

Vol. 17, Issue 3
September – December 2022

EXCERPT

<https://www.aifirm.it/rivista/progetto-editoriale/>



The new supervisory outlier test (SOT) on net interest income (NII): empirical evidence from a sample of Italian banks

**Domenico Curcio, Igor Gianfrancesco, Annalisa Pansini,
Alina Preger**

The new supervisory outlier test (SOT) on net interest income (NII): empirical evidence from a sample of Italian banks

Domenico Curcio (University of Naples “Federico II”), Igor Gianfrancesco (University of Bari “Aldo Moro”), Annalisa Pansini (Prometeia) and Alina Preger (Prometeia)¹

Article submitted to double-blind peer review, received on 27th September 2022 and accepted on 14th November 2022

Abstract

This paper contributes to prior literature and to the current debate concerning the prudential supervisory framework to measure interest rate risk in the banking book (IRRBB), which has been significantly changed on April 2016, when the Basel Committee on Banking Supervision (BCBS) published the latest update of its measurement standards. The consultation launched by the European Banking Authority (EBA) on December 2021, aiming at introducing the supervisory outlier test (SOT) on net interest income (NII), presents several issues and policy implications which could influence in the next future banks' asset and liability management strategies, their internal control systems, risk policies and procedures.

By analyzing a sample of 28 Italian commercial banks at the end of 2021, representing more than 70% of Italian banking system's total assets, we observe that the thresholds proposed by the EBA appear very strict and significantly depend on: i) the sample considered, ii) the lower bound applied to interest rates in the downward scenarios and iii) the current level of interest rates term structure. Our results suggest that the proposed values should be considered with caution as it seems that their potential impacts have not been thoroughly assessed. Further analyses are therefore necessary to guarantee greater robustness of the methodology used for the calibration of the thresholds, taking also into account a wider sample of banks and longer time series, as well as the correlation between the two approaches.

Key words: interest rate risk in the banking book, banking regulation, supervisory outlier test, net interest income.

JEL CODE: G21, G28, G32.

1. Introduction

The prudential regulation of interest rate risk in the banking book (IRRBB) has been going through a period of significant changes starting from April 2016, with the publication of the Basel Committee on Banking Supervision (BCBS)'s new standards, which replaced those issued in 2004. BCBS (2016) confirmed the second pillar classification of IRRBB, given its heterogeneous nature, and introduced new elements for its measurement and management. The new 2016 BCBS standards were implemented in the European Union in two phases. Firstly, through the update of the EBA guidelines issued in July 2018 (EBA/GL/2018/02) in those areas where the supervisor felt the need for a more practical approach. Particularly, the main innovations were:

- i) the introduction of the new six interest rate shock scenarios, represented by a) parallel shock up; b) parallel shock down; c) steeper shock; d) flattener shock; e) short rates shock up; and f) short rates shock down;
- ii) the removal of the non-negativity constraint, which has been replaced by a new floor of -100 basis points for the time bands up to 1 year and increasing by 5 basis points per year up to 0 for maturities beyond 20 years. The above-mentioned guidelines were introduced in Italy through the 32nd update of the Bank of Italy's Circular 285/2013 in April 2020.

Secondly, through the publication, in May 2019, of Directive (EU) 2019/878 and Regulation (EU) 2019/876 of the European Parliament and of the Council, that amended Directive 2013/36/EU and Regulation (EU) No 575/2013, introducing the remaining elements of the BCBS's 2016 standards in the European regulatory framework. Particularly, Directive (EU) 2019/878 gave the mandate to the EBA to issue specific Regulatory Technical Standards (RTS) and a further update of the guidelines, to provide a detailed regulation of the whole new IRRBB prudential framework. Subsequently, on December 2021, the EBA published the following three consultation documents:

- i) EBA/CP/2021/36, a draft of RTS regarding the implementation of the supervisory outlier test (SOT) with reference to the economic value of equity (EVE) and net interest income (NII) approach. Particularly, in accordance with the article 98(5a) of Directive 2013/36/EU, the consultation document specifies the supervisory shock scenarios, the modelling and parametric assumptions for the SOT on EVE and on NII and provides a definition and calibration of the concept of "large decline" within the NII approach. Two different definitions of NII are proposed. It is worth noting the proposed modification of the EBA floor from -100 to -150 basis points for maturities up to 1 year, that increases by only 3 basis points per year (instead of the current 5 basis points). Consequentially, the new floor reaches the 0 level for maturities of 50 years and beyond (EBA, 2021a).
- ii) EBA/CP/2021/37, a draft update of the guidelines currently in force. Particularly, based on article 84(6) of Directive 2013/36/EU, the consultation document provides specific criteria: a) for the assessment and monitoring of credit spread risk from non-trading book activities (CSRBB) and b) to determine whether the internal systems implemented by institutions for the purpose of evaluating IRRBB are not satisfactory. Furthermore, it is extended to the full amount of non-financial deposits the five-year cap in terms of weighted average repricing date (EBA, 2021b).

¹ The authors thank Corrado Meglio (Deputy President of the Italian Association of Financial Risk Managers - AIFIRM) and all the participants to the AIFIRM Working group on IRRBB for the many useful discussions and suggestions. The views expressed are solely of the authors and so cannot be taken to represent those of University of Bari “Aldo Moro”, University of Naples “Federico II” and Prometeia.

At the end of the double-blind review process, the EBA published the final reports of the consultation started on December 2021. With regards to the SOT on NII, the final report EBA/RTS/2022/10 confirms Metric 1, the “narrow NII” definition and the associated threshold proposed during the consultation. This makes the issues described in this article very topical and relevant from a business and risk management perspective. The Metric 2 has been discarded, as AIFIRM also suggested.

iii) EBA/CP/2021/38, a draft of RTS for a standardized methodology to evaluate IRRBB within both EVE and NII approach. Particularly, in accordance with article 84(5) of Directive 2013/36/EU, the consultation document defines a collection of procedural aspects and applicable assumptions for the standardized methodology and also describes the simplified standardized methodology for small and non-complex institutions, as defined in point 145 of Article 4(1) of Regulation (EU) n. 575/2013. The simplified methodology relies on various simplifications to reflect the generally less advanced capabilities of small and non-complex institutions and to satisfy, at the same time, the need for a methodology that is at least as conservative as the standardized one.

