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Pricing Liquidity Support: A PLB for Switzerland*

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Abstract

The proposed revision of the Swiss Banking Act introduces a public liquidity backstop (PLB) for distressed systemically important banks (SIBs), in part to facilitate resolution. We examine the impact of the PLB on fiscal balances, societal welfare, and the incentives of bank shareholders and management. A PLB, like too-big-to-fail (TBTF) status, acts as a subsidy for non-convertible bonds, which can create negative externalities. Corrective measures must be implemented before the PLB is activated to align incentives with societal interests. We conservatively estimate that Swiss SIBs' TBTF status results in funding cost reductions far greater than the proposed ex-ante compensation, with UBS Group AG alone gaining at least USD 2.9 billion in 2022. The risk for Switzerland of hosting SIBs warrants additional precautionary savings.

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Executive Summary

The paper discusses the proposed framework for implementing a Public Liquidity Backstop (PLB) in Switzerland as part of revisions to the Swiss Banking Act. The PLB aims to provide liquidity support to systemically important banks (SIBs) in distress, to prevent systemic financial disruption and facilitate their orderly resolution. While a PLB can help stabilize the banking system, it has costly side effects. Addressing those is crucial to ensure that the PLB framework benefits society rather than mostly SIB owners. Specifically, the paper makes the following points:

First, a government guarantee for liquidity support, like other too-big-to-fail (TBTF) policies, effectively subsidizes non-convertible bond financing for SIBs, further encouraging a leverage-heavy funding model that, when combined with limited liability, distorts the incentives of shareholders and management. The distortions induce management choices that generate negative externalities for society. If they lead to bank failure, the government is compelled to intervene, regardless of the fiscal impact, even if the intervention may result in higher government debt, taxes, and inflation. Corrective measures need to be employed to align the incentives of shareholders and management with the broader societal interest.

Second, terms and conditions of a PLB once liquidity is provided do not effectively correct the incentive problems, as they hold limited relevance for initial shareholders and management. After all, liquidity support only materializes once the initial shareholders have been wiped out and, most likely, management has been replaced. Moreover, it is questionable whether authorities would have sufficient leverage in a crisis to enforce stringent ex-post conditions. Therefore, corrective measures must be applied before liquidity is provided, with a forward-looking approach that is independent of the SIB's financial performance.

Third, the proposed framework envisions an ex-ante fee as compensation for the potential provision of a default guarantee and to mitigate potential competitive distortions. It suggests an assessment rate of 0.005%–0.015%, amounting to total fees of CHF 0.07–0.21bn for all Swiss SIBs in 2022.

Because PLB support is tied to a bank's systemic importance, the effects of the PLB cannot be disentangled from the bank's SIB status. Therefore, rather than setting an ex-ante fee specifically for anticipated PLB support or introducing PLB-specific regulation (as well as parallel measures for other support mechanisms), policy makers should focus on the overall TBTF subsidy enjoyed by SIBs and develop a comprehensive set of corrective measures.

Erring on the side of caution by systematically making conservative assumptions that should lead us to under- rather than overestimate TBTF subsidies, we find subsidy rates that are orders of magnitude larger than the proposed ex-ante

PLB fee. Our most conservative estimate suggests a subsidy rate on senior debt of approximately 1.6%, resulting in a total TBTF funding advantage of at least USD 2.9bn for UBS Group AG alone in 2022. Government measures to counteract this TBTF subsidy need not be limited to taxes or fees. Stricter equity requirements and other regulatory tools can have similar corrective effects.

Fourth, the presence of SIBs and the potential for their failure of resolution introduce uncertainty. Government finances become riskier because the liquidity support may not be fully repaid. Macroeconomic outcomes also become more uncertain, as a SIB crisis followed by a failed resolution can have significant negative consequences for economic activity, price stability, the reputation of the financial sector, and the country's international standing.

In response to this increased risk, both the government and the private sector should engage in additional precautionary saving, building buffers to weather potential adverse outcomes. A priori, there is no reason for SIBs to fund this precautionary saving. But the need for it should be factored into the societal cost-benefit analysis when evaluating the merits of a SIB presence and the appropriate bank regulation.

1 Introduction

The failure of a systemically important bank (SIB) can trigger severe financial and economic disruptions, imposing significant costs on society. To mitigate this risk—without resorting to bank nationalization or relying on a takeover by a rival—policymakers worldwide have worked to enhance the resilience and resolvability of SIBs, in particular within the framework of the Basel Accords and the initiatives of the Financial Stability Board.

Since effective bank resolution typically requires central bank liquidity support, these efforts have also included measures to ensure access to sufficient liquidity during times of crisis. Specifically, several countries have developed legal frameworks that allow for the use of Public Liquidity Backstops (PLBs) as a policy tool during banking crises. A PLB facilitates access to central bank liquidity for a distressed SIB by providing a guarantee from the national treasury. The primary goal of a PLB is to support the bank's restructuring process and prevent its complete collapse, thereby mitigating the risk of broader systemic disruption.

In 2022, the Swiss Federal Council decided to introduce a framework for implementing a PLB in Switzerland, and it instructed the Federal Department of Finance to develop a proposal by mid-year 2023. However, in March 2023, using emergency legislation, the Federal Council enacted measures, including the introduction of a PLB, aimed at preventing the uncontrolled collapse of Credit Suisse.[1] Later, in September 2023, the Federal Council adopted a Dispatch on introduction of a PLB for SIBs.[2]

This note examines the rationale for a Swiss PLB and its remuneration by banks. Section 2 provides a brief overview of the Federal Council's proposal. Section 3 discusses the effects of a PLB and its fee structure on fiscal balances, bank shareholders and management, and society at large. We draw four conclusions.

First, a PLB influences the investment decisions of a SIB's shareholders and management because it distorts debt prices, effectively subsidizing non-convertible bond financing. This further encourages a leverage-heavy funding model, which, when combined with limited liability, skews the incentives of shareholders and management, potentially resulting in negative externalities for society, for instance due to excessive risk-taking. In the event of distress, the government is compelled to intervene, even at the cost of higher debt, taxes, and inflation. To address these problems, corrective measures need to be imposed.

Second, ex-post terms and conditions of a PLB are not effective to address the root

[1] See, for example, Böni et al. (2023) and Coelho et al. (2023).

[2] See https://www.newsd.admin.ch/newsd/message/attachments/82424.pdf for the Dispatch (in German) and https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-97631.html for a brief summary.

cause of moral hazard, as they hold limited relevance for initial shareholders and management. After all, liquidity support for a SIB as a "gone concern" only materializes once the initial shareholders have been wiped out and, most likely, management has been replaced. Furthermore, it is questionable whether authorities would have sufficient leverage in a crisis to enforce stringent ex-post conditions. To be effective, corrective interventions must therefore be implemented before liquidity support is provided, with a forward-looking approach that is independent of the SIB's financial performance.

Third, since PLB support is tied to a bank's systemic importance, its effects must be assessed alongside other government measures for distressed SIBs, which collectively form a too-big-to-fail (TBTF) subsidy. (By TBTF, we mean that a SIB is sufficiently large to compel the government to intervene on its behalf rather than letting it fail in an uncontrolled way.) As the TBTF status cannot be separated from PLB access, it is difficult to identify their individual contributions. Rather than setting an ex-ante fee specifically for anticipated PLB support or introducing PLB-specific regulation (as well as parallel measures for other support mechanisms), policy makers should focus on the overall TBTF subsidy enjoyed by SIBs and develop a comprehensive set of corrective measures. Such measures may include taxes or fees, stricter equity requirements, or other regulatory tools.

Fourth, the presence of SIBs and their risk of failure introduce uncertainty, both for government finances, the broader economy, and society. This necessitates increased precautionary savings both by government and the private sector to build stronger buffers that can help weather adverse outcomes. While SIBs need not necessarily fund this buffer, its necessity should be factored into the societal cost-benefit analysis when evaluating the merits of a SIB presence and the appropriate bank regulation.

Against that background, Section 4 reports estimates in the literature of the value of implicit TBTF subsidies and presents a new one. Our estimate is derived from the Merton (1974) and Finkelstein et al. (2002) models, both of which are widely used in risk assessment. Erring on the side of caution by systematically making conservative assumptions that should lead us to under- rather than overestimate TBTF subsidies, we find subsidy rates that are orders of magnitude larger than the proposed ex-ante PLB fee. Our most conservative estimate suggests a subsidy rate on senior debt of approximately 1.6%, resulting in a total TBTF funding advantage of at least USD 2.9bn for UBS Group AG alone in 2022, which compares with net profits of USD 7.2bn.

