 2: conceptual discussion of how the leverage ratio could change banks' incentives and ability to facilitate liquid markets;

⁷ "EBA report on the leverage ratio requirements under Article 511 of the CRR", EBA-Op-2016-13, 3 August 2016. The contents of this paper were published in Annex III to the EBA report. There are some minor differences between the two publications reflecting data updates and other developments since the submission of the analysis to the EBA.

⁸ Article 451 of the Capital Requirements Regulation, **Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1)**.

⁹ A stylised framework for analysing the demand and supply of high-quality collateral, including the role of broker-dealers as intermediaries, has been proposed recently by Baranova, Liu and Noss ("**The role of collateral in supporting liquidity**", Bank of England Staff Working Paper No. 609, August 2016.)



- Section 3: some information about the range of other regulations that have been influencing banks since the global financial crisis and a summary of banks' own views on the most important regulatory factors affecting them;
- Section 4: empirical methods used to explore the relationship between the leverage ratio, inventories and repo assets;
- Section 5: conclusions.



Section 2

Conceptual discussion – *how to assess the impact of a leverage ratio requirement on the role of banks in facilitating liquid markets*

The leverage ratio was proposed in 2009 by the BCBS following concern over excessive leverage in the lead up to the 2008 financial crisis and previous financial crises. The leverage ratio is complementary to risk-weighted capital requirements and is intended to constrain the creation of excessive leverage in the banking system. It seeks to be risk insensitive, including both on- and off-balance-sheet banking activities. On-balance-sheet items are generally measured at their notional accounting value. There is a specific treatment for SFTs, derivatives and off-balance-sheet exposures. For example, in the case of SFTs, some limited netting of cash is permitted in specific circumstances such as when the counterparty and settlement dates are aligned. In the case of derivatives, which are associated with very high (and sometimes changeable) notional values, an approach was developed to capture the replacement cost and potential future exposure.¹⁰ However, for the broad majority of a bank's activities, any exposure, irrespective of risk profile or credit mitigation, is in scope and attracts a leverage exposure and capital charge.

With a minimum leverage ratio set at 3%, as currently envisaged by the BCBS, the vast majority of large internationally active banks subject to the BCBS rules – which are likely to include the most significant market-making banks – would currently meet the leverage ratio. This is shown in Table 1, taken from the March 2016 BCBS Monitoring Report, which shows that only 3.4% of banks in the international sample would fail to meet a 3% leverage ratio if they are compliant with their Tier 1 risk-weighted requirements.¹¹ In other words, even if an exposure would nominally attract a leverage ratio charge, the absolute amount of capital the bank has to hold in the risk-weighted framework would exceed the implied leverage ratio capital charge at the level of the aggregate balance sheet. However, those firms who currently fail to meet a 3% leverage ratio and so are bound by it may choose to reprice or withdraw certain activities. Even those firms who are not bound by the leverage ratio at the portfolio level may choose to manage some portfolios at business-line levels or use this as a rationale for adjusting their pricing.

¹⁰ The current BCBS definition of the leverage exposure measure is described here: <http://www.bis.org/publ/bcbs270.pdf>. The BCBS consulted on certain revisions to this definition between April and July 2016.

¹¹ Table 1 in this report was published as Table 3 in Basel Committee on Banking Supervision (2016), **Basel III Monitoring Report**, March.



Table 1

Share of banks meeting the Basel III leverage ratio before and after capital raising to meet the risk-based target Tier 1 ratio

(full sample of banks, percentages)

		Target Tier 1 ratio binding (<8.5% + GSIB surcharge)?		Total	Total after capital raising to meet target Tier 1 ratio
		Yes	No		
Leverage ratio binding (<3%)?	Yes	0.5	2.9	3.4	3.4
	No	4.3	92.3	96.6	96.6
	Total	4.8	95.2	100.0	100.0

Source: Basel Committee on Banking Supervision.

As noted in Dudley (2016),¹² two types of activities that banks may reprice or withdraw from may be particularly relevant to market liquidity. First, dealers may become less willing to hold inventory in markets where the on-balance-sheet assets attract low risk weights. This is an example of “risk shifting”, where banks may choose to change the composition of their balance sheet, favouring higher risk and higher return activities because they have to hold a minimum amount of regulatory capital in any case. Grill et al. (2015), for example, explored this effect and found that, overall, a leverage ratio requirement can incentivise greater risk-taking.¹³ However, they also noted that any increase in risk-taking can be outweighed by the benefits of greater bank resilience.

Second, banks may become less willing to finance leveraged intermediaries who take positions in markets, referred to as “funding liquidity”. These SFTs, particularly where against high-quality collateral, typically attract low risk weights, but are captured in the leverage ratio. Moreover, because intermediating SFTs has never been a particularly profitable activity for banks – it tends to be a relationship business – the additional capital costs may make it unaffordable or unattractive for banks to provide this service widely.

All things being equal, in normal market conditions the leverage ratio may make some market liquidity-related activities less attractive for a part of the banking sector and result in increased capital costs for firms with low average risk weights. This might particularly affect the holding of inventory in markets where the expected returns are relatively low, such as sovereign bonds and high-quality corporate bonds, and the intermediation of SFTs.

The importance of these effects for market liquidity depends on a number of factors.

