DNB Working Paper

No 868 / September 2026

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DeNederlandscheBank

EUROSYSTEEM

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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

Working Paper No. 868

September 2026

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Systemic at Home: the Persistence of a Too-Big-to-Fail Premium in Europe*

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August 31, 2026

Abstract

We quantify the implicit too-big-to-fail (TBTF) funding advantage of large European banks using CDS market data. Applying a reduced-form asset pricing framework, we decompose spreads into a fundamental credit-risk component and a residual wedge attributable to implicit government support. We do not find evidence that G-SIB designation is associated with lower funding costs once bank fundamentals and sovereign factors are taken into account. By contrast, banks whose assets exceed half of home-country GDP enjoy at least 30% lower credit spreads than those of otherwise comparable peers. A time-varying specification reveals that the TBTF wedge persists through 2024, and while average spreads are significantly lower across the board compared to the period around the Great Financial Crisis, the implicit bailout guarantee as a proportion of total spreads has not diminished in recent years. Moreover, the results suggest that the TBTF premium depends on sovereign fiscal strength: the funding advantage of systemic banks declines when home-sovereign CDS spreads rise. This points to Europe's TBTF problem being primarily domestic in nature and relates to the strength of the home sovereign.

Keywords: too-big-to-fail; CDS spreads; implicit subsidies; systemic risk; European banking; sovereign-bank nexus
JEL Classification: G21; G28; G12; H81

*We would like to thank Maurice Bun, Francesco Caiola, Eric Cuijpers, Sebastien Gallet, Robert van Geffen, Jan Kakes, Kenny Martens, Natalya Martynova, Brendon Pinch, David Rijsbergen, Marc Roovers, Anna Samarina and Marloes van Schaik, Sandra Wesseling, and Bas ter Weel for valuable input, as well as seminar participants at IFABS 2026 for the discussions. Special thanks to Jack Bekooij for the assistance in data collection.

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1 Introduction

Given that a bank's failure may threaten to destabilise the broader financial system, public authorities may face strong pressure to intervene rather than allow an orderly resolution. This prospect of government support creates an implicit subsidy, known as the too-big-to-fail (TBTF) premium: when creditors expect a bailout, they demand lower compensation for the risk of lending to systemic institutions, thereby compressing their funding costs relative to smaller, non-systemic peers with comparable fundamentals (Berndt, Duffie, and Zhu, 2025; Gandhi and Lustig, 2015; Ueda and di Mauro, 2012). The resulting funding advantage goes beyond a mere distributional concern. It weakens market discipline (Acharya, Anginer, and Warburton, 2013), encourages excessive risk-taking and leverage (Andersen and Jensen, 2022; Farhi and Tirole, 2012), and provides incentives for further growth and consolidation that reinforce the very systemic importance that generates the premium in the first place (Boyd and Heitz, 2016; Brewer and Jagtiani, 2013).

The post-Global Financial Crisis (GFC) regulatory agenda was, in large part, designed to eliminate this problem. In Europe, reforms such as the Bank Recovery and Resolution Directive (BRRD), the creation of the Single Resolution Board (SRB), and the introduction of mandatory bail-in tools were intended to make bank failures credibly manageable without recourse to public funds, thereby severing the link between systemic size and implicit government support. Whether these reforms have been sufficient to shift market expectations away from anticipated public support remains an open empirical question, and it is independent of any assessment of the operational effectiveness of the European resolution framework. Berndt et al. (2025) (BDZ hereafter) find that the bailout expectations of US Global Systemically Important Banks (G-SIBs) have declined relative to the pre-GFC period; Hellwig (2021) argues that TBTF incentives remain pervasive despite major regulatory reforms; and Tölö, Jokivuolle, and Virén (2021) find that expectations of public support in the euro-area interbank market declined only marginally in the post-crisis years. Horváth and Silva-Buston (2026) show that creditors price bail-in risk, while we show that they continue to price bailout expectations as well. For Europe, the most up-to-date, market-based evidence on the persistence of TBTF premia and on what drives them remains scarce. This paper fills that gap.

We quantify the implicit TBTF funding advantage of large European banks using daily 5-year credit default swap (CDS) spreads on senior unsecured debt for a panel of 32 banks over 2008–2024. Building on the reduced-form asset pricing framework of BDZ, we decompose CDS spreads into a fundamental credit-risk component—in our case proxied by a rich set of CAMEL-based bank controls[1] and a residual wedge attributable to implicit government support. We then ask whether a TBTF premium remains embedded in

[1] CAMEL refers to the five core dimensions of bank health: Capital adequacy, Asset quality, Management quality, Earnings, and Liquidity.

European bank funding markets through the way creditors price the prospect of government support and, if so, what drives it. Persisting bailout expectations reflected in CDS prices would translate into lower funding costs for systemic institutions, with potential consequences for market discipline and competitive dynamics within the banking sector.

Our main empirical findings can be summarised as follows. First, we find that G-SIB designation on its own does not generate a measurable funding advantage in a European context: the G-SIB coefficient is statistically insignificant and even carries the wrong sign once bank fundamentals and time fixed effects are controlled for. By contrast, banks whose total assets exceed approximately half of their home-country GDP enjoy credit spreads on senior unsecured debt that is roughly 30% lower than the spread of comparable non-systemic banks—a premium that is both statistically significant and economically large. Second, this domestic TBTF wedge persists through 2024, though its magnitude has evolved. The estimated no-bailout risk component as a share of total spreads was significantly higher during the GFC than today, potentially reflecting uncertainty about sovereign fiscal capacity at the time. It has stabilised at a persistently low level since around 2016, indicating that markets continue to assign substantial value to expected public support.

We make three contributions to the literature. First, we transport the reduced-form pricing framework of BDZ from the US to Europe and show that it identifies a significant TBTF premium only when systemic importance is measured relative to domestic fiscal capacity rather than global designation. In the US, G-SIB status and domestic dominance largely coincide, so the two cannot be identified separately. In Europe's fragmented fiscal union—where crisis management still implicitly remains anchored to national sovereigns, fiscal backstops are heterogeneous, and the Banking Union remains incomplete—the two dimensions are empirically distinct. Our findings thus suggest that the BDZ framework identifies a TBTF premium in Europe only when systemic importance is defined relative to domestic economic size. This suggests that market participants place greater weight on the potential fiscal burden a bank represents for its home sovereign than on its formal global systemic designation. This interpretation is consistent with the sovereign-bank nexus literature (Acharya, Drechsler, and Schnabl, 2014; Altavilla, Pagano, and Simonelli, 2017; Demirgüç-Kunt and Huizinga, 2013), which argues that expectations of public support depend on the domestic sovereign's fiscal capacity relative to the scale of the banking sector.

Consistent with this interpretation, we find that the TBTF premium varies systematically with sovereign credit conditions. At the aggregate level, movements in sovereign CDS spreads explain a large share of the time variation in the estimated TBTF wedge. At the bank level, the funding advantage of domestically systemic institutions shrinks as home-sovereign CDS spreads rise, implying that markets treat the implicit guarantee as contingent on the fiscal health of the sovereign standing behind it. These findings provide direct evidence that the value of the TBTF subsidy depends not only on bank characteristics but also on the credibility of the public backstop.

Second, we provide the most up-to-date market-based evidence on the persistence of the TBTF wedge in Europe, covering the full arc from the GFC through the implementation of the Banking Union and up to 2024. Prior European studies using CDS or bond data typically end before 2016 (Barth and Schnabel, 2013; Bijlsma, Lukkezen, and Marinova, 2014), leaving open the question of whether post-reform markets still price implicit support. We find that the TBTF premium has narrowed in absolute terms since the GFC, but this largely reflects the broad-based decline in bank credit spreads over the same period. The evidence does not suggest a corresponding decline in bailout expectations. On the contrary, because a smaller fraction of spreads is now attributable to fundamental default risk, the relative contribution of implicit support expectations to CDS pricing appears as important as ever, and possibly more so. This suggests that the substantial post-crisis decline in bank credit spreads reflects improvements in bank resilience and risk profiles more broadly, rather than a thorough disappearance of the TBTF premium. While reforms such as higher capital requirements, enhanced liquidity standards, and the development of the European resolution framework have reduced overall levels of credit risk, our results indicate that markets continue to price a funding advantage for domestically systemic banks relative to comparable peers.

Third, we offer a methodological contribution to how TBTF studies should be conducted in cross-country European samples. We show that the apparent G-SIB premium in naive regressions is largely a sovereign-risk artefact: G-SIBs are predominantly headquartered in core countries with strong sovereigns, so their lower spreads partly reflect the quality of the domestic fiscal backstop rather than their global systemic designation. Once the periphery indicator is included, the G-SIB coefficient becomes insignificant, while the domestic size coefficient remains large and significant. This suggests that studies using G-SIB status as the TBTF proxy in heterogeneous European samples risk misattributing a sovereign-risk effect to global systemic importance.

