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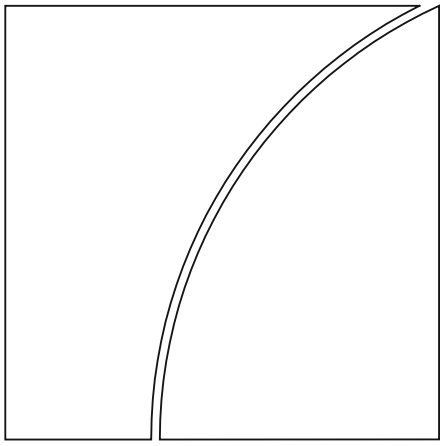

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The leverage ratio and the output floor: complementarities and overlaps

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Abstract

This paper examines analytically and empirically whether the Basel III leverage ratio (LR) and output floor (OF) requirements act as substitutes for or complements to each other and how they interact with risk-based regulatory requirements. These requirements determine banks' overall capital requirements and therefore their capacity to support credit and growth in the economy as well as their resilience to negative shocks.

A simple analytical framework maps the three requirements to a common metric, the risk-weighted asset (RWA) density, and defines regions in which either the risk-based requirements, the LR or the OF determine a bank's required capital. The framework identifies the conditions under which one backstop can substitute for the other and derives the potential change in capital from removing a binding backstop.

Publicly available data for 29 global systemically important banks (G-SIBs) over 2014–25 show that the proportion of banks for which the LR is the highest requirement increased materially alongside a broad decline in unfloored RWA densities. Yet the most constraining requirement is not necessarily stable: banks switched between LR and risk-based constraints 55 times in the period, based on annual frequency data. More generally, and in line with the conceptual analysis, the highest requirement varies significantly across banks and jurisdictions due to differences in the prevailing requirements and RWA densities. For the 13 G-SIBs currently disclosing OF data (ie those in Canada, the European Union, Japan and Switzerland), none was bound by the OF at end-2025 owing to transitional arrangements. However, under a fully phased-in 72.5% OF, six banks would be bound by the OF. Interestingly, this includes cases where the LR would not even partially reproduce the outcome of the OF constraint in its absence, highlighting the complementary nature of the two backstops.

Although both backstops constrain required capital when risk weight densities are undesirably low, they are not substitutes. Each addresses a failure that the other cannot: the LR constrains excessive leverage that risk measures might miss, while the OF constrains excessive RWA variability due to internal models by linking effective RWA to standardised approaches, preserving buffer usability and some risk sensitivity.

Contents

The leverage ratio and the output floor: complementarities and overlaps[1]

Section 1 – Introduction

The revisions to the regulatory framework for banks that followed the Great Financial Crisis (GFC), known as Basel III, aimed to improve, among other objectives, the risk sensitivity of capital requirements. However, evidence from the lead-up to the GFC also exposed the limits of risk-weighted capital requirements. Banks could report strong risk-weighted capital metrics while running high leverage, which could lead to destabilising deleveraging in downturns. To address these concerns, the initial phase of Basel III in 2010 introduced a minimum leverage ratio (LR) requirement, as a complement to the risk-weighted requirements.[2]

Authorities also found excessive variability in how banks calculated their risk-weighted assets (RWA) when allowed to do so on the basis of their own models.[3] To restore credibility in that calculation, in 2017 the final phase of Basel III introduced various restrictions on internally modelled approaches for calculating RWA. A key element of those restrictions is the output floor (OF), which limits the regulatory capital benefit that a bank using internal models can derive relative to standardised approaches.[4]

The LR and the OF serve different, complementary objectives, yet they both set floors for overall capital requirements that are binding when risk-weighted assets may be too small in relation to total exposures. They may therefore act as substitutes rather than complements, depending on a bank's portfolio and risk profile, and influence banks' risk-taking, lending practices and capital allocation. This raises an important question: whether the degree of substitution between the LR and the OF is such that a single backstop would be sufficient to achieve their objectives, meaning that the capital framework is unnecessarily complex.

These dynamics are at play today. Since its implementation in 2018, the LR has become the highest constraint for a growing number of banks – almost 40% of internationally active banks as of mid-2025.[5] The OF began to phase in from 2023 in some jurisdictions and could bind a material share of banks at the end of the transition. Meanwhile, some authorities have revised, or are considering revising, the design and calibration of the LR and/or the OF in their jurisdictions. Some industry stakeholders believe that the use of two prudential backstops and their calibration should be reconsidered.[6] Ultimately, the risk-weighted capital requirements, the LR and the OF determine banks' overall capital requirements and therefore their capacity to support credit and growth in the economy, as well as their resilience to negative shocks.

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[2] See BCBS (2014).

[3] See BCBS (2013, 2016). Unwarranted variability in RWA has also been analysed in academic literature; see eg Mariathasan and Merrouche (2014) and Behn et al (2022).

[4] See BCBS (2017).

[5] See the Interactions tab of the BCBS dashboard "High-level results and cumulative impact dashboard", available on the BIS website.

[6] See eg the responses to the European Commission's 2026 targeted consultation on the competitiveness of the banking sector by the European Banking Federation (EBF (2026)) and the Association for Financial Markets in Europe (AFME (2026)), and Arnal and Lannoo (2026).

This paper examines the interaction of the three requirements using a simple analytical framework. It then applies that framework to data for global systemically important banks (G-SIBs), the largest internationally active banks. The analytical framework in this paper extends previous work on the links between different regulatory constraints to analyse the interaction between the risk-based requirements, the output floor and the leverage requirements.[7]

The rest of the paper proceeds as follows. Section 2 sets out the analytical framework, identifies under which conditions each requirement is the highest, and assesses substitutability. Section 3 applies the framework to G-SIB data for 2014–25. Section 4 concludes.

Section 2 – Analytical framework

2.1 Three requirements brought together

The Basel III risk-based framework requires banks to hold a minimum proportion of capital against their RWA:

$$capital/RWA \geq capital\ ratio\ requirement.$$

RWA translate a bank's exposures into a risk-adjusted measure. Banks calculate RWA using standardised approaches or internal model-based approaches the supervisor has approved. While internal models should in principle deliver more risk sensitivity, they can also produce unwarranted variability across banks. Moreover, both standardised and model-based approaches can suffer from model risk, especially for low-risk exposures, where default data are scarce and requirements can become very low. To control for those risks, the Basel III framework incorporates LR and OF as two different backstops for the capital ratio requirement.

The LR has two explicit goals: to restrict the build-up of leverage in the banking sector and avoid destabilising deleveraging, and to add robustness to the risk-based requirements with a simple, non-risk based backstop measure.[8] Basel III stipulates that banks must hold Tier 1 capital of at least 3% of their leverage ratio exposure measure. The exposure measure covers on-balance sheet assets together with derivatives, securities financing transactions and off-balance sheet exposures. G-SIBs face an additional LR buffer requirement, set to 50% of their risk-based G-SIB buffer in most jurisdictions, intended to maintain the relative roles of the two frameworks.[9]

The OF has different goals: to reduce excessive variability in RWA and to improve the comparability of risk-based capital ratios.[10] It does so by preventing a bank's RWA from falling below a set percentage of the RWA the standardised approaches would produce. Specifically, a bank must calculate its floored RWA as the higher of: (i) the total RWA under the approaches it is approved to use;[11] and (ii) 72.5% of the total RWA calculated using standardised approaches only. During the transition period,

7 See eg Bank of England (2014), ESRB (2015), Fender and Lewrick (2015) and Casellina et al (2026). The latter focuses on the interaction between capital and liquidity requirements, which are not in scope for this paper.

8 See Section LEV20.1 of the consolidated Basel Framework.

9 In the United States, the standard G-SIB LR buffer has been effective only since April 2026. Until then, US G-SIBs were subject to a 2% LR buffer requirement. Other jurisdictions have also introduced additional LR buffers and add-ons such as Pillar 2 LR requirements and guidance and countercyclical LR buffers, have recalibrated minimum LR requirements and the scope of the LR exposure measure, or have applied more conservative requirements for the permissible type of capital. See Baudino et al (2026) for further details.

