

## Research Note

# ABS and Covered Bond Risk and Solvency II Capital Charges

### Executive summary

This study analyses the relative risk of European Asset Backed Security (ABS) tranches and Covered Bonds (CBs) and draws lessons about how insurer capital charges should be calibrated in the context of Europe's Solvency II regulations. The data employed in the study consists of information on all active ABS and European CB listed on the Bloomberg platform. The dataset runs from 1/1/2010 to 25/6/2021. Using these data, we construct our own indices that represent the values of diversified portfolios of securities.

We compare the risk of: Senior Simple, Transparent and Standardised (STS) ABS, Non-Senior STS ABS, Non-STs ABS, and CB by calculating VaR statistics estimated using return indices for these categories of security. Within the current Solvency II rules, of the four categories, Senior STS securitisations are subject to the lowest capital charges, at a level somewhat higher than the capital charges of CBs. Non-senior STS capital charges are around two to three times higher than Senior STS securitisations. Other securitisations (excluding re-securitisations) are not distinguished for their seniorities and are assigned a much higher (around 3 to 4 times before reaching the ceiling) capital charge than Non-senior STS securitisations.

The Solvency II SCR rules involve applying multipliers or 'stress factors' to exposures within an asset class and then aggregating across asset classes adjusting for diversification. To obtain a clear view of the stringency of capital charges, one must consider how they operate for typical insurer balance sheets since the nature of the balance sheet affects the diversification adjustment. We, therefore, compute the marginal capital charges that a typical European Life Insurer would face in holding securitisations after adjustment for diversification effects.

Our principal findings are that, for both Non-senior STS and for Non-STs ABS, the capital charges implied by our analysis are substantially lower than those contained in the current Solvency II rules.

## 1. Introduction

This study<sup>1</sup> compares the risk of Asset-Backed Securities (ABS) and Covered Bonds (CB) and draws lessons for their capital treatment under Solvency II, the prudential framework for European insurers.<sup>2</sup> The Solvency II rules differentiate the capital treatment of individual ABS depending on their seniority, modified duration and whether that meet a complex set of criteria for 'high quality securitisations', attracting the designation Simple, Transparent and Standardised (STS).

We analyse relative risk by calibrating capital charges using techniques similar to those employed by the European authorities in the original calibration of Solvency II capital charges. The approach consists of calculating Value-at-Risk (VaR) statistics from cumulative security return indices. We construct the indices ourselves using granular data from Bloomberg for the two asset classes for the period January 2010 to June 2021. We also study a sub-sample of the data from April 2019 to June 2021 for which one may observe whether individual ABS are STS.

<sup>1</sup> The study was prepared by William Perraudin and Yixin Qiu. Queries should be addressed to [william.perraudin@riskcontrollimited.com](mailto:william.perraudin@riskcontrollimited.com).

<sup>2</sup> The study has been commissioned by the Association of Financial Markets in Europe (AFME).

We compare the risk of:

1. Senior STS ABS,
2. Non-Senior STS ABS,
3. Non-STS ABS, and
4. CB.

by calculating VaR statistics estimated using return indices for these categories of security.

To infer capital charges resembling those found in the Solvency II Solvency Capital Requirements (SCR), we scale the capital charges for CBs within the Solvency II rules by the ratios of VaRs obtained from our statistical analysis.

Under Solvency II, capital charges for securitisation exposures held on the asset side of an insurer's balance sheet are generally determined by so-called Standard Formula rules.<sup>3</sup> Standard Formula securitisation capital charges fall within the Spread Risk section of the rules applicable to corporate bonds and other credit sensitive fixed income securities.

The latest Solvency II securitisation capital rules are set out in Commission Delegated Regulation (EU) 2018/1221. This replaces the Type 1/Type 2 distinction, found in earlier versions of the rules, with a 4-fold categorisation consisting of:

1. Senior Simple, Transparent and Standardised (STS)
2. Non-senior STS
3. Re-securitisations
4. Others

Here, STS securitisations are those that satisfy a long list (of about fifty requirements) covering multiple aspects of the transactions involved. The word 'senior' indicates that the exposure is the most senior tranche of a given securitisation structure. The Solvency II rules specify schedules of capital charges increasing according to the modified duration of the exposures in question to a ceiling of 100%, i.e., effective deduction.