Fourth, we extend the empirical implementation to better reflect the institutional features of European banking. We employ a comprehensive CAMEL-based specification that captures the main dimensions of bank financial health, augmented with controls for gone-concern loss-absorbing capacity and for sovereign-risk heterogeneity. These extensions are particularly relevant in Europe, where creditor-loss allocation rules and differences in sovereign fiscal strength may substantially affect CDS pricing. By incorporating these factors, we obtain a cleaner measure of the residual spread component attributable to implicit support expectations.

Our findings carry direct policy relevance. The ongoing debates on banking consolidation and the creation of larger cross-border institutions implicitly assume that scale brings efficiency without accounting for the potential increase in systemic risk. Our results suggest that markets already price in a substantial implicit subsidy for domestically dominant banks, and that this subsidy is anchored to the domestic fiscal backstop rather than to formal resolution arrangements. Larger cross-border banks may therefore exacerbate the TBTF problem if bailout expectations remain anchored to domestic sovereigns. In that case, cross-border expansion would alter the geographic distribution of banking activities without necessarily weakening expectations of public support.

The remainder of the paper is organised as follows: Section 2 discusses a simple pricing model of credit risk and defines in this context the TBTF premium; Section 3 describes the data and our construction approach of a TBTF indicator; Section 4 presents the empirical framework; Section 5 reports the results and robustness checks; Section 6 augments the analysis with sovereign spreads, and finally Section 7 concludes.

2 Baseline theory of pricing TBTF credit risk

Following BDZ, we begin with a simple pricing identity that separates banks according to their systemic status. Let $\mathcal{K}$ denote the subset of banks perceived by market participants as TBTF, and let the remaining banks form the non-TBTF comparison group. The observed credit spread of bank $i \in \mathcal{K}$ at time t reflects both its fundamental credit risk and the extent to which its creditors expect to be protected by public support.

In the absence of expected government support, we know that the credit spread of bank i would reflect its probability of default and the loss incurred by creditors in the event of default. We denote this counterfactual spread by

$$s_{it}^{CF} \;=\; p_{it}\,\mathrm{LGD}_{it}, \tag{1}$$

where p_{it} is the bank-specific default probability and LGD_{it} is its loss given default. We refer to s_{it}^{CF} as the bank's fundamental, or no-support, credit spread.

Expected public support reduces the losses priced by creditors. Let $\pi_t \in (0,1]$ denote the market-implied no-bailout probability of TBTF banks. Assume that this probability is common across banks in $\mathcal{K}$, although we allow it to vary over time. The observed spread of a TBTF bank can then be written as

$$s_{it}^{TBTF} \;=\; \pi_t\, s_{it}^{CF} \;=\; \pi_t\, p_{it}\,\mathrm{LGD}_{it}, \qquad i \in \mathcal{K}. \tag{2}$$

When $\pi_t = 1$, creditors price the bank's full fundamental credit risk. When $\pi_t < 1$, expected public support compresses the observed spread below its no-support level. A lower value of π_t therefore represents stronger bailout expectations and a larger funding advantage for TBTF banks.

The TBTF wedge. Conditional on an observed spread of a TBTF bank and on an estimate of the no-bailout probability, Equation (2) then gives the counterfactual spread that a TBTF bank would face if creditors no longer priced the additional protection associated with its systemic status:

$$s_{it}^{CF} \;=\; \frac{s_{it}^{TBTF}}{\pi_t}. \tag{3}$$

We then define the TBTF wedge as the logarithmic difference between the credit spread of a TBTF bank and its counterfactual:

$$\log s_{it}^{TBTF} - \log s_{it}^{CF} \;=\; \log \pi_t. \tag{4}$$

This wedge is negative whenever $\pi_t < 1$, indicating that a TBTF bank pays a lower credit spread than an otherwise comparable bank whose creditors price the full exposure to fundamental credit risk. Section 4 maps this relationship into the empirical specification and shows how $\log \pi_t$ is recovered from the estimated coefficient on TBTF status.

The TBTF premium. To express the funding advantage in basis points, we also define the TBTF premium as the difference between the counterfactual no-support spread and the observed spread of a TBTF bank. Averaging across the set $\mathcal{K}$ of TBTF banks gives

$$\Delta_t \;=\; \mathbb{E}\big[s_{it}^{CF} - s_{it}^{TBTF} \,\big|\, i \in \mathcal{K}\big] \;=\; \left(\frac{1}{\pi_t} - 1\right) \mathbb{E}\big[s_{it}^{TBTF} \,\big|\, i \in \mathcal{K}\big]\,. \tag{5}$$

The premium is zero when $\pi_t = 1$, because creditors price the bank's full fundamental credit risk. It increases as π_t declines and expected public support becomes more valuable. In the limiting case in which π_t approaches zero, the implicit guarantee removes nearly the entire counterfactual credit spread.

Normalization. The interpretation above uses the normalization that the no-bailout probability of a counterfactual non-TBTF bank equals one. This can be seen as a scaling choice reflecting the fact that we cannot identify separately the no-bailout probability of banks that are not labeled as TBTF, i.e. not in the set $\mathcal{K}$. Nevertheless, the current setting allows for non-TBTF banks to also receive implicit support with positive probability, the only assumption for still being able to identify π_t in Equation (2) is that the no-bailout probability of TBTF banks is systematically lower than that of non-TBTF banks. To see this, let π_t^{TBTF} and π_t^{non} denote the underlying no-bailout probabilities of TBTF and non-TBTF banks, respectively. The parameter identified by comparing otherwise similar banks across the two groups is

$$\pi_t \equiv \frac{\pi_t^{TBTF}}{\pi_t^{non}}. \tag{6}$$

Setting $\pi_t^{non} = 1$ simply expresses the no-bailout probability of TBTF banks relative to that of the non-TBTF comparison group. Thus, $\pi_t < 1$ means that creditors expect greater public support for TBTF banks than for otherwise comparable non-TBTF banks.

Consequently, the model identifies the incremental support associated with TBTF status rather than the absolute probability that a TBTF bank will not be bailed out. If non-TBTF banks also benefit from implicit support, then $\pi_t^{non} < 1$ and the absolute no-bailout probability of TBTF banks satisfies

$$\pi_t^{TBTF} = \pi_t \cdot \pi_t^{non} \leq \pi_t. \tag{7}$$

The estimated π_t therefore provides an upper bound on the absolute no-bailout probability of TBTF banks. Correspondingly, the premium Δ_t calculated under the normalization provides a lower bound on their total funding advantage. Section 4 explains further how these relative quantities are estimated in the static and time-varying specifications.

3 Data and factor selection

3.1 Sample selection

We use CDS spreads on senior unsecured debt as a market-based measure of the credit component of banks' wholesale funding costs. A single-name CDS is a standardised contract under which the protection buyer pays a periodic premium, referred to as the CDS spread, in exchange for compensation if the reference entity experiences a credit event. The spread therefore reflects the market price of the expected loss on the reference obligation per unit of notional and time. We focus on five-year CDS contracts, which represent the most liquid and widely quoted maturity. We use contracts referencing senior unsecured debt because they capture the credit risk borne by senior creditors, whose pricing is particularly relevant for assessing the value of expected public support. The CDS spreads are observed at a daily frequency and obtained from Refinitiv.

Single-name CDS spreads are closely correlated with the yield spreads on the references entity's debt and often lead bond markets in price discovery, particularly during periods of financial stress.[2] We therefore use CDS spreads as a liquid, market-based proxy for the

[2]See, for example, Kim (2017) and Augustin and Schnitzler (2021) on the relative liquidity of CDS and bond markets; Bai and Wu (2016) on the relation between CDS spreads and firm fundamentals; and

credit component of banks' marginal funding costs on senior unsecured debt. Although CDS spreads may also contain liquidity premia and other non-credit components, these are not the focus of our analysis. We mitigate their influence through time and bank fixed effects, together with controls for observable bank fundamentals.

Our sample consists of 32 large European banks from 13 countries, covering the period January 2008 to December 2024. Annex A provides the full list of banks, while Table 1 provides summary statistics for the estimation sample. We start from the list of banks designated as domestically systemically important by the European Banking Authority.[3] We retain banks for which Refinitiv can provide a sufficiently long and liquid CDS series. In addition, we also include UBS as a bank which is domestically important in Switzerland, as it operates under a similar regulatory framework to the euro area. Our sample thus covers a range of fiscal domiciles, while still preserving cross-bank comparability.

3.2 Model controls

We construct our time-varying bank-level controls following the CAMEL framework (Berger and Davies, 1998; Hirtle and Lopez, 1999), which assesses five core dimensions of financial health: Capital adequacy (measured by Tier 1 capital ratio), Asset quality (loan-loss reserves over gross loans), Management efficiency (cost-to-income ratio), Earnings (net interest margin), and Liquidity (liquid assets over total assets). These controls are intended to purge CDS spreads of observable solvency drivers, so that any residual spread differential between bank groups can be attributed to implicit support expectations rather than differences in fundamentals.