10 See Section CRE20.11 of the consolidated Basel Framework.

11 A bank may have supervisory approval to use internal model-based approaches for all or only certain portfolios.

the floor typically starts at 50% or 55% depending on the regional transpositions, and rises by 500 basis points every year to reach 72.5% in 2030.[12]

A common metric

The three requirements are designed differently but they ultimately constrain the same quantity, ie the RWA density that determines required capital, as shown below. Define a bank's unfloored RWA density as the ratio of its RWA to its total exposures (TE):

$$d \equiv RWA/TE.$$

Let d^{OF} denote the ratio between the minimum RWA implied by the OF and the total exposures TE, so that a bank's risk-based nominal capital requirement (C^{RB}), after the OF, is:

$$C^{RB} = RB \cdot TE \cdot \max(d, d^{OF}).$$

where RB is the applicable Tier 1 capital ratio requirement, including buffers and add-ons.[13] The minimum capital implied by the LR requirement is:

$$C^{LR} = LR \cdot TE,$$

where LR is the applicable LR requirement, including buffers and add-ons. Comparing the two gives:

$$C^{LR} \geq C^{RB} \Leftrightarrow \max(d, d^{OF}) \leq \frac{LR}{RB} \equiv d^{LR}.$$

The ratio of LR/RB, ie d^{LR}, is the RWA density below which the LR is the relevant constraint. For example, a 3% LR combined with a 10% risk-based requirement implies a minimum density of 30%. Below that density, the relevant capital requirement is independent of the riskiness of the assets. When d and d^{LR} coincide, risk-based and LR nominal requirements are equal. Therefore, required Tier 1 capital per unit of exposure can be expressed as:

$$C/TE \equiv \frac{\max(C^{RB}, C^{LR})}{TE} = RB \cdot \max(d, d^{OF}, d^{LR}).$$

All three requirements are floors on the same variable and only the highest of the three densities determines required capital. It is worth noting that d^{LR} falls as the risk-based requirement rises. Because most risk-based buffers have no LR counterpart, adding buffers to the risk-based capital ratio requirements mechanically makes the LR less likely to bind. The G-SIB buffer is the exception: set at 50% of the risk-based G-SIB buffer, it leaves d^{LR} unchanged across G-SIB buckets.[14] The capital conservation buffer, the countercyclical capital buffer (CCyB), Pillar 2 requirements and other buffers do not generally have such a counterpart.[15] Table 1 shows the range this generates.

[12] Phase-in paths differ. In Japan, the floor took effect in March 2024 at 50%, rising by 5 percentage points a year to 72.5% by 31 March 2029. In Switzerland it reached 60% in March 2025, rising to 72.5% by 2028. In Canada a 65% floor took effect in April 2023 but was paused at 67.5% in February 2025, with at least two years' notice before further increases. In the European Union, the floor was set at 50% in January 2025, rising to 72.5% by 2030.

[13] Banks must generally meet the LR requirement with Tier 1 capital. For simplicity, the analysis assumes the same for risk-based requirements. In practice, banks must meet separate CET1, Tier 1 and total capital ratios, and several buffers must be met with CET1 capital only. In addition, the formulas use the LR exposure measure as the common denominator, rather than total assets, as generally done in the literature, to facilitate comparison between the risk-based and leverage ratio requirements.

[14] With a LR requirement of 3% + b/2 and a Tier 1 risk-based requirement of 6% + b, where b is the risk-based G-SIB buffer, the implied minimum density is (3 + b/2)/(6 + b) = 50% for every bucket.

[15] In the United Kingdom, the countercyclical leverage buffer, set at 35% of the CCyB (its risk-weighted equivalent), is an exception.

In the paper, a regulatory capital constraint (ie risk-based, LR, or OF) is said to be "binding" when the corresponding capital level is the highest of the three.[16]

Minimum RWA density implied by the leverage ratio (d^{LR}) Table 1

Leverage ratio requirement (LR) (%)	Tier 1 risk-based requirement (RB) (%)					
	6	8	10	12	14	16
3	50.0	37.5	30.0	25.0	21.4	18.8
4	66.7	50.0	40.0	33.3	28.6	25.0
5	83.3	62.5	50.0	41.7	35.7	31.3

The density d^{LR} is calculated as the ratio of LR to RB.

Source: Authors' elaboration.

Mapping the boundaries

The formulation above allows the boundaries between the three requirements to be drawn in two dimensions. Graph 1.A places the unfloored RWA density d on the horizontal axis and the implied minimum density d^{LR} on the vertical axis.

The 45-degree line represents all points at which the LR and the unfloored risk-based requirements coincide (ie $d = d^{LR}$). Without the OF, every point above the line implies a binding LR requirement, and every point below it a binding risk-based requirement. The OF adds a second minimum density d^{OF}, shown on the horizontal axis. The boundary at which the LR and the floored risk-based requirement coincide is:

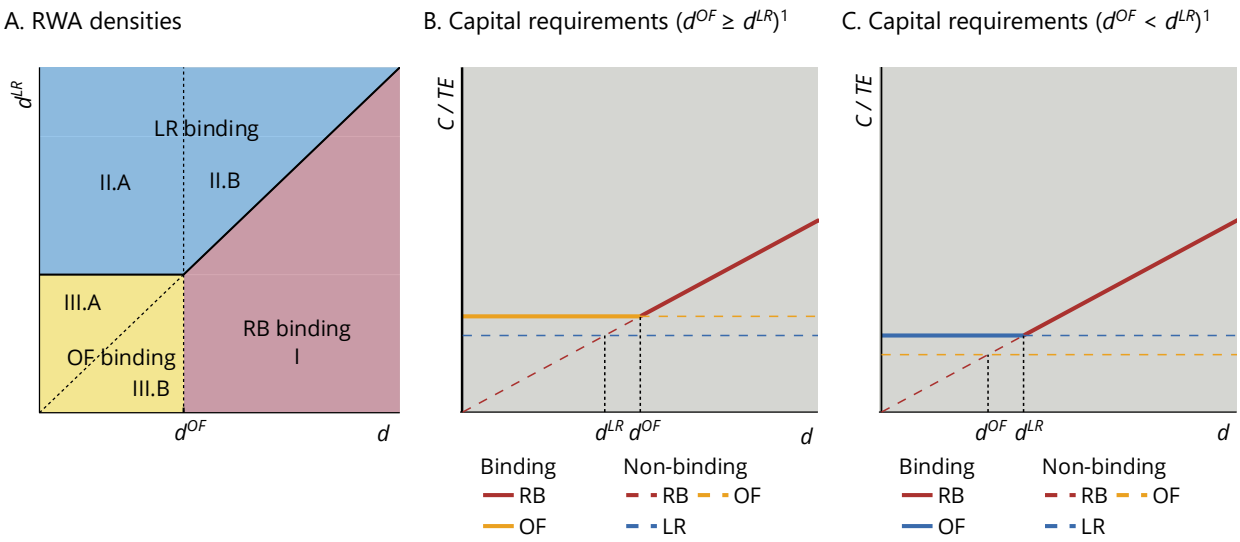
$$d^{LR} = \max(d, d^{OF}).$$

With the OF, the boundary remains along the diagonal line where the unfloored density exceeds the floored density and becomes horizontal where the OF determines effective RWA. Setting aside cases in which two requirements are equal, three outcomes are possible, corresponding to regions I, II and III in Graph 1.A.

To illustrate the implications of the requirements in terms of nominal capital level, Graphs 1.B and 1.C show the level of Tier 1 capital implied by the applicable capital requirement, as a function of the RWA density. Each graph is subdivided in two quadrants replicating the partition in Graph 1.A. In both cases, the capital requirements grow linearly, as a function of the density, when its value is above either the density implied by the OF (d^{OF}) or by the LR requirement (d^{LR}). When the density is below the higher of the two, the applicable density is the one implied by that constraint and is fixed at that level.

[16] In the literature, the binding capital constraint is usually intended as the one for which the actual and required capital levels are closest. For ease of presentation, and as this paper does not discuss the distance between actual and required levels of capital, the alternative concept of bindingness is used.

Interactions between leverage ratio, output floor and risk-based requirements Graph 1



d = unfloored RWA density; d^{OF} = floored RWA density, d^{LR} = minimum density implied by the leverage ratio. Panel A: diagonal line is the 45 degree line. Panel B and C: the red line represents the unfloored risk-based requirements ($RB \cdot d$).

[1] Tier 1 capital requirements per unit of exposure as a function of the unfloored RWA density.

Source: Authors' elaboration.

2.2 When does each requirement bind?

Because required capital equals $RB \cdot \max(d, d^{OF}, d^{LR})$, identifying the highest requirement reduces to a single comparison among the three densities. This section takes each region in turn and asks what would change if the higher backstop were removed (Table 2).

Bindingness regions Table 2

Region	Conditions	Binding requirement	Binding without the output floor	Binding without the leverage ratio
I	$d \geq \max(d^{OF}, d^{LR})$	Risk-based	Risk-based	Risk-based
II.A	$d^{LR} \geq d^{OF} > d$	Leverage ratio	Leverage ratio	Output floor
II.B	$d^{LR} > d \geq d^{OF}$	Leverage ratio	Leverage ratio	Risk-based
III.A	$d^{OF} > d^{LR} > d$	Output floor	Leverage ratio	Output floor
III.B	$d^{OF} > d \geq d^{LR}$	Output floor	Risk-based	Output floor

Where two densities coincide, the requirements are identical. For these cases, the following labelling convention is used: d takes precedence over both backstops, and d^{LR} takes precedence over d^{OF}.

Source: Authors' elaboration.