- **The proportion of incumbents affected by a leverage ratio constraint.** If intermediation in a given market is currently provided by relatively more constrained firms, then market liquidity may be more affected and for longer while these banks adjust to the new regulation and until less constrained banks also adapt. Activities and markets that are characterised by a high degree of bank concentration may be affected to a greater extent.
- **The ability of less constrained banks to expand their market share.** The easier it is for this to occur then the lower the impact on market liquidity as the less constrained banks can take over activities performed by constrained banks. However, there are some fixed costs for particular activities which may act as barriers to entry, for example, costs associated with

¹² Dudley, W.C. (2016), “**Market and Funding Liquidity: An Overview**”, May.

¹³ Grill, M., Lang, J. H. and Smith, J. (2015) “**The Leverage Ratio, Risk-Taking and Bank Stability**”, November.



access to central counterparties and more limited netting opportunities for banks operating with fewer counterparties or smaller balance sheets.

- **To the extent that the leverage ratio does increase the effective capital requirements for incumbent or new providers, how those costs are absorbed.** For example, whether the costs are passed on through increased liquidity premia, greater fees for clients, or reduced returns for shareholders.

Importantly, aside from any costs resulting from these potential adjustment actions, the leverage ratio can be expected to support market liquidity, particularly during periods of stress. First, it makes firms better able to absorb shocks. The leverage ratio's function of ensuring that firms' capital does not fall below a certain fraction of their total exposures (given by the calibration of the requirement) is important to guard against model risk and measurement errors in the risk-weighted framework. This is particularly important for low-probability, high-impact events such as a sovereign default, for example. It ensures that firms are better able to cope with stresses they were not expecting. Further, the leverage ratio should also put them in a better position to continue to support markets even in periods of heightened uncertainty. In extremis, if banks are less likely to fail then they will not rapidly withdraw services that support market liquidity.

Second, there may also be an impact on market liquidity through banks' own funding costs. While the Modigliani/Miller theorem may hold over the cycle, better capitalised banks may be better able to absorb short-term stresses and maintain financial services as their debt funding costs are likely lower in times of market-wide stress.¹⁴ This matters particularly in situations when equity is only available at very high cost exactly when market liquidity-related activities are likely most needed.

As suggested in the ESRB Handbook chapter on macroprudential leverage ratios,¹⁵ the design (as well as the calibration) of a leverage ratio framework is likely to be important in terms of its impact, namely, the proportion of the leverage ratio requirement that is a minimum requirement and the proportion that is a buffer. While the leverage ratio in itself is naturally countercyclical¹⁶, a countercyclical buffer element of the requirement could further strengthen this. For example, a buffer would allow a bank to reduce capital in a stressed period, without risk of attracting a stigma. This may in turn lower the risk of market-makers reducing their intermediation in core markets owing to perceived leverage constraints, while also limiting the build-up of unsustainable exposures in an upswing. More generally, if there is a buffer element to the leverage ratio framework, consideration should be given to its design, for example, whether there should be automatic or more discretionary consequences of a buffer breach. This may influence how banks respond when their leverage ratio falls.

In summary, to assess the net impact of the leverage ratio on market liquidity, it is necessary to compare any costs that may result from imposing a leverage ratio requirement owing to potentially

¹⁴ The Modigliani/Miller theorem shows that the volatility of returns on equity fall and the safety of debt investments rise as the amount of equity capital held rises. In consequence, under the specific assumptions of the theorem, the weighted average cost of finance to the institution stays the same even when the composition of its liabilities changes. See Modigliani, F. and Miller, M. (1958), "The Cost of Capital, Corporation Finance and the Theory of Investment", *American Economic Review*, Vol. 48, No 3, pp. 261-297.

¹⁵ Addendum chapter to the [ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector](#).

¹⁶ There is evidence that the Basel III leverage ratio is significantly more countercyclical than the risk-weighted regulatory capital ratio: it is a tighter constraint for banks in booms and a looser constraint in recessions. See Brei, M. and Gambacorta, L. (2014), "[The leverage ratio over the cycle](#)", *BIS Working Papers*, No 471, November.



rising liquidity premia and/or quantity restrictions¹⁷ with the benefits. The benefits relate to (i) curbing excessive market liquidity in times of exuberance, which may sow the seeds for market fragility in future, and (ii) increasing the resilience of dealer banks, which improves their ability to provide market and funding liquidity, including in stressed periods. It should be noted that there is limited historical experience on which to base an assessment of how the financial system is likely to adapt and evolve in response to regulatory changes such as the introduction of the leverage ratio and those presented in Box 1. To quantitatively assess the costs and benefits, it would be useful if a partial equilibrium model adapted to the current characteristics of the EU banking sector were developed.

Recent policy papers have discussed the costs and benefits outlined above. For example, Dudley (2015)¹⁸ argues that the hypothesis of diminished market-making is not supported by the available evidence. First, he argues that the evidence to date that market liquidity has diminished markedly is, at best, mixed. Second, he states that it is not clear whether regulation is the primary driver, as other factors have also played an important role (technological change, for example). Moreover, he goes on to say that “even if a connection could be made to regulatory causes, the costs of any reduction in liquidity might be low relative to the benefits of the regulations”. Recent regulatory changes have made major financial institutions less prone to failure, as shown by the sharp fall in credit default swap spreads for major dealers in recent years. In a more recent speech¹⁹, Dudley underlined the importance of both funding and market liquidity, arguing that “the changes in the regulatory regime are likely important, but we need to do considerably more work before we reach a definitive conclusion on their relative contribution”. In particular, he reiterates, even if a decline in market liquidity was found to have occurred, it might not be persistent as innovation takes place.