The present work aims to shed more light on the implications deriving from the definition and calibration of the “large decline” within the NII approach as defined by EBA/CP/2021/36. The contribution is placed on the research line that analyzes the robustness of the IRRBB prudential regulatory framework. To our knowledge, this is the first work dealing with the NII approach in a regulatory perspective. Most of the existing literature has focused on the drawbacks of the previous regulatory framework based on BCSB (2004), which only considered the EVE approach, by mainly testing its underlying assumptions.

As for papers published on international journals see Fiori and Iannotti (2007), Entrop et al. (2008), Entrop et al. (2009), Abdymomunov and Gerlach (2014), Coccozza et al. (2015) and Cerrone et al. (2017)². As concerns papers published on Italian journals see Curcio and Gianfrancesco (2011, 2012), Partesotti and Preger (2015), Gianfrancesco (2016, 2017, 2018). A second research line concerning IRRBB is represented by those works that used evidence from the application of regulatory methodologies to study the determinants of risk exposure through specific econometric frameworks, such as Esposito et al. (2015), Chauldron (2018) and Hoffmann et al. (2019). Recently, a third research line has begun to analyze the implications deriving from the regulatory changes proposed by BCSB (2016), such as Curcio et al. (2022) and Coccozza et al. (2022).

AIFIRM gave particular attention to IRRBB issues by publishing three different position papers. The first, in 2015, following the participation to the consultation promoted by BCBS on the new regulatory standards in June 2015. Subsequently, in 2019 AIFIRM established a specific working group on IRRBB, whose works led in February 2021 to the release of a second position paper regarding the implications of the new supervisory regulatory framework based on BCBS (2016). Finally, the third position paper was published in April 2022, following the response that the IRRBB working group gave to the EBA consultation launched last December on the RTS and the guidelines update listed above.

By analyzing a sample of 28 Italian commercial banks at the end of 2021, representing more than 70% of Italian banking system’s total assets, our evidence shows that the calibration methodology proposed by EBA (2021a) is significantly dependent on the sample the agency took into account, as well as on the lower bound applied and/or the level of interest rates term structure. Generally, the proposed thresholds seem to be too strict and therefore should be considered with caution. We support the need of further analyses to guarantee a greater robustness of the methodology used to calibrate the thresholds, also account for a wider sample of banks to capture different business models, as well as longer time series to consider banks behavior under different interest rate environments. The correlation between the two different the EVE and NII approaches, and the results they produce, also represent an important driver to consider. Finally, caution in calibration should be suggested also by the current context of restrictive monetary policy carried out by the European Central Bank, and the expected introduction of the new accounting framework for macro fair value hedge, which will pose further constraints in managing IRRBB.

The rest of the paper is organized as follows. Section 2 provides an overview of the new SOT declined by EBA (2021a), focusing on the two different metrics proposed for the NII approach. Section 3 presents the results obtained by applying the methodological framework described in the previous paragraph 2 to a sample of Italian commercial banks, by also making a comparison with the thresholds proposed by EBA (2021a). Finally, in Section 4 we present our main conclusions and the related policy implications.

2. The new supervisory Outlier Tests (SOTs)

2.1. An overview

The consultation on IRRBB supervisory outlier tests (EBA/CP/2021/36) has fulfilled the mandate required in Article 98 (5a) of Directive (EU) 2019/878 of 20 May 2019 to define regulatory technical standards for: i) the regulatory shock scenarios; ii) the modeling and parametric assumptions underlying the SOT in the context of both EVE and NII approach; and iii) the definition and calibration of the concept of “large decline” associated with NII. It is important to highlight that the article 98 of Directive 2013/36/EU sets at point a) the threshold at 15% of Tier 1 within the EVE approach. The same article in the following point b) refers only to the concept of “large decline” in the NII approach without any further specifications. Therefore, there is no threshold set for the NI approach, and its definition is mandated to EBA.

If a bank exceeds the aforementioned thresholds, the competent authorities may use the powers referred to in Article 104 of Directive 2013/36/EU which include the request for a capital increase and the limitation of business activities deemed excessively risky. In addition, as indicated in paragraph 5 of article 98 of Directive 2013/36/EU, the competent authorities themselves could specify further modeling and parametric assumptions, in addition to those in force. However, the same paragraph 5 of Article 98 establishes that the competent authorities are not required to exercise the above-mentioned supervisory powers if they believe, based on the assessments made, that the management of the risk by the same bank is adequate and that the bank itself is not excessively exposed. As regards the EVE approach, the consultation document EBA/CP/2021/36 refers to the indications suggested in BCBS (2016) and partly reported in the guidelines issued in 2018. Particularly, the consultation document aims to confirm:

- i) the modeling and parametric assumptions reported from point a) to j) and at point m) of Article 4 of the draft RTS. In this context, it is important to highlight the possibility, reported at point i), to exclude commercial margins and other spread

² See Appendix A for a short description of these papers.

components from the calculation of the economic value and the adoption of the assumption, reported at point j), of a "run-off balance sheet", according to which maturing existing balance sheet items are not replaced. It is the so-called static balance sheet assumption;

- ii) the six scenarios of changes in interest rates, already included in EBA (2018), represented by a) parallel shock up; b) parallel shock down; c) steeper shock; d) flattener shock; e) short rates shock up; and f) short rates shock down, which remain, in fact, unchanged in terms of both size and sign associated to the different time-bands of the regulatory maturity ladder.

Compared to the current regulatory framework, it is worth noting the revision of the floor to post shock interest rates defined by point k), which now starts from a level of -150 basis points and then increases by 3 basis points per year up to the 0 level for maturities of 50 years and more. It has been also updated the criterion defined in point i) used to aggregate currencies to calculate banks' risk exposure. Particularly, positive changes can be weighted by a factor of 80%, previously set at 50%, only in the case of an exchange rate mechanism (ERM) with a formally agreed fluctuation band narrower than the standard band of ± 15 basis points to offset losses in euro currency. In the other cases it is confirmed a weighting factor equal to 50%.