Removing a binding backstop lowers the required capital to the level set by the next-highest density, except for region I, where no backstop is binding (Table 2). Per unit of exposure, the fall equals the risk-based requirement, RB, multiplied by the distance between the two densities. This distance measures how much of the capital required by the highest requirement would be reproduced by the remaining constraints. However, a narrow distance does not necessarily imply that the underlying objective of the backstop that is removed is substitutable. Each region is examined in turn below.

Region I – risk-based requirements binding

In region I, neither backstop is active. This describes a bank with moderate to high risk-weighted portfolios and relatively conservative RWA models. The unfloored density exceeds the minimum implied by the LR, which limits concerns about excessive leverage. It also exceeds the floored density, so modelled RWA are not excessively low relative to standardised RWA. Removing either backstop changes nothing.

Region II.A – leverage ratio binding, output floor would bind in its absence

In region II.A, both the floored and unfloored densities are below the minimum implied by the LR. This describes a bank with relatively low risk-weighted portfolios and relatively aggressive RWA models. The LR binds and constrains leverage directly. Removing the LR requirement would lower required capital and switch the constraint back to the risk-based framework. Required capital would fall by $RB \cdot (d^{LR} - d^{OF})$ per unit of exposure. The OF could work as an (imperfect) substitute for the LR, acting as a more moderate backstop while retaining some risk sensitivity, because it tracks standardised risk weights rather than ignoring risk altogether.

Region II.B – leverage ratio binding, risk-based requirements would bind in its absence

In this region, the LR binds and the unfloored density is lower than the minimum density implied by the LR. This describes a bank with relatively low risk-weighted portfolios and relatively conservative internal models. Removing the LR would make requirements fall back to the bank's own modelled RWA (a reduction equal to $RB \cdot (d^{LR} - d)$), leaving limited protection against excessive leverage. This case is particularly relevant in cases of potentially material deficiencies in the standardised approach (SA), such as when SA risk weights are not aligned with the true riskiness of the exposure, or are very low or zero (eg in the case of certain sovereign and public sector exposures);[17] this may result in an excessively low floored density, making the OF less effective.[18]

The contrast between subregions II.A and II.B is an important result. In region II.A, the backstops overlap, albeit imperfectly, but in II.B they do not. Whether the LR and the OF act as (imperfect) substitutes therefore depends on which subregion a bank occupies – something a regulator cannot control and which the bank can influence.

Region III.A – output floor binding, leverage ratio would bind in its absence

In region III.A, the OF binds and the unfloored density falls below the minimum density implied by the LR. This describes a bank with relatively low risk-weighted portfolios and relatively aggressive internal models. Removing the OF would make the LR the binding constraint, so a backstop remains in place. Required capital would fall by $RB \cdot (d^{OF} - d^{LR})$ per unit of exposure (Graph 1.B). This substitution would be less effective the greater the distance between the floored and the LR-implied densities. This case also illustrates that, in the presence of an LR constraint, the removal of the output floor would not necessarily increase the risk sensitivity of capital requirements.

Region III.B – output floor binding, risk-based requirements would bind in its absence

In region III.B, the OF binds and both floored and unfloored densities exceed the minimum implied by the LR, so leverage is not a concern. This describes a bank with moderate to high-risk portfolios and relatively conservative internal models. Removing the OF would leave no backstop against excessive RWA variability. The LR cannot substitute for the OF because the unfloored density is already high enough to keep the LR

[17] See sections CRE20.7–14 of the Basel Framework.

[18] Moreover, because the floor applies to aggregate RWA, a bank may be able to offset high floored RWA for portfolios where models are aggressive with portfolios where modelled RWA are closer to those under the SA.

slack. Required capital would fall by $RB \cdot (d^{OF} - d)$ per unit of exposure, back to the level implied by the bank's own models (Graph 1.B).

The contrast between regions III.A and III.B mirrors the pattern of regions II.A and II.B: in region III.A, the backstops overlap, albeit imperfectly, but in III.B they do not.

Limitations

Some qualifications apply to the discussion above. First, the framework assumes a static balance sheet, but in practice banks would re-optimise in response to a change in requirements. Removing the LR may incentivise balance sheet growth, particularly when funding costs are low. Removing the OF would allow more aggressive internal models and, if the LR becomes the binding requirement, a larger proportion of high-risk exposures since the higher risk would not trigger additional required capital until the risk-based RWA density exceeds the LR-implied minimum density. Both responses may move a bank across regions with the effects described earlier. Second, the analysis abstracts from management buffer considerations. Third, while the Basel III requirements are meant to be applied at the consolidated level, some jurisdictions require requirements to be met also at subsidiary/legal entity level, which may drive some capital planning decisions. Fourth, the analysis assumes that all requirements are formulated in terms of Tier 1 capital, while some requirements must be met exclusively with Common Equity Tier 1 capital. Finally, the framework abstracts from other constraints such as requirements derived from stress tests, resolution requirements and liquidity standards, as well as market-based constraints, which may play a material role.[19]

2.3 Substitutes or complements?

Both backstops can be seen as constraints on the required capital impact of low densities. In this narrow arithmetic sense, they can be substitutes: only the tighter of the two constraints ever determines required capital. Moreover, at least in some cases (regions II and III.A), the removal of one constraint, when binding, would make the other one binding. However, this should not automatically lead to the conclusion that the two constraints could converge to a single one. Four considerations are relevant in that regard.

The two requirements transmit differently

The OF raises RWA, scaling the entire risk-based approach proportionately (including minima and buffers) while the LR replaces the risk-based stack with a single floor on Tier 1 capital. Two consequences follow. First, for a bank in region II.A or II.B, capital buffers may become unusable during a downturn.[20] Thus, releasing the CCyB frees no capital, making this instrument ineffective from a macroprudential point of view. Second, the marginal capital cost of an additional exposure no longer varies with its risk. This creates a well documented incentive to shift towards riskier assets.[21] In contrast, a bank constrained by the OF faces neither problem. Its buffers remain usable and its marginal capital costs follow standardised risk weights, thus retaining the bank's risk sensitivity, even if only partially.

Non-binding backstops can still be relevant

A requirement that is not binding at a certain point may still provide for a desired risk coverage. For a bank whose floored density is below the minimum implied by the LR, but above the unfloored density, the OF

[19] See Casellina et al (2026) for a study on the interaction between capital and liquidity requirements. Stress tests may determine the size of specific capital buffers across jurisdictions, such as the stress capital buffer in the United States, the Pillar 2 guidance in the European Union and Pillar 2B in the United Kingdom, thus affecting the relative bindingness of the various capital requirements. The latter may also be affected by TLAC requirements, which are set both in relation to RWA and exposure measures.

[20] See eg Pfeifer (2020) and Leitner et al (2023).

[21] See Acosta-Smith et al (2024) and Choi et al (2020).

still raises effective RWA, lowers reported risk-based ratios, raises buffer requirements in nominal terms, moves the distribution restriction trigger, and raises the risk-weighted leg of TLAC or other resolution requirements. Moreover, the modelling discipline imposed by the OF remains in force – replacing the OF with the LR would remove that discipline, rather than relocate it.

No single calibration can bridge the gap

Hypothetically, an authority that wanted to retain only one backstop but escape the trade-off between constraining leverage and constraining RWA variability could set $d^{\mathrm{OF}} = d^{LR}$ so that the two constraints coincide and their level matches the authority's priorities. However, since the minimum Pillar 1 LR requirement is the same across all banks but the OF requirement is bank-specific and varies over time, equalising the two densities for one bank would necessarily mis-set them for the other banks.

This approach highlights the limitation of using the LR as a substitute for the OF when the latter binds (ie in region III.B). If the authority set $d^{LR} = d^{\mathrm{OF}}$, every bank with an unfloored density below the new threshold would become constrained by the LR, including banks whose modelled and standardised RWA are already sufficiently close, and which the OF was not intended to bind. The framework would then restrict more banks and use a less risk-sensitive instrument.

The binding constraint is not stable

The regions are not fixed properties of a bank. Unfloored densities under internal ratings-based approaches tend to decline in upswings, as default probabilities evolve with the business cycle, while standardised densities are designed to be less sensitive to that cycle. As a result, a bank would tend to move rightward in Graph 1.A during a downturn, and the risk-based requirement might take over as the dominant requirement.

Such adjustments over the business cycle highlight an element of procyclicality in the relative bindingness of the three requirements. An economic contraction that deteriorates portfolio quality tends to narrow the gap between IRB- and SA-based RWA, and vice versa in an expansion. This mechanically alters the degree to which the output floor binds relative to the rest of the risk-based framework, independently of any change in modelling practice. Conversely, the LR requirement does not respond to the cycle at all.[22] However, given that the OF's bindingness is itself partly cyclical, the constraint that ultimately prevails vis-à-vis the leverage ratio will also carry a cyclical component.

In the literature, the impact of the business cycle on the relative bindingness of the LR is demonstrated also by Gambacorta and Karmakar (2018), who reach the same conclusion from a general equilibrium model: the LR is tight in booms and slack in busts.