The Committee on the Global Financial System (CGFS) recently carried out a study into the related subject of fixed income market liquidity.²⁰ They found that “more stringent regulatory requirements to contain systemic risks in the financial system, in turn, have – by design – curbed dealers’ risk-taking capacity. As a result, many dealers reportedly provide liquidity only when they can easily match client orders, but step back from quoting during more volatile market conditions, particularly in the absence of formal market-making arrangements.” However, the Committee noted that benchmarking costs arising from curbs on dealer capacity against the cost of liquidity before the crisis was misleading since this does not reflect market changes since that time, or banks’ greater resilience to stress. In a recent speech, Shin (2016) argued that encouraging banks to maintain broad foundations for their intermediation activity through adequate capital may help to secure robust, reliable market liquidity.²¹

In early 2016, the European Commission closed a call for evidence to gather information on the interactions between and cumulative impact of the EU regulatory framework for financial services. Some of the responses received made reference to the impact of EU regulation on market liquidity.²² Between 7-8% of the responses referred to market liquidity, making it the sixth most

¹⁷ The costs may differ in the transition and the steady state when banks have adapted to all forthcoming regulations and structural changes.

¹⁸ Dudley, W.C. (2015), “**Regulation and Liquidity Provision**”.

¹⁹ Dudley, W.C. (2016), “**Market and funding liquidity – an overview**”.

²⁰ CGFS: Fixed income market liquidity, <https://www.bis.org/publ/cgfs55.pdf>.

²¹ Shin, H.S. (2016), “**Market liquidity and bank capital**”, *Bank for International Settlements*.

²² European Commission, “**Summary of contributions to the ‘Call for Evidence: EU regulatory framework for financial services – understanding the interactions and cumulative impact of regulation’**”, published 17 May 2016.



referenced topic out of a total of fifteen that were mentioned in the responses.²³ Feedback on the market impact of different rules was largely qualitative or based on external studies. The Commission commented that this may reflect the difficulty of assessing the impact of rules that are very recent (or not yet implemented or adopted) and also the difficulties inherent in isolating the impact of EU rules from other factors (e.g. monetary policy, national policy changes and macroeconomic developments) that may also play a significant role.²⁴ The Commission summarises that:

“A number of market participants argued that specific pieces of legislation and the cumulative impact of certain EU rules have had a detrimental impact on market liquidity, particularly in corporate bond markets. Other respondents questioned whether regulation was responsible for the decline in market liquidity, arguing that other factors play a greater role, and that the evidence of an adverse impact of regulation is unclear. Some public sector respondents cautioned that part of the impact of regulation was intended and reminded of the risks of excessive liquidity before the financial crisis.”²⁵

It is also significant that a number of non-banks (infrastructure providers, custodians, fund managers and other financial actors) responded by saying that regulatory change affecting them could have a possible bearing on market liquidity. In this way, it is not just regulation that would apply to the banking sector, such as the leverage ratio, that may be significant for the state of market liquidity.

Box 1

Summary of post-crisis regulatory changes affecting banks

A wide range of regulatory changes that affect banks have been implemented or announced following the financial crisis. The impact on banks of adjusting to the new regulatory landscape, including the Basel III leverage ratio, may influence their role in supporting liquid markets. Table 2 summarises a number of key reforms.

In terms of capital regulations, the interaction between risk-weighted capital requirements and the leverage ratio is particularly important. However, several banks in the EU will need to make balance sheet and structural changes to be in line with the other areas of regulation. Additionally, banks may take longer to reach their optimal new equilibrium structure if they have to understand and adapt to several regulations at once.

Further, other regulatory changes which do not apply directly or exclusively to banks are relevant to understanding market liquidity, for example, the Markets in Financial Instruments Directive II (MiFID II), the Markets in Financial Instruments Regulation (MiFIR) and the European Market Infrastructure Regulation (EMIR). As discussed in Section 3, banks report that all of these regulations are affecting them. For this reason, it is important to take account of broader regulatory changes when analysing the potential impact of the leverage ratio.

²³ Chart 3 in European Commission (2016), “**Summary of contributions to the ‘Call for Evidence: EU regulatory framework for financial services – understanding the interactions and cumulative impact of regulation’**”

²⁴ Page 7 of European Commission (2016), “**Summary of contributions to the ‘Call for Evidence: EU regulatory framework for financial services – understanding the interactions and cumulative impact of regulation’**”.

²⁵ Page 9 of European Commission (2016), “**Summary of contributions to the ‘Call for Evidence: EU regulatory framework for financial services – understanding the interactions and cumulative impact of regulation’**”.