Despite EBA (2021a) retains appropriate the recalibration of the lower bound on the basis of a AAA bond yield analysis reported in the accompanying documents of the consultation, AIFIRM (2022) believes that it is too low and that the current bound should be maintained. Particularly, under the new proposal, the bound would be set to a level far below any level that interest rates have reached in the past. Besides, the EBA Guidelines currently in force already envisage the possibility to adapt the lower bound in case of interest rates curves were lower than the bound. AIFIRM (2022) also pointed out that the impacts on IRRBB metrics of the proposed new lower bound has never been properly tested with previous QIS or IRRBB dedicated supervisory exercises. As a matter of fact, the QIS data used to support the calibration of SOT assumptions only include metrics calculated according to the current bound and the unconstrained negative scenarios. Moreover, the EBA itself admits that only a limited number of banks participating in the QIS exercise filled in the IRRBB sections and the data provided had some quality issues.

In addition, a specific provision was introduced in point n), referring to interest rate sensitive products that are linked to inflation or other market factors, which requires the application of prudent assumptions in assessing the related risks. Particularly, these assumptions must be based on the current/last observed value, on the forecast of a renowned economic research institute or on other largely accepted market practices and must be generally dependent on the scenario. Finally, it is no longer reported the provision referred to the previous point o), relating to the treatment of retail and non-financial wholesale deposits without any specific repricing dates (non-maturity deposits), which should be constrained to a maximum average of 5 years. This issue is now treated within the new updated version of guidelines (EBA/CP/2021/37) at point 111, which also proposes applying the five-year cap to the full amount of non-maturity deposits.

With regard to the NII approach, the SOT proposed in the consultation document EBA/CP/2021/36/ is based on:

- i) the application of only two parallel scenarios with respect to the six scenarios considered within the EVE approach;
- ii) interest income and expenses over a 1-year time horizon, regardless of the maturity and the accounting treatment of the relevant interest rate sensitive non-trading instruments;
- iii) the same assumptions applied in the EVE approach except for those referred to in points (i) and (j), respectively concerning the hypothesis of a run-off balance sheet and the treatment of commercial margins and other components. Under the NII approach, it is required to apply the assumption of constant balance sheet and to always include commercial margins in the NII projections.

Therefore, within NII approach it is required the application of the EBA floor previously described, as well as the new method of aggregation between the currencies introduced for the EVE approach. Compared to this latter, it is important to highlight the use of the "constant balance sheet" hypothesis according to which maturing positions are replaced with comparable characteristics regarding the volume, maturity and features (e.g., caps/floors). Furthermore, commercial margins of the new business should be based on those related to recently bought or sold products with similar characteristics. In the case of instruments with observable market prices it is required to use recent and not historical market spreads. As pointed by the EBA itself, the reason underlying this choice is that historical/original commercial margins might no longer be representative under current market conditions.

In this context EBA (2021a) also underlines that using a one-year horizon and a constant balance sheet assumption in the NII SOT seems a better balance between accuracy, reliability of estimates and operational feasibility for its management, instead of three years and a dynamic balance sheet, for example. In addition, EBA (2021a) also introduces a wider definition of NII, which includes not only the impact on interest rate income and expenses, as reported in the previous point ii) (the so-called narrow NII), but also the effects related to changes in market value of non-trading financial instruments with a maturity of more than one year accounted at fair value, either shown in the profit and loss account or directly in equity via other comprehensive income. The inclusion of such items in the NII will be decided by the EBA itself as part of the consultation. Finally, two different measurement metrics with related thresholds are proposed, described in detail in the next paragraphs, to identify the so-called "large decline" for the purpose of the SOT for NII.

AIFIRM (2022) agrees on the proposal of a one-year time horizon and the constant balance sheet assumption since, as pointed out by EBA (2021a) itself, it is consistent with banks' internal practices. AIFIRM (2022) recognizes that the proposal to consider current commercial margins aims at obtaining more precise NII projections, although observing that it implies the use of a simulation approach, thus potentially requiring the evolution of current models and operational processes. However, it should be noted that for managerial purposes different assumptions might be considered for commercial margins when banks use NII projections for planning process. Therefore, the NII projections carried out for risk measurement might still not be aligned with the internal ones.

Finally, regarding the choice to include changes in market value in the calculation of NII SOT, AIFIRM (2022) highlights that accounting approaches are not consistent across the European Union. Therefore, the above-mentioned inclusion may reduce comparability, which is one of supervisors' objectives. Besides, a wider NII metric would differ both from the current managerial NII metrics and from the accounting measures of NII. Hence, AIFIRM (2022) states a preference to exclude market value changes from the NII SOT calculation. Nonetheless, in case the regulatory choice will include this component, AIFIRM (2022) suggests that more detailed instructions for the calculation should be provided in order to avoid unintended double counting of the impact of NII and EVE of fair value instruments over the first year.

It should be clarified that the changes in fair value should be calculated at the end of the NII time horizon. Finally, AIFIRM (2022) noted that the issue of double counting arises also in the disposal set in the RTS for the standardized methodology, where the computation of market value changes is explicitly calculated at the beginning of the time horizon.

2.2. The two different metrics in the SOT on NII

The NII SOT aims to identify the decline of an institution's income which would jeopardize its normal business operations, due to its non-trading book's IRRBB exposure. It is the so-called "large decline". To do that two steps need to be followed: firstly, to determine the metric for measuring a decline of the NII; secondly, to calibrate the threshold associated with the chosen metric. A breach of the threshold would indicate the presence of a "large decline" in the NII, following the application of the supervisory shock scenarios. In the consultation paper EBA/CP/2021/36 two different metrics are proposed, described below in this sub-paragraph. The next sub-paragraph 3.3 deals with the calibration of the thresholds.

The first metric proposed by EBA (2021a) is based on the ratio between change in NII following the application of the parallel scenarios and the Tier 1 capital. In symbols:

$$\frac{NII_{shock} - NII_{baseline}}{Tier\ 1\ Capital} < [threshold] \quad (1.)$$

Where NII_{shock} is the (minimum) level of forecasted NII following the application of the parallel scenarios and $NII_{baseline}$ is the level of forecasted NII in the baseline scenario.