We augment the core CAMEL variables with several controls that are particularly relevant to the European institutional setting. We refer to this extended specification as CAMEL+. First, we include subordinated liabilities as a share of total assets to capture differences in gone-concern loss-absorbing capacity. This control is especially important when comparing G-SIBs with non-G-SIBs. Although European banks within the scope of the resolution framework are subject to the Minimum Requirement for Own Funds and Eligible Liabilities (MREL), G-SIBs are also subject to the Total Loss-Absorbing Capacity (TLAC) standard, which imposes stricter requirements on the amount and subordination of eligible liabilities. As a result, G-SIBs typically maintain larger stocks of subordinated and bail-inable debt than their non-G-SIB peers. This provides an additional layer of protection for senior creditors in resolution, reducing expected loss-given-default independently of a bank's underlying risk profile.

Acharya and Johnson (2007); Avino, Conlon, and Cotter (2019) on CDS–bond co-movement and the role of CDS markets in price discovery.

[3]See `https://www.eba.europa.eu/risk-and-data-analysis/risk-analysis/risk-monitoring/other-systemically-important-institutions-o-siis`

Since CDS spreads reflect both the probability of default and expected losses conditional on default, omitting subordinated liabilities from the controls would risk conflating differences in bail-in capacity with differences in implicit government support. The importance of this distinction follows directly from the creditor hierarchy under the European resolution framework, where subordinated liabilities absorb losses ahead of senior unsecured creditors (see Annex B).

Second, we include government securities as a share of total assets to capture banks' exposure to sovereign risk and the associated sovereign-bank feedback channel, which is particularly relevant in Europe (Acharya et al., 2014). Our measure covers banks' total holdings of government securities rather than only their exposure to the home sovereign. This broader definition captures the balance-sheet risk arising from sovereign debt portfolios more generally: banks with larger holdings may face greater valuation losses and funding pressures when sovereign stress increases, irrespective of the nationality of the issuer. This consideration is especially relevant to the European sovereign debt crisis of 2010–2012, when banks held substantial cross-border sovereign exposures.

All bank-level balance sheet data needed for the construction of these controls are sourced on an annual basis from Orbis Bank Focus. The annual time series are interpolated to daily frequency to match the CDS series. GDP data are obtained from Eurostat. Table 2 provides summary statistics of the variables.

Finally, we also include a time-invariant periphery indicator, equal to one for banks headquartered in Greece, Ireland, Italy, Portugal, and Spain, to account for persistent sovereign-risk differentials across the euro area due to financial fragmentation documented in the euro area (Candelon, Luisi, and Roccazzella, 2022; Horny, Manganelli, and Mojon, 2018).

3.3 TBTF Identification

Next, we construct the indicator that partitions the population into TBTF and non-TBTF banks. The central empirical challenge is to identify which banks, if any, are perceived by market participants as too big to fail. We consider two alternative classifications. The first captures *global* systemic importance and classifies a bank as TBTF if it has received an official G-SIB designation:

$$\mathrm{TBTF}_i^{\text{G-SIB}} = \mathbb{1}\{\text{bank } i \text{ has been designated as a G-SIB}\}. \tag{8}$$

To obtain a fixed indicator over the sample period, we treat a bank as a G-SIB if it has held this designation at any point during the period. This affects BBVA and UniCredit, whose designations ended in 2015 and 2023, respectively.

Table 1: Bank-level CAMEL+ control variables

Variable	**Metric**	**Rationale**
Tier 1 ratio	Tier 1 capital / risk-weighted assets	(C) Loss-absorbing capacity; higher capitalization is expected to reduce funding risk.
LLR / Loans	Loan-loss reserves / gross loans	(A) Proxy for asset quality; higher values may indicate elevated credit risk.
Efficiency ratio	Cost-to-income ratio	(M) Measures managerial and operational efficiency.
Net interest margin	Net interest income / earning assets	(E) Profitability buffer; higher margins should strengthen resilience.
Liquidity	Liquid assets / total assets	(L) Captures short-term funding resilience and liquidity strength.
Subordinated liabilities	Subordinated liabilities / total assets	Captures gone-concern loss-absorbing capacity.
Government securities	Government securities / total assets	Controls for sovereign exposure and potential bank-sovereign nexus effects.
Periphery indicator	Dummy for GR, IE, IT, PT, and ES	Controls for cross-country sovereign risk heterogeneity.

Notes: Variables labeled (C), (A), (M), (E), and (L) correspond to the CAMEL dimensions of Capital adequacy, Asset quality, Management quality, Earnings, and Liquidity, respectively. These variables are included as bank-level controls in the subsequent empirical analysis to account for differences in bank fundamentals across the sample.

The second approach takes a *domestic* perspective and designates a bank as TBTF if its total assets exceed a threshold q relative to the GDP of its home country:

$$\mathrm{TBTF}_i^{\mathrm{DOM}}(q) = \mathbb{1}\left\{ \frac{\mathrm{Assets}_{i,2024}}{\mathrm{GDP}_{c(i),2024}} > q \right\}, \tag{9}$$

where $c(i)$ denotes the home country of bank i. Our baseline threshold is $q = 50\%$, close to the mean and median of the sample (see Table 2). Again, we use a fixed classification by basing the threshold on 2024 values. This also helps prevent changes in TBTF status from being driven mechanically by short-term fluctuations in bank assets or GDP. The underlying size-to-GDP ratios are relatively stable, and the results are robust to using alternative reference years.

The two classifications capture conceptually distinct dimensions of systemic importance. The G-SIB indicator follows BDZ, who use it as a proxy for systemic importance in the United States. This is a natural choice in the US setting, where G-SIB status and domestic dominance largely coincide. In Europe, by contrast, some banks have a large balance sheet relative to their domestic economy without being formally designated as G-SIBs; see Annex A. Because the fiscal consequences of public intervention may ultimately fall on the home sovereign, a bank's size relative to domestic GDP may be particularly relevant to bailout expectations. A bank can represent a substantial contingent liability for its sovereign even if it is not globally systemic, potentially creating pressure for intervention despite the availability of formal resolution tools (Acharya et al., 2014; Demirgüç-Kunt

Table 2: Summary statistics of the estimation sample

	Mean	Std. Dev.	P25	Median	P75
CDS spread (bps)	219.19	354.46	56.62	94.79	178.46
Log CDS spread	4.73	1.02	4.04	4.55	5.18
Tier 1 ratio (%)	14.93	3.62	12.32	14.81	17.00
LLR / Loans (%)	3.71	4.57	1.16	2.40	4.12
Cost-to-income ratio (%)	64.05	67.87	52.83	60.96	70.04
Net interest margin (%)	1.99	0.80	1.43	1.86	2.40
Liquid assets / Assets (%)	27.22	10.44	20.49	26.00	32.39
Gov. securities / Assets	0.08	0.06	0.04	0.08	0.11
Sub. liabilities / Assets	0.02	0.01	0.01	0.01	0.02
Assets / GDP	0.51	0.34	0.30	0.48	0.65

and Huizinga, 2013). We therefore evaluate both classifications and assess which one better captures the spread compression associated with expected public support.

Although the 50% threshold provides a transparent baseline, we also validate it by estimating a threshold from the data following Hansen (1999, 2000). This is done by treating q as an unknown parameter and re-estimating the baseline regression over a fine grid of candidate thresholds in $(0, 1)$, excluding values that leave too few banks on either side of the partition. For each candidate value, we record the residual sum of squares, $\mathrm{SSR}(q)$, and select the threshold that provides the best fit:

$$\hat{q}^* = \arg\min_{q \in (0,1)} \mathrm{SSR}(q). \tag{10}$$

Under the regularity conditions in Hansen (1999), this estimator is consistent for the population threshold $q_0 = \arg\min_q \mathbb{E}[\mathrm{SSR}(q)]$. The procedure yields $\hat{q}^* \approx 47\%$, closely supporting the 50% baseline threshold. We report results for both classifications in Section 5.

3.4 Descriptive evidence

Table 3 reports average CDS spreads by bank group over the full sample period. A large raw spread differential is visible under both classifications: G-SIBs exhibit spreads that are 61% lower than non-G-SIBs (85 vs. 220 bps), while banks with assets exceeding 50% of domestic GDP exhibit spreads 75% lower than their smaller peers (80 vs. 315 bps). These raw differences should not be interpreted as evidence of a TBTF premium on their own, as they also reflect systematic differences in bank fundamentals across groups. The empirical framework in Section 4 addresses this by controlling for observable fundamentals before attributing any residual spread difference to implicit public support.

Table 3: Average CDS spreads (bps) by bank group, 2008–2024

	Non-G-SIBs	**G-SIBs**	**Assets** $\leq$50% **GDP**	**Assets** >50% **GDP**
Senior unsecured debt	248.1	83.0 (−66.6%)	300.7	75.1 (−75.0%)

Note. Raw average CDS spreads before controlling for bank fundamentals. Percentage differences relative to the non-G-SIB and assets $\leq$50% GDP groups, respectively.