Within the existing Solvency II rules, of the four categories, Senior STS securitisations are subject to the lowest capital charges, at a level somewhat higher than the capital charges of CBs. Non-senior STS capital charges are around two to three times higher than Senior STS securitisations. Other securitisations (excluding re-securitisations) are not distinguished for their seniorities and are assigned a much higher (around 3 to 4 times before reaching the ceiling) capital charge than Non-senior STS securitisations.

Note that to calculate capital under the Solvency II SCR rules, one applies multipliers or 'stress factors' to exposures within an asset class and then aggregates across asset classes adjusting for diversification. This diversification adjustment means that the marginal contribution to capital of a particular exposure depends on what else the institution is holding in its balance sheet. Thus, to obtain a clear view of the stringency of capital charges, one must consider how they operate for typical insurer balance sheets.

As a final stage in our analysis, we, therefore, compute the marginal capital charges that a typical European Life Insurer would face in holding securitisations after adjustment for diversification effects. The implied capital charges are substantially lower than those contained in the current Solvency II rules for both Non-senior STS and for Non-STS ABS.

Finally, note that this paper builds on an earlier Risk Control study, namely Kutas, Perraudin and Qiu (2016). The calibration is redone with a different dataset which stretches up to the present and with updated index construction methods in line with the current Solvency II securitisation capital rules.

Our findings may be summarised as follows.

- The risk of Senior ABS as measured by a VaR estimated from a return index is about 30% higher than that of CB if one looks across the entire sample period of 2010 to 2021. This may well be an over-estimate because the number of ABS available for our index construction is very low in the early part of the sample period in which ABS volatility is particularly high so the index in this period is probably subject to quite significant idiosyncratic risk associated with shocks to individual securities, whereas

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<sup>3</sup> Insurers are, in principle, also permitted, under Solvency II, to develop internal models for calculating securitisation capital but obtaining permission to do so is reportedly very difficult in most national jurisdictions. So, only a handful of European insurers calculate securitisation capital using internal models.

the CB data includes information on many individual securities even early in the sample period. The comparison of risk is even more conservative if it is applied to Senior STS since the statistical exercise is actually based on all Senior ABS. The increment in risk between Senior ABS and Non-senior ABS as measured by our VaR estimates for indices equals about a further 30% increase, again if one considers the sample period as a whole.

- If one focusses on the most recent period (from April 2019 to June 2021) in which the STS status of individual ABS is observable, the risk of ABS appears much lower relative to that of CB. Senior STS ABS exhibit a VaR that is 5% lower than that of CB. More striking yet, the VaR for Non-senior STS ABS is 3% lower than that of CB. The VaR for Non-STS ABS is slightly more than double that of CB but this ratio is still very small compared to the relative Solvency II capital charges for these asset classes.
- We infer capital charges for ABS by scaling the existing CB capital charges based on the relative magnitude of VaR statistics for asset class categories (Senior STS, Non-senior STS and Other (Non-STS)). This approach may be characterised by assuming the CB charges are correct and then inferring from the return index VaRs what are the relative risks of asset class categories.
- We find that the inferred capital charges for Senior STS are quite close to the charges that Solvency II specifies for this ABS category. The scaling we employ is based on VaRs for the whole sample period. This is probably conservative for the reason stated above that the ABS indices are based on few securities early in the sample period which means they contain a significant amount of idiosyncratic risk.
- A more striking finding is the substantial gap between Solvency II capital charges and Non-senior STS. We use the same approach to infer capital charges for Non-senior STS but using the ratio of 1.84. This suggests that Solvency II is overly conservative for Non-senior ABS, a material finding since one might expect insurers to be natural investors in senior mezzanine ABS tranches (more so than senior). In broad terms, the actual Solvency II capital charges appear to be double what is implied by our calibration exercise.
- Again, when we calibrate capital charges for Other (Non-STS) ABS, we find substantial differences between the capital implies by the calibration and those prevailing in the current Solvency II rules. The gap appears to represent a doubling of capital charges compared to our calibrated values.
- The last exercises we perform are to calculate Solvency II capital charges inclusive of diversification adjustments for ABS, for a representative European Life Insurer balance sheet. As expected, the diversification adjustment substantially reduces capital charges compared to their pre-diversification levels (more or less halving them) but the pattern of results already described of Solvency II Senior STS being more or less in line with inferred values while Non-senior STS and Other (Non-STS) appear to be treated with much greater conservatism than is justified by the empirical evidence.