This is a capital related metric consistent with the idea behind the EVE SOT that relates the losses in EVE to the Tier 1 Capital. According to EBA itself it seems to be the most manageable option from an operational perspective. Even if it measures the losses of NII, it does not consider other non-NII related elements in the assessment of the sustainability of the business operations. In other words, it makes more straightforward to calculate the indicator, but it does not allow to assess whether the post-shock NII can sustain normal business operations.

The second metric proposed by EBA (2021a) is the ratio between the value of the NII following the application of the parallel scenarios and the NII obtained via the baseline scenario. Both NII measures are adjusted to consider the administrative expenses component multiplied by a coefficient α , given by the ratio of the bank's interest margin to the total banking operating income. In symbols:

$$\frac{NII_{shock} - \alpha \cdot administrative\ expenses}{NII_{baseline} - \alpha \cdot administrative\ expenses} - 1 < [threshold] \quad (2.)$$

where administrative expenses shall be taken from FINREP, as the amount of administrative expenses reported in column 0010 of row 0360 of the template F02.00 on the "Statement of profit or loss" and referred to the latest end-year value. The parameter α is calculated as follows:

$$\alpha = \frac{NII_{hist}}{Operating\ income} \quad (3.)$$

where NII_{hist} is the latest year-end historical NII from FINREP, calculated for this purpose as the difference between the amount of "Interest Income" and "Interest expenses" as reported in column 0010 of rows 0010 and 0090 respectively, of the template F02.00 in the "Statement of profit or loss" table. In case EBA should decide in favor of the broader definition of NII, the values related to column 0010 of rows 0287 and 0290 of the same template should be added. Operating income shall be taken from FINREP as the amount of "Total operating income" reported in column 0010 of row 0355 of the template F02.00 on the "Statement of profit or loss" and referring to the latest end-year value. This is a cost related metric that takes also into account the part of the administrative expenses that can be attributable to the interest margin. The parameter α represents the share of NII in the operating income of the institution and is used as a criterion to measure the part of the administrative expenses attributable to the NII. According to EBA (2021a), this approach has the main advantage to consider both the business model and the cost-structure of a bank in assessing the continuity of the business operations. However, it builds on a strong assumption for the definition of the administrative expenses to be considered. Furthermore, it should be noted that the parameter α is time specific and should be updated yearly, although it should not be expected to vary significantly from year to year.

AIFIRM (2022) states a preference for the first metric (metric 1), since it believes it is simpler to manage by the risk-taking center, easier to communicate to top management and more aligned to EVE metric, making the two measures able to provide better integrated information. In this regard AIFIRM (2021) remarks that during the RAF process, the limits setting should ensure coherence between EVE and NII limits, so that managing IRRBB may impact both measures without any other noisy factor. Having the thresholds set

with the same metric would help this process. On the opposite, the second metric (metric 2) could be strongly influenced by extraordinary events (for example, merger and acquisition, pandemic events, etc...) and multi-annual budget planning which are, in most of the cases, not related to the specific risk factors. For these reasons, AIFIRM (2021) believes that this formulation would add an undesired volatility to the indicator and moreover it would reduce the comparability across banks.

2.3. The calibration of the thresholds

The calibration of the thresholds for the definition of the so-called “large decline” in the SOT on NII was carried out based on the EBA QIS as of December 2020, where dedicated EU-specific IRRBB worksheets have been included in the Basel III monitoring exercise. It is important to highlight, as pointed out by EBA itself, that: i) less than half of participating banks provided data on IRRBB; ii) the exercise did not consider the lower bound EBA under two different time horizons respectively of 1 and 3 years; and iii) the QIS data do not show strongly different results if fair value changes are included or not. Therefore, based on these data, the final calibration was not much influenced by the different NII definitions adopted. The calibration of the thresholds was carried out based on the principle, stated in the consolidated version of BCBS standards at point 31.83, that supervisors may also implement additional outlier or materiality tests, provided these tests are applied through their jurisdiction in the same form. These additional tests could use a different capital measure or capture the bank’s IRRBB relative to earnings. However, the relative threshold for defining an outlier bank should be at least as stringent as 15% of Tier 1 capital. Therefore, the SOT on NII is expected to be at least as severe as the SOT on EVE.

Based on this principle, EBA decided to set the threshold to a level so that the number of banks becoming outliers according to the SOT on EVE is at least equal to the number of outlier banks according to the SOT on NII. Consequently, based on the QIS data provided by a sample of 53 banks, the percentile of the distribution of the EVE changes associated with a risk indicator equal to or above the regulatory threshold of 15% was calculated.

To do that, EBA considered for each bank the most penalizing scenario, i.e., the scenario of changes in interest rates among the six required by the supervisory prudential regulatory framework, which leads to the highest reduction in the economic value. The percentile obtained through the application of this criterion was equal to 0.086. Therefore, this percentile has been applied to the four distributions of changes in NII, considering the most penalizing scenario between the two regulatory parallel scenarios and taking into account both the two different metrics and the two definitions of NII previously described. The four thresholds calculated and proposed by EBA (2021a) are reported in the following Table 1 where the number of banks that provided data within the QIS exercise for each specific metric combination are in the brackets.

Table 1. Thresholds in the SOT on NII (1 year time horizon)

Metric	Definition of NII	
	Narrow	Wider
1	-2,5% (46)	-3,0% (37)
2	-35,0% (38)	-30,0% (33)

Note: Metric 1 is based on the ratio between change in NII following the application of the parallel scenarios and the Tier 1 capital as reported in the equation (1.). Metric 2 is the ratio between the value of the NII following the application of the parallel scenarios and the NII obtained via the baseline scenario as reported in the equation (2.), including the adjustment for the administrative expenses component as defined in equation (2.) and (3.). Narrow NII is determined as interest income minus interest expenses. Wider NII is determined as interest income minus interest expenses including fair value changes. In brackets is indicated the number of banks that provided data within QIS exercise.

The final draft RTS on IRRBB supervisory outlier tests (SOT) published on 20 October 2022 confirms Metric 1, the “narrow NII” definition and the associated threshold proposed during the consultation equals to -2,5%. The metric 2 has been discarded.