Table 2

Overview of key banking regulatory changes and their potential impact on banks as market-makers

Regulations	Summary impact on banks
<p><i>Reforms to capital requirements</i></p> <ul style="list-style-type: none"> - The standardised approach to credit risk and role of internal ratings-based models - The fundamental review of the trading book - The leverage ratio 	<p>These reforms change the relative cost of activities. Broadly, changes to the risk-weighted capital rules seek to ensure appropriate capital holdings for known risks - so if risk had been underestimated in the past, it will now be more costly. The leverage ratio, which is not risk-sensitive, will constrain a bank's ability to take on excessive leverage and will guard against model risk and measurement errors in the future. The leverage ratio is likely to particularly affect firms with predominantly low risk-weighted activities.</p>
<p><i>Reforms to funding and liquidity requirements</i></p> <ul style="list-style-type: none"> - Liquidity coverage ratio (LCR) - Net stable funding ratio (NSFR) 	<p>These reforms will require some banks to change their funding activities and asset structure. For example, the LCR may incentivise firms to reduce the maturity mismatch over one month of their book, shortening wholesale lending and seeking out longer-term funding. It also influences their demand for liquid assets. The NSFR restricts the use of short-term wholesale funding to fund longer-term activities above one year.</p>
<p><i>Structural reforms</i></p> <ul style="list-style-type: none"> - Ring-fencing within EU banking groups - Volcker rule for US banks - Other structural requirements such as requirements for intermediate holding companies 	<p>These reforms affect both the activities that banks can carry out and the level of risk-sharing permitted across banking groups. These may interact with other regulatory requirements – for example, a liquidity requirement may have a different impact if applied to a banking group than to a deposit-taking subsidiary.</p>



Section 3

Market-makers' feedback on factors affecting their market-making capacity and market liquidity – *how does regulation fit in?*

The ESRB's qualitative survey of bank market-makers in the EU (described in Section 1) provides some information on the effects of regulation in general, and the leverage ratio in particular, on market liquidity. According to most respondents, perceived lower market liquidity has its origin in a reduction in the number of market participants (investors in general and market-makers in particular), as well as capital and balance sheet constraints, potentially as a result of regulation. Other cited determinants of perceived market illiquidity relate mostly to changes in the market structure. This section will focus on the reduction in market-makers' activities in the context of changing regulatory requirements and its potential contribution to reducing market liquidity.

Respondents report that regulatory initiatives would alter the revenue-cost basis underlying their market-making activities. The participating banks identify market regulation on the one hand and the regulation of market participants on the other hand as the main causes of reduced market-making. Besides other effects, the latter may increase traders' balance sheet (and in particular capital) constraints and so limit market-makers' ability and willingness to trade or enter new positions. In particular, they mention MiFID II, MiFIR, EMIR, the Central Securities Depositories Regulation, the Securities Financing Transaction Regulation and the regulation on short-selling, as well as Basel III capital and liquidity requirements. The main arguments made by the market-makers were as follows.

1. Additional capital requirements increase capital charges and therefore the costs of providing liquidity.
2. The new liquidity framework increases the funding needs related to market-making. At the same time, these costs are not balanced by additional revenues and therefore disincentivise market-making.
3. Additional transparency requirements under the MiFID II/MiFIR/EMIR framework reduce the scope to make gains as other market participants are better informed about the risk positions held by market-makers.

It is important to note that some of the respondents' answers were imprecise and it is not always possible to distinguish their feelings about specific regulations from their responses. In particular, references to "capital requirements" may relate to the leverage ratio and/or changes to risk-weighted capital requirements, for example owing to the fundamental review of the trading book. Similarly, some banks refer to the CRD IV/CRR framework in general while others distinguish different measures specified therein. Another factor which might have been influencing the respondents and which has not been controlled for when analysing the responses is respondents' own position with respect to the requirements, e.g. the size of their capital or leverage ratios or net stable funding ratio.

Only a few respondents explicitly mention a negative effect owing to the leverage ratio. If mentioned, respondents make the criticism that the leverage ratio may eliminate the risk-sensitivity of capital requirements and that this could incentivise market-makers to increasingly refrain from supporting liquidity provision in low-risk markets. In particular, respondents warn that repo markets may be disproportionately affected.



However, when asked about which markets would primarily be affected by a reduction or withdrawal in the provision of liquidity, respondents indicate that periods of distress would reduce their risk appetite and their ability to exit positions in general and across all asset classes. Further, less liquid (i.e. high yield) bond markets and generally more risky markets are among the markets where respondents would reduce their liquidity provision first. Those responses could indicate that expected reduction in market-making in times of stress is not driven by regulation but by risk aversion and other bank-internal considerations. Or the responses could indicate that, at least in times of stress, the incentive effects from risk-based capital requirements outweigh the effects of risk-insensitive requirements such as the leverage ratio.

Overall, the key messages from market-makers are that a range of regulations have an impact on their activities. Market-makers expect capital and liquidity regulations, including but not exclusively the proposed leverage ratio requirement, and market regulation, in particular transparency requirements, to negatively affect their profit and incentive structure in a way that would lead to a reduction or withdrawal of market-making services in the future. However, market-makers also pointed out that other factors besides regulation and their own market-making activities have an impact on market liquidity. In interpreting the results of the qualitative questionnaire, it is important to keep in mind that these are the views of the market-makers in the sample only and that there are some limitations when interpreting the survey results. These limitations include the fact that responses were provided in open text format and are therefore not always precise and easily comparable.