The study is organised as follows. Section 2 describes the methodology including the nature the data employed, how these are used to calculate return indices for different asset classes and the computation of Value at Risk (VaR) statistics. Section 3 presents results of the risk and capital parameter calculations. Section 4 presents analysis of the capital charges after adjustment for diversification within the balance sheet of a representative European life insurer. Section 5 concludes.

## 2. Methodology

### 2.1 Data description

This section describes the data used in the study. We analyse data on all active ABS and European CB listed on the Bloomberg platform. The dataset runs from 1/1/2010 to 25/6/2021. In the case of CB, we select all active European bonds that are covered by a pool of assets. On ABS, Bloomberg maintains ABS data in two universes, a set of older tranches in the Corporate bond database and newer tranches in the Mortgage database. Our ABS dataset combines information on tranches for which data are available in both databases.

The pricing and modified duration data of the European CB and ABS are obtained from Bloomberg. All prices are quote clean. Modified duration is the weighted average of the times of principal payments, with the weight being the ratio of each principal payment to the total principal outstanding. Due to the uncertainty of future payment timing and amount, the modified duration is an estimate based on a securitisation's payment structure, as well as a forecast of the prepayment and default rate vectors of the underlying pool. Typically, a senior tranche's modified duration should decrease overtime.

The cash flows to mezzanine or junior tranches are typically paid after the senior tranche, and the former, therefore, typically have longer modified duration than senior tranches. Unable to download the modified duration as a time-series, we download the modified duration of CB and ABS at origination and August 2021

with Bloomberg's underlying prepayment and delinquency assumptions. We linearly interpolate the two modified duration estimates to obtain a time series of modified duration.

Historical ratings data is downloaded from Refinitiv Eikon which provides Moody's and Fitch ABS issue-level ratings and CB issuer-level ratings. Filtering bonds with both pricing data and ratings data, we find seven countries for which information on reasonable numbers of both ABS and CB are available. These are France, Germany, Netherlands, Ireland, Spain, Italy and United Kingdom.

Indicators of whether securitisations possess STS status are downloaded from Bloomberg. The data are largely unavailable for securitisations issued before 2019. This fact and its implications will be discussed more in Section 3.

## 2.2 Index construction

This section explains how we construct indices from the raw data described above. We start by constructing three return indices for:

- Senior ABS,
- Non-senior ABS,
- CB.