4 Empirical Set-up

Next, we map the wedge between TBTF and non-TBTF banks into regression coefficients by translating the fundamental credit risk component in Equation (2) to a set of balance sheet ratios and fixed effects. First, in Section 4.1 we provide a restricted specification of the model, assuming that the wedge between TBTF and non-TBTF banks (and thus the no-bailout probability) is fixed over time. Then, in Section 5.2 we relax this assumption and provide the time-varying wedge estimates.

4.1 Static TBTF Wedge Specification

We model fundamental credit risk as a linear function of the CAMEL+ bank controls, time effects, and an idiosyncratic error:

$$\log s_{it} \;=\; \alpha \;+\; \beta^{\top} X_{it} \;+\; \gamma\,\mathrm{TBTF}_i \;+\; \delta_t \;+\; \varepsilon_{it}, \tag{11}$$

where $i = 1, ...N$ indexes banks and $t = 1, ..., T_i$ indexes time in days; X_{it} is a vector of bank controls (all of them are time-varying apart from the periphery indicator); δ_t are daily time fixed effects, absorbing aggregate macro-financial conditions common to all banks, including crisis episodes and monetary policy shifts; ε_{it} is an idiosyncratic error term. The panel is unbalanced, so the number of observations T_i varies across banks depending on the availability of CDS quotes and balance-sheet data. Standard errors are clustered at the bank level throughout.

The coefficient γ then identifies $\log \pi$ in Equation (12) under fixed no-bailout probability, such that

$$\gamma = \log s_{it}^{TBTF} - \log s_{it}^{CF} = \log \pi \tag{12}$$

where the counterfactual spread is determined by switching off the TBTF factor. A negative estimate of γ implies that TBTF banks systematically bear lower credit spreads than comparable non-TBTF ones.

Note that we have normalised the no-bailout probability of banks that are not labeled as TBTF to one. Conceptually the current framework holds even without the normalization, as long as the bailout probability of non-TBTF banks is consistently lower compared to TBTF banks. As a result, the γ coefficient provides an upper bound on the true no-bailout probability, as from Equation (3) we would have

$$\begin{aligned} \gamma = \log s_{it}^{TBTF} - \log s_{it}^{CF} \ &= \ \log \pi^{TBTF} - \log \pi^{CF} \\ \implies \ \log \pi_{it}^{TBTF} &= \gamma - \log \pi_t^{CF} \end{aligned}$$

where π_t^{CF} is the no-bailout probability of the counterfactual non-TBTF bank. Consequently, the TBTF premium Δ in Equation (5) would be a lower bound. Since we cannot identify separately the no-bailout probability of the counterfactual banks, we continue with the normalization and we will interpret our estimates on π and Δ as upper and lower bounds, respectively.

4.2 Time-Varying TBTF Wedge Specification

Assume now that the no-bailout probability has changed over time. To assess the time sensitivity of the TBTF wedge, particularly following the BRRD and the introduction of bail-in tools we allow the TBTF coefficient to vary monthly, such that

$$\log s_{it} \ = \ \alpha \ + \ \beta^{\top} X_{it} \ + \ \gamma_t \, \mathrm{TBTF}_i \ + \ \delta_i \ + \ \delta_t \ + \ \varepsilon_{it}, \tag{13}$$

where δ_i are bank fixed effects, δ_t are monthly time fixed effects, and X_{it} captures all CAMEL+ controls apart from the periphery indicator which is now absorbed by the more granular bank fixed effects.

In Equation (13), $\{\gamma_t\}$ is a sequence of coefficients each identifying $\log \pi_t$ from Equation (2) at the corresponding date

$$\gamma_t = \log s_{it}^{TBTF} - \log s_{it}^{CF} = \log \pi_t \tag{14}$$

The coefficients $\{\gamma_t\}$ are estimated by interacting TBTF_i with a full set of month dummies with December 2024 as the reference period. By excluding the reference period dummy the estimates are interpreted as normalisation around $\gamma_{t_0} = 0$ with a positive $\hat{\gamma}_t$ indicating that the TBTF spread compression was *weaker* at time t than in December 2024 and a larger share of spreads reflected true default risk then than today.

5 Results and discussion

We now turn to the core question of the paper of whether TBTF status is associated with a persistent funding advantage in credit markets. To address this question, first in Section 4.1 we estimate the baseline specification developed under the restriction of a fixed wedge between TBTF and non-TBTF banks; then, in Section 4.2 we examine the time-varying wedge and document the evolution of the TBTF premium over time.

5.1 Static wedge: Domestic size drives the TBTF premium

Tables 4 and 5 report estimates across a set of specifications when TBTF banks are defined as G-SIBs and when they are defined as domestically large, respectively. Both tables include entity-clustered standard errors; CAMEL-based controls are included where indicated but suppressed in these tables for brevity; and Annex 10 provides the full regression details.

G-SIB designation. First, Table 4 traces the G-SIB coefficient as the model specification is progressively enriched. Column (1) includes only the TBTF indicator, with no controls and no fixed effects. The coefficient is large and negative ($\hat{\gamma} = -0.632$), reflecting the significant raw unconditional spread differential between G-SIBs and non-G-SIBs. This gap narrows sharply once the periphery indicator is added in Column (2) ($\hat{\gamma} = -0.059$), indicating that a substantial part of the raw G-SIB discount is a sovereign-risk artifact: G-SIBs are predominantly headquartered in core countries, so without controlling for bank location the regression conflates the TBTF effect with the core–periphery spread differential. Adding CAMEL+ controls in Column (3) and the full specification with time fixed effects in Column (4) yields positive and statistically insignificant estimates ($\hat{\gamma} = 0.119$ and $\hat{\gamma} = 0.251$, respectively). G-SIB designation therefore carries no measurable funding advantage once bank fundamentals, country location, and aggregate time variation are controlled for. The R^2 rises from 0.055 in Column (1) to 0.634 in Column (4), with much of the improvement attributable to the inclusion of the periphery indicator, bank-level controls, and time fixed effects.

Domestic size-to-GDP. Table 5 repeats a similar specification progression for the domestic size indicator defined by Equation (9). We first examine the baseline threshold of $q = 50\%$. Column (1) shows a large unconditional discount ($\hat{\gamma} = -1.009$, $p < 0.01$). Adding the periphery indicator in Column (2) reduces the coefficient to -0.425 ($p < 0.01$) but leaves it negative and highly significant, in contrast to the G-SIB case where the same step nearly eliminated the effect. This already suggests that domestic scale captures something fundamentally different from country location. Adding CAMEL controls in Column (3) yields $\hat{\gamma} = -0.373$ ($p < 0.01$), and the full specification with time fixed effects in Column (4) gives $\hat{\gamma} = -0.378$ ($p < 0.01$). The coefficient is thus stable and

Table 4: Baseline regression results: G-SIB banks

	(1)	(2)	(3)	(4)
TBTF	-0.632^{***}	-0.059	0.119	0.251
Periphery		1.150^{***}	0.435^{***}	0.559^{***}
Controls	No	No	Yes	Yes
Time FE	No	No	No	Yes
R^2	0.055	0.317	0.583	0.634

Note. OLS estimates of Equation (11) on log 5-year senior unsecured CDS spreads with G-SIB designation as the TBTF indicator. Columns progress from a sparse specification with no controls or fixed effects to the full specification. Controls comprise CAMEL variables together with government securities holdings and subordinated liabilities ratios. Standard errors are clustered at the bank level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

remains significant across the progressive enrichment of the specification, indicating that the domestic TBTF discount is not an artifact of omitted fundamentals or aggregate time variation.

Columns (5)–(7) examine the sensitivity of the result to the choice of threshold. At the more inclusive $q = 10\%$ threshold, which classifies the majority of banks as TBTF, the coefficient becomes economically and statistically insignificant ($\hat{\gamma} = 0.010$), as expected when the comparison group is thin and the TBTF classification loses discriminatory power. At the more restrictive $q = 80\%$ threshold, the coefficient remains negative ($\hat{\gamma} = -0.160$) but is no longer statistically significant, reflecting the small number of banks meeting this stringent criterion. The endogenously estimated threshold $q^* = 47\%$ yields the largest coefficient in absolute value ($\hat{\gamma} = -0.438$, $p < 0.01$) and the highest R^2 (0.666), consistent with this threshold best partitioning the sample. At $q = 50\%$, the periphery indicator is only marginally significant, while at $q^* = 47\%$ it remains positive and statistically significant. Nevertheless, the coefficient is substantially smaller than in the sparser specifications, suggesting that domestic scale absorbs an important part of the sovereign-risk heterogeneity that would otherwise be attributed to country location. Once a bank's balance-sheet size relative to its home economy is controlled for, the core–periphery distinction becomes markedly less informative for CDS pricing.