Section 5 concludes.

2 The Swiss PLB Proposal

The September 2023 Dispatch adopted by the Federal Council proposes to change the Swiss Banking Act.[3] The Dispatch envisions the PLB as a third line of defense in ensuring the orderly resolution of SIBs. The first line of defense requires SIBs to meet their liquidity needs through their own liquid assets and market sources, with additional liquidity buffers mandated under the TBTF requirements. The second line involves the provision of extraordinary liquidity loans from the SNB, available only against suitable collateral. In cases where these measures are inadequate, the PLB would offer a third line of defense, providing liquidity support through loans with a government-backed default guarantee.[4]

The Federal Council proposal defines a PLB as[5]

> a state liquidity provision that is a standard instrument internationally in banking crises. [After the first two lines of defense have been exhausted, the PLB makes it possible] for the central bank to provide additional liquidity which is guaranteed by the state as part of a restructuring of the affected bank. The level of the guarantee is defined on a case-by-case basis depending on the circumstances.

The proposal envisions that five requirements would have to be met for a PLB to be granted to a SIB:[6]

- Subsidiarity: The SIB's liquid assets, market refinancing options, and any available regular liquidity assistance from the SNB must be exhausted.
- Restructuring: A restructuring procedure must be initiated or imminent, overseen by FINMA, the Swiss financial market supervisor.
- Solvency: The SIB must be deemed adequately capitalized, with solvency either confirmed or ensured by an appropriate restructuring plan approved by FINMA.
- Public Interest: The failure to grant a government-backed liquidity loan must pose a significant threat to the Swiss economy and financial system.

[3] The Federal Council rejected several alternatives, including the status quo without a legal framework for a PLB or a change of the National Bank Act that would allow the SNB to extend liquidity support to a SIB even if the latter lacked collateral; see pp. 13-14 of the Dispatch. The Council also rejected tighter liquidity regulation measures; see p. 15 of the Dispatch.

[4] See pp. 27–28 of the Dispatch.

[5] https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-97631.html.

[6] See pp. 29, 40, 42–44 of the Dispatch.

- Proportionality: The liquidity assistance loan must be both necessary and appropriate for the SIB's restructuring.

However, the PLB framework would not establish an entitlement for a distressed SIB to a PLB. Final decision powers would rest with the government, after consultation with FINMA and the SNB.

According to the proposal, SIBs would pay a risk-based annual fee to the Confederation as compensation for the potential provision of a default guarantee and to mitigate potential competitive distortions.[7] This fee would be paid into the federal budget, regardless of whether the guarantee were actually granted.[8] In addition, conditional on granting a loan and a PLB, the federal government would be entitled to a provision fee; the SNB would receive interest on the loan; and both the government and the SNB would receive risk premia.[9]

To reduce the financial risks for the Confederation, the proposal introduces a bankruptcy privilege for claims arising from government-backed liquidity loans. In case of bankruptcy, SNB claims and related fees (such as premiums and interest) would be prioritized after the first and second classes of creditors (e.g., after employee wages, social contributions, and privileged deposits). The government guarantee would become effective after the completion of bankruptcy proceedings.[10] In addition, SIBs would have to comply with restrictions during the use of the default guarantee, such as a ban on dividend payments and restrictions on lending to their parent companies.[11]

Article 32c of the proposed revision to the Banking Act outlines the calculation of the ex-ante fee.[12] The envisioned fee is risk-based, meaning it is proportional to both the likelihood of the government activating a default guarantee for a particular SIB and the potential extent of that guarantee. The proposed assessment rate is uniform across all SIBs and reflects the overall risk to the Confederation of providing such a guarantee for

[7] "Der Umstand, dass der Bund für den Krisenfall eine Ausfallgarantie für Liquiditätshilfe-Darlehen der SNB an eine SIB bereitstellen kann, bedeutet für den Bund, dass er im Fall der Krise einer SIB und bei Erfüllung der gesetzlich festgelegten Voraussetzungen grundsätzlich bereit ist, zugunsten der Sicherung der Finanzstabilität ein gewisses Verlustrisiko einzugehen. Zur Abgeltung dieser grundsätzlichen Bereitschaft des Bundes soll eine entsprechende Pauschale eingeführt werden. Die Möglichkeit, im Krisenfall eine zusätzliche, vom Bund abgesicherte Liquiditätshilfe zu erhalten, wirkt zudem bereits präventiv und hat für sämtliche SIBs einen entsprechenden Wert. Es können ihnen tiefere Refinanzierungskosten anfallen und das Vertrauen ihrer Kunden und Investoren wird gestärkt. Dies führt zu einer Wettbewerbsverzerrung zugunsten der SIBs, die durch die Pauschale kompensiert werden soll" (p. 45 of Dispatch).

[8] See p. 29 of the Dispatch.

[9] See p. 30 of the Dispatch.

[10] See pp. 29–30 of the Dispatch.

[11] See p. 30 of the Dispatch.

[12] See pp. 45 ff, 67 ff of the Dispatch.

liquidity assistance loans. It is designed to be based on estimates of potential losses in the event of bankruptcy and would also take into account the SIB's financial performance (e.g., group profit or loss before tax) to ensure affordability.[13]

The assessment base would reflect the specific characteristics of each SIB and be calculated as total exposure (as defined by the denominator of the Basel leverage ratio) minus Tier 1 capital, high-quality liquid assets, and assets designated for SNB collateral.[14]

As a result, SIBs with higher capital or liquidity levels would be subjected to a lower fee. The Federal Council would also factor in the particularities of cantonal state guarantees when determining the fee.[15] Without providing specific details, the proposal suggests an assessment rate ranging from 0.005% to 0.015% (0.5–1.5 basis points (bps)), which would result in total ex-ante fees for all SIBs in 2022 of approximately CHF 0.07–0.21bn.[16]

Article 32d of the proposed revision of the Banking Act outlines additional features of the provision fee, risk premia, interest charges, and additional costs.[17] The provision fee is intended to replace—and likely exceed—the ex-ante fee. The risk premium for the SNB would cover potential costs that are not offset by interest charges, for instance SNB interest payments on reserve balances or on SNB Bills that are issued to absorb liquidity. The Confederation and the SNB, in consultation with the Confederation, would individually determine the applicable risk premia. The interest rate charged by the SNB would be linked to the policy rate but would not fall below zero. Any additional costs arising from third-party services would be borne by the borrower, regardless of whether the loans are ultimately granted. While the Dispatch does not provide specific quantitative information, it discusses the policy parameters in the context of the Credit Suisse failure (pp. 68 ff).

The proposal highlights the importance of ex-ante and provision fees in mitigating

[13] "Die berechnete Pauschale muss schliesslich im Vergleich zum Geschäftsergebnis ... verhältnismässig beziehungsweise tragbar sein. Die Pauschale soll einen mit der Einführung einer staatlichen Liquiditätssicherung für SIBs entstehenden Wettbewerbsvorteil kompensieren, soll aber gleichzeitig nicht zu einem Wettbewerbsnachteil führen" (p. 45 of Dispatch).

[14] Presumably, quantitative and qualitative facilitations would be accounted for; that is, only the effective capital and stock of liquid assets would be subtracted. For a discussion of facilitations in the years leading to the Credit Suisse failure, see https://www.parlament.ch/centers/documents/de/9.%20Zellweger.pdf.

[15] Total exposure includes off-balance sheet items; see https://www.bis.org/publ/bcbs270.pdf or https://assets.kpmg.com/content/dam/kpmgsites/ch/pdf/ch-finma-circular-2015-03-en.pdf. See also the reports by UBS Group AG (https://secure.ubs.com/minisites/group-functions/investor-relations/annual-report/2023/digital-ar23-group/digital-ar23-group/index.html#sub_book_0_3) and FINMA (https://www.finma.ch/fr/documentation/publications-finma/kennzahlen-und-statistiken/kennzahlen/kennzahlen-banken/), which show total exposure as "leverage ratio denominator."

[16] According to the Dispatch (p. 46) this amounts to 0.6–1.8% of pre-tax group profits of all SIBs.

[17] See pp. 46 ff of the Dispatch.

potential competitive distortions inherent in a PLB framework.[18] Since PLB liquidity assistance enhances the resilience of SIBs in a liquidity crisis but has no direct benefit for non-SIBs, it could lead to lower refinancing costs for SIBs in the market, creating a potential for competitive distortion. Once a default guarantee were granted, this would further alter the competitive dynamics compared to a laissez-faire approach.