In the case of metric 1 and the narrow definition of NII, the threshold corresponding to the 0.086 percentile of the distribution of changes in NII calculated on a sample of 46 banks is equal to -2.5%. This threshold is equal to -3,0% if the delta NII includes market values changes in addition to interest income and expenses, according to the 37 banks that provided data used for this specific analysis. Similar considerations can be made for the metric 2.

In conclusion, following the analysis implemented on the basis of QIS data, EBA shall still make two decisions for the definition of the SOT on NII, in terms of the metric and of the definition of NII, in order to finally specify the concept of a large decline in NII and, consequently, the threshold that identifies outlier banks.

3. The case of Italian banks

In this paragraph, we provide a benchmark analysis carried out on a sample of 28 Italian commercial banks with data referred to the end of 2021, to support discussion about the NII thresholds calibration, taking into account both the floor currently in force and the new one proposed by EBA (2021a). Our sample represents more than 70% of Italian banks’ total assets. NII metrics are computed according to the narrow definition as the difference between interest income and expenses, thus not considering fair value changes. Our results are shown in the following Table 2, where the level of risk indicators for both the EVE and NII approach is reported, starting from the bank with the highest risk indicator and gradually all the others, down to the one with the lowest indicator. The level of the risk indicators has been obtained for each bank through the application of the criterion of the most penalizing scenario both in the EVE and NII approach. A negative sign in the indicator represents a decrease in economic value.

Table 2. Benchmark analysis on SOT metrics.

	NII Metric 1 (A)	NII Metric 2 (B)	NII Metric 1 new lower bound (C)	NII Metric 2 new lower bound (D)	EVE (E)	EVE new lower bound (F)
1	-17,9%	-154,2%	-9,9%	-304,1%	-23,1%	-30,1%
2	-8,5%	-132,4%	-8,2%	-91,7%	-19,7%	-23,1%
3	-5,5%	-107,4%	-8,1%	-80,8%	-16,5%	-19,8%
4	-4,2%	-37,0%	-6,3%	-67,7%	-16,5%	-19,5%
5	-4,1%	-36,2%	-4,8%	-67,0%	-14,9%	-17,8%
6	-2,9%	-33,8%	-4,7%	-59,1%	-14,0%	-17,0%
7	-2,4%	-33,7%	-4,5%	-55,3%	-13,5%	-16,9%
8	-2,3%	-31,6%	-4,4%	-54,2%	-12,1%	-16,2%
9	-2,3%	-27,2%	-3,5%	-45,6%	-11,9%	-15,5%
10	-2,3%	-27,0%	-3,2%	-41,8%	-11,5%	-15,0%
11	-1,8%	-20,8%	-3,0%	-39,0%	-11,1%	-13,5%
12	-1,8%	-18,1%	-2,9%	-33,2%	-10,9%	-12,6%
13	-1,6%	-17,9%	-2,9%	-33,1%	-10,2%	-11,7%
14	-1,6%	-17,1%	-2,6%	-25,7%	-9,5%	-9,1%
15	-1,4%	-16,2%	-2,5%	-24,9%	-8,8%	-9,0%
16	-1,4%	-15,6%	-2,3%	-24,1%	-8,5%	-8,7%
17	-1,3%	-12,8%	-1,7%	-24,0%	-7,6%	-7,9%
18	-1,3%	-12,5%	-1,4%	-16,4%	-7,5%	-7,5%
19	-1,2%	-12,3%	-1,3%	-10,6%	-7,5%	-7,5%
20	-1,1%	-12,2%	-1,2%	-10,0%	-6,7%	-5,0%
21	-1,0%	-11,4%	-0,9%	-9,7%	-5,6%	-3,8%
22	-0,9%	-9,2%	2,1%	16,3%	-4,5%	-3,5%
23	-0,9%	-8,8%	n.a.	n.a.	-4,5%	3,9%
24	-0,6%	-7,4%	n.a.	n.a.	-3,8%	n.a.
25	-0,5%	-5,0%	n.a.	n.a.	-3,3%	n.a.
26	-0,5%	-4,5%	n.a.	n.a.	-2,8%	n.a.
27	-0,2%	-2,3%	n.a.	n.a.	-1,9%	n.a.
28	0,6%	4,6%	n.a.	n.a.	-1,4%	n.a.
N.number of banks	28	28	22	22	28	23
Number of outlier	6	5	15	11	4	9
Outlier %	21,4%	17,8%	68,2%	50,0%	14,3%	39,1%
Average risk indicator	-2,5%	-29,3%	-3,6%	-50,1%	-9,6%	-12,5%
Median risk indicator	-1,5%	-16,6%	-3,0%	-36,1%	-9,1%	-12,6%