Section 4

Empirical investigation

Some of the channels described in the conceptual analysis above and the survey evidence from market-makers suggest that banks which are targeting higher leverage ratios may hold smaller trading inventories or provide less secured financing than if they had not been trying to boost their leverage ratios. This may amount to reducing inventories or repo activity from previous levels, or not increasing them as much as they would otherwise have done, in turn potentially putting pressure on market liquidity. **The following two boxes empirically explore the relationship between the leverage ratio and trading, repo activity and inventories.**

While it is difficult to investigate empirical evidence for EU banks at this time as there is not yet a harmonised leverage ratio solvency requirement, banks have reported that they are already adapting to an anticipated future leverage ratio requirement and the existing disclosure requirement.²⁶ This is confirmed by the analysis on the impact of the leverage ratio on risk-taking and bank stability shown by Grill, Lang and Smith (2015).²⁷ It is also likely that some banks have had a market incentive to improve their leverage ratios since the 2008 financial crisis when some investors had more confidence in leverage ratios than risk-weighted capital requirements.²⁸ For these reasons, a relationship may be observable in recent data. Nevertheless, data availability will improve with time and future analysis could expand on the current work.

Box 2

Trading and repo activities – is there a causal link with expected leverage ratio requirements?

Borrowing from the methodology of Grill, Lang and Smith (2015), this box considers the impact on trading assets and repo activity of imposing a leverage ratio requirement. In particular, a difference-in-difference type analysis is performed, whereby banks are separated into those that already meet the anticipated requirement and those that would need to adjust their balance sheets to do so. The activities of these two groups of banks can then be compared and, if enough other factors are controlled for, any differences can be attributed to their leverage ratio positions.

More specifically:

- institutions whose leverage ratio is below the target form the so-called “treatment group”;
- institutions whose leverage ratio is above the target form the “control group”.

²⁶ EU credit institutions have been required to disclose their leverage ratios in a uniform way since 1 January 2015. See Article 451 of the Capital Requirements Regulation, **Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1).**

²⁷ Grill, M., Lang, J. H and Smith, J. (2015), “**The impact of the Basel III leverage ratio on risk-taking and bank stability**”, Financial Stability Review, ECB, November, pp. 120-132.

²⁸ Cunliffe, J. (2014), “**The role of the leverage ratio and the need to monitor risks outside the regulated banking sector**”.



The BCBS leverage ratio was first announced in December 2009. At that time, the BCBS made the decision to start testing a minimum Tier 1 leverage ratio of 3% until January 2017.²⁹ Given that an annual dataset is used for the purposes of this analysis, 2010 is taken as the start date of the “treatment”, i.e. when the sample of banks is split into two groups. 3% is taken to be the target leverage ratio at that time; banks whose Tier 1 leverage ratios were lower than 3% would have had to adjust their balance sheets to comply with the anticipated requirement.

Using annual data on around 500 banks from 27 EU countries over the period from 2005 to 2014,³⁰ two groups of regressions are run using the above technique to assess whether there are any significant changes in **(A) trading assets** and **(B) repo activity** of banks bound by the leverage ratio requirement relative to those that were not bound over the same period. The specific data series chosen for these variables was influenced by data availability (time series data for a large sample of banks is required); the series should be reasonable proxy variables of the market liquidity-related activities of interest.

Formally, the regressions run are of the form:

$$y_{i,j,t} = \alpha + \mu_i + \lambda_t + v_j \cdot \lambda_t + \beta T_{i,j,t} + \theta' X_{i,j,t-1} + \varepsilon_{i,j,t}$$

where μ_i , λ_t and v_j are bank, time and country fixed-effects respectively, $T_{i,j,t}$ is the “**treatment indicator**”, and $X_{i,j,t-1}$ is a set of bank-specific control variables.³¹ The treatment indicator is defined as zero for all banks before 2010; it is still zero after 2010 for all banks with leverage ratios *above* 3% and it is equal to one for all banks with leverage ratios *below* 3% after 2010.

(A) Trading assets

Two regressions were run: the first regression uses the value of trading assets³² in billions of euros as the dependent variable $y_{i,j,t}$, and the second regression uses the proportion of trading assets to total assets as the dependent variable. Tables 4 and 5 display the results, where the treatment indicator is the main variable of interest.

²⁹ Basel Committee on Banking Supervision (2009), “**Strengthening the resilience of the banking sector**”, consultative document, December.

³⁰ The dataset has three main building blocks: (i) a large set of bank-specific variables based on publicly available financial statements from SNL Financial and Bloomberg; (ii) a unique collection of bank distress events that covers bankruptcies, defaults, liquidations, state aid cases and distressed mergers as in Betz et al. (2014); and (iii) various country-level macro-financial variables from the ECB’s Statistical Data Warehouse. The dataset builds upon and expands the dataset described in Betz, F., Oprica, S., Peltonen, T. and Sarlin, P. (2014), “Predicting distress in European banks”, *Journal of Banking & Finance*, Vol. 45, pp. 225-241.

³¹ In both regressions, control variables are lagged by one period. For indicator variables (which take the value 1 or 0), the control is based on the value of the variable in the previous period. The following firm-specific variables are included in each regression: the change in balance sheet size (measured via the logarithm of total assets) since it is assumed that the size of the institution may affect its trading assets; profitability (measured via the pre-tax return on assets) since there may be a relationship between a firm’s recent profitability and trading assets; the liquid asset ratio (liquid assets to liabilities) to capture any relationship between having a liquid balance sheet and trading assets; and the leverage ratio (measured as Tier 1 capital to total assets) to control for the amount of leverage on a firm’s balance sheet.

³² An SNL Financial data series used: “Total Assets Held for Trading”.