Table 5: Baseline regression results: domestically large banks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TBTF definition	$q = 50\%$	$q = 50\%$	$q = 50\%$	$q = 50\%$	$q = 10\%$	$q = 80\%$	$q^* = 47\%$
TBTF	-1.009^{***}	-0.425^{***}	-0.373^{***}	-0.378^{***}	0.010	-0.160	-0.438^{***}
Periphery		0.906^{***}	0.180	0.274^{*}	0.513^{***}	0.483^{***}	0.279^{**}
Controls	No	No	Yes	Yes	Yes	Yes	Yes
Time FE	No	No	No	Yes	Yes	Yes	Yes
R^2	0.225	0.341	0.598	0.651	0.628	0.630	0.666

Note. OLS estimates of Equation(11) on log 5-year senior unsecured CDS spreads with a domestic size-to-GDP indicator as the TBTF measure. Columns (1)–(4) trace the $q = 50\%$ specification from a sparse to the full benchmark, adding the periphery indicator, CAMEL controls, and time fixed effects sequentially. Columns (5)–(7) examine sensitivity to the choice of threshold in the full specification. Controls comprise CAMEL variables together with government securities holdings and subordinated liabilities ratios. Standard errors are clustered at the bank level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

The CAMEL controls (see Table 10 in the Annex) behave in line with prior expectations throughout. Higher loan-loss reserves raise spreads, reflecting elevated credit risk. Tier 1 capital ratios enter with a negative and significant coefficient, consistent with better-capitalised banks being perceived as less risky. Liquid asset holdings also compress spreads significantly across all columns. The net interest margin and government securities ratio are generally insignificant in the cross-sectional specification, suggesting their effects are better captured by within-bank variation in the time-varying wedge specification.

Quantitative implications. Now, we can provide a quantitative interpretation of the estimated TBTF coefficient in terms of the implicit funding subsidy TBTF banks receive. For the baseline specification estimate of $\hat{\gamma} = -0.378$, equation (12) gives

$$\hat{\pi} = \exp(-0.378) \approx 0.685,$$

implying an upper bound on the market-perceived bailout probability of approximately 31.5% over the full sample period.

In addition, based on Equation (3) $\hat{\pi}$ also provides the ratio of the spread of a TBTF bank and its counterfactual. As a result, we estimate that due to implicit bailout expectation, a TBTF bank has, on average, $1 - \hat{\pi} = 31.5\%$ lower spreads compared to a counterfactual bank with the same fundamentals. While still significant, this is considerably lower than the 75% difference obtained from raw average spreads of TBTF and non-TBTF banks reported in Table 3. This is not surprising. The unconditional gap reflects not only the implicit guarantee but also systematic differences in bank fundamentals and country location between the two groups. Our conditional estimate controls for these factors and therefore shrinks the spread differential, providing a cleaner estimate of the true TBTF subsidy.

Finally, substituting the sample mean CDS spread $\bar{s}^{TBTF} = 75.1$ bps for domestically large banks from Table 3 into Equations (3) and (5) we get the counterfactual spread given the absence of bailout expectations and the corresponding lower bound on the TBTF premium:

$$\begin{aligned}\hat{s}^{CF} &= \frac{75.1}{0.685} \approx 109.6 \text{ bps},\\ \hat{\Delta} &= 75.1 \times \left(\frac{1}{0.685} - 1\right) \approx 34.5 \text{ bps}.\end{aligned}$$

Over our sample period, therefore, assuming that CDS spreads are robust proxies for banks' credit funding costs, domestically large banks paid approximately 35 bps less (on an annualised basis) than they would have in the absence of an implicit government guarantee. This remains a substantial funding advantage that persists after conditioning on observable bank fundamentals and aggregate time variation.

Robustness of the results. Our baseline finding that TBTF premia exist on a domestic scale is also robust to a range of alternative sample restrictions and specification choices. Table 6 summarises the TBTF coefficient across five perturbations of the baseline model specification under Equation (11) with $q = 50\%$.

Columns (1) and (2) address sample composition. Excluding holding-company structures (1) leaves the coefficient essentially unchanged ($\hat{\gamma} = -0.362$, $p < 0.05$), confirming that the result is not driven by the legal form of the issuer. Dropping the Greek banks from the sample, as they are the institutions that react strongest to euro-area sovereign debt crisis, in (2) removes potential outliers whose CDS dynamics may be seen as too extreme. This does not change the estimated wedge coefficient and only marginally reduces the explanatory power of the regression.

Column (3) shortens the estimation window to the post-BRRD period (2014–2024). The coefficient rises in absolute value to -0.495 ($p < 0.01$), confirming that the premium is not an artefact of the pre-reform era and, if anything, has become more pronounced in recent years (more on this in Section 6). Column (4) replaces the binary size-to-GDP indicator with the continuous ratio of bank total assets to home-country GDP. The coefficient on the continuous measure is -0.337 ($p < 0.01$), and the implied economic magnitude is comparable to the threshold specification, confirming that the result is not driven by the discretisation of the size variable in our baseline specification.

CDS liquidity. A potential concern is that CDS spreads reflect not only credit risk and implicit support expectations but also liquidity premia, which may differ systematically across banks. Three considerations mitigate this concern. First, our TBTF estimate is identified from the *cross-sectional divergence* in spreads between systemically impor-

Table 6: Robustness: TBTF coefficient across alternative specifications

	(1) No HoldCo	(2) No outliers	(3) Post-BRRD	(4) Continuous
TBTF	-0.362^{**}	-0.362^{***}	-0.495^{***}	
Size / GDP				-0.337^{*}
Controls	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No
R^2	0.595	0.580	0.656	0.563

Note. Each column reports OLS estimates of Equation (11) on log 5-year senior unsecured CDS spreads under the stated sample restriction or specification change. Columns (1)–(3) focus on the TBTF indicator, defined based on domestic size; while column (4) uses a continuous variable of bank size over domestic GDP. All specifications include time fixed effects and entity-clustered standard errors. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$.

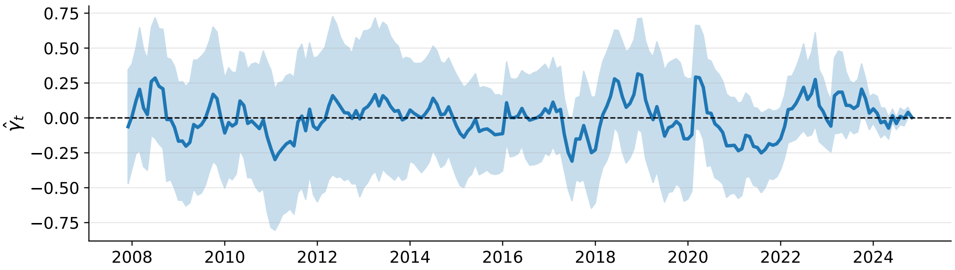
tant and non-systemic banks, after absorbing aggregate time variation via time fixed effects. A systematic liquidity component—even one that varies over time—cancels out in this differential and does not bias the TBTF coefficient. Second, bank fixed effects absorb any time-invariant bank-specific liquidity premium, so that persistent differences in CDS liquidity across institutions do not contaminate the estimate. The residual threat is therefore confined to time-varying and consistent differences in liquidity premia between TBTF and non-TBTF banks—a considerably narrower concern. Third, Bongaerts, De Jong, and Driessen (2011) and Dimitrov and van Wijnbergen (2026) already show that liquidity premia in single-name CDS markets are economically small, suggesting that even time-varying liquidity differences, if present, are unlikely to account for the 35 basis point differential we document.

5.2 Time-varying wedge: The TBTF premium persists

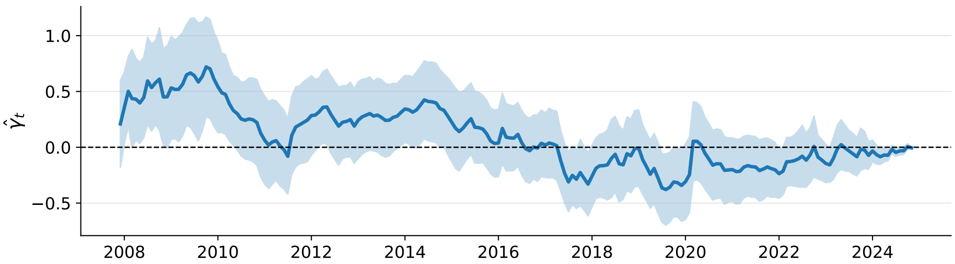
Figure 1 reports the time paths $\{\hat{\gamma}_t\}$ from Equation (13) when the wedge is is estimated based on G-SIB as a TBTF indicator, and when domestic size is used. The resulting coefficient series can, as shown in Equation (14), be interpreted as the logarithm of the no-bailout probability of a TBTF bank relative to the reference period (December 2024). Thus, a positive $\hat{\gamma}_t$ indicates that markets assigned a higher no-bailout probability at time t than today, implying weaker bailout expectations then than now, while a negative $\hat{\gamma}_t$ indicates the reverse.