Section 3 shows how often G-SIBs have crossed the boundaries in practice. Such variability of the binding constraint over time would be a sign that the backstops are acting as intended.

Putting it all together

As a whole, these considerations suggest that the LR and the OF are not substitutes. They coincide in effect only for banks in certain regions, only for a calibration-dependent subset of banks and only in the level of required capital – not in how the requirement transmits through the framework and provides specific incentives to banks. Each addresses a failure that the other cannot detect: the LR catches excessive leverage that any risk measure might miss and the OF catches aggressive risk weights that the LR is too blunt to distinguish. The two backstops are therefore largely complementary from a conceptual point of view. Section 3 examines how much this matters in practice.

[22] Some jurisdiction-specific LR buffer requirements, such as the LR Pillar 2 requirement in the European Union and the countercyclical leverage buffer in the United Kingdom, would be affected by changes in the business cycle.

Section 3 – Evidence from G-SIBs

This section applies the framework described above for the interaction between the three requirements to G-SIBs and investigates which of the bindingness regions described above have been relevant over the last decade. It uses a bank-level database of capital requirements constructed from annual reports, Pillar 3 disclosures and other public reports.[23]

3.1 Data and approach

The G-SIB full sample comprises the 29 banks identified by the Financial Stability Board in November 2025 and covers annual financial year-end observations from 2014 to 2025. The analysis uses a constant sample of banks throughout, irrespective of when each bank first entered the G-SIB list. The starting point reflects both data availability and the early implementation of Basel III requirements.

The database captures the bank-level components of the risk-based and leverage ratio requirements. Throughout the analysis, RB and LR refer to the full applicable Tier 1 requirements, including relevant regulatory add-ons and buffers, such as Pillar 2 requirements in the European Union and Pillar 2A in the United Kingdom, but excluding non-binding buffers (Pillar 2 guidance in the European Union and Pillar 2B in the United Kingdom, for which bank-level data are not publicly available and, for consistency, the Domestic Stability Buffer in Canada).[24]

For consistency with the analytical framework described in Section 2, the denominator to derive RWA densities is the total leverage ratio exposure measure applicable to each bank, rather than total assets, which are more commonly used to derive this ratio.[25]

The empirical analysis of the OF focuses on the 13 G-SIBs that published the necessary end-2025 disclosures: seven in the European banking union, two in Canada, one in Switzerland and three in Japan. This smaller sample allows the pre-floor RWA density and the density implied by the fully phased-in OF to be compared directly.[26] The wider 29-bank sample is used to examine the historical interaction between the LR and risk-based requirements.

In the analysis, the granular treatment of applicable requirements allows for a more accurate study than possible in simplified exercises which omit Pillar 2 requirements or use only selected buffers. Such omissions tend to make the LR appear more important relative to risk-based requirements. The analysis also applies the actual jurisdictional phase-in arrangements where relevant, rather than assuming a uniform Basel implementation timetable.

[23] These sources are not published in a harmonised format and are often not available in machine-readable form, requiring substantial manual collection and processing.

[24] The Domestic Stability Buffer in Canada is a non-binding risk-based buffer that applies to all domestic systemically important banks, including the two Canadian G-SIBs. As of end-2025, it was set to 3.5% of RWA.

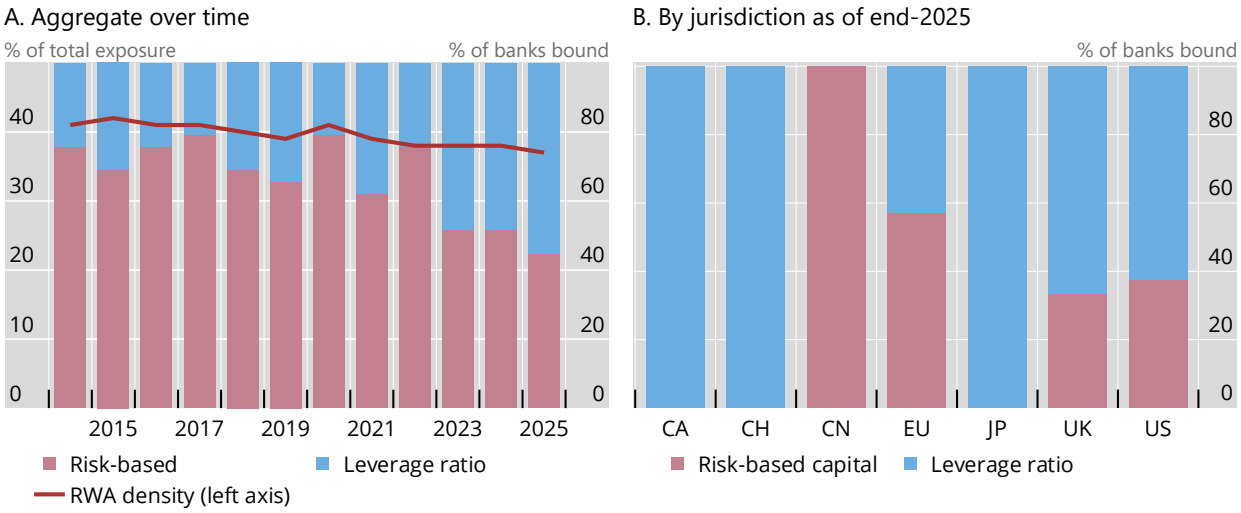
[25] See footnote 13. This implies that central bank reserves are not included in the denominator for banks in jurisdictions that exclude those assets from the leverage ratio exposure measure for the periods in which those exclusions were applicable (eg temporary exclusions due to the Covid-19 pandemic, or permanent exclusions in the United Kingdom and Japan).

[26] In Japan, the floor became effective in March 2024 at 50%, rising by 5% annually to reach 72.5% by 31 March 2029. In China, the floor was implemented at 72.5% in January 2024, without a transition phase. In Switzerland, it reached 60% in March 2025, rising to 72.5% by 2028. In Canada, a 65% floor became effective in April 2023, but was paused at 67.5% as of February 2025, with at least two years' notice before further increases. In the European Union, the floor was set to 50% in January 2025, rising to 72.5% by 2030. In the United Kingdom, the implementation will start in January 2027 at 60%, reaching 72.5% in 2030. In March 2026, US authorities published for consultation their latest proposals for the implementation of the final Basel III rules. The proposals do not envision an output floor but instead remove the use of internal models for credit and operational risk, and retain it for market risk for the largest banks.

3.2 The leverage ratio has become the most constraining requirement

The share of G-SIBs bound by the LR has increased materially over time (Graph 2.A). At the end of 2014, the LR was the binding requirement in less than 25% of G-SIBs, all of them in the United States.[27] By end-2025, it bound more than 55%. The shift is not monotonic: the share fell in 2017, 2020 and 2022. The pattern varies sharply across jurisdictions (Graph 2.B). At end-2025 the LR bound every G-SIB in Canada, Japan and Switzerland, five out of eight in the United States and two out of three in the United Kingdom. It bound three of the seven G-SIBs in the European Union and none of the five in China.

Share of G-SIBs constrained by Tier 1 risk-based and leverage ratio requirements[1] Graph 2



CA = Canada; CH = Switzerland; CN = China; EU = European Union; JP = Japan; UK = United Kingdom; US = United States.

[1] Based on the higher nominal requirement at financial year-end, including minima, buffers and add-ons but excluding non-binding buffers and guidance (ie the Domestic Stability Buffer in CA, Pillar 2 guidance in the EU and Pillar 2B in the UK). For US G-SIBs, the Collins floor is applied: the nominal risk-based requirement equals the higher of the standardised approach and advanced approach requirements. LR requirements applied from 2014 in the US, 2015 in Canada and China, 2016 in Switzerland and the UK, 2019 in Japan and 2021 in the EU. G-SIB LR buffers applied from 2016 in the UK (phase-in completed 2019), 2017 in Switzerland (phase-in completed 2021), 2018 in the US (as part of the enhanced supplementary leverage ratio introduction), 2023 in the EU, Canada and Japan, and 2024 in China. RWA density is defined as the ratio of RWA to the leverage ratio exposure measure.

Sources: Banks' disclosures; S&P Capital IQ; authors' calculations.

The observed increase has been driven by two forces. First, the unfloored RWA density has fallen: the average density across the 29 G-SIBs in the sample fell from 40.5% in 2014 to 36.8% in 2025, with most banks and jurisdictions recording a decline over time (Graph 3.B).[28] This was partly related to a de-risking by most banks when facing tighter requirements, and partly reflecting the expansion of central banks' balance sheets since 2014, particularly during the Covid-19 pandemic. As reserves accumulated on banks' balance sheets, they mechanically increased banks' LR exposure measures while decreasing their RWA density, since central bank reserves carry a 0% risk weight, tightening the LR requirements.

[27] The United States was also the only jurisdiction in the sample to apply a LR requirement to its G-SIBs in 2014. Basel LR requirements applied from 2015 in Canada and China, 2016 in Switzerland and the United Kingdom, 2019 in Japan and 2021 in the European Union.