Table 3
Regression results when trading assets is the dependent variable

Explanatory variable	Coefficient
<i>Treatment indicator (LR≤3%, yr≥2010)</i>	<i>-15.685** (7.330)</i>
Tier 1 risk-weighted requirement threshold indicator	-0.583 (1.286)
Leverage ratio	-0.999** (0.463)
Liquid assets to liabilities	-0.012 (0.010)
Δ Size (Δ log total assets)	3.525* (2.101)
Pre-tax return on assets	0.971* (0.568)
Dummy (LR≤3%)	26.774*** (9.806)
Observations	2567
Constant, bank, time, country*time fixed effects	Yes

Notes: All regressors are lagged by one period to take account of endogeneity concerns. Robust standard errors are in brackets. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4
Regression results when trading assets/total assets is the dependent variable

Explanatory variable	Coefficient
<i>Treatment indicator (LR≤3%, yr≥2010)</i>	<i>0.385 (1.013)</i>
Tier 1 risk-weighted requirement threshold indicator	0.023 (0.339)
Leverage ratio	-0.0712 (0.065)
Liquid assets to liabilities	0.046** (0.021)
Δ Size (Δ log total assets)	0.258 (0.196)
Pre-tax return on assets	0.077 (0.092)
Dummy (LR≤3%)	0.023 (0.339)
Observations	2541
Constant, bank, time, country*time fixed effects	Yes

Notes: All regressors are lagged by one period to take account of endogeneity concerns. Robust standard errors are in brackets. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Looking at Table 3, the first regression suggests that, over the whole time period from 2005 to 2014, banks with leverage ratios lower than 3% held, on average, €27 billion more in trading assets than those banks with higher leverage ratios. However, they held on average €16 billion fewer trading assets after the anticipation of the leverage ratio requirement. This shows that banks reduced their trading assets compared with the amount they otherwise would have held if they had not been bound by the expected leverage ratio requirement. Moreover, the results reveal that overall banks with higher leverage ratios have lower holdings of trading assets: a 1 percentage point increase in a bank's leverage ratio is associated with around €1 billion lower holdings of trading assets. This suggests that the expected introduction of a leverage ratio requirement may have led to a decrease in some banks' trading assets between 2010 and 2014. Importantly, however, this result should be seen in the light of the broader deleveraging by banks since 2010, which is analysed in the second regression.

Table 4 suggests that there seems to have been no effect from the expected introduction of the leverage ratio requirement on the share of trading assets in banks' portfolios.³³ Taken in the context of the overall portfolio, the leverage ratio requirement does not appear to have had a negative impact on trading assets. In this sense, there is evidence that the anticipation of a regulatory requirement and possibly market pressure for banks to maintain a certain leverage ratio since 2010 have precipitated a certain degree of exposure reduction by banks (as well as capital raising and retention) in order to become less highly leveraged.

³³ The coefficient on the treatment indicator variable is insignificant and so we cannot reject the null hypothesis that the leverage ratio had no effect on the share of trading assets to total assets.



(B) Repo activity

In another regression, a similar analysis is run with repo assets³⁴ as a proportion of total assets as the dependent variable. This variable was used to investigate the impact on repo assets of the leverage ratio being below 3% from 2010 – Table 5 displays the results. The coefficient on the treatment indicator is insignificant, suggesting that the leverage ratio requirement has not caused banks to reduce the amount of repos to total assets on their balance sheet between 2010 and 2014.

Table 5
Regression results when repo/total assets is the dependent variable

Explanatory variable	Coefficient
Treatment indicator (LR≤3%, yr≥2010)	0.364 (0.778)
Tier 1 risk-weighted requirement threshold indicator	0.133 (0.434)
Leverage ratio	0.468 (0.166)
Liquid assets to liabilities	0.076*** (0.016)
Δ Size (Δ log total assets)	0.857 (0.798)
Pre-tax return on assets	-0.228* (0.136)
Dummy (LR≤3%)	0.650 (0.778)
Observations	646
Constant, bank, time, country*time fixed effects	Yes

Notes: All regressors are lagged by one period to take account of endogeneity concerns. Robust standard errors are in brackets.

*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Summary of results

We have investigated the impact of the leverage ratio requirement on inventories, trading assets and repo activity from the date of the BCBS announcement in 2010 until the end of 2014. The findings suggest that banks that needed to improve their leverage ratios to meet a 3% requirement or market expectation have been doing so in part by reducing the size of their balance sheets, including by reducing their trading assets relative to the amount they would have held if not bound by the leverage ratio. However, neither trading assets nor repos have significantly fallen as a share of these banks' total assets since 2010. Arguably, a general deleveraging has been a desired effect of the leverage ratio for banking regulators, and it is positive for market liquidity considerations that trading and financing activities have not been reduced disproportionately as part of this process.

It is important to note that these results are based on activity until 2014 only. It is possible that an effect on trading and financing activities has started to crystallise more recently or that banks are yet to adjust their portfolios in response to the incentives created by the leverage ratio that were

³⁴ A Bloomberg data series used: "Securities sold with a repurchase agreement". Note that this is used as a proxy for overall repo market activity and will capture banks' own repo funding as well as dealer banks' intermediation in repo markets in which they buy and sell securities with a repurchase agreement ("matched book activity").



discussed in Section 2. It will therefore be important to monitor changes in these types of exposures in the future.

Box 3

Exploring the relationship between market-makers' inventories and leverage ratios

In this box, the data collected by the ESRB (described in Section 1) is used to analyse the recent relationship between market-makers' inventories and their leverage ratios.