Figure 1: Time-varying estimate of TBTF wedge, scaled to Dec 2024

(a) G-SIBs



(b) Domestically Large Banks ($q = 50\%$)



Note. The figure plots the monthly interaction coefficients $\hat{\gamma}_t$ from Equation (13), estimated on daily 5-year senior unsecured CDS spreads for a panel of European banks over Jan 2008–Dec 2024. Each $\hat{\gamma}_t$ is identified from the interaction of the TBTF indicator with a monthly time dummy, with Dec 2024 omitted as the reference period so that all coefficients are normalised to zero at that date. The shaded areas show 95% confidence interval around the estimated interaction coefficients. Panel (a) uses G-SIB designation as the TBTF indicator. Panel (b) uses a domestic size-to-GDP threshold at $q = 50\%$, classifying a bank as TBTF if its total assets exceed 50% of home-country GDP.

G-SIB Status. Panel (a), based on G-SIB status, shows no systematic pattern over the sample period. The estimated wedge fluctuates around zero throughout, with wide confidence bands, and displays no discernible trend. This is consistent with the baseline result in Table 4: the G-SIB indicator does not produce a robust or stable TBTF premium once controls and time fixed effects are included. The time-varying estimates confirm that this is the case throughout the sample period, as we do not identify any substantial change relative to the reference period.

Domestically large banks. Panel (b) is based on the domestic size-to-GDP threshold ($q = 50\%$). Three distinct phases are visible here in the evolution of the TBTF wedge. During the Global Financial Crisis and the European sovereign debt crisis (2008–2013), $\hat{\gamma}_t$ is large and positive, indicating that markets assigned a substantially higher no-bailout probability to domestically large banks than they do today. This is consistent with the acute uncertainty about the scope and credibility of sovereign backstops during this period. With governments already under fiscal strain, markets may be less confident that a bailout would materialise. We revisit this point in Section 6.

The estimates peak around 2009–2010, when the no-bailout risk index reached its highest values in the sample. A pronounced and persistent decline follows from approximately 2013 onward. As European sovereign stress receded and fiscal positions consolidated, $\hat{\gamma}_t$ falls steadily, turning negative around 2015–2016 and remaining so through the end of the sample. This trajectory indicates that bailout expectations have strengthened progressively since the post-crisis period: markets today price a larger implicit guarantee than at any point during the crisis years. The stabilisation of $\hat{\gamma}_t$ at negative values from 2016 onward, with confidence bands that largely exclude zero, provides evidence of a persistent and statistically significant decline in the no-bailout probability following the European sovereign debt crisis. Finally, the post-2020 episode shows overall stabilisation around zero.

5.3 Credit spread decomposition

Based on Equations (3) and (5), by replacing the population expectations with the sample equivalents

$$\bar{s}_t^{CF} = \frac{\bar{s}_t^{TBTF}}{\hat{\pi}_t}, \quad \Delta_t = \bar{s}_t^{TBTF}\left(1/\hat{\pi}_t - 1\right)$$

we can write the empirical sample decomposition of the credit spread of TBTF banks

$$\underbrace{\bar{s}_t^{CF}}_{\text{True credit risk}} = \underbrace{\bar{s}_t^{TBTF}}_{\text{Observed spread}} + \underbrace{\Delta_t}_{\text{TBTF premium}}, \tag{15}$$

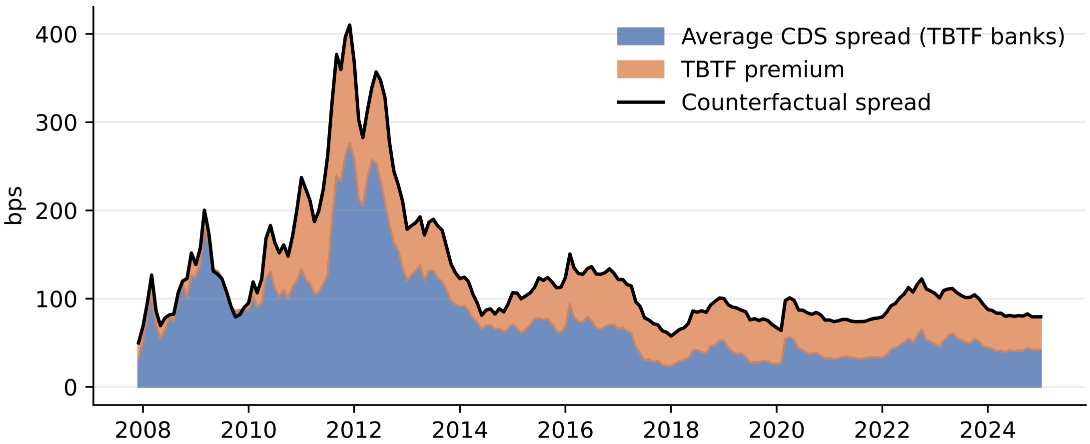
One challenge working with the time-varying wedge $\{\gamma_t\}$, however, is that it is estimated as a scaled series anchored to the most recent period in the sample (see Section 5.2). We approach this problem in two stages. First, we estimate Equation (13) over the full sample period. Second, we estimate Equation (11) to be able to anchor the estimates. Using the full-sample baseline estimate from Equation (11) is an unsuitable anchor: pooling the entire 2008–2024 sample yields a time-average of the TBTF wedge that conflates periods of acute bailout uncertainty—the GFC and the European sovereign debt crisis—with the more recent environment, systematically biasing the anchor upward. As a result, we use the more recent period January 2016–December 2024, during which the time-varying wedge is observed to be relatively stable (see Section 4.2). This local estimate, $\hat{\gamma}_{t_0}$, anchors the TBTF wedge at the reference date from cross-sectional variation between TBTF and non-TBTF banks. Finally, as a result, we can evaluate

$$\hat{\pi}_t = \exp(\hat{\gamma}_{t_0} + \hat{\gamma}_t).$$

Figure 2 presents this credit spread decomposition as a cumulative area plot over the full sample period. The blue area is the average observed CDS spread of TBTF banks, $\bar{s}_t^{TBTF}$;

the orange area stacked above it is the estimated TBTF premium Δ_t; and their sum is the counterfactual spread $\bar{s}_t^{CF}$ traced by the black line, representing the credit risk these banks would carry in the absence of any implicit government support.

Figure 2: Credit spread decomposition of TBTF banks.



Note. The figure plots the credit spread decomposition of Equation (15) for the set of domestically large banks (size-to-GDP threshold $q = 50\%$) over Dec 2007–Dec 2024. The blue area is the cross-sectional mean observed CDS spread of TBTF banks, $\bar{s}_t^{TBTF}$. The orange area stacked above it is the TBTF premium, representing the implicit funding subsidy attributable to market expectations of public support. The black line is the counterfactual spread, the spread these banks would pay in the absence of any implicit guarantee.

Three features of the decomposition stand out. First, Δ_t remains strictly positive throughout the entire sample, confirming that the implicit funding advantage has not been eliminated after the financial crisis. This holds through the introduction of the BRRD, the activation of the Single Resolution Mechanism, and the full implementation of bail-in tools—none of which appear to have durably compressed the premium to zero.

Second, holding everything else constant, the absolute magnitude of Δ_t depends on the overall level of credit spreads. During the GFC and the European sovereign debt crisis (2008–2012), the premium reaches its highest levels in basis points, exceeding 150 bps at the peak. In relative terms, however, it has remained substantial and takes even a larger share of the overall counterfactual spreads when compared to the period of elevated stress. This suggests that the implicit guarantee has become structurally embedded in the pricing of large bank credit risk rather than being a crisis-specific phenomenon. What is more, the crisis period may even have depressed the relative share of the TBTF premium. We examine this point further in the next section.

6 The sovereign-bank nexus and TBTF premia

Following the sovereign-bank nexus literature, one can argue that expectations of public support depend critically on the fiscal capacity of the home sovereign relative to the scale of its banking sector (Acharya et al., 2014; Altavilla et al., 2017; Demirgüç-Kunt and Huizinga, 2013; Hristov, Hülsewig, and Kolb, 2026). As a result, a government that is itself under fiscal stress cannot credibly commit to backstopping its banking system: the implicit guarantee is only as strong as the sovereign's ability to honor it. This suggests that the TBTF premium varies with sovereign stress. One would then expect that when the home sovereign is perceived as fiscally constrained, the guarantee loses credibility and the spread differential between TBTF and non-TBTF banks should compress. Conversely, when fiscal capacity is ample, markets should price a larger wedge in anticipation of a credible backstop.

This mechanism provides a natural interpretation for the time variation in $\{\gamma_t\}$ documented in Section 4.2. As shown in Figure 1, the no-bailout risk index was elevated during the GFC and the European debt crisis period, precisely when sovereign fiscal capacity was most in doubt, and has stabilised at a lower level since 2016, as sovereign stress receded and fiscal positions consolidated. We test this link through two complementary approaches. In the next sections, first, we look at aggregate evidence that suggests linking the time varying TBTF wedge to sovereign stress. Second, we embed sovereign stress and its interaction with the TBTF variable into the bank-level panel regressions. This allows us to verify that the contingent-guarantee mechanism operates at the individual bank level.