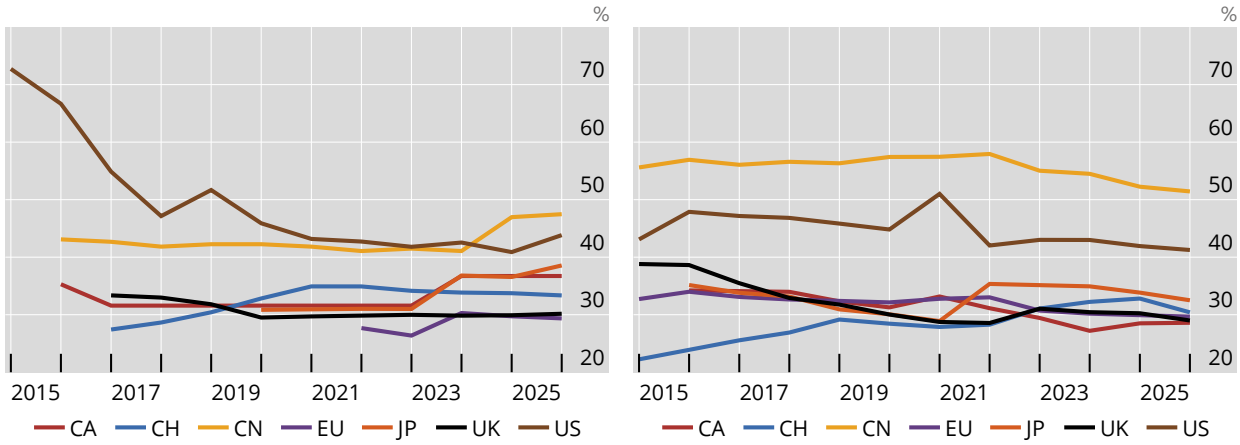
[28] See Baudino et al (2026) for a discussion of the evolution of RWA densities over the sample period. Possible drivers of a reduction in risk-weights are also discussed in Bank of England (2025, Box C): for UK banks, about half of the decline between 2016 and 2025 was the shift in banks' portfolios towards lower risk-weighted asset classes. Other factors were the decline in the average risk weight within different asset classes and the fall in operational, market and credit valuation adjustment risk relative to the size of banks' balance sheets. Similar drivers may have affected the risk weights of other banks over the same time period.

Prudential authorities responded in two ways. All G-SIB jurisdictions except China granted temporary exclusions of central bank exposures from the LR exposure measure during the pandemic, which materially reduced the share of banks that would have been constrained by the leverage ratio during that period.[29] The expiry of these measures reversed the effect, leading to a material decrease in G-SIBs' leverage ratios.[30] Other jurisdictions permanently excluded central bank reserves from the LR exposure measure and applied a one-off recalibration of the minimum LR (the United Kingdom in 2016, well before the pandemic, and Japan in 2024, transitioning from temporary exclusions; see the box).

The second driver is the additional leverage requirements which have been introduced for G-SIBs and, in some jurisdictions, under Pillar 2.[31] These additional requirements might have increased d^{LR}, even though risk-based buffers have grown over the same period. The net effect is mixed across banks, with G-SIBs in the United States and United Kingdom experiencing an average decline in d^{LR} over the years, and banks in other jurisdictions showing an average increase (Graph 3.A, and Table A.3 in the Annex).

Evolution of RWA densities[1]

G-SIBs, country-average — Graph 3



[1] The minimum RWA density d^{LR} is defined as the ratio of the leverage ratio and the Tier 1 risk-based ratio requirement. RWA density is defined as the ratio of RWA to the leverage ratio exposure measure.

Sources: Banks' disclosures; authors' calculations.

Disaggregating the results by banks highlights material differences across banks and jurisdictions which may drive some of the observed differences in LR bindingness. At end-2025, applicable leverage requirements range from about 3.5 to 5%, and risk-based requirements from about 9.5 to 15% (Graph 4.A). The resulting d^{LR} varies from roughly 27% to above 52% across the sample. Two banks with identical portfolios and RWA density can therefore sit in different regions (Graph 4.B). Differences in the calculation

[29] See Corrias (2021). The analysis shows that without the exclusions the share of G-SIBs bound by the LR as of end-2020 would have increased from 20% to 50%.

[30] See BCBS (2022). The expiration of the Covid-19 exclusions led to an average 10% increase in G-SIBs' LR exposure measure and a 46 basis point average decrease in their LR between end-2020 and June 2021.

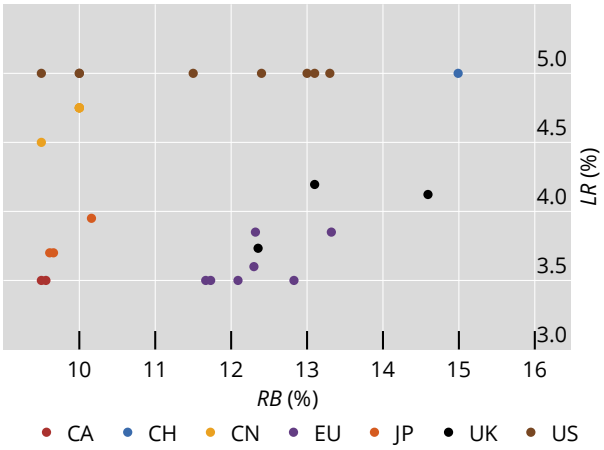
[31] For instance, the LR G-SIB buffer (and the enhanced supplementary LR (eSLR) in the United States), Pillar 2 requirements or a LR CCyB buffer in some jurisdictions. In the United States, the eSLR requirement, including the eSLR buffer, has applied since 2018. G-SIB leverage ratio buffers have applied since 2023 in the European Union, Canada and Japan; since 2024 in China; since 2017 in Switzerland (phase-in completed in 2021); and since 2016 in the United Kingdom (phase-in completed in 2019).

of RWA, which can yield materially different RWA densities for similar portfolios, can also play a role in the bindingness of one constraint over the others.[32]

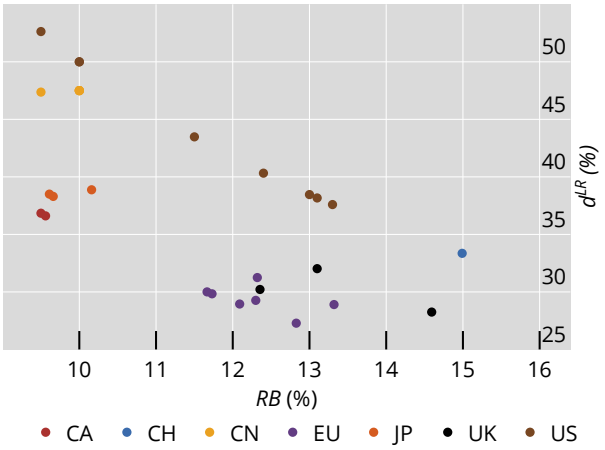
Leverage ratio, Tier 1 risk-based requirements and LR-implied minimum RWA density[1]

G-SIBs, end-2025 Graph 4

A. Leverage and risk-based ratio requirements



B. Risk-based requirements and minimum RWA density



CA = Canada; CH = Switzerland; CN = China; EU = European Union; JP = Japan; UK = United Kingdom; US = United States.

[1] The minimum RWA density d^{LR} is defined as the ratio of the leverage ratio and the Tier 1 risk-based ratio requirement. Risk-based requirements include minima, buffers and add-ons but exclude non-binding buffers and guidance (ie the Domestic Stability Buffer in CA, Pillar 2 guidance in the EU and Pillar 2B in the UK).

Sources: Banks' disclosures; S&P Capital IQ; FSI calculations.