For a given level of capital, holding more inventories increases the leverage exposure measure and reduces the leverage ratio (the ratio of regulatory capital to leverage exposures). In anticipation of a regulatory minimum leverage ratio, banks may choose to reduce their inventories to boost their leverage ratio in response.³⁵ Given this, the following relationships might be expected in the data.

- From a **time series perspective**: for the banks that have been targeting higher leverage ratios in recent years, we may expect to see their inventories falling, *unless* they sufficiently reduced other exposures or raised capital over the period. If they took other actions to increase their leverage ratio, any change in their inventories may be unrelated to their leverage ratio position and there may not be an apparent relationship between the two in the data.
- From a **cross-sectional perspective**: those banks in the sample with higher inventories in general may have lower leverage ratios, *unless* these banks also are the best capitalised or have smaller holdings of other assets (e.g. in the banking book). If these banks are the best capitalised or have fewer non-trading assets, then there may be no apparent relationship between inventories and leverage ratios.

To better understand the relationship between market-makers' inventories and leverage ratios, some simple statistical regressions were performed. We ran several different regressions with inventory as the dependent variable and leverage ratio as the independent variable.³⁶ Because leverage ratio reporting has only started in recent years, the dataset used in the statistical analysis is not large: it included seven banks over seven periods from the first quarter of 2014.

Results

To summarise the results, only three out of the total 24 regression analyses performed revealed a significant relationship between inventory holdings and the leverage ratio, of which one was negative and two were positive. The three significant relationships all came from using the more simple regression models. In the more sophisticated models which took account of time and bank

³⁵ A similar effect could occur if banks perceive there to be a "market" minimum leverage ratio requirement, i.e. investors, counterparts and analysts expect them to exceed a certain leverage ratio in order to be considered healthy and viable in the market.

³⁶ These covered three types of regressions: (i) pooled Ordinary Least Squares (OLS) using levels of leverage ratios and inventories; (ii) pooled OLS using the quarterly change in these variables; and (iii) a panel regression with bank fixed effects using levels of leverage ratios and inventories. Each type of regression was conducted with and without time fixed effects. Further, two definitions of the leverage ratio have been investigated: the EU definition using a transitional definition of Tier 1 capital, and the EU definition using a fully phased-in definition of Tier 1. As data on leverage is bound by zero and as levels of inventory are very high, the regressions are repeated taking the logarithm of leverage and inventories. As a further robustness check, missing inventory data is also interpolated.



fixed effects, no significant relationships were found. While the simpler models were investigated owing to the small sample size, the omission of controls for unobserved time and bank-specific fixed effects may bias the estimated coefficients in those regressions and give a misleading picture of the relationship between the variables.

Given this sparse evidence of a significant relationship and the contradicting signs, we conclude that it is difficult to confirm the hypothesis that, in this sample, banks that needed to improve their leverage ratio have been reducing their inventory holdings, or that banks with higher leverage ratios have had fewer inventories. It should be stressed that this analysis and our conclusions rely on a very small sample and cannot truly show whether or not there is a causal relationship (unlike the analytical method used in Box 2, which required a longer time series and larger sample of banks). A similar analysis could be repeated at a future date for a larger sample of banks as an increased sample size could provide more accurate results. In addition, future analysis could take account of any developments in banks' responses to the expected leverage ratio requirement.



Section 5

Conclusions

A mixture of conceptual and empirical, including qualitative and quantitative, analyses have been used in this paper to investigate the potential positive and negative effects of the leverage ratio requirement on market liquidity. It is important to remember that the potential for analysing this topic is currently limited for a few reasons: several factors may have been influencing the state of market liquidity in recent years and it is difficult to disentangle the effect of specific factors; the leverage ratio is still only an anticipated capital requirement for the majority of EU banks; and there is no agreed theoretical framework for market liquidity, market-making and regulation which can be used to model the impact of introducing a leverage ratio requirement. However, it has been possible to establish some important considerations for assessing the costs and benefits and to draw some initial conclusions about the impact to date of banks already anticipating the leverage ratio requirement. The key messages are summarised below.

1. Market-makers are currently subject to many factors, including much regulatory change, which may be changing their incentives to provide market-making and financing services. Market-makers self-report that several regulations are influencing them at present, including: reforms to capital, liquidity and funding requirements and structural reforms. Further, there are a number of important changes to market regulation, for example additional transparency requirements.
2. Conceptually, there are channels by which the leverage ratio specifically could reduce incentives to act as a market-maker or provide market financing. We have identified two relevant activities that may be affected: (i) dealers providing inventory, particularly for low risk-weighted assets; and (ii) the willingness of banks to finance leveraged intermediaries who take positions in markets, so-called “funding liquidity”. In this way, the leverage ratio could make some market liquidity-related activities less attractive for a part of the banking sector and result in increased capital costs for firms with low average risk weights. But the size of any resulting effect on market liquidity will depend on a number of factors, including: the proportion of incumbents affected by a leverage ratio constraint (in aggregate, not expected to be large based on recent BCBS quantitative impact study data); the ability of less-constrained firms to expand their market share; and, to the extent that the leverage ratio increases costs for some banks, how much these costs are absorbed.
3. Aside from any costs related to these potential adjustment actions, the leverage ratio can also be expected to support market liquidity, particularly during periods of stress. First, it ensures a minimum degree of resilience at all stages in the financial cycle, making banks better able to absorb shocks, putting them in a better position to continue to support markets even in periods of heightened uncertainty. In extremis, if banks are less likely to fail then they will not rapidly withdraw services that support market liquidity. Second, there may also be an impact through banks’ own funding costs. Better capitalised banks may be more able to absorb short-term stresses and maintain financial services as their debt funding costs are likely lower in times of market-wide stress. This matters particularly in situations when equity is only available at very high cost and exactly when market liquidity-related activities may be most needed.
4. To assess the net impact of the leverage ratio on market liquidity, it is necessary to compare any costs that may result from imposing a leverage ratio requirement owing to potentially rising liquidity premia and/or quantity restrictions with the benefits. The benefits relate to (i)