3 Conceptual Considerations

In the context of the Swiss proposal, a PLB is granted only if, among other conditions, the SIB is deemed solvent and undergoing restructuring. The most likely scenario for a government default guarantee thus involves the SIB reaching the "gone concern" stage, with total loss absorbing capacity fully exploited (initial equity and AT1 bonds fully written off, and Tier 2 convertible bonds converted into new equity). Our discussion focuses on this scenario.[19]

3.1 Effects of PLB Once Liquidity is Provided

The extension of liquidity support exposes the consolidated government to the risk that the SIB may be unable to repay the support. If the guarantee is effective, this risk is borne by the Confederation; if it is weak or uncertain, the Confederation effectively shifts risk to the (other) SNB shareholders, in particular cantons. The net fiscal cost to the consolidated government is the amount of liquidity support provided, less the discounted value of the risky repayments from the SIB.[20]

Liquidity support is fiscally sound when the net fiscal costs to the consolidated government are no greater than zero. However, fiscal soundness should not be the primary consideration in deciding whether to provide liquidity support. The key factor should be whether the broader societal benefits, net of costs, are positive. This is likely the case, as failing to provide support could lead to severe disruption. Once a SIB is in distress, the government's choice is not so much whether to provide liquidity support, but rather how to do so in the most efficient manner.

The presence of a formal framework for implementing a PLB has limited impact on the government's ex-post trade-offs. Unless the absence of such a framework makes it practically impossible to provide liquidity support with a government-backed default guarantee,

[18] See p. 69 of the Dispatch.

[19] A PLB without complete write offs and conversions would render non-convertible bonds riskier.

[20] Discounting occurs at prevailing market rates or, ideally, the government stochastic discount factor. For the latter, see, for example, Farhi (2010).

the government will always find ways to extend support, as it is, ex post, in society's best interest.[21] However, having a clear arrangement for dealing with the fiscal implications of the rescue package can help ensure that the net societal benefit of the bank rescue is fairly distributed between the *new* bank shareholders and taxpayers.

A more binding limit to the liquidity support could be that the SIB is "too big to save." When the SNB provides liquidity to a distressed SIB, it credits the bank's sight deposit account at the SNB with additional balances. In return, the SNB receives a claim against the bank, promising future repayment. If the liquidity is provided under the PLB, this claim is guaranteed by the Confederation. While the SNB can, in theory, create unlimited amounts of liquidity—and thus always bail out a SIB with CHF liabilities—the Confederation's finite capacity to collect taxes constrains the amount that can credibly be guaranteed. This constraint can render a SIB "too big to save," particularly if the SNB is committed to rejecting (or trying to reject) Confederation guarantees that lack credibility and could force the SNB to absorb huge losses with negative consequences for price stability.[22]

3.2 Effects of PLB Before Liquidity is Provided

It is important to recognize that the PLB serves as a guarantee to senior non-convertible debt holders, as without it, the SIB may be forced to default on these liabilities sooner rather than later. Therefore, with a PLB in place, senior debt holders will not fully price in the true risk of the SIB reaching a crisis stage, and the SIB does not need to remunerate its senior non-convertible bonds at fair value, leading to lower funding costs. This encourages the SIB's management to lever up and, due to limited liability, affects the investment strategy approved by shareholders. As a result, both management and shareholders fail to fully internalize the societal costs of bank failure. Ex ante, a key policy consideration is therefore to align incentives: shareholders and management should be encouraged to adopt a business model that fully accounts for the societal costs of potential distress.[23]

How can this be achieved? One approach is to leverage the terms and conditions attached to government liquidity support during a crisis. When lending to a distressed

[21] This also implies that we should not expect existence of a formal PLB framework to correlate with SIB ratings or other risk measures.

[22] The SNB may also be unwilling to extend liquidity support in the event of a conflict between the authorities. Assessing a bank's solvency is notoriously difficult, and FINMA's assessment could be contested. Eventually, the Confederation will almost certainly have the upper hand.

[23] The societal optimum may permit some level of crisis risk, depending on the effectiveness of the resolution regime.

SIB, the government could impose stricter terms than those required for fiscal soundness, or it could limit dividend payouts and cap management compensation. By making the distress scenario highly unattractive to decision-makers within the distressed bank, the goal would be to incentivize more cautious strategic and managerial decisions ex ante. However, there are at least three major problems with this approach.

First, the attractiveness of the distress scenario to decision-makers within the distressed bank is largely irrelevant to shareholders and management making decisions ex ante. After all, liquidity support only materializes once the initial shareholders have been wiped out and, most likely, management has been replaced. From an ex ante perspective, the terms of financing for the SIB as a "gone concern" are largely irrelevant.

Second, the expectation of liquidity support—even with harsh conditions attached—is what makes non-convertible bonds more attractive compared to a crisis scenario without support, in which these bonds would likely be written off, at least partly. Therefore, harsh ex-post conditions do not address the root cause of the moral hazard problem, which is the mis-pricing of the SIB's debt.[24]

Finally, harsh ex-post financing terms are unlikely to be implemented. Once a crisis unfolds, authorities are in a weak bargaining position, because, as noted earlier, the compelling societal benefits of averting widespread disruption make a rescue the most persuasive course of action.

For these reasons, the terms and conditions of liquidity support once granted are an ineffective mechanism for aligning private sector incentives before the SIB is in distress. Ex-ante taxes, fees, or other measures directly tied to the bank's pre-distress choices are far more effective in correcting incentives. Unlike the approach envisioned in the Swiss PLB proposal, these measures should not depend on the SIB's financial performance, which reflects past choices and luck.

3.3 Effects of PLB on TBTF Subsidy

It is sometimes understood that a bank is TBTF when the government has no choice but to take steps to recapitalize the SIB to guarantee its solvency and the stability of the financial system. In this case, senior bond holders are always made whole, leading to mispriced senior debt claims and distorted incentives. Some have favored resolution mechanisms as a solution to the implicit state guarantee of solvency. Yet again, orderly

[24]This relates to the concern about "competitive distortions" due to a PLB that is discussed in the Swiss proposal. Such distortions could be mitigated if, for example, all bonds were wiped out in a crisis, or if all banks had access to a PLB.

resolution requires liquidity assistance, and the proposal makes that guarantee explicit. However, such explicit guarantee also favors senior bond holders and does nothing to tackle the mispricing of debt.

In addition, because PLB support is tied to a bank's systemic importance, its effects must be assessed alongside other government measures for distressed SIBs, which collectively form a too-big-to-fail (TBTF) subsidy. As the TBTF status cannot be separated from PLB access, it is difficult to identify their individual contributions. Rather than setting an ex-ante fee specifically for anticipated PLB support or introducing PLB-specific regulation (as well as parallel measures for other support mechanisms), policy makers should focus on the overall TBTF subsidy enjoyed by SIBs and develop a comprehensive set of corrective measures.

In Section 4, we provide an estimate of the TBTF subsidy and funding advantage for UBS Group AG. Erring on the side of caution by systematically making conservative assumptions that should lead us to under- rather than overestimate TBTF subsidies, we find subsidy rates that are orders of magnitude larger than the proposed ex-ante PLB fee. Government measures to counteract this TBTF subsidy need not be limited to taxes or fees. Quantity restrictions on equity and other regulatory tools can have similar corrective effects.

3.4 Broader Effects of PLB

Resolution is no panacea. In a positive scenario, it is successful and the SIB repays the liquidity support enabled by the PLB. In a negative one, resolution fails and the public sector suffers losses even if the liquidity support was extended on actuarially fair terms.[25] Macroeconomic outcomes may also be adversely affected, as a SIB crisis followed by a failed resolution can depress economic activity, endanger price stability, and harm the reputation of the Swiss financial sector as well as Switzerland's broader international standing.

In response to these risks, both the government and the private sector should engage in additional precautionary savings, building capital and net foreign asset buffers that can help withstand potential adverse outcomes. A priori, there is no reason for the SIB to fund this precautionary saving. But the need for such saving should be factored into the societal cost-benefit analysis when evaluating the merits of a SIB presence in Switzerland

[25] In the wake of the great financial crisis, government support measures for Royal Bank of Scotland, Fortis Bank, and Commerzbank AG generated losses (https://www.faz.net/aktuell/finanzen/commerzbank-und-bankenrettung-ein-potenzielles-verlustgeschaeft-19965723.html).

and the appropriate bank regulation.

3.5 Revenue and Fee Allocation

Central bank liquidity support with a government-backed default guarantee shifts the default risk to the treasury, and it is reasonable to expect this to be remunerated.[26] The treasury is also the natural recipient of corrective taxes and fees levied ex ante. In contrast, the risk-free interest rate on the liquidity support should accrue to the central bank, as it is the entity providing the liquidity.