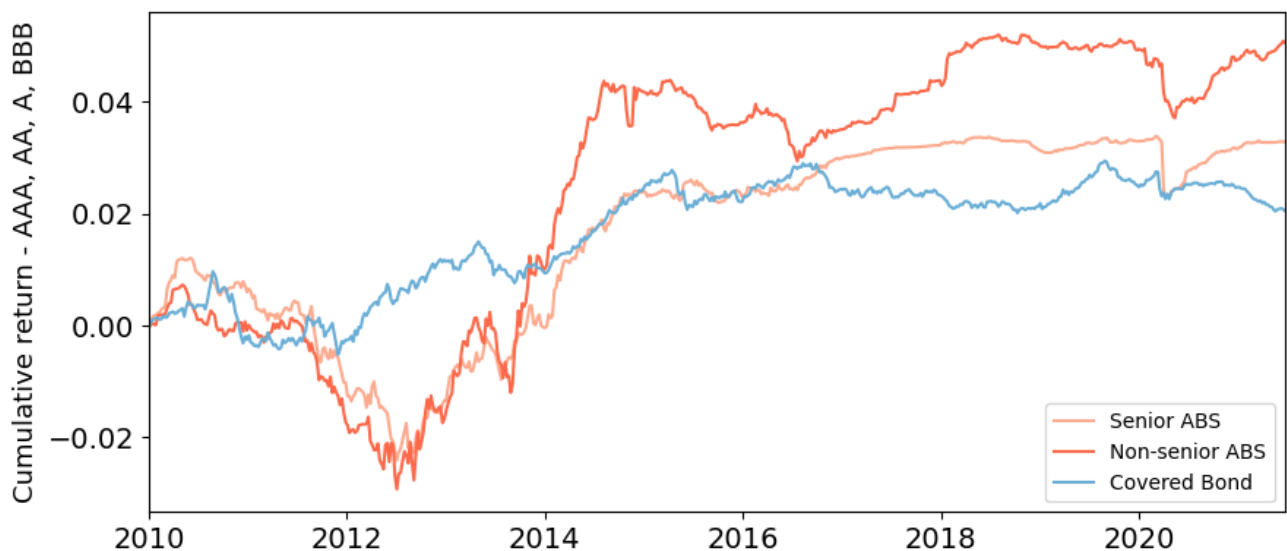
We do this by, for a given day, averaging the weekly returns (the difference between the natural logarithm of the prices on each Wednesday and one week earlier) divided by the modified duration in years, for those bonds that satisfy the following list of criteria:

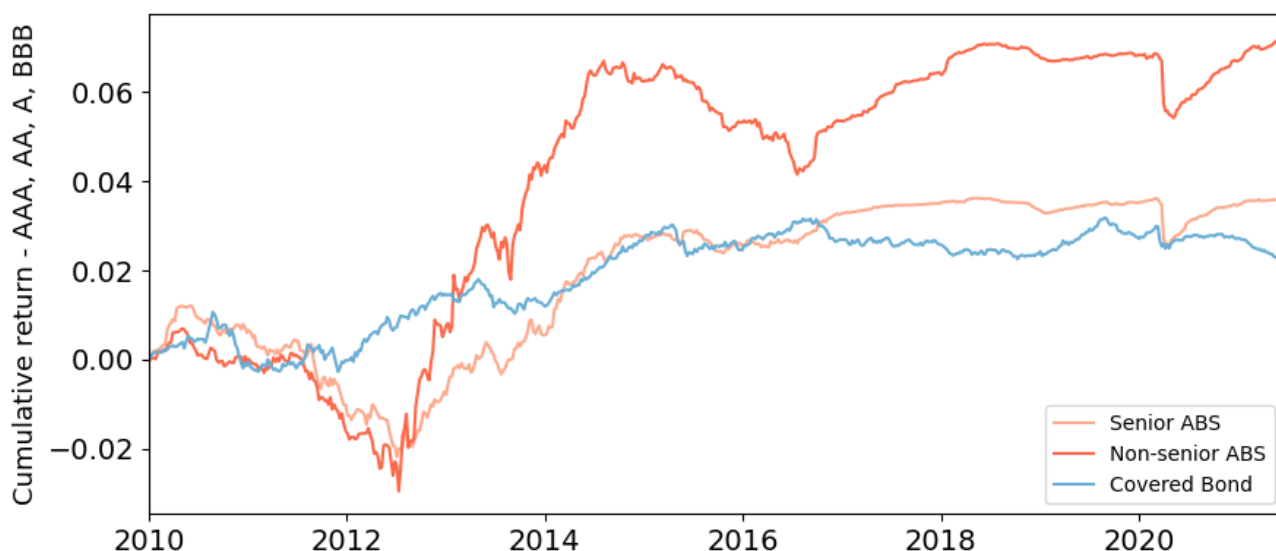
1. The country of the bond is one of France, Germany, Netherlands, Ireland, Spain and Italy.
2. The bond is rated BBB or above by Moody's, or by Fitch when Moody's ratings are unavailable.
3. For ABS, we exclude Commercial Mortgage-Backed Securities (CMBS) and there are no re-securitisations in the dataset.

We also create indices for bonds from the above group of countries plus the United Kingdom.