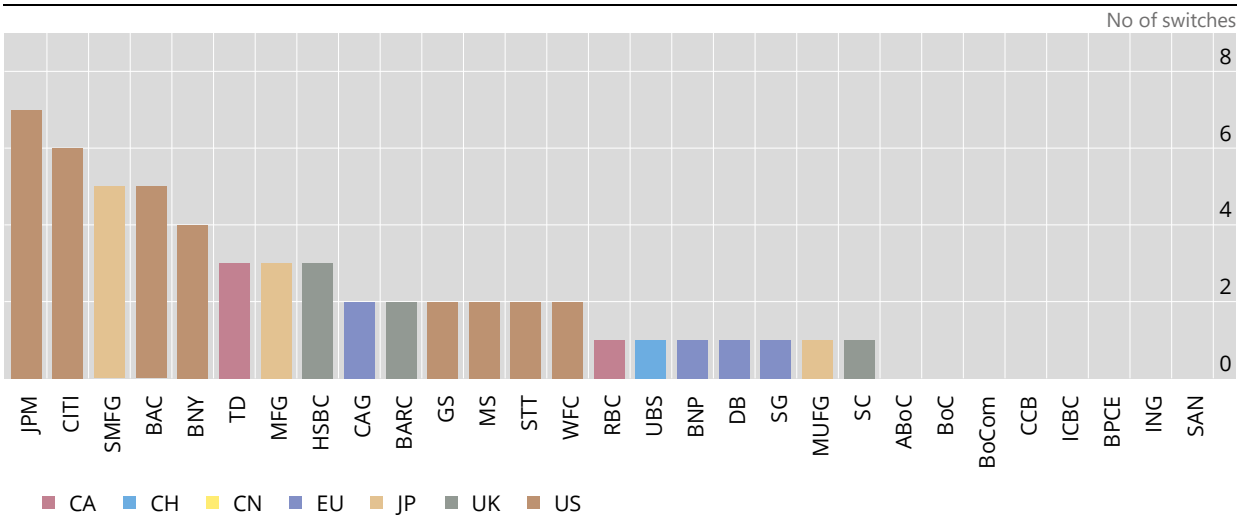
Switching between constraints

Bank-level data over time reveal a feature that aggregate shares hide: banks move between constraints repeatedly (Graph 5). Across the 29 banks and 11 year-on-year transitions, the binding requirement changed 55 times. JPMorgan switched seven times, Citigroup six and Bank of America and Sumitomo Mitsui five times each. Only eight banks never switched: three in the European Union and all five in China. The frequency of switches is likely to be higher when considering quarterly or monthly data. While the switches are partially driven by the phase-in of the LR requirements, the trend is not monotonic for all banks (Table A.2 in the Annex).

[32] See eg Baudino et al (2026) for a discussion of comparability in capital requirements for G-SIBs across jurisdictions.

Switches between Tier 1 risk-based and leverage requirements[1]

Based on year-end values between 2014 and 2025 Graph 5



CA = Canada; CH = Switzerland; CN = China; EU = European Union; JP = Japan; UK = United Kingdom; US = United States.

[1] Changes in the most binding nominal requirement including minima, buffers and add-ons but excluding non-binding buffers and guidance (ie the Domestic Stability Buffer in CA, Pillar 2 guidance in the EU and Pillar 2B in the UK). Full names and acronyms for the G-SIBs are provided in Table A.1.

Sources: Banks' disclosures; S&P Capital IQ; FSI calculations.

Although definitive conclusions cannot be reached based on the limited sample, frequent switching between the risk-based and the LR constraints could speak to banks optimising to be near the boundary and is consistent with the backstop nature of the latter. Otherwise, the LR constraint could be considered as either irrelevant – if it were never binding – or overly stringent – if it always dictated actual capital requirements, regardless of the evolution of RWA. Even if a bank's capital requirements were determined by the risk-based requirements for some time, the possibility of a switch to a binding LR may act as a deterrent to particularly aggressive modelling of risk weights.

3.3 Adding the output floor

This section applies the analytical framework set out in Section 2 to the 13 G-SIBs that currently disclose OF figures. As of end-2025, under transitional arrangements, four of the 13 banks sit in region I and are constrained by the risk-based requirement (Graph 6.A). The remaining nine sit in region II.A, constrained by the LR. The OF, which is not yet fully phased-in, binds none of them.

Applying the fully phased-in 72.5% OF changes the classification of several banks. For one bank, the unfloored risk-based density is above the other two under both the transitional and fully phased-in OF, so it remains in region I (the filled-in diamond in Graph 6.A); while six banks that are bound by the LR remain in region II.A (blue circles). For the remaining six banks, the OF becomes the binding requirement (yellow circles). Three banks fall in region III.A: without the OF, the LR would have constrained them, so the OF replaces a backstop that would have delivered a less risk-sensitive floor to capital requirements. The other three fall in region III.B, where the LR would offer no substitution for the OF. Put differently, the fully phased-in OF is providing a backstop to capital requirements that the LR would not at least partially replicate for roughly one bank in four in this sample. While that is a small and partial sample, since the Chinese, US and UK G-SIBs, as well as non-G-SIBs, are absent, and the omitted jurisdictions include cases where the LR requirement is currently the most binding, it already shows that region III.B might be applicable to a non-negligible proportion of banks.

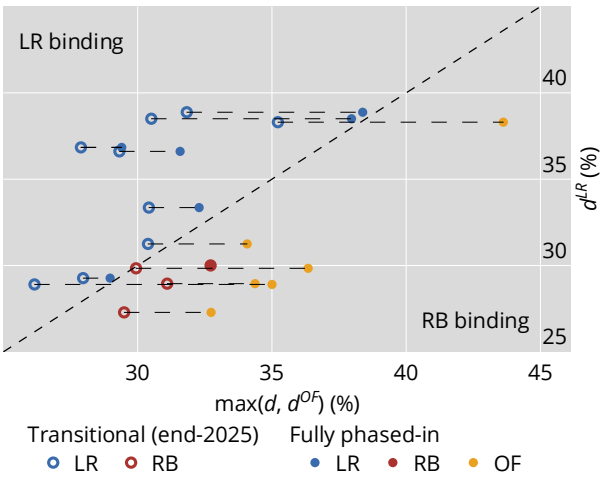
Counting banks by region establishes how relevant each constraint is, but it does not establish how well one backstop could stand in for the other. That depends on the distance between the implied densities. Where d^{OF} and d^{LR} are close, removing one backstop changes required capital little. Where they are far apart, the substitution is materially imperfect, in the direction described in Section 2.

Graph 6.B shows the dispersion across the three relevant risk densities (with the fully phased-in OF) for each of the 13 G-SIBs. The banks are first grouped by region and then by the absolute distance between d^{OF} and d^{LR}. First, the dispersion between the highest and lowest of the three densities is wide for most banks, highlighting the relevance of at least one backstop for those banks. Second, the distance between d^{OF} and d^{LR} is substantial for more than half of the banks, including several banks in regions II.A and III.A. In those regions, while the two backstops could partially substitute for each other, that distance would make the substitution highly imperfect. Third, the presence of several banks in region III.B, where the two backstops cannot act as substitutes, confirms that the two backstops perform distinct functions in real life.

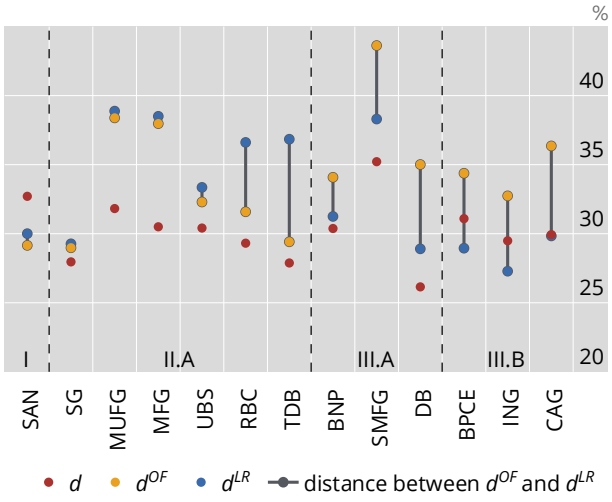
Interaction of leverage ratio, output floor and Tier 1 risk-based requirements[1]

G-SIBs from Canada, the European Union, Japan and Switzerland; end-2025 Graph 6

A. Applicable RWA density and binding constraint



B. RWA densities (fully phased-in output floor)



d = unfloored RWA density; d^{OF} = floored RWA density; d^{LR} = minimum density implied by the leverage ratio.

[1] Sample of banks is limited to G-SIBs which publish Pillar 3 output floor disclosures as of end-2025, which are the seven G-SIBs in the European Union, the two G-SIBs in Canada, one G-SIB in Switzerland and the three G-SIBs in Japan. No bank is constrained by the output floor as of end-2025 due to transitional arrangements; six banks would become constrained by a fully phased-in output floor requirement. See footnote 26 for a description of the OF transitional arrangements across jurisdictions.

Sources: Banks' disclosures; S&P Capital IQ; authors' calculations.

Developments in the leverage ratio and output floor requirements across jurisdictions

Leverage ratio

Concerns about the LR's bindingness over the risk-based requirements started to emerge early on due to the expansion of central bank reserves after 2014. In 2016, the Bank of England permanently removed these reserves from the LR computation to avoid hindering the monetary policy transmission; in exchange, it raised the LR requirement from 3% to 3.25% to maintain the same level of capital at the time (Bank of England (2025)). In Japan, in 2022, the temporary exclusion of central bank reserves in response to the Covid-19 pandemic was retained, together with an increase in the required leverage ratio to 3.15% (3.20% for G-SIBs) (JFSA (2022)).

More recently, revisions or proposals have emerged in the United States, European Union and United Kingdom. In the US, since April 2026 the applicable LR G-SIB buffer is no longer a fixed 2% add-on to the 3% minimum LR requirement; instead, the LR G-SIB buffer is set to 50% of the risk-based Basel III G-SIB surcharge, which results in a lower surcharge and is in line with international practice (Federal Register (2026a)).