curbing excessive market liquidity in times of exuberance, and (ii) greater resilience of dealer banks which improves their ability to provide market and funding liquidity, including in stressed periods. It is possible that the structure and design features of the leverage ratio requirement (e.g. minimum versus buffer) may influence how banks respond when their leverage ratio falls.

5. There is limited historical experience on which to assess how the financial system is likely to adapt and evolve in response to this kind of regulatory change alongside other concurrent regulatory changes. To quantitatively assess the costs and benefits, it would be useful to develop a partial equilibrium model adapted to the current characteristics of the EU banking sector. Some recent policy papers have discussed the costs and benefits. Dudley (2015, 2016) and Shin (2016) have emphasised the benefits of recent regulatory change for delivering robust and reliable market liquidity via banks. The Committee on the Global Financial System found that more stringent regulatory requirements have curbed dealers' risk-taking capacity but also noted that benchmarking costs arising from these curbs on dealer capacity against the cost of liquidity before the crisis is misleading, as it does not account for market changes since that time, nor banks' greater resilience to stress.
6. In addition to examining the conceptual channels by which the leverage ratio may have an impact on market liquidity, we have also drawn on information provided to the ESRB via a qualitative survey of major European market-making banks. Overall, the key messages from market-makers were that a range of regulations have an impact on their activities. They expect capital and liquidity regulations – including but not exclusively the proposed leverage ratio requirement – and market regulation such as transparency requirements, to negatively affect their profit and incentive structure in a way that would lead to some reduction or withdrawal of market-making services in the future. But market-makers also pointed out that other factors besides regulation and their own market-making activities have an impact on market liquidity. In interpreting the results of the qualitative questionnaire, it is important to remember that these are the views of the market-makers in the sample and that there are some limitations when interpreting the survey results since responses were provided in open text format and so are not always precise and easily comparable.
7. Some of the channels described in the conceptual analysis above and the survey evidence from market-makers suggest that banks which are targeting higher leverage ratios may hold smaller trading inventories or provide less secured financing than if they had not been trying to boost their leverage ratios. Banks may reduce inventories or intermediate less secured funding to achieve this effect. Alternatively, they may not increase inventories as much as they would otherwise have done, thereby potentially putting pressure on market liquidity. While it is difficult to investigate empirical evidence for EU banks at this time as there is not yet a harmonised leverage ratio solvency requirement, banks have reported that they are already adapting to an anticipated future leverage ratio requirement and the existing disclosure requirement. It is also likely that some banks have had a market incentive to improve their leverage ratios since the 2008 financial crisis when some investors had more confidence in leverage ratios than risk-weighted capital requirements. This is why a relationship may be observable in recent data and efforts were made to perform an initial quantitative analysis.
8. An empirical method was used to investigate the evidence for a causal impact of the leverage ratio requirement on banks' market liquidity-related business after the date of the initial BCBS announcement in 2009. The findings suggest that banks which needed to improve their leverage ratios to meet a 3% requirement or market expectation have been doing so in part by reducing the size of their balance sheets. This has included reducing their trading assets relative to the amount they would have held if not bound by the leverage ratio; however



neither trading assets nor repos have significantly fallen as a share of these banks' total assets since 2010. Arguably, a general deleveraging has been a desired effect of the leverage ratio for banking regulators, and it is positive for market liquidity considerations that trading and financing activities have not been reduced disproportionately as part of this process. It is important to note that these results are based on activity until 2014 only so it is possible that an effect on trading and financing activities has started to crystallise more recently, or that banks are yet to adjust their portfolios in response to the incentives created by the leverage ratio. It will therefore be important to monitor changes in these types of exposures in the future.

9. Some preliminary statistical analysis was performed to investigate the relationship between dealers' inventories and their leverage ratio position for the seven euro area banks included in the ESRB data collection. This analysis showed very little evidence of a significant relationship between the two since the start of the data series in 2014. We therefore cannot conclude that, in this sample, banks that needed to improve their leverage ratio have been reducing their inventory holdings, or that banks with higher leverage ratios have had fewer inventories. It should be stressed that this analysis and our conclusions rely on a very small sample and cannot show whether or not there is a causal relationship between dealers' inventories and their leverage ratio position.
10. It is difficult to comment currently on whether the introduction of the leverage ratio, or a particular calibration of it, is likely to significantly affect the future state of market liquidity. This preliminary analysis suggests there may be some costs associated with the leverage ratio for broker dealers, but that there are also expected to be benefits: the leverage ratio may help to ensure that banks can sustain the provision of services that are important to market liquidity, particularly taking account of stressed periods. The analysis presented in this paper should be the starting point for future and deeper theoretical and empirical investigation into whether the leverage ratio will affect market liquidity.



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