The weekly returns employed in constructing the indices are non-overlapping. If an index contains very few underlying bonds, say under 10, the fluctuation in the index return is likely to be dominated by idiosyncratic risks associated with particular bonds or issuers rather than asset-class wide common factors. We set the minimum number of underlying bonds that must be available for a weekly return to be calculated at 10. There are not enough observations to calculate indices specific to each rating category. We, therefore, combine all investment grades bonds to form one index.

Figure 2.1: Cumulative Return of Constructed Indices  
Panel (A): Without UK bonds





Our indices commence at the start of 2010 and end in June 2021. For any date or index, data on no fewer than 14 bonds are used to construct a given observation. For all three indices, individual weekly observations are based on data for relatively few bonds at the start of 2010 but the numbers increase substantially over time. By the last observation in June-2021, data on 1,362 CB, 114 Senior ABS, and 297 Non-senior ABS are used in constructing the index observations, excluding UK bonds.

In addition, we construct indices for Senior STS ABS, Non-senior STS ABS and other Non-STs ABS. These indices only stretch back as far as April 2019, since data on STS status is lacking for periods before this date. We use the return indices for these three ABS categories in ways similar to the longer time series to analyse the relative risk of these three types of ABS.

Note that Solvency II expresses capital charge per year of modified duration (with decreasing risk weights for longer maturity buckets). Before calibrating capital charges, we, therefore, divide log returns by the modified duration of the CB or ABS in question in our calibration. In line with Solvency II regulations specified in EU 2018/1221, modified duration less than a year is regarded as a year.

Note that Solvency II risk weights decrease for higher modified duration buckets while we calibrate risk weights to be proportional to maturity. Our intention is to shed light on the relative capital charges of different asset charges and we are not seeking to estimate charges separately for different duration buckets.

Taking the cumulative sum of the log returns for the three indices from the start of 2010, we derive cumulative return or 'price level' indices. These are displayed in Figure 2.1. The figure reveals several interesting facts.

- Without (Panel A) or with (Panel B) the UK, CB appears to be less affected by the European sovereign debt crisis from 2010 to mid-2012 than are ABS.
- After mid-2012, Senior ABS index exhibit volatility that is similar to that of CB. The volatility of the Non-senior ABS index appears greater, however.
- In contrast to what happened in the European sovereign debt crisis, in the Covid-19 crisis of 2020, ABS appear to have recovered faster than CB.
- The overall shape of the indices with and without the UK appear similar but the ABS indices that include UK data seem to be smoother, possibly reflecting the greater numbers of underlying bonds and, hence, the diversification of idiosyncratic risk.

### 2.3 Value at Risk calculations

This section explains how we calculate Value at Risk statistics from the index data in order to measure the relative risk of different asset classes.

The risks of Senior ABS, Non-senior ABS and CB are measured by computing the Value at Risk (VaR) of yearly losses at a 99.5% level. The VaR is defined as the loss that is exceeded no more than some fraction  $\alpha$  of occasions (where  $\alpha = 0.005$  or 0.5% in our case) when the portfolio is held for a given time period (1 year in our



case). The choices we make for time interval and confidence level,  $\alpha$ , are consistent with those employed by EIOPA in calibrating Solvency II as reported in the fifth Quantitative Impact Study (QIS5)<sup>4</sup>.

To simulate a set of indices, we randomly draw 52 weeks in our sample period with replacement and sum the weekly returns for those indices in the weeks in question. This yields a simulated dataset of yearly logarithm return. We generate a dataset of simulated yearly returns by repeating this exercise 10,000 times. Ranking the simulated yearly returns from low to high, we take the observation at the 0.5% position in the ranked dataset. This number represents the 99.5% VaR.

### 3. Risk and Capital Estimation Results

#### 3.1 VaR results

Table 3.1 presents VaRs calculated under the methodology described in Section 2. Recall that the VaRs are calculated for return indices computed per year of modified duration.