Legend and explanatory notes

(A) NII Metric 1	<p>Is the change in Net Interest Income (NII) over one year, corresponding to the worst impact under the two parallel regulatory shocks. The NII is calculated as the difference between interest income and expenses, excluding market value changes of positions accounted for at fair value.</p> <p>It corresponds to Metric 1 referred to in Article 6 of the EBA/CP/2021/36: $(NII.shock - NII.baseline)/Tier1$ For the negative shock scenario, the current lower bound envisaged in par.115(k) of EBA/GL/2018/03 is applied</p>
(B) NII Metric 2	<p>Is the change in Net Interest Income (NII) over one year, corresponding to the worst impact under the two parallel regulatory shocks. The NII is calculated as the difference between interest income and expenses, excluding market value changes of positions accounted for at fair value.</p> <p>It corresponds to Metric 2 referred to in Article 6 of the EBA/CP/2021/36: $(NII.shock - \alpha * Admin.Expenses) / (NII.baseline - \alpha * Admin.Expenses) - 1$. For the negative shock scenario, the current lower bound envisaged in par.115(k) of EBA/GL/2018/03 is applied</p>
(C) NII Metric 1 new lower bound	<p>Is the change in Net Interest Income (NII) over one year, corresponding to the worst impact under the two parallel regulatory shocks. The NII is calculated as the difference between interest income and expenses, excluding market value changes of positions accounted for at fair value.</p> <p>It corresponds to Metric 1 referred to in Article 6 of the EBA/CP/2021/36: $[NII(shock) - NII(baseline)]/Tier1$. For the negative shock scenario, the new proposed lower bound envisaged in Article 4(k) of EBA/CP/2021/36 is applied</p>
(D) NII Metric 2 new lower bound	<p>Is the change in Net Interest Income (NII) over one year, corresponding to the worst impact under the two parallel regulatory shocks. The NII is calculated as the difference between interest income and expenses, excluding market value changes of positions accounted for at fair value.</p> <p>It corresponds to Metric 2 referred to in Article 6 of the EBA/CP/2021/36: $(NII.shock - \alpha * Admin.Expenses) / (NII.baseline - \alpha * Admin.Expenses) - 1$. For the negative shock scenario, the new proposed lower bound envisaged in Article 4(k) of EBA/CP/2021/36 is applied</p>
(E) EVE	<p>Change in the economic value of equity / Tier1 capital, corresponding to the worst impact under the six regulatory shocks. It is the measure referred to in the current regulatory framework, i.e. par. 114 and 115 of EBA/GL/2018/02</p>
(F) EVE new lower bound	<p>Change in the economic value of equity / Tier1 capital, corresponding to the worst impact under the 6 regulatory shocks. It is the measure referred to in the current regulatory framework, i.e., par. 114 and 115 of EBA/GL/2018/03, except for the application of the lower bound. Here the new proposed lower bound envisaged in Article 4(k) of EBA/CP/2021/36 is applied</p>

The application of the regulatory thresholds defined by EBA (2021a) for the NII SOT leads to 6 and 5 outliers (highlighted in gray) for respectively Metric 1 and Metric 2. If we applied to our sample banks the calibration methodology proposed by EBA (2021a), based on the number of outliers observed for the EVE SOT under the current lower bound, which is equal to 4 (see Column 6 of Table 2), the NII threshold should be set at -4,2% (shown in bold in column 2) in case of Metric 1, instead of the proposed -2,5%, and at -37,0% (shown in bold in column 3) for Metric 2, instead of the proposed -35,0%. The two above mentioned thresholds have been calculated with reference to the number of outlier banks in the EVE approach (equals to 4) corresponding to the 0,1429 percentile of the distribution, which is higher than that defined by EBA (2021a), equal to 0,086. Referring to Metric 1, the 2 banks (number 5 and 6) that present a risk indicator equal respectively to -4,1% and -2,9% would be considered outliers according to the regulatory threshold, but not outliers according to the threshold calculated on the basis of our sample. As for Metric 2, only bank number 5 would have a different treatment depending on the threshold used. These results show that the calibration is significantly dependent on the sample considered.

The switch to the new proposed lower bound of post shock interest rates leads to an increase of the share of outlier banks over the total number of banks goes from 14,3% (4 out of 28) to 39,2% (9 out of 23) in the case of EVE SOT, while for NII SOT the outlier percentage would rise from 21,4% (6 out of 28) to 68,2% (15 out of 22) and from 17,8% (5 out of 28) to 50,0% (11 out of 22) for metric 1 and metric 2 respectively. The switch also determines an increase in the average risk exposure of our sample banks both in EVE (from -9,6% to -12,5%) and in NII (from -2,5% to -3,6% for Metric 1 and from -29,3% to -50,1% for Metric 2).

The increase in the average exposure is attributable to banks exposed to downward scenarios. The application of wider negative changes in interest rates, as a consequence of lowering the floor, leads, *ceteris paribus*, to a greater reduction in economic value and

in interest margins and therefore to a higher level (in absolute value) of the corresponding risk indicators. The impacts of the introduction of the new proposed lower bound appear to be extremely material both for EVE and NII measures under negative shock scenarios, with significant implications for IRRBB management and strategy.

The application of the new proposed floor to our sample banks would lead to a reduction of the thresholds for NII metrics under metric 1, which should be set at -3,5% (shown in bold in column 4). This value is lower than the one obtained in our sample under the floor currently in force, equals to -4,2%, but would still be higher than the regulatory one. In the case of metric 2 we would find a new threshold of -45,6% (shown in bold in column 5), which is higher than both the value obtained in our sample with the floor currently in force (equals to -37,0%) and the regulatory one. The two thresholds are calculated considering a number of outlier banks in the EVE approach equal to 9 (shown in bold in column 7). Thus, these results show that the setting of threshold also depends on the floor applied.

We also find that this approach to thresholds calibration leads to a counterintuitive result, as the threshold on NII SOT calculated for metric 1 decrease from -4,2% to -3,5% despite a greater risk exposure by banks. This suggests the need for further analysis to guarantee a greater robustness of the methodology to be used for the calibration of the thresholds in the NII approach. We note that this counterintuitive result is not observed for metric 2, where we observe an increase in the threshold on NII SOT from -37,0% to -45,6% following the higher risk exposure driven by the application of the new proposed lower bound.

In this context, it is important to underline that the effects deriving from the introduction of the proposed lower bound could also be determined by an increase in the term structure of interest rates, that would lead to an increase in the size of the shock applied, even under the current lower bound. Therefore, banks exposed to a decrease in interest rates could be characterized by an increase in their IRRBB exposure in a rising interest rates environment such as the current one.

From a methodological perspective, several factors could influence the calibration of the thresholds, in addition to the ones already mentioned (the choice of the reference sample, the level of the lower bound and the level of the term structure of interest rates), for instance: the correlation between the EVE and NII approach, the different number of scenarios considered under the two approaches as well as the different time horizon considered. These factors interact with each other. For example, the change in the lower bound impacts differently on the two measures (EVE and NII) depending on the related time horizon and slope of the term structure of interest rates.

It is important to highlight that the greater average risk exposure and the higher number of outlier banks registered in both the EVE and NII approaches following the transition to the new proposed floor could depend also on the asset and liability management strategies implemented by banks in the low interest rates environment that characterized the recent past. Therefore, the results obtained should be assessed with caution and, at the same time, suggest using longer series of historical observations to calibrate thresholds, so to capture banks' behaviors in different interest rates environments, including those that did not require any floor. This should be in line with the prudential regulatory framework in force. For example, the calibration of the new six interest rates scenarios by BCBS (2016) was based on interest rates time series ranging from 2000 to 2015. Or, referring to the treatment of non-maturity deposits, EBA (2021a) requires a ten-year observation period for modelling the stable / non-stable part of deposits. Hence, a wider data set with longer series of historical observations seems to be necessary to apply the proposed calibration methodology based on outliers' distribution.