Any deviations from this allocation are of secondary importance from a macroeconomic perspective, since central bank profits are ultimately transferred to the treasury. Nevertheless, such deviations may of course still be significant from a political economy or legal perspective.

3.6 Summary

We draw four main conclusions from these conceptual considerations.

First, a government guarantee for liquidity support, like other TBTF policies, distorts debt pricing by subsidizing non-convertible bond financing, encouraging excessive leverage and risk-taking by SIBs. These distortions impose societal costs and increase the risk that the government is compelled to intervene, possibly resulting in higher government debt, taxes, and inflation. Corrective measures are necessary to align the incentives of shareholders and management with the broader societal interest.

Second, ex-post terms and conditions of a PLB fail to address moral hazard effectively, as they hold limited relevance for initial shareholders, who are wiped out during crisis, or the management, who most likely will be replaced. Authorities may also have insufficient leverage in a crisis to enforce stringent ex-post conditions. Therefore, corrective measures must be applied ex ante, with a forward-looking approach that is independent of the SIB's financial performance.

Third, because PLB support is tied to a bank's systemic importance, regulation should address the overall TBTF subsidy for SIBs and not just PLB support (as currently envisaged in the government proposal). A comprehensive set of corrective measures may include taxes, fees, quantity restrictions on equity, or other regulatory tools.

Fourth, the presence of SIBs and the potential for their failure introduce uncertainty. Both the government and the private sector should therefore engage in additional pre-

[26] However, see the discussion in Section 3.1.

cautionary savings. While SIBs need not necessarily fund this, the need for stronger precautions should be given careful consideration when evaluating the merits of a SIB presence in Switzerland and the appropriate bank regulation.

4 Implicit TBTF Subsidies

We have argued that ex-post measures aimed at stabilizing TBTF SIBs, including liquidity support with a government-backed default guarantee, fail to properly incentivize initial shareholders and management. In fact, they may achieve the opposite by effectively subsidizing non-convertible debt and reducing the bank's ex-ante financing costs. In the following, we attempt to quantify this implicit subsidy, which generates a need for ex-ante corrective measures, such as stricter equity requirements or taxes targeting risky bank activities or balance sheet positions. We note that the implicit subsidy of interest results in a funding cost advantage for SIBs, unless there are other guarantees with a similar effect that benefit smaller banks.

Recall that the Swiss proposal suggests ex-ante fee amounts based on an assessment rate ranging from 0.5 to 1.5bps (0.005%–0.015%) and totalling CHF 0.07–0.21bn in 2022. While we compare our findings to this range from the Swiss proposal, we emphasize that the comparison should be interpreted with caution, as we focus on the full TBTF subsidy reflecting government interventions to support SIBs that reach the gone concern stage. As discussed earlier, expected PLB support and TBTF status cannot be disentangled. Compensatory and corrective measures for SIBs therefore should not be considered in isolation for each of these measures separately, but rather as part of a comprehensive package.

4.1 Our Estimate

To price the implicit TBTF subsidy, we calculate by how much it lowers a SIB's cost of funding. We use credit default swaps (CDSs), which serve as insurance against bond defaults. The CDS spread represents the cost of this insurance, expressed as a percentage of the bond's value.

Without a government guarantee, bondholders seeking to protect their investment must purchase CDS protection, which reduces their net return to the bond interest rate minus the CDS spread. With a government guarantee, bondholders need to buy less protection—or none at all if the guarantee is perfect—resulting in a higher net return. Consequently, a non-guaranteed bank must offer a higher interest rate to compete, cover-

ing the CDS spread. This interest rate differential, equal to the CDS spread, reflects the funding advantage provided by the government guarantee.

For didactic reasons, we start with a simple model to make our main argument, deferring the discussion of the full model and its calibration to Appendix A. We assume that with probability $1 - P$, the SIB experiences financial distress, while with probability P (the "survival probability"), it remains solvent and liquid. For now, we treat P as given, but we endogenize it in the full model. We compare two scenarios: a realistic one, in which the government (including the central bank) intervenes in the event of distress, facilitating the resolution of the SIB and repayment of its senior debt; and a counterfactual scenario, in which the government refrains from intervention, leading to the collapse of the SIB. In both scenarios, we assume that initial shareholders as well as holders of AT1 and Tier 2 convertible bonds are completely wiped out.

Without government intervention, the recovery rate R on senior debt is significantly below unity, due to bankruptcy costs and fire-sale losses on the remaining assets. As explained above, a credit default swap (CDS) insures against these losses. For each CHF invested in senior debt, the expected insurance benefit is CHF $(1 - P)(1 - R)$, as distress occurs with probability $1 - P$ and the insurance covers the loss CHF $(1 - R)$. The actuarially fair premium for the CDS contract costs CHF c^*, where

$$c^* = \frac{1 - P}{P}(1 - R)$$

ensures that the expected payment to the insurer when the SIB survives, CHF c^*P, matches the expected payment from the insurer to the senior debt holders when it does not.[27]

With government intervention, in contrast, financial market participants expect a higher recovery rate in a distress scenario[28], rendering insurance cheaper: the observed CDS spread, $\tilde{c}$, falls below c^*. Following standard practice, we interpret the difference between the counterfactual spread c^* and the observed spread $\tilde{c}$ as a measure of the

[27] The formula also applies when the insurance arrangement spans multiple periods, or in a continuous-time framework. Consider an arrangement lasting T periods. Let $q \equiv P/(1 + r)$, where r denotes the interest rate. The present value of the insurance premiums is CHF $c^*P(1 + q + q^2 + \ldots + q^{T-1})$, and the present value of insurance payouts is CHF $(1 - R)(1 - P)(1 + q + q^2 + \ldots + q^{T-1})$. Both are equal when $c^* = (1 - P)/P(1 - R)$. Analogous conclusions can be drawn in a continuous-time framework. Assume the SIB survives for a duration t with probability $P(t)$, such that the instantaneous probability of distress after duration t is $-P'(t)$. The insurance premium CHF c^* is paid continuously until a distress event occurs. In this case, the actuarially fair arrangement satisfies the condition $c^* \int_0^\infty P(t) \exp(-rt)dt = (1 - R) \int_0^\infty -P'(t) \exp(-rt)dt$. If $P(t) = \exp(-\mu t)$, with $\mu > 0$, this results in $c^* = \mu(1 - R)$.

[28] They might also expect P to increase.

reduction in the bank's financing costs that results from expected government support tied to the bank's SIB and TBTF status. In other words, the gap between the CDS premiums in the two scenarios reflects the "TBTF subsidy rate" for senior debt.[29] Formally, this subsidy rate, s^{TBTF}, is given by

$$s^{\text{TBTF}} = c^* - \tilde{c} = \frac{1-P}{P}(1-R) - \tilde{c}. \tag{1}$$

US data suggests recovery rates R of 77% and far lower.[30] Furthermore, the CDS spread for senior debt of UBS Group AG (UBS) in 2022—the baseline year for our calibration and the Swiss proposal—was 84.79bps, so we set $\tilde{c} = 0.85\%$.[31] The solid black line in Figure 1 illustrates the implied subsidy rate, s^{TBTF}, as a function of the bank's solidity, measured by the annual survival probability P, when $R = 0.7$. We see that a survival probability of 90% is associated with an implied subsidy rate of 2.5%. Even with P as high as 94%, senior debt remains subsidized at a rate exceeding 1%. The implied subsidy disappears (i.e., falls below zero) when the survival probability reaches 97.25%.

The red line in Figure 1 represents the average assessment rate under the Swiss PLB proposal, which stands at 0.01%. While the assessment rate is applied to a base that does not precisely match the quantity of senior debt, it nonetheless provides a valuable reference point for evaluating the subsidy rate. The comparison shows that the proposed assessment rate is very low unless one assumes the SIB to be extremely solid: s^{TBTF} exceeds 0.01% unless the survival probability P is greater than 97.22%. To contextualize, an annual survival probability of 97.22% implies an expected duration of nearly 36 years between consecutive distress events, while a survival probability of 95% corresponds to an expected duration of 20 years.[32]

These results change when we assume that senior debt holders are less reliant on government support, i.e., when the recovery rate R absent government intervention is higher. The dashed black line in Figure 1 illustrates the relationship between the survival probability and the implied subsidy rate when $R = 0.8$ rather than 0.7. While the implied subsidy rate decreases substantially, it still exceeds the proposed assessment rate unless

[29] We abstract from counterparty risk and illiquidity in the CDS market. Accounting for counterparty risk (the risk that the insurance provider defaults) would increase the estimated TBTF premium (see Zhao (2018, p. 84)). Conversely, accounting for illiquidity might reduce it.