Table 3.1: 99.5% VaRs of 1-Year Returns and Ratios between VaRs

Panel A: Whole period without distinguishing STS

Country	Covered Bond	Value at Risk		Ratios	
		Senior ABS	Non-senior ABS	Senior ABS VaR / CB VaR	Non-senior ABS VaR / CB VaR
FR, DE, NL, IE, ES, IT	1.10%	1.55%	1.90%	1.41	1.73
FR, DE, NL, IE, ES, IT, GB	1.09%	1.40%	2.00%	1.29	1.85

Panel B: Distinguishing STS

Country	Covered bond	Value at Risk			Ratios
		Senior STS ABS	Non-senior STS ABS	Non-STS ABS	
FR, DE, NL, IE, ES, IT, GB	1.18%	1.12%	1.15%	2.61%	2.21

Note: Country codes FR, DE, IE, ES, IT and GB correspond to France, Germany, Ireland, Spain, Italy and United Kingdom.

In Panel A, the two rows of the table correspond to two sets of indices with and without the UK. The left-hand section of the table shows VaRs as loss ratios (therefore positive). Covered Bonds appear to have the lowest risk among the three categories, followed by Senior ABS and Non-senior ABS.

Panel B shows results calculated using indices that distinguish STS and Non-STS ABS. These are based on data coming from a shorter sample period. The UK is included in this exercise since, otherwise, the number of observations would be insufficient.

To evaluate the relative riskiness of the three indices, we divide the VaRs of Senior ABS and Non-senior ABS by the VaR of CB. The ratios are displayed in the right-hand section of Table 3.1. Key findings are as follows:

- Panel A shows that the VaRs of Senior ABS is about 29% to 41% higher than CB, and the VaRs of Non-senior ABS is about 73% to 85% higher than CB.
- In Panel B, the VaR of Senior STS and Non-senior STS are slightly lower than CB. Non-STS ABS exhibit higher risks as measured by a VaR 2.21 times the VaR of CB.

To summarise, for the entire sample period (which includes the 2012-13 and 2020 stress periods) Senior ABS appear somewhat although not greatly riskier than CB. The risk of Non-senior ABS is somewhat greater but not by an order of magnitude as is implied by the current Solvency II capital charges. Focussing on the more recent period (which itself includes the Covid-19 stress period), both Senior and Non-senior STS are less risky than CB while Non-STS are some riskier (by a factor of 2.2).

#### 3.2 Solvency II capital charges

We now turn to the implications of the above results for Solvency II capital charges.

Commission Delegated Regulation (EU) 2018/1221 revised the securitisation capital requirements in Solvency II. The revision introduces distinctions between STS securitisations and Non-STS securitisations. The updated framework categorises securitisations into four categories: Senior-STS, Non-senior STS, Re-securitisations and Others. Capital charges vary according to the four categories, the modified duration and the credit quality step or rating of the tranches in question. The mapping of credit quality steps to agency ratings categories is displayed in Table 3.2.

<sup>4</sup> See EIOPA (2011) Report on the fifth Quantitative Impact Study (QIS5) for Solvency II.

Table 3.2: Mapping of ECAI Ratings to CQS

CQS	0	1	2	3	4	5	6
Long term issue/issuer rating	AAA	AA	A	BBB	BB	B	CCC, CC, C, D

Each of the four categories listed above is assigned its own capital parameters. The calculation of the capital requirement for spread risk on securitisation positions may be explained as follows.

First, a floor of 1 year is imposed on the modified duration.

$$duration = \max(1, duration) \quad (3.1)$$

Capital equals a risk factor stress times the par value of the position. The risk factor  $stress_i$  depends on the modified duration. The first column of Table 3.3 shows a set of modified duration ranges (each with a corresponding (*floor*, *ceiling*)) that the particular bond  $i$  occupies.

If a modified duration happens to equal the ceiling value of a range, then its per-year-of-modified-duration capital charge equals the  $a_i$  value shown in the table. If its duration lies above a given ceiling but below the next higher, one must employ both  $a_i$  and  $b_i$  parameters to infer the per-year-of-modified-duration capital charge. Given the Credit Quality Step (CQS) of the bond, this involves looking up the  $a_i$  and  $b_i$  parameters and calculating  $stress_i$  using equation (3.2).

$$stress_i = a_i + (duration - floor) \times b_i \quad (3.2)$$

CQS is credit quality scale allocated to a bond based on credit ratings assigned to it by External Credit Assessment Institutions (ECAI). The technical standard of CQS is laid down in Commission Implementing Regulation (EU) 2016/1800 and the mapping from ECAI rating to CQS is summarised in Table 3.2.