4. Conclusions and policy implications

This paper contributes to the current debate concerning the revision of the prudential supervisory framework dealing with IRRBB, which has gone through significant changes since April 2016, when BCBS published its latest standards. The recent consultation issued by EBA on December 2021 aiming at introducing the SOT on NII presents several issues, which could influence in the next future banks' asset and liability management strategies, as well as their internal control systems, risk policies and procedures.

By analyzing internal data referred to a sample of 28 Italian commercial banks, observed at the end of 2021 and representing more than 70% of the Italian banking system in terms of total assets, this paper results suggest that the thresholds proposed by EBA (2021a) appear to be very strict and also depending significantly on the sample considered, as well as on the lower bound applied. Therefore, the proposed values should be considered with caution as their potential impacts deserve to be thoroughly assessed. Particularly, the switch to the new floor would lead to a significantly high number of outlier banks, as well as to an increase of the banks average detected risk exposure, both under the EVE and the NII approach. In fact, the application of wider negative changes in downward scenarios following the lowering of the floor would lead, at equal conditions, to a greater reduction in economic value and net interest income, thus increasing the level (in absolute value) of the corresponding risk indicators.

Overall, the above-mentioned regulatory changes might cause limit breaches, triggering managerial actions to adjust the IRRBB position of a bank, causing potential negative impacts on profitability. Similarly, in terms of market disclosure, the publication of higher risk indicators in Pillar III reports could also have possible consequent reputational effects, thus suggesting a thorough assessment of potential implications on the market.

We suggest the need for further analysis in order to guarantee a greater robustness of the methodology used for the calibration of the thresholds, possibly taking into account a wider sample of banks to capture different business models and longer time series aiming at considering banks' behaviors under different interest rate environments. The correlation between the results for EVE and the setting of the threshold for the NII SOT also represents an important driver to be carefully assessed, also considering the different assumptions underneath the two approaches (e.g., shocks scenarios and time horizons).

References

- Abdymomunov, A. & Gerlach, J. (2014). Stress testing interest rate risk exposure. *Journal of Banking & Finance*, 49, 287-301.
- AIFIRM (2015). *Risposta al documento di consultazione Interest Rate Risk in the banking book del Comitato di Basilea sulla vigilanza bancaria* (edit by Curcio D. & Gianfrancesco I.). Position Paper n.4, September.
- AIFIRM (2021). *Rischio di tasso di interesse del portafoglio bancario (IRRBB): evoluzione normativa ed implicazioni gestionali* (edit by Curcio D., Gianfrancesco I., Meglio C., Pansini A., Preger A. & Trentini S.). Position Paper n. 25, February.
- AIFIRM (2022). *Risposta alle consultazioni EBA sul rischio di tasso di interesse del portafoglio bancario* (edit by Curcio D., Gianfrancesco I., Meglio C., Pansini A. & Preger A.). Position Paper n.34, April.
- Basel Committee on Banking Supervision (2004). Principles for the management and supervision of interest rate risk. *Bank for International Settlements*, July.
- Basel Committee on Banking Supervision (2015). Interest rate risk in the banking book. *Bank for International Settlements*. Consultative document, June.
- Basel Committee on Banking Supervision (2016). Interest rate risk in the banking book. *Bank for International Settlements*, April.
- Cerrone, R., Coccozza, R., Curcio, D. & Gianfrancesco, I. (2017). Does prudential regulation contribute to effective measurement and management of interest rate risk? Evidence from Italian banks. *Journal of Financial Stability*, 30, 126-138.
- Chaudron, R. F. (2018). Bank's interest rate risk and profitability in a prolonged environment of low interest rates. *Journal of Banking & Finance*, 89, 94-104.
- Coccozza, R., Curcio, D. & Gianfrancesco, I. (2015). Non-maturity deposits and banks' exposure to interest rate risk: Issues arising from the Basel regulatory framework. *Journal of Risk*, 17(5).
- Coccozza R., Curcio D., Gianfrancesco I. & Onorato G. (2022). *Interest rate risk in the banking book and internal capital: what implications from the new supervisory regulatory framework?*. Paper presented at the International Finance and Banking Society (IFABS) Conference held at the University of Naples Federico II from 7 to 9 September 2022.
- Curcio D. & Gianfrancesco I. (2011). La misurazione del rischio di tasso di interesse del portafoglio bancario in Basilea 2: quali possibili criticità nella ricerca di nuove best practices?. *Newsletter AIFIRM*, Anno 6, Numero 1.
- Curcio D. & Gianfrancesco I. (2012). Il rischio di tasso di interesse del banking book: profili applicativi. *Banche e Banchieri*, n.2.
- Curcio D., Gianfrancesco I., Modena M. & Onorato G. (2022). La disciplina del rischio di tasso di interesse del portafoglio bancario: evoluzione e impatti sulle prassi. *Bancaria*, n. 5.
- Entrop, O., Memmel, C., Wilkens, M. & Zeisler, A. (2008). Analyzing the interest rate risk of banks using time series of accounting-based data: Evidence from Germany. *Deutsche Bundesbank Discussion Series 2: Banking and Financial Studies*, No.1/2008.
- Entrop, O., Wilkens, M. & Zeisler, A. (2009). Quantifying the interest rate risk of banks: assumptions do matter. *European financial management*, 15(5), 1001-1018.
- Esposito, L., Nobili, A. & Ropele, T. (2015). The management of interest rate risk during the crisis: evidence from Italian banks. *Journal of Banking & Finance*, 59, 486-504.
- European Banking Authority (2018). Guidelines on the management of interest rate risk arising from non-trading book activities. Final Report, July.
- European Banking Authority (2021a). *Draft Regulatory Technical Standards specifying supervisory shock scenarios, common modelling, and parametric assumptions and what constitutes a large decline for the calculation of economic value of equity and of the net interest income in accordance with Article 98(5a) of Directive 2013/36/UE*, December.
- European Banking Authority (2021b). *Draft Guidelines issued on the basis of Article 84(6) of Directive 2013/36/EU specifying aspects of the identification, evaluation, management and mitigation of the risks arising from potential changes in interest rates and of the assessment and monitoring of credit spread risk, of institutions' non trading-book activities*, December.
- European Banking Authority (2021c). *Draft Regulatory Technical Standards specifying standardized and simplified standardized methodologies to evaluate the risks arising from potential changes in interest rates that affect both the economic value of equity and the net interest income of an institution's non-trading book activities in accordance with 84(5) of Directive 2013/36/EU*, December.
- Fiori, R. & Iannotti, S. (2007). Scenario-based principal component value-at-risk when the underlying risk factors are skewed and heavy-tailed: an application to Italian banks' interest rate risk exposure. *The Journal of Risk*, 9(3), 63.
- Gianfrancesco I. (2016). L'esposizione al rischio di tasso di interesse del portafoglio bancario: quali implicazioni per le strategie di Asset & Liability Management? *Newsletter AIFIRM*, Anno 11, Numero 3-4.
- Gianfrancesco I. (2017). L'applicazione dei nuovi scenari di variazione dei tassi di interesse proposti dal Comitato di Basilea: quali implicazioni per le banche italiane? *Risk Management Magazine*, Anno 12, Numero 3.
- Gianfrancesco I. (2018). La misurazione dell'esposizione al rischio di tasso di interesse del portafoglio bancario: quali implicazioni in sede ICAAP a seguito della recente introduzione dell'approccio del margine di interesse nel quadro normativo di vigilanza prudenziale? *Risk Management Magazine*, Anno 13, Numero 3.
- Hoffmann, P., Langfield, S., Pierobon, F. & Vuillemeij, G. (2019). Who bears interest rate risk?. *The Review of Financial Studies*, 32(8), 2921-2954.
- Partesotti A., & Preger A. (2015). Risposta di Prometeia alla consultazione "Interest Rate Risk in the Banking Book" del Basel Committee on Banking Supervision. *Newsletter AIFIRM*, Anno 10, Numero 4.