In the EU, the European Commission issued a communication in July 2026 outlining regulatory reform proposals that will be formalised in the following years. Among them is the proposal to remove Pillar 2 capital requirements related to the LR (European Commission (2026)).

In the UK, the Bank of England announced in July 2026 its intention to consult on revisions to the LR requirements (Bank of England (2026)). This includes removing the UK-specific Countercyclical Leverage Buffer; increasing the calibration of the LR surcharge for systemic banks (the Additional Leverage Ratio Buffer) from 35% to 50% of a bank's risk-based systemic add-on (either the G-SIB surcharge or the surcharge for other systemically important banks), in line with international standards; and replacing the 3.25% minimum LR requirement with a 3% minimum plus a 0.25% releasable buffer (while retaining the exclusion of central bank reserves).

Output floor

While the calibration of the OF has long been contentious across Basel jurisdictions, the debate has recently re-intensified amid heightened sensitivity to cross-border level-playing-field issues and as implementation draws near or began in some jurisdictions, with some authorities signalling openness to a softer approach.

In the EU, the OF became effective in 2025, set at 50% of RWA under the standardised approach, gradually increasing until its final level of 72.5% in 2030. EU banks are granted various reliefs during the transition, including a 125% cap on the additional capital stemming from the OF, and lower standardised risk weights for mortgages and unrated corporate exposures. In its 2026 Communication the European Commission noted its intention to introduce proposals regarding the output floor and its treatment of mortgage and unrated corporate exposures, as well as its interaction with other elements of the prudential framework (European Commission (2026)).

In the UK, the implementation of Basel III was delayed to January 2027 while shortening the transitional period to meet full implementation of the output floor by 2030. At the same time, the Prudential Regulation Authority introduced some deviations to the calculation of standardised risk weights, including those for SME, unrated corporates and mortgage lending, which also affect the calculation of the output floor (Evans (2024)).

In Canada, in early 2025 the regulator decided to freeze the OF at 67.5% and defer further increases indefinitely, due to uncertainty about full implementation of Basel III in other jurisdictions (OSFI (2025)).

In the US, large banks have long been subject to the "Collins floor", akin to an output floor, using a dual-stack framework that requires calculating capital under both standardised and internal models approaches and applying the more binding result. Under proposals published in 2026, the dual stack would be removed and, rather than adopting an output floor, risk weights would be determined using standardised approaches for all exposures, except for market risk, where internal models could continue to apply (Federal Register (2026b)).

Some authorities have drawn attention to the interaction between the OF and the risk-based requirements. To reduce cases of possible double-counting of risks once the OF becomes binding, the European Banking Authority introduced temporary adjustments to Pillar 2 requirements for a bank that first becomes bound by the OF (EBA (2025)). In a similar vein, the Bank of England recognised that improved risk measurement under Basel III, such as the introduction of the OF, warranted a reduction in the target Tier 1 ratio by 100 basis points, to 13%.

Section 4 – Conclusions

This paper develops an analytical framework to assess how the LR and the OF requirements interact as backstops to risk-based capital requirements, and applies it to G-SIBs' data over 2014–25.

The LR and the OF provide complementary safeguards. The LR floor requires capital at a minimum RWA density, directly constraining leverage, but, when binding, reduces risk sensitivity and potentially impairs buffer usability, for example when buffers such as the CCyB are released. The OF constrains excessive RWA variability due to internal models by linking effective RWA to standardised approaches, preserving buffer usability and some risk sensitivity. The analytical "bindingness regions" developed in this paper confirm the limited substitutability among the three sets of requirements.

Data show that the bindingness has shifted towards the LR over time and is heterogeneous across jurisdictions. The LR bound less than 25% of G-SIBs in 2014, but this share rose to almost 60% by end-2025, alongside a broad decline in unfloored RWA densities. At end-2025, the LR bound all G-SIBs in Canada, Japan and Switzerland, most G-SIBs in the United States, almost half in the European Union and none in China. The minimum RWA density implied by the LR varied widely, reflecting differences in LR and risk-based ratio requirements across banks and jurisdictions.

In principle, a backstop which generally remains the highest requirement for extended periods may signal inadequate calibration and insufficient risk sensitivity in capital requirements. However, the analysis shows that, despite an overall increase over time, the bindingness of the leverage ratio is not stable over time. G-SIBs switched between LR and risk-based binding constraints 55 times between 2014 and 2025 according to annual frequency data, with several banks switching five to seven times (higher-frequency data would probably reveal further intra-annual switches). This pattern is consistent with the intended backstop role of the LR, the cyclicality of model-based RWA and evolving buffer stacks.

The role of the OF is expected to grow as it phases in. Of the 13 G-SIBs with OF disclosures (those in Canada, the European Union, Japan and Switzerland), none was bound by the OF at end-2025, owing to transitional arrangements. Assuming a fully phased-in 72.5% OF, six would become bound: three banks in the region where the LR would otherwise bind and three in the region where risk-based requirements would otherwise bind. Therefore, for roughly one in four banks in this sample, the LR would not replicate the OF's constraint, not even partially. While the analysis is necessarily partial as the omitted jurisdictions include cases where the LR requirement is currently the most binding, it highlights the complementary nature of the two backstops.

At the same time, heterogeneous calibrations of the minimum RWA density implied by the LR (due to different LR and risk-based capital ratio requirements), different OF phase-ins and other jurisdiction-specific choices imply that different constraints may bind for banks with similar risk profiles, underscoring the need for transparent disclosures and continued monitoring to preserve cross-border comparability and identify any unintended incentive effects.

To better understand the drivers of cross-country and cross-firm differences, a deeper analysis of differences in relevant risk densities would be warranted. For instance, the analysis could shed light on whether differences in densities could be explained by differences in portfolio allocation across asset classes or in average risk weights within asset classes. A second extension could further explore the impact of macroeconomic conditions on the binding constraints and how these may change over different phases of the business cycle. Distinguishing the impact of common macroeconomic factors across banks versus idiosyncratic factors affecting only specific firms could be helpful to the prudential authority assessing the resilience of individual banks.

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Annex

A.1 Banks included in the sample

Table A.1 provides a list of the 29 G-SIBs in the sample, along with their jurisdictions and acronyms as used in Graph 2. The final column identifies the 13 G-SIBs in the reduced OF sample, ie, the banks that publish Pillar 3 output floor disclosures as of end-2025. These data are not available for G-SIBs in China, the United Kingdom and the United States.

List of G-SIBs (full sample)[1] Table A.1

Bank name	Jurisdiction	G-SIB designation[2]	Acronym	Reduced sample (OF data available)[3]
Royal Bank of Canada	CA	2012–25	RBC	✓
Toronto-Dominion Bank	CA	2019–25	TD	✓
UBS	CH	2012–25	UBS	✓
Agricultural Bank of China	CN	2014–25	ABoC	
Bank of Communications	CN	2022–25	BoCom	
Bank of China	CN	2012–25	BoC	
China Construction Bank	CN	2015–25	CCB	
Industrial and Commercial Bank of China	CN	2013–25	ICBC	
Deutsche Bank	EU (DE)	2012–25	DB	✓
Banco Santander	EU (ES)	2012–25	SAN	✓
BNP Paribas	EU (FR)	2012–25	BNP	✓
BPCE Group	EU (FR)	2012–25[2]	BPCE	✓
Crédit Agricole Group	EU (FR)	2012–25	CAG	✓
Société Générale	EU (FR)	2012–25	SG	✓
ING Group	EU (NL)	2012–25	ING	✓
Mizuho Financial Group	JP	2012–25	MFG	✓
Sumitomo Mitsui Financial Group	JP	2012–25	SMFG	✓
Mitsubishi UFJ Financial Group	JP	2012–25	MUFG	✓
Barclays	UK	2012–25	BARC	
HSBC	UK	2012–25	HSBC	
Standard Chartered	UK	2012–25	SC	
Bank of New York Mellon	US	2012–25	BNY	
Citigroup	US	2012–25	CITI	
Wells Fargo	US	2012–25	WFC	
Bank of America	US	2012–25	BAC	
JPMorgan	US	2012–25	JPM	
Morgan Stanley	US	2012–25	MS	
Goldman Sachs	US	2012–25	GS	
State Street	US	2012–25	STT	

[1] Constant sample includes all banks with G-SIB status as of end-2025 from 2014 to 2025, regardless of changes in G-SIB status. [2] Not designated as a G-SIB in 2017. [3] Reduced sample of banks is limited to G-SIBs which publish Pillar 3 output floor disclosures as of end-2025 (Template CMS1 ("Comparison of modelled and standardised RWA at risk level under DIS21")).

Source: FSI calculations.