Finally, the capital charge or stress parameters greater than 100% are capped at 100% as shown in equation (3.3).

$$stress_i = \min(stress_i, 100\%) \quad (3.3)$$

The STS securitisation framework was introduced by Commission Regulation (EU) 2017/2402. That document sets out stringent and complex rules that ‘true-sale’ or funded securitisations and Asset-Backed Commercial Papers (ABCP) must satisfy to qualify as STS. The complexity of the rules makes it hard for us to identify the STS status of securitisations in our dataset<sup>5</sup>.

We, therefore, do not attempt to distinguish STS and Non-STS securitisations in our main set of indices (for which results are reported in Panel A of Table 3.1). However, flags for STS are available on Bloomberg for the latter part of the sample period and hence we are able to perform a comparison of risk for STS and Non STS the results of which are shown in Panel B of Table 3.1.

Since Non-STS securitisations have much higher Solvency II capital charges than STS securitisations, the risk measures calculated using indices based on both STS and Non-STS securitisation data should be higher than if the calculations were performed using indices built with STS securitisations only. In our results for the full sample, it is, therefore, highly conservative to compare risk measures calibrated from our indices to the STS capital charges in Solvency II.

Table 3.3: Solvency II Capital Charges of Covered Bonds

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>
Up to 5	-	0.7	-	0.9	-	1.4	-	2.5	-	4.5	-	7.5	-	3
5 to 10	3.5	0.5	4.5	0.5	7	0.7	12.5	1.5	22.5	2.5	37.5	4.2	15.0	1.7
10 to 15	6	0.5	7	0.5	10.5	0.5	20	1	35	1.8	58.5	0.5	23.5	1.2
15 to 20	8.5	0.5	9.5	0.5	13.0	0.5	25	1	44	0.5	61.0	0.5	29.5	1.2
More than 20	11	0.5	12	0.5	15.5	0.5	30	0.5	46.5	0.5	63.5	0.5	35.5	0.5

<sup>5</sup> STS status data can be retrieved from data vendors such as Bloomberg. However, since the STS framework was introduced relatively recently, securitisations with such information are relatively new and their price data do not cover the European debt crisis period.

Table 3.3 displays the spread risk capital charges for CB set out in Commission Delegated Regulation (EU) 2015/35. The calculation of the stress is the same as described in equations (3.1) to (3.3). In the next section, we will compare the CB capital charges to those for ABS. If we presume that the CB capital charges are correct, we can infer capital charges for ABS using ratios of the VaR statistics presented in Section 3.1.

### 3.3 Inferring capital charges from VaR results

Recall that in Table 3.1, Panel A, we calculated the ratio between the Senior ABS VaR and CB VaR for France, Germany, Ireland, Spain, Italy and UK to be 1.29. Now, we infer risk weights for Senior STS securitisations from Solvency II capital charges of CB by scaling the Solvency II capital charge of CB by 1.29. This is achieved by the following steps.

For a given CQS, let  $b_i(\text{floor}, \text{asset})$  and  $a_i(\text{floor}, \text{asset})$  denote the Solvency II stress parameters for the duration bucket starting at  $\text{floor}$  for a certain  $\text{asset}$  class (Senior STS, Non-senior STS and Others). Our inferred  $b_i^*$  parameters are:

$$b_i^*(\text{floor}, \text{Senior STS}) = b_i(\text{floor}, \text{CB}) \times 1.29 \quad (3.4)$$

$a_i^*$  is the capital charge cumulated along durations until the lower bound of each duration bucket.

$$a_i^*(0, \text{Senior STS}) = 0 \quad (3.5)$$

$$a_i^*(\text{floor}, \text{Senior STS}) = a_i^*(\text{floor} - 5, \text{Senior STS}) + b_i^*(\text{floor} - 5, \text{Senior STS}) \times 5, \text{floor} > 5 \quad (3.6)$$