6.1 Aggregate Evidence: Sovereign Stress and the TBTF Wedge

We collect data on the sovereign CDS spreads of the domicile countries for the banks in our sample. The data is summarised by Table 7. Figure 3 further plots the estimated $\{\gamma_t\}$ alongside the median log sovereign CDS spread and its 25–75 percentile range across sample countries. Two patterns stand out.

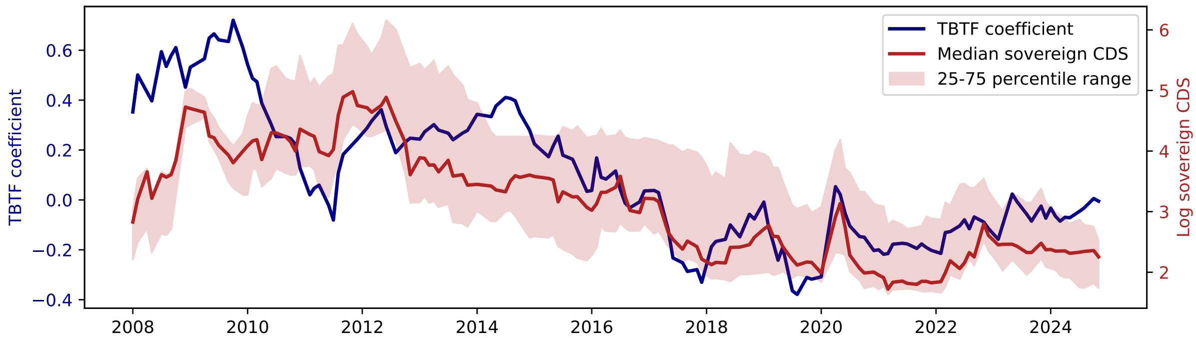
Table 7: Summary statistics of sovereign CDS spreads

	Mean	Std. Dev.	P25	Median	P75	Min	Max
CDS spread (bps)	385.76	2130.09	8.64	22.11	69.41	2.16	14911.74
Log (CDS spread)	3.402	1.574	2.156	3.096	4.240	0.770	9.610

First, the TBTF wedge (scaled to December 2024) is positive in the early part of the sample, indicating that the spread compression associated with TBTF status was weaker during the Global Financial Crisis than at the December 2024 reference date (no-bailout probabilities were higher). This is consistent with a period of acute and indiscriminate sovereign and bank stress, in which the market-implied guarantee had not yet been priced in as a systematic funding advantage.

Second, from around 2015 onward the two series move closely together. The TBTF coefficient turns persistently negative as sovereign stress subsides following the resolution of the European debt crisis, declines further through 2017–2018, and partially recovers during the COVID-19 spike in sovereign CDS in 2020. This co-movement is strongly consistent with the sovereign-bank doom loop: when sovereign stress is elevated, the value of the implicit guarantee is eroded by the perceived weakness of the guarantor, compressing the TBTF discount. The bank-level specifications in the next section test this mechanism directly.

Figure 3: Time-varying TBTF wedge estimate vs. sovereign credit risk



Note. The figure plots the estimated time-varying TBTF wedge from Equation (13) (left axis) against the cross-sectional median CDS spread on European sovereign debt (right axis, logarithmic). The shaded section represents the area between the 25% to 75% cross sectional quantiles on the sovereign CDS price.

6.2 Bank-level evidence: sovereign stress and the TBTF interaction

Next, we embed the sovereign stress channel directly into our baseline model. We want to test further whether the TBTF discount is contingent on the fiscal capacity of the home sovereign. This may indicate that the implicit guarantee loses value precisely when it is most likely to be under strain.

We augment Equation (11) with the log home sovereign CDS spread and its interaction with TBTF status, according to

$$\begin{aligned}\log s_{it} = \alpha + \beta^\top X_{it} + \gamma_1 \,\mathrm{TBTF}_i + \gamma_2 \log(\mathrm{SovCDS})_{c(i),t} \\ + \gamma_3 \left(\mathrm{TBTF}_i \times \log(\mathrm{SovCDS})_{c(i),t}\right) + \delta_t + \varepsilon_{it}.\end{aligned} \tag{16}$$

The interaction term is the key object of interest: a positive γ_3 would indicate that the spread wedge between TBTF and non-TBTF banks narrows as sovereign stress rises, consistent with the guarantee losing credibility when fiscal capacity is under pressure. A negative γ_3 would indicate the opposite—that the wedge widens under stress, consistent with markets believing that a fiscally constrained sovereign has even stronger incentives to prevent the failure of a systemic bank, since the systemic costs of non-intervention are largest precisely when the sovereign is already under pressure.

Identifying γ_3 cleanly requires confronting two tensions. The first concerns the level effect of TBTF status. Bank fixed effects absorb the time-invariant TBTF indicator, eliminating identification of the baseline coefficient γ_1. Therefore, we estimate first a specification without bank fixed effects, preserving γ_1 from cross-sectional variation between TBTF and non-TBTF banks. To assess robustness to time-invariant omitted bank characteristics, we estimate a second specification that replaces bank-level controls with bank fixed effects.

The second tension concerns the sovereign interaction effect. Since European sovereign spreads tend to move largely in tandem—particularly during the debt crisis and its aftermath—including time fixed effects has the potential to absorb much of the common variation in the sovereign CDS spreads over the period. This may leave little residual cross-country dispersion to identify γ_3. We therefore estimate specifications with and without time fixed effects and compare the results.

Finally, each specification includes $\log(\text{SovCDS})_{c(i),t}$ as a standalone regressor to capture the direct effect of sovereign credit spreads on bank spreads regardless of TBTF status. Including this effect ensures that any general transmission of stress from the sovereign to banks is not attributed to the interaction TBTF term.

Two features of our specification mitigate reverse causality concerns arising from sovereign-bank doom-loop dynamics, Brunnermeier, Garicano, Lane, Pagano, Reis, Santos, Thesmar, Van Nieuwerburgh, and Vayanos (2016). First, following Acharya et al. (2014) we work at daily frequency. Day-to-day changes in sovereign CDS are plausibly driven by fiscal and macroeconomic news orthogonal to any individual bank's condition on that day, making it unlikely that the estimated co-movement reflects banks driving sovereign stress contemporaneously. Second, we include banks' government securities holdings as a control variable, absorbing the balance-sheet channel through which sovereign stress is mechanically transmitted to bank creditworthiness.

Table 8 reports the estimates. Within each specification, Column (1) and Column (3) present the baseline without time fixed effects; Columns (2) and (4) add time fixed effects to assess how much of the interaction is absorbed by common time variation. All specifications are complementary by design: the specifications with TBTF level term (columns (1) and (2)) recover the full effect of TBTF status at the cost of cross-sectional identification; the specifications with bank fixed effects (columns (3) and (4)) are robust to time-invariant omitted heterogeneity but recovers only the differential sensitivity of TBTF banks to sovereign credit risk.

The results in Table 8 again support the contingent-guarantee hypothesis. The baseline

Table 8: Sovereign stress and TBTF premia: bank-level evidence

	TBTF Indicator		Individual Bank FE	
	(1)	(2)	(3)	(4)
TBTF (γ_1)	-0.850^{***}	-0.697^{***}	absorbed by bank FE	
	(0.252)	(0.244)		
TBTF $\times$ **log(SovCDS)** ($\hat{\gamma}_3$)	0.168^{**}	0.100	0.211^{***}	0.182^{***}
	(0.076)	(0.071)	(0.069)	(0.058)
log(SovCDS) ($\hat{\gamma}_2$)	0.310^{***}	0.228^{***}	0.366^{***}	0.123^{*}
	(0.037)	(0.040)	(0.075)	(0.067)
Controls	Yes	Yes	Yes	Yes
Time FE	No	Yes	No	Yes
Bank FE	No	No	Yes	Yes
R^2	0.731	0.783	0.601	0.725
Observations	115,556			

Note. OLS estimates of Equation (16) on log 5-year senior unsecured CDS spreads. The TBTF indicator is the domestic size-to-GDP threshold at $q^* = 47\%$. $\log(\text{SovCDS})_{c(i),t}$ is the log 5-year sovereign CDS spread of bank i's home country at date t. Within each specification, Column (1) and Column (3) exclude time fixed effects to exploit cross-country dispersion in sovereign stress; Columns (2) and (4) add time fixed effects. In Columns (3)–(4), the time-invariant TBTF level effect is absorbed by bank fixed effects and γ_3 is identified from within-bank variation in sovereign stress. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TBTF level effect $\hat{\gamma}_1$ is large, negative, and highly significant in both columns of Equation (16) (-0.850 without time fixed effects, -0.697 with), confirming that the domestic TBTF discount survives the inclusion of sovereign stress as an additional control. The general sovereign-bank transmission channel is also strongly present: $\hat{\gamma}_2$ is positive and significant throughout, indicating that higher home sovereign stress raises CDS spreads for all banks regardless of systemic status.