[30] See Bennett and Unal (2015) and Table 1 in Begenau and Landvoigt (2022).

[31] Long-term averages of senior debt CDS spreads of UBS and Credit Suisse Group AG are of a similar magnitude. We use daily data from Refinitiv for 5-year CDS spreads on senior unsecured debt. From 2010 to 2024, the average CDS spread for UBS (`UBSJ5YEUAM=R`) was 77bps, and for Credit Suisse Group AG (`CSGN5YEUAM=R`), 103bps. From 2004 to 2024, the average spreads were 71 and 87bps, respectively. We use 5-year CDS contracts rather than annual contracts because of their higher liquidity.

[32] This assumes independence of distress events. Note that $\sum_{t=1}^{\infty} tP^{t-1}(1-P) = 1/(1-P)$.

the survival probability exceeds 95.89%, corresponding to an expected duration of more than 24 years between consecutive distress events. In other words, through the lens of the model and with $R = 0.8$, the proposed assessment rate continues to be very low unless one assumes the SIB to be extremely solid.

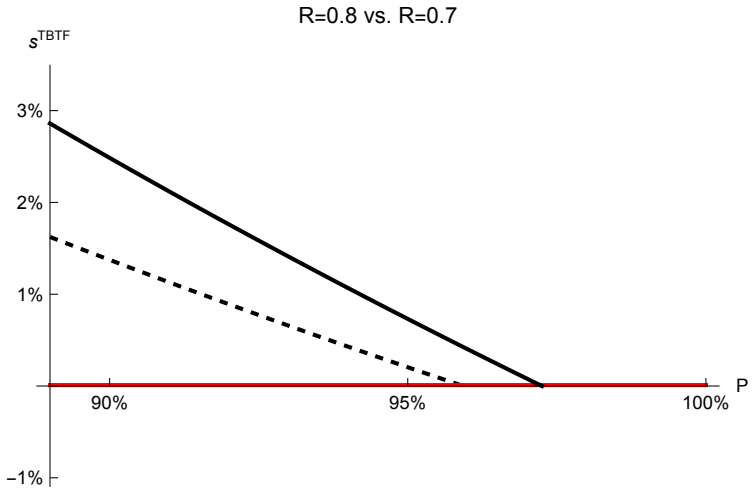

Figure 1: Relationship between survival probability, P, and implied subsidy rate, s^{TBTF}, when $R = 0.8$ (black dashed) and $R = 0.7$ (black solid); assessment rate under the Swiss PLB proposal (red).

The analysis thus far treats the distress probability $1 - P$ as exogenous. To discipline our conclusions, we adopt a standard approach that models distress risk as the probability that the bank's randomly fluctuating asset value falls below the level of its senior debt (Merton, 1974), i.e., below the level of liabilities net of convertible debt and equity. With a specified recovery rate R, the model-implied distress risk translates into the actuarially fair premium for insurance against losses on the bank's senior debt, c^* (Finkelstein et al., 2002, Equation (2.15)). This premium then determines the implied subsidy rate, $s^{\text{TBTF}} = c^* - \tilde{c}$. Similar modeling approaches are used, for example, in Lambert et al. (2014) and Allenspach et al. (2021).

In Appendix A, we describe our quantitative approach in detail. We start with a standard calibration based on Finkelstein et al. (2002), which yields a TBTF subsidy rate in a range around 5.74% when we set $R = 0.77$—a conservative value in the sense that it should lead us to under- rather than overestimate the TBTF subsidy rate. We then re-calibrate the model, emphasizing the distinction between senior debt on the one hand and total loss-absorbing capacity (TLAC, composed of equity and subordinated debt) on the other. Focusing again on UBS, we estimate the volatility of UBS's asset growth rate, calibrate the bank's loss-absorption capacity using 2022 balance sheet data, and assume

that there is no uncertainty regarding this capacity. We use the 2022 data for UBS's loss-absorption capacity because it stood at a historical high in that year. As a consequence, our results tend to under- rather than over-estimate the TBTF subsidy rate.

Table 1 collects the main results. We find a TBTF subsidy rate of at least 1.6%. To calculate the total TBTF subsidy, we multiply this rate by the total debt. A key issue is whether deposits should be treated as senior debt, i.e., whether they should be included among the securities benefiting from TBTF subsidies.

A common view is that SIB status does not confer any protection for deposits because they are anyway covered by deposit insurance (up to a certain limit). But this view neglects that the Swiss deposit insurance system is limited and does not fully cover deposits at large SIBs such as UBS. In other words, deposits of a SIB may still benefit from TBTF guarantees, even if the deposit insurance system covers deposits at smaller banks. We leave the decision on this matter to the reader. When we include deposits as benefiting from the TBTF subsidy, UBS's total subsidy in 2022 amounts to USD 11.6bn; otherwise, it is USD 2.9bn. For comparison, UBS's net profit in 2022 was USD 7.2bn.

	Standard calibration	New calibration
$s^{\text{TBTF}}(5)$ senior debt	5.74%	1.62%
UBS subsidy excl. deposits	USD 10.3bn	USD 2.9bn
UBS subsidy incl. deposits	USD 41.1bn	USD 11.6bn

Table 1: Lower bounds for TBTF subsidy rates and total UBS subsidy in 2022.

4.2 Estimates in the Literature

A meta analysis by the Bank for International Settlements yields 106 estimates of the funding cost advantage of SIBs based on 19 studies for banks in several countries. The mode of the estimates is in the 20–30bps range, 60% of the estimates lie in the 0–50bps range, and the minimum and maximum estimates are −10 and 350bps, respectively.[33] In the following, we focus on studies that specifically consider the Swiss case.

Allenspach et al. (2021) measure the TBTF subsidy based on extensions of the Merton (1974) model, specifically the CreditGrades model (that we also use) and Moody's CreditEdge model. They refine these approaches by incorporating the effect of Contingent Convertible bonds and bail-in bonds, finding that while these instruments reduce the

[33] See https://www.bis.org/frame/tbtf/impact-estimates.htm?m=247.

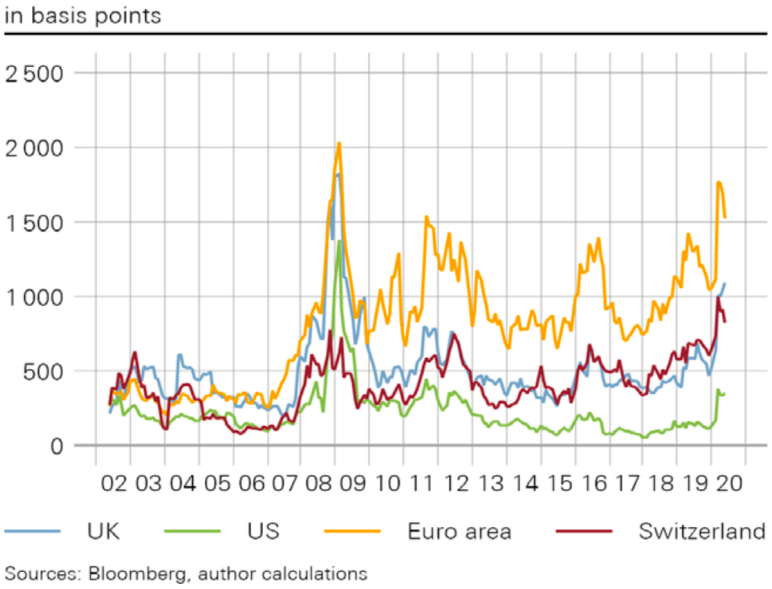

Figure 2: Allenspach et al. (2021, p. 15): TBTF subsidy rate for Swiss banks in international comparison (bps).

TBTF subsidy, they do not completely eliminate it. The results reveal that the TBTF issue remains specific to the banking sector, as large non-financial firms do not benefit from a similar subsidy. While the TBTF subsidy for banks has decreased since the peak of the Global Financial Crisis, it remains higher than pre-crisis levels. Allenspach et al. (2021) identify significant regional differences, with European banks generally experiencing a more pronounced TBTF subsidy than U.S. banks, especially since 2017.[34] The estimated TBTF subsidy rate for Swiss SIBs amounts to around 400bps in the period 2008–2018; it increased to 1000bps at the onset of the Covid crisis, see Figure 2.