Appendix A: review of literature

Table 3: Papers published in international journals

Authors	Description
Fiori and Iannotti (2007)	The authors develop a <i>Value at Risk (VaR)</i> methodology based on a principal component Monte Carlo simulation. By analyzing a sample of the 18 major Italian banks, they show that their results are consistent with the findings obtained through the parallel scenario of +/-200 bp if the regulatory duration coefficients are calibrated on the basis of current market data at the evaluation date.
Entrop et al. (2008)	The authors develop the so-called times-series accounting based model (TAM) to estimate the distribution of bank's assets and liabilities within each time band of regulatory maturity ladder. Referring to a sample of German banks, the authors show that TAM is able to explain the cross-sectional variation in bank's interest rate risk better than the regulatory methodology proposed by BCBS (2014) and provides results that are more in line with those obtained by banks' internal models.
Entrop et al. (2009)	The authors analyze how bank's risk exposure changes if some of the main assumptions underlying the regulatory model are modified. By considering the aggregated German universal banking systems, the authors find that bank's risk exposure depends significantly on the assumption underlying the regulatory framework. Therefore, they warn that results coming from the regulatory framework should be treated with caution if used for supervisory and risk management purposes.
Abymomuvov and Gerlach (2014)	The authors propose a new methodology for generating yield-curve scenarios for stress testing bank's exposure to interest rate risk based on the Nielson-Siegel (1997) yield curve model. By considering an aggregated bank's balance sheet based on Call Report data from a sample of large United States banks, they show that their methodology produces scenarios with a wider variety of slopes and shapes than others generated by internal methods commonly used in industry and proposed in literature including the regulatory methodologies of +/-200bp parallel shift.
Cocozza et al. (2015)	The authors develop a behavioral model to allocate non-maturity deposits in the time bands of maturity ladder. By considering a sample of 30 Italian commercial banks, the authors show that different criteria to allocate non-maturity deposits could impact not only on the size of the risk indicator but also on the nature of risk exposure. The authors also discover the presence of risk-neutral banks in a low interest rate environment, i.e., banks that appear to experience an increase in their equity economic value whether interest rates decrease or increase under the parallel shifts method.
Cerrone et al. (2017)	The authors show how banks might adapt internal measurement systems based on simulation techniques to face the risk-neutrality phenomenon detected by Cocozza et al. (2015). They also develop a back-testing procedure, modifying the original framework proposed by Lopez (1996) in the IRRBB perspective, to test the consistency of regulatory and simulation methodologies' results with the actual bank risk exposure. By considering a representative sample of 130 Italian banks between 2006 and 2013, the authors show that simulation techniques perform better than those regulatory methodologies.
Esposito et al. (2015)	The authors measure interest rate risk using the duration gap approach proposed by the BCBS (2004). Based on a representative sample of 68 Italian intermediaries observed from the second half of 2008 to the first half of 2012, they show that the Italian banking system has a limited exposure to interest rate risk. Italian banks have managed this risk by using changes in their balance-sheet exposure and interest rate derivatives as substitutes. They also show the relationship with other risks such as credit and liquidity risk.

**Chaudron
(2018)**

The author investigate how bank risk position changes over time by analyzing the interest-rate risk position of 42 Dutch banks during the period 2008 – mid-2015. The empirical evidence obtained show that interest-rate risk positions are negatively related to on-balance sheet leverage, exhibit a U-shaped relation with solvability, and do not vary systematically with the size of the banks. Finally, banks that received government help during the crisis took on greater interest rate risk.

**Hoffmann et al.
(2019)**

The authors study the allocation of interest rate risk for a sample of 104 banks from 18 euro area countries. Their results show that banks' exposure is limited on aggregate but there is a considerable heterogeneity across individual institutions. In contrast to conventional wisdom roughly half of the banks benefit from an increase in interest rates in terms of both EVE and NII. Finally, hedging via interest rate swaps eliminate only 25% of on-balance sheet exposure arising from deposit taking and lending activities.