A.2 Binding constraints and RWA densities over time

Binding Tier 1 requirement[1] Table A.2

Bank name	Jurisdiction	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	switches
Royal Bank of Canada	CA	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	LR	1
TD Bank	CA	RB	LR	RB	RB	LR	LR	LR	LR	LR	LR	LR	LR	3
Average RWA density	CA		*34.2*	*34.1*	*34.0*	*32.3*	*31.3*	*33.2*	*31.1*	*29.4*	*27.2*	*28.5*	*28.6*	
UBS	CH	RB	RB	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	1
Average RWA density	CH	*22.2*	*23.8*	*25.6*	*26.9*	*29.2*	*28.4*	*27.9*	*28.3*	*31.1*	*32.2*	*32.8*	*30.4*	
Agricultural Bank of China	CN	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
Bank of China	CN	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
Bank of Communications	CN	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
China Construction Bank	CN	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
ICBC	CN	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
Average RWA density	CN	*55.6*	*56.9*	*56.1*	*56.6*	*56.3*	*57.4*	*57.5*	*57.9*	*55.0*	*54.5*	*52.3*	*51.4*	
BNP Paribas	EU (FR)	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	LR	1
Crédit Agricole	EU (FR)	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	RB	2
Deutsche Bank	EU (DE)	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	LR	1
Groupe BPCE	EU (FR)	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
ING	EU (NL)	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
Santander	EU (ES)	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	0
Société Générale	EU (FR)	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	LR	1
Average RWA density	EU	*32.7*	*34.3*	*33.1*	*32.7*	*32.4*	*32.1*	*32.8*	*33.0*	*30.7*	*30.2*	*29.9*	*29.7*	
MUFG	JP	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	LR	LR	1
Mizuho FG	JP	RB	RB	RB	RB	RB	LR	LR	RB	LR	LR	LR	LR	3
Sumitomo Mitsui FG	JP	RB	RB	RB	RB	RB	LR	LR	RB	RB	LR	RB	LR	5
Average RWA density	JP		*35.2*	*33.8*	*33.2*	*30.9*	*30.1*	*28.9*	*35.4*	*35.1*	*34.9*	*33.8*	*32.5*	
Barclays	UK	RB	RB	RB	LR	LR	LR	LR	LR	RB	RB	RB	RB	2
HSBC	UK	RB	RB	RB	RB	RB	LR	LR	LR	RB	RB	RB	LR	3
Standard Chartered	UK	RB	RB	RB	RB	RB	RB	RB	LR	LR	LR	LR	LR	1
Average RWA density	UK	*38.8*	*38.6*	*35.5*	*32.9*	*31.8*	*30.0*	*28.7*	*28.6*	*31.1*	*30.4*	*30.3*	*29.0*	
Bank of America	US	LR	LR	RB	RB	RB	RB	RB	LR	RB	LR	RB	RB	5
Bank of New York Mellon	US	LR	LR	LR	LR	LR	LR	RB	LR	LR	RB	LR	LR	4
Citigroup	US	LR	LR	LR	RB	LR	RB	RB	LR	RB	RB	RB	LR	6
Goldman Sachs	US	LR	LR	LR	LR	LR	LR	RB	RB	RB	RB	LR	LR	2
JPMorgan	US	LR	LR	LR	RB	LR	RB	RB	LR	RB	LR	RB	RB	7
Morgan Stanley	US	LR	LR	LR	LR	LR	LR	RB	LR	LR	LR	LR	LR	2
State Street	US	LR	LR	LR	LR	LR	LR	RB	LR	LR	LR	LR	LR	2
Wells Fargo	US	RB	LR	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	2
Average RWA density	US	*43.1*	*47.9*	*47.2*	*46.8*	*45.8*	*44.8*	*51.0*	*42.0*	*43.0*	*43.0*	*41.9*	*41.2*	

CA = Canada; CH = Switzerland; CN = China; DE = Germany; ES = Spain; EU = European Union; FR = France; JP = Japan; NL = Netherlands; UK = United Kingdom; US = United States.

[1] Most constraining Tier 1 requirement at the highest level of consolidation (financial year-end), determined as the higher of: (i) the nominal required risk-based Tier 1 capital (RB); and (ii) the nominal required leverage ratio requirement (LR). Required amounts include the Basel minima plus applicable buffers and capital add-ons but do not include non-binding supervisory guidance. For US G-SIBs, the Collins floor is applied: the nominal risk-based requirement equals the higher of the standardised approach and advanced approach requirements. Cells where the LR is more constraining are shaded. For the US, the enhanced supplementary leverage ratio requirement applies since 2018. Considers the transitional output floor impact for the 13 G-SIBs where relevant data are disclosed (see Table A.1). "Switches" reports the number of changes in the most binding metric between LR and RB over the period. RWA density is defined as the ratio of RWA to the leverage ratio exposure measure.

Sources: Banks' disclosures; S&P Capital IQ; FSI calculations.

Minimum RWA density implied by the LR (d^{LR}) over time, by bank[1] Table A.3

Bank name	Jurisdiction	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Royal Bank of Canada	CA		35.3	31.6	31.6	31.6	31.6	31.6	31.6	31.6	36.6	36.5	36.6
TD Bank	CA		35.3	31.6	31.6	31.6	31.6	31.6	31.6	31.6	36.8	36.8	36.8
Average	CA		35.3	31.6	31.6	31.6	31.6	31.6	31.6	31.6	36.7	36.7	36.7
UBS	CH			27.4	28.6	30.4	32.8	34.9	34.9	34.2	33.8	33.7	33.4
Agricultural Bank of China	CN		42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	42.1	45.0	47.5
Bank of China	CN		42.1	42.1	40.0	40.0	40.0	40.0	40.0	40.0	40.0	47.5	47.5
Bank of Communications	CN		47.1	47.1	47.1	47.1	47.1	47.1	43.2	43.2	43.2	47.3	47.4
China Construction Bank	CN		42.1	42.1	40.0	42.1	42.1	40.0	40.0	42.1	40.0	47.5	47.5
ICBC	CN		42.1	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	47.5	47.5
Average	CN		43.1	42.7	41.8	42.3	42.3	41.8	41.1	41.5	41.1	47.0	47.5
BNP Paribas	EU (FR)								27.4	26.8	32.4	31.8	31.3
Crédit Agricole	EU (FR)								29.2	28.1	31.7	30.0	29.8
Deutsche Bank	EU (DE)								25.8	24.1	28.5	29.2	28.9
Groupe BPCE	EU (FR)								29.8	27.2	30.5	29.2	28.9
ING	EU (NL)								24.3	24.2	27.3	27.8	27.3
Santander	EU (ES)								28.8	27.6	31.7	30.5	30.0
Société Générale	EU (FR)								28.5	26.7	30.0	29.6	29.3
Average	EU								27.7	26.4	30.3	29.7	29.4
MUFG	JP						29.9	30.0	30.0	30.0	37.4	36.9	38.9
Mizuho FG	JP						31.4	31.5	31.5	31.5	36.6	36.5	38.5
Sumitomo Mitsui FG	JP						31.3	31.5	31.5	31.5	36.5	36.3	38.3
Average	JP						30.8	31.0	31.0	31.0	36.8	36.6	38.6
Barclays	UK			31.6	31.6	30.0	27.3	27.8	28.0	28.8	28.4	28.4	28.3
HSBC	UK			34.3	33.2	32.8	31.2	31.0	31.6	31.7	31.8	31.8	32.0
Standard Chartered	UK			34.2	34.2	32.7	30.1	30.3	29.9	29.4	29.3	29.5	30.2
Average	UK			33.4	33.0	31.8	29.5	29.7	29.9	30.0	29.8	29.9	30.2
Bank of America	US	72.7	66.7	54.2	45.7	51.3	45.5	45.5	45.5	42.0	45.5	41.0	43.5
Bank of New York Mellon	US	72.7	66.7	57.1	50.0	55.6	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Citigroup	US	72.7	66.7	54.2	45.7	49.4	43.5	43.5	41.7	38.5	36.2	36.8	38.2
Goldman Sachs	US	72.7	66.7	54.2	47.1	51.3	45.5	33.1	33.6	33.8	34.5	32.9	40.3
JPMorgan	US	72.7	66.7	51.6	44.4	47.6	41.7	39.1	39.4	37.0	38.8	36.2	38.5
Morgan Stanley	US	72.7	66.7	54.2	45.7	49.4	43.5	34.0	34.0	33.8	34.7	33.3	37.6
State Street	US	72.7	66.7	57.1	50.0	55.6	50.0	52.6	52.6	52.6	52.6	52.6	52.6
Wells Fargo	US	72.7	66.7	56.1	48.5	53.3	47.6	47.6	45.0	46.7	48.1	44.2	50.0
Average	US	72.7	66.7	54.9	47.1	51.7	45.9	43.2	42.7	41.8	42.5	40.9	43.8

[1] The minimum RWA density implied by the LR (d^{LR}) is calculated as the ratio of *LR* to *RB*, where *LR* represents a bank's overall leverage ratio requirement (in per cent), and the *RB* represents its overall risk-based capital requirement (in per cent). Cells where the nominal LR requirement is more constraining are shaded (see Table A.2).

Sources: Banks' disclosures; S&P Capital IQ; FSI calculations.