Lambert et al. (2014) report several estimates of implicit subsidies. Using CDS spreads and Moody's CreditEdge model, they find a subsidy rate of approximately 50bps in 2008 and around 175bps in 2013 for Swiss SIBs.[35] Based on credit ratings, they estimate a subsidy rate of about 100bps in 2009, but only around 15bps during calmer periods.[36] The authors estimate the value of TBTF subsidies for large Swiss banks at USD 50bn during the post-GFC period (2011–2012) based on the CDS approach, and between USD

[34]The authors also highlight the ambiguity of TBTF indicators during calm periods, noting that low indicator values can reflect either a low likelihood of government support or of financial distress.

[35]See their Figure 3.8. Lambert et al. (2014) include in their sample all global systemically important banks plus the three largest banks by asset size in each country.

[36]See their Figure 3.10. For banks just below investment grade, the authors report that the subsidy rises to around 70–75bps during times of market calm.

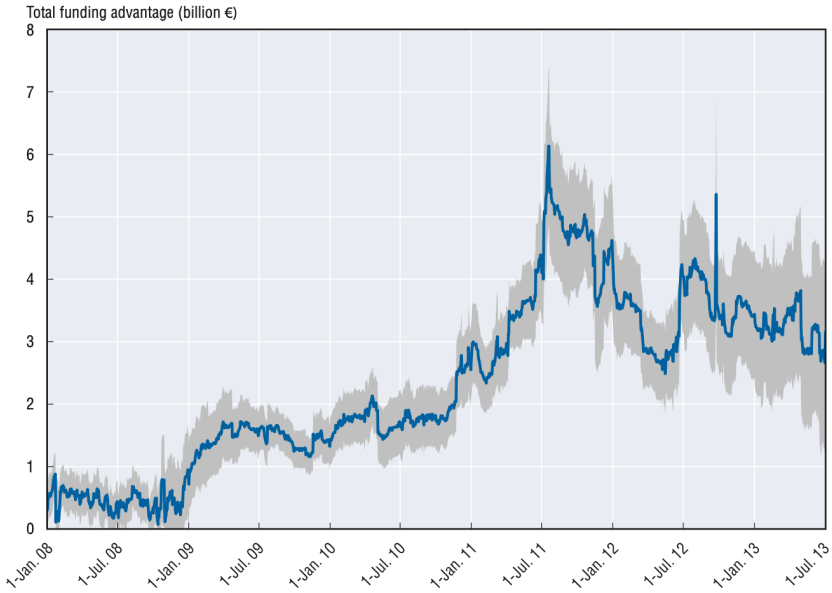

Figure 3: Schich et al. (2014, p. 29): Funding cost reduction due to implicit TBTF guarantees for Swiss banks (billions of EUR).

5 and 20bn using the credit rating approach.[37]

Ueda and Weder di Mauro (2013) find that anticipated government support boosts the ratings of systemically important Swiss banks by 2.6–3.2 notches (out of 15) in 2007 and by 3.1–3.9 notches in 2009. Drawing on the conversion from Soussa (2000), which indicates that a three-notch improvement in the rating of five-year bonds corresponds to a funding cost reduction of 5–128bps for banks rated between A and B, the estimates by Ueda and Weder di Mauro (2013) imply funding cost reductions of 4–137bps in 2007 and 5–166bps in 2009.

Schich et al. (2014) calculate banks' funding cost reduction due to implicit TBTF guarantees as the product of three factors: the 'uplift' (the difference between the credit rating with and without guarantees), the strength of the uplift's effect on the interest rate the bank has to pay, and the amount of rating-sensitive debt issued by the bank. They find particularly high funding cost reductions in countries with large banking sectors. For Switzerland, they estimate a funding cost reduction of just over 0.6% of GDP in 2012 and 2013.[38] Figure 3 illustrates the time series of the estimated funding cost reduction for Swiss banks.

[37] See their pp. 114, 118.

[38] See their p. 16. The authors include the following Swiss banks in their sample: Bank Julius Baer & Co. Ltd, Banque Cantonale Vaudoise, Clariden Leu AG, Credit Suisse AG, Raiffeisen Schweiz Genossenschaft, St. Galler Kantonalbank, UBS AG, Valiant Bank AG, Zürcher Kantonalbank.

Zhao (2018) examines CDS spreads for senior and junior debt to infer implicit government guarantees. For 2007, the study identifies implicit subsidy rates of 220bps for Credit Suisse and 195bps for UBS. During quieter periods, Zhao (2018) finds significantly smaller subsidy rates of approximately 1bp.[39]

Finally, it is instructive to consider the profit shares that Swiss cantonal banks distribute to their owners.[40] In 2017, cantonal banks distributed approximately 4.5% of profits before tax as compensation for cantonal guarantees.[41] Zürcher Kantonalbank, the only SIB with an explicit state guarantee, distributed on average 2.7% of pre-tax profits to compensate the canton of Zurich for the state guarantee in the years 2017–2022.[42]

To summarize these results from the literature, estimated TBTF subsidy rates exhibit significant co-variation with prevailing conditions in financial markets. During "quiet" periods, subsidy rates are typically in the single digit or low double-digit basis points, whereas in times of financial stress, they can surge to several percentage points.

5 Conclusion

We have examined the rationale for a Swiss PLB and its fee structure, and argued that corrective measures are essential to align the incentives of SIB managers and shareholders with societal interests. The ex-post terms and conditions attached to SNB liquidity support and a PLB are ineffective for this purpose for several reasons. Most importantly, they have limited relevance for initial shareholders and management, and their impact is overshadowed by the implicit subsidy of non-convertible debt that arises from the expectation of crisis support measures. We have also argued that the presence of SIBs calls for increased precautionary savings, as the potential for their failure introduces uncertainty and significant downside risks for government finances and the broader economy.

Finally, we have estimated the implicit subsidy for UBS resulting from its status as a TBTF SIB and compared our estimate with other estimates in the literature. According

[39] See p. 96 in Zhao (2018).

[40] Arguably, cantonal banks generate additional "dividends" for their owners by providing mandated services, e.g., to local businesses. Even without explicit state guarantees, market participants anticipate government support for cantonal banks in times of crisis. See, for example, Moody's October 2024 rating of Berner Kantonalbank AG (https://www.bekb.ch/-/media/bekb/portal/documents/news/rating_action-moodys-ratings-affirms-berner-20241004.pdf): "The affirmation of BEKB's ratings follows the affirmation of the bank's a2 BCA and a1 Adjusted BCA, the latter incorporating our unchanged assumption of a high affiliate support from its majority owner, the Canton of Berne, resulting in one notch of rating uplift for the bank's Adjusted BCA."

[41] See pp. 40 in https://www.bak-economics.com/fileadmin/documents/reports/BAK_Economics_Volkswirtschaftliche_Bedeutung_Kantonalbanken.pdf.

[42] See p. 68 of the Dispatch.

to our analysis, UBS's funding cost advantage amounts to a subsidy rate of at least 1.6% on its senior debt, equating to a total TBTF subsidy of at least USD 2.9bn, which compares with 2022 net profits of UBS of USD 7.2bn. We argue that bank regulation should address the overall TBTF subsidy holistically, rather than attempting to correct the PLB-related component in isolation.

We conclude with four qualifications. First, our work highlights the substantial uncertainty about TBTF subsidies given the limited amount of granular balance sheet data. We have tried to address this limitation by making conservative assumptions.

Second, the TBTF subsidy we focus on is only one part of the broader spectrum of explicit and implicit subsidies that banks receive. Most notably, banks benefit from a liquidity premium on instruments like deposits, which lowers their financing costs. This premium arises partly from the central bank's role as lender of last resort, both in times of crisis and during normal periods, and is thus, in part, a subsidy.

Third, the economic costs of government interventions to support financial institutions can be larger or smaller than the subsidy we have identified, depending on factors such as elasticities and other market frictions.

Finally, government measures to counteract the TBTF subsidy need not be limited to taxes or fees. Quantity restrictions and other regulatory tools can have similar corrective effects. Given the large sums at stake, SIBs are likely to resist such measures, regardless of their form.

A Calibration of Merton (1974) and Finkelstein et al. (2002) Model

A.1 Credit Grade Model

We construct a theoretical CDS spread measure using a structural model proposed by Finkelstein et al. (2002), and known as the CreditGrade model. We will refer to this paper as CG going forward. CG applies their methodology to non-financial as well as financial corporates, and it has become a standard in the literature to estimate theoretical CDS spreads, although there are differences in how the model is calibrated. Here we show the main equations of the CG model and we refer the interested reader to Finkelstein et al. (2002) for the details.