The estimated interaction coefficient $\hat{\gamma}_3$ is positive across all four columns, consistent with the guarantee losing credibility as sovereign stress rises. In Equation (16) without time fixed effects (Column 1), $\hat{\gamma}_3 = 0.168$ ($p < 0.05$). Adding time fixed effects in Column (2) attenuates the estimate to 0.100 and renders it insignificant, consistent with the concern noted earlier: time fixed effects absorb the common component of European sovereign stress, leaving limited residual cross-country variation to identify the interaction.

The specification which includes individual bank fixed effects (Columns (3) and (4)) sharpens further our conclusions. Identified from within-bank variation in sovereign stress after absorbing bank fixed effects, $\hat{\gamma}_3$ is positive and significant in both columns (0.211, $p < 0.01$ without time fixed effects; 0.182, $p < 0.01$ with). The consistency across the two time-effect specifications—and the fact that adding time fixed effects attenuates but does not eliminate the estimate—lends credibility to the within-bank identification and rules out the concern that the result is driven by aggregate time trends correlated with both sovereign stress and bank spreads.

7 Conclusion

This paper quantifies the implicit too-big-to-fail funding advantage of large European banks using daily CDS spreads for a panel of 32 institutions over 2008–2024. We find that G-SIB designation on its own does not generate a measurable funding advantage in a European context, whereas banks whose assets exceed approximately 50% of domestic GDP enjoy roughly 30% lower than those of comparable non-systemic peers after controlling for bank fundamentals and aggregate time variation. This domestic TBTF wedge persists through 2024: post-crisis reforms reduced overall spread levels and the absolute magnitude of the premium, but did not eliminate it. If anything, the declining share of spreads attributable to true default risk suggests that the relative importance of implicit support expectations has increased in the post-reform era.

These findings have direct policy implications. First, the locus of the TBTF problem in Europe is domestic rather than global. Markets price systemic importance through the contingent liability a bank poses to its home sovereign, not through a formal G-SIB designation, or global complexity metrics. This does not diminish the importance of G-SIB frameworks for other regulatory purposes— such as managing cross-border contagion or global resolution coordination—but it does suggest that, when it comes to targeting the implicit funding subsidy, macroprudential buffers anchored to domestic systemic importance, such as the O-SII framework, are better aligned with how markets actually price bailout expectations. Our results therefore provide market-based support for the O-SII buffer as a tool for internalising the TBTF externality in the European context.

Second, the ongoing debate on European banking consolidation and the creation of larger cross-border institutions should account for the fact that domestically dominant banks already enjoy a substantial implicit subsidy. Consolidation that increases domestic concentration without a commensurate strengthening of the common fiscal backstop may deepen rather than resolve the TBTF problem, shifting the contingent liability to a different sovereign without reducing it.

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A List of Banks

Table 9 shows the sample of banks included in our study. Several banks were excluded from the sample initially collected for data-availability reasons. Volksbank is not included because its CDS quotes are available only at a 4-year maturity rather than the standard 5-year tenor we use; although it could be incorporated in principle, we exclude it to maintain consistency. Nordea is omitted due to missing 2024 balance sheet data following its head-office relocation, which prevents a reliable classification into our large versus non-large categories. Banco Santander is excluded because its CDS spreads are only reported in USD, which would mix currency-specific risk premia with credit effects. Monte dei Paschi di Siena (MPS) is missing from the initial country-level dataset for technical reasons, but will be added in a subsequent data update. Bank of Ireland is omitted due to lack of CDS coverage over the relevant period. Finally, Credit Suisse is excluded because post-resolution data do not allow for a meaningful classification based on 2024 asset-size-to-GDP ratios, and including it would conflate structural breaks with TBTF effects. Overall, the resulting sample includes banks for which CDS markets are active and for which systemic-importance measures can be consistently defined over time. See Annex A for the full list of banks.

Table 9: Bank sample overview

Bank Name	Country	Size/GDP*	G-SIB	Avg Spread	Max Spread	Min Spread
Erste Group Bank	AUSTRIA	72%	No	101.4	414.8	30.4
Raiffeisen Bank	AUSTRIA	40%	No	114.4	525.0	56.6
BNP Paribas Fortis	BELGIUM	61%	No	70.5	288.8	18.7
KBC Group	BELGIUM	60%	No	97.0	508.4	19.8
Danske Bank	DENMARK	128%	No	79.7	338.7	22.7
BNP Paribas	FRANCE	93%	Yes	74.7	361.2	17.9
Crédit Agricole	FRANCE	79%	Yes	84.3	397.9	15.7
Société Générale	FRANCE	54%	Yes	91.5	434.6	18.7
Bayerische Landesbank	GERMANY	6%	No	79.1	313.2	24.1
Commerzbank	GERMANY	13%	No	107.7	361.2	39.5
Deutsche Bank	GERMANY	32%	Yes	119.8	308.1	37.0
Hamburg Commercial Bank	GERMANY	1%	No	175.6	413.8	102.5
Alpha Services and Holdings	GREECE	30%	No	803.0	3153.4	142.5
Eurobank Ergasias	GREECE	43%	No	967.2	5440.9	110.0
National Bank of Greece	GREECE	32%	No	1275.5	6289.0	135.0
Allied Irish Banks	IRELAND	25%	No	402.1	1813.0	41.2
Permanent TSB	IRELAND	5%	No	333.2	2498.7	125.0
Intesa Sanpaolo	ITALY	42%	No	140.7	618.2	49.5
Mediobanca	ITALY	5%	No	138.3	598.6	35.5
UniCredit	ITALY	24%	No	151.9	678.3	38.9
ABN Amro	NETHERLANDS	34%	No	61.0	61.0	61.0
Coöperative Rabobank	NETHERLANDS	56%	No	58.1	210.8	14.5
ING Groep	NETHERLANDS	91%	Yes	54.2	474.0	23.0
Banco Comercial Portugues	PORTUGAL	35%	No	348.4	1875.5	40.5
Caixa Geral	PORTUGAL	37%	No	246.4	1178.4	46.8
BBVA	SPAIN	48%	No	121.1	510.4	27.5
Sabadell	SPAIN	15%	No	172.6	814.6	48.0
Bankinter	SPAIN	8%	No	176.3	820.1	35.4
SEB	SWEDEN	59%	No	70.9	262.5	19.6
Svenska Handelsbanken	SWEDEN	55%	No	54.7	170.7	16.5
Swedbank	SWEDEN	47%	No	77.1	400.0	20.9
UBS	SWITZERLAND	168%	Yes	40.6	124.3	13.9

This table shows the banks included in our sample. Size-to-GDP ratio is based on reference year 2024.

B Loss hierarchy in bank resolution

Under the European resolution framework, losses are allocated according to a well-defined creditor hierarchy. From most junior to most senior, the relevant layers are:

1. Common Equity Tier 1 (CET1) equity capital;
2. Additional Tier 1 (AT1) hybrid capital instruments, including contingent convertibles (CoCos);
3. Tier 2 (T2) subordinated debt;
4. Senior non-preferred (SNP) debt explicitly designed to absorb losses ahead of senior operating liabilities;
5. Senior preferred (SP) debt the reference obligation for standard senior unsecured bank CDS;
6. Deposits and other non-bail-in liabilities.

C Detailed results under static wedge specification

Table 10: Baseline regression results: TBTF coefficient across specifications

TBTF definition	(1) G-SIB	(2) $q = 10\%$	(3) $q = 50\%$	(4) $q = 80\%$	(5) $q^* = 47\%$
TBTF	0.251	0.010	-0.378^{***}	-0.160	-0.438^{***}
T1R	-0.025	-0.034^{**}	-0.032^{**}	-0.035^{**}	-0.032^{**}
LLR / Loans	0.089^{***}	0.089^{***}	0.090^{***}	0.089^{***}	0.084^{***}
Efficiency ratio	0.000	0.000	-0.000	0.000	-0.000
Net interest margin	0.052	0.048	0.026	0.042	0.067
Liquid / Total assets	-0.023^{***}	-0.019^{***}	-0.016^{***}	-0.018^{***}	-0.015^{***}
Gov. / Total assets	0.590	0.277	0.900	0.354	0.932
Periphery	0.559^{***}	0.513^{***}	0.274^{*}	0.483^{***}	0.279^{**}
Sub. liab. / Total assets	2.063	0.068	-2.671	-0.776	-3.202
Time FE	Yes	Yes	Yes	Yes	Yes
Bank FE	No	No	No	No	No
R^2	0.634	0.628	0.651	0.630	0.666

Note. OLS estimates of Equation (11) on log 5-year senior unsecured CDS spreads. The columns correspond to different specifications of the TBTF indicator: (1) G-SIB; (2) to (5) domestically large banks with threshold coefficient q of 10%, 50%, 80%, and endogenously determined, respectively. All specifications include time fixed effects and entity-clustered standard errors. The TBTF coefficient (bold) is the parameter of interest; remaining rows report CAMEL-based controls. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

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