CG assumes that the firm's assets V_t follows a diffusion process,

$$\frac{dV_t}{V_t} = \mu dt + \sigma_V dW_t, \tag{2}$$

where μ is a constant drift term, W_t denotes a Brownian motion, and σ_V indexes the asset growth volatility. CG assumes that $\mu = 0$ and that the firm's debt is fixed over the horizon of interest. As a consequence, expected leverage is fixed. The firm defaults when V_t falls below some default threshold, LD, where L is the average recovery rate of firm debt D. CG discusses that with a fixed threshold LD the model underestimates the default probability. As a remedy, CG introduces a stochastic default threshold by assuming that L is distributed according to a lognormal distribution, with mean $\bar{L}$, and percentage standard deviation λ, so that

$$LD = \bar{L}De^{\lambda Z - \lambda^2/2}, \tag{3}$$

where Z is a standard normal random variable. Given these assumptions, the survival probability of the firm from now (date 0) to date t is

$$P(t) = \Phi\left(-\frac{A_t}{2} + \frac{\log(d)}{A_t}\right) - d\Phi\left(-\frac{A_t}{2} - \frac{\log(d)}{A_t}\right) \tag{4}$$

with

$$d = \frac{E + \bar{L}D}{\bar{L}D}e^{\lambda^2}$$

and

$$A_t = \sqrt{\sigma_V^2 t + \lambda^2},$$

where $\Phi(\cdot)$ denotes the normal cumulative distribution function, and E is the equity value at date 0.

Equipped with the survival probability of the firm, it is now possible to price protection (a CDS) against losses on debt D by equating the present (expected) values of the protection premium payments c^* to the CDS seller and insurance payouts from the CDS seller in case of losses on the debt. For protection with duration t, the CG model yields a (risk neutral) premium $c^*(t)$ equal to

$$c^*(t) = r(1-R)\frac{1 - P(0) + e^{r\xi}\left[G(t+\xi) - G(\xi)\right]}{P(0) - P(t)e^{-rt} - e^{r\xi}\left[G(t+\xi) - G(\xi)\right]}, \tag{5}$$

where r is the risk free interest rate, R denotes the recovery rate over the class of senior debt in the absence of government insurance, and $\xi = \lambda^2/\sigma^2$. The function G is

$$G(u) = d^{z+1/2}\Phi\left(-\frac{\log(d)}{\sigma_V\sqrt{u}} - z\sigma_V\sqrt{u}\right) + d^{-z+1/2}\Phi\left(-\frac{\log(d)}{\sigma_V\sqrt{u}} + z\sigma_V\sqrt{u}\right)$$

with $z = \sqrt{1/4 + 2r/\sigma_V^2}$.

As explained in the main text, the spread $c^*(t)$ is the hypothetical insurance premium that a protection seller (CDS issuer) would accept in exchange for providing insurance against losses on debt, in the absence of any government guarantee. $c^*(t)$ is higher than the CDS premium $\tilde{c}(t)$ observed in the data when debt holders expect to benefit from a government bailout. Then $c^*(t) - \tilde{c}(t)$ is the subsidy rate that a too-big-to-fail bank receives on its debt.

A.2 Standard Calibration

CG calibrates $\bar{L} = 0.5000$ and $\lambda = 0.3000$ based on Portfolio Management Data and Standard & Poor's database. CG approximate σ_V based on data on share price variability, using an (approximate) relationship between the volatility of equity price growth and the volatility of asset value growth given by

$$\sigma_V = \sigma_S \frac{S \times \text{share price}}{S \times \text{share price} + \bar{L}D} = \sigma_S \frac{E}{E + \bar{L}D},$$

where S denotes the stock price and σ_S the equity price growth volatility. For σ_S, CG uses 1000-day historical volatility estimates. We follow this approach and consider the 300-, 600-, and 900-day historical averages of the stock price volatility of UBS, selecting the highest and lowest volatilities as bounds. For the recovery rate R, we use the range 48%–

77% based on US studies. Finally, we set the risk-free rate to $r = 0.4858\%$, the average yield on 5-year government bonds in 2022.[43] Table 2 summarizes the CG calibration, which we refer to as "standard calibration."

	Value or range	Source
σ_S	$[0.3226, 0.3399]$	Extrema of 300-, 600-, and 900-day averages of UBS stock price growth (annualized), Refinitiv data
λ	0.3000	Finkelstein et al. (2002)
$\bar{L}$	0.5240	Schweikhard and Tsesmelidakis (2012), Table III A, Fin, post-crisis period
$\frac{E}{E+LD}$	0.0944	2022 UBS annual report
r	0.4858%	2022 average risk-free rate on 5-year Swiss Confederation bonds, Refinitiv data
R	$[0.4800, 0.7700]$	Average historical recovery rate (Begenau and Landvoigt, 2022), optimistic historical average (Bennett and Unal, 2015)

Table 2: Standard calibration.

Based on this calibration and for $R = 0.48$, we obtain the range $[1490, 1496]$bps for the theoretical 5-year CDS spread in 2022, $c^*_{CG,2022}(5)$. For $R = 0.77$, we obtain the range $[659, 661]$bps.

A.3 New Calibration

To better capture the specific characteristics of the Swiss context, we re-calibrate the CG model, emphasizing the distinction between senior debt and TLAC. In CG, the firm defaults when its assets fall below LD, the average recovery rate of all bond categories on the firm's balance sheet once in bankruptcy. We find it more natural to interpret $(1 - L)D$ as the value of the bonds that can be converted into equity or devalue (e.g., AT1, AT2 bonds) before or at the time of bankruptcy. This is relevant in the context of the PLB discussion, because the Swiss proposal foresees that the PLB will only be triggered once all subordinated debt has been wiped out. Therefore, our interpretation

[43] Using the 5-year forward swap rate gives essentially the same results.

of CG interprets the probability of bankruptcy as the probability that UBS will access the PLB. Since we seek a conservative estimate of the TBTF subsidy rate, we assume that all bonds that contribute loss-absorption capacity are completely wiped out before the government intervenes. Moreover, we posit that UBS' loss-absorption capacity will be stable at the historical maximum attained in 2022.

Rather than relying on share price data as in the CG calibration, and to align with our interpretation of the model, we estimate σ_V using maximum likelihood estimation based on historical UBS data.[44] Our estimates of σ_V vary significantly across different time periods. Specifically, we find $\sigma_V = 0.2563$ for the period 1995–2005; 0.1556 for 2005–2015; 0.0531 for 2015–2022; and 0.2049 for the full 1995–2022 period. We report results for the whole range of estimates. The most conservative estimate, $\sigma_V = 0.0531$, implies the smallest TBTF subsidy rate.

We set the risk free rate to $r = 0.4858\%$ and the recovery rate on senior debt (in the absence of government intervention) to $R = 0.77$. As explained before, this constitutes again a conservative approach. Figure 4 illustrates the time series of the data we use and Table 3 summarizes the calibration.

	Value or range	Source
σ_V	$[0.0531, 0.2563]$	Extrema of estimated asset growth volatility, Refinitiv data
λ	0.0000	Conservative assumption
$\frac{V}{LD}$	1.1054	Maximum TLAC share (2022), UBS annual reports
r	0.4858%	2022 average risk-free rate on 5-year Swiss Confederation bonds, Refinitiv data
R	0.7700	Optimistic historical average (Bennett and Unal, 2015)

Table 3: New calibration.

[44] We include the trend μ in the estimation equation but do not report it.

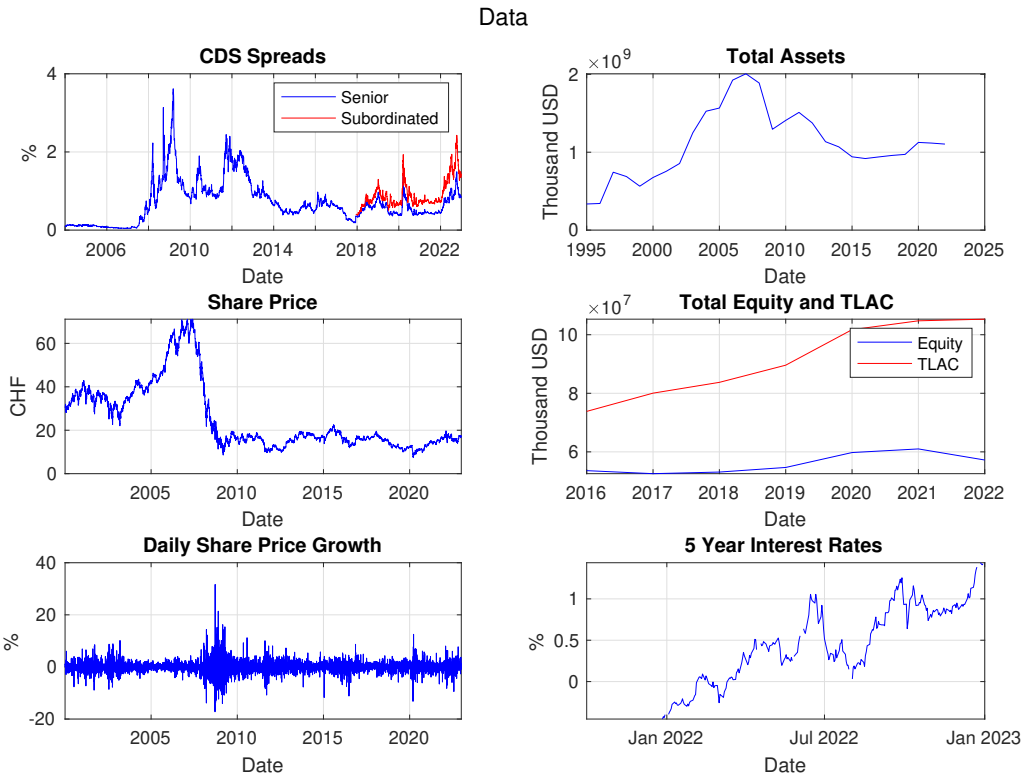

Figure 4: Data underlying the calibration (UBS except for interest rates).

A.4 Results

Next, we express (5) as a function of R, $c^*(t) = (1-R)X^{cal}(t)$, where

$$X^{cal}(t) \equiv r\frac{1 - P(0) + e^{r\xi}\left[G(t+\xi) - G(\xi)\right]}{P(0) - P(t)e^{-rt} - e^{r\xi}\left[G(t+\xi) - G(\xi)\right]}$$

can be interpreted as a default factor, and can be computed based on our calibration. Given the range for σ_V, $X^{cal}(5)$ lies in a range as well, namely $X^{cal}(5) \in [0.1074, 0.8453]$. For $R = 0.77$, the theoretical CDS spread thus satisfies

$$c^*(5) \in (1 - 0.77) \times [0.1074, 0.8453] = [0.0247, 0.1944].$$

To calculate the TBTF subsidy rate, we need to subtract the observed CDS spread from $c^*(5)$. Table 4 reports the 5-year CDS spread, both for senior unsecured as well as subordinated UBS debt as of 2022.

	Value	Source
$\tilde{c}(5)$ senior	0.8479%	2022 annual average, Refinitiv series `UBSJ5YEUAM=R`
$\tilde{c}(5)$ subord.	1.4256%	2022 anual average, Refinitiv series `UBSJ5YEUSM=R`

Table 4: 5-year CDS spreads.

Using the data for senior debt, the subsidy rate then satisfies

$$s^{\text{TBTF}}(5) \in [0.0247, 0.1944] - 0.8479\% = [0.0162, 0.1859],$$

that is, it lies between one and nineteen percent. Parallel calculations for the CG calibration yield the tighter range $[0.0574, 0.0577]$, i.e., a subsidy rate of nearly six percent.

We can similarly compute a TBTF subsidy rate for subordinated debt. Under the assumption that, absent government intervention, subordinated debt is fully wiped out upon bankruptcy, the actuarially fair CDS spread simply equals $X^{cal}(5)$. Using the observed CDS spread for subordinated debt, this implies a subsidy rate on subordinated debt in the range $[0.1074, 0.8453] - 1.4256\% = [0.0931, 0.8311]$, i.e., a TBTF subsidy rate of between nine and eighty three percent. With the CG calibration, the range is $[0.2724, 0.2734]$. Table 5 summarizes these results. Its main message is that, even under the most conservative assumptions, UBS benefits from a TBTF subsidy rate of more than 1.6%. Figure 5 illustrates how estimated TBTF subsidy rates on senior debt vary with the recovery rate, R.

	Standard calibration	New calibration
$s^{\text{TBTF}}(5)$ senior	$[0.0574, 0.0577]$	$[0.0162, 0.1859]$
$s^{\text{TBTF}}(5)$ subord.	$[0.2724, 0.2734]$	$[0.0931, 0.8311]$

Table 5: Estimated TBTF subsidy rates.

A completely credible TBTF regime should be associated with subsidy rates on junior debt near zero, and after the investor losses on Credit Suisse AT1 bonds in 2023, we indeed expect lower anticipated subsidies. To err, again, on the side of caution, we assume the subsidy rate on junior debt to be zero in what follows.

To derive an estimate of the absolute value of TBTF subsidies, we multiply the es-

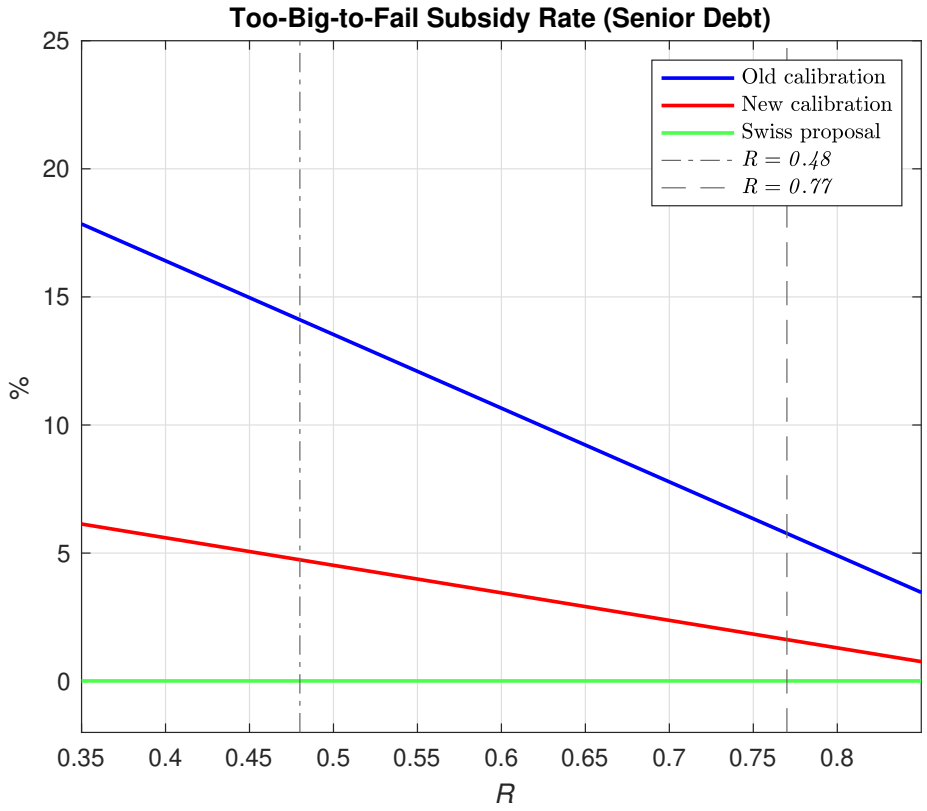

Figure 5: Estimated TBTF subsidy rates on senior debt for different recovery rates, R.

timated subsidy rate with the amount of debt. Focusing on senior debt, an important question is whether deposits belong to this category. While some authors argue that deposits are covered by deposit insurance and therefore should be excluded,[45] the matter is more complicated for UBS as the Swiss deposit insurance system would not be able to cover all UBS depositors. We report the TBTF subsidy for insured senior debt both including and excluding deposits.

In 2022, UBS reported deposits valued at USD 536bn, total debt of USD 228bn, equity of USD 57bn, and TLAC of USD 105bn, such that subordinated debt equalled USD $(105 - 57)$bn = USD 48bn. We conclude that senior unsecured debt excluding deposits totalled USD $(228 - 48)$bn = USD 180bn, while unsecured debt plus deposits equalled USD $(536 + 180)$bn = USD 716bn. Using the lowest estimates of the TBTF subsidy rate on senior debt, this yields the subsidy amounts reported in Table 6. For comparison, the 2022 net profit of UBS was USD 7.2bn.

[45] See, for example, Acharya et al. (2022).

	Standard calibration	New calibration
UBS subsidy excl. deposits	USD 10.3bn	USD 2.9bn
UBS subsidy incl. deposits	USD 41.1bn	USD 11.6bn

Table 6: Lower bounds for estimated TBTF subsidy.

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