Once  $a_i^*(\text{floor}, \text{Senior STS})$  reaches the 100% ceiling, the corresponding parameter  $b_i^*(\text{floor}, \text{Senior STS})$  is set to zero, as the capital will no longer increase.

$$a_i^*(\text{floor}, \text{Senior STS}) = \min(a_i^*(\text{floor}, \text{Senior STS}), 100) \quad (3.7)$$

$$b_i^*(\text{floor}, \text{Senior STS}) = \begin{cases} b_i^*(\text{floor}, \text{Senior STS}), & \text{if } a_i^*(\text{floor}, \text{Senior STS}) < 100 \\ 0, & \text{if } a_i^*(\text{floor}, \text{Senior STS}) = 100 \end{cases} \quad (3.8)$$

Table 3.4 compares actual Solvency II capital charges for Senior STS ABS to inferred capital charges. Where parameters higher than the corresponding parameters in Solvency II, they are highlighted in red. Figure 3.1 compares the stresses (actual and inferred) for different credit quality steps, plotting them by modified duration.

Table 3.4: Senior STS Securitisations Solvency II and Inferred Stress Parameters

Panel A: Solvency II

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i
Up to 5	-	1	-	1.2	-	1.6	-	2.8	-	5.6	-	9.4	-	4.6
5 to 10	5	0.6	6	0.7	8	0.8	14	1.7	28	3.1	47	5.3	23	2.5
10 to 15	8	0.6	9.5	0.5	12	0.6	22.5	1.1	43.5	2.2	73.5	0.6	35.5	1.8
15 to 20	11	0.6	12	0.5	15	0.6	28	1.1	54.5	0.6	76.5	0.6	44.5	0.5
More than 20	14	0.6	14.5	0.5	18	0.6	33.5	0.6	57.5	0.6	79.5	0.6	47	0.5

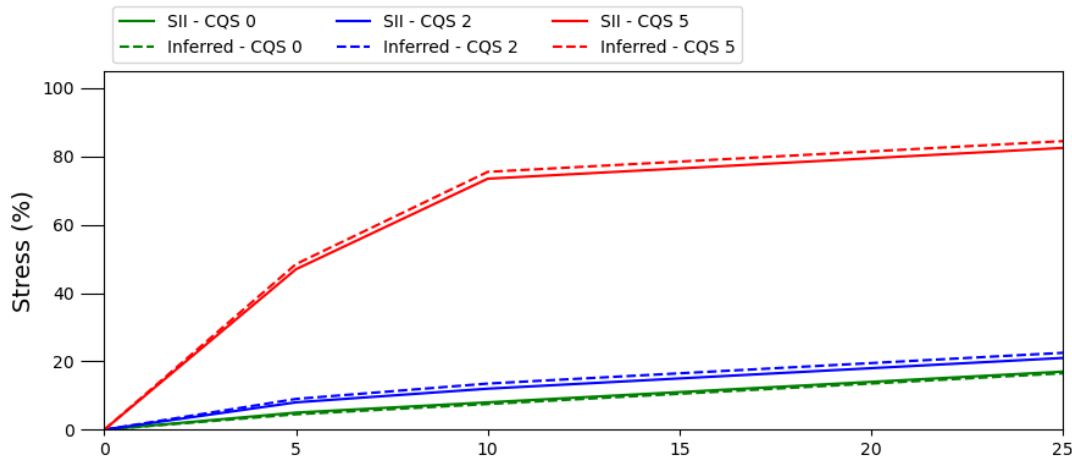
Panel B: Our calibration

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i	a_i	b_i
Up to 5	-	0.9	-	1.2	-	1.8	-	3.2	-	5.8	-	9.7	-	3.9
5 to 10	4.5	0.6	6.0	0.6	9.0	0.9	16.0	1.9	29.0	3.2	48.5	5.4	19.5	2.2
10 to 15	7.5	0.6	9.0	0.6	13.5	0.6	25.5	1.3	45.0	2.3	75.5	0.6	30.5	1.6
15 to 20	10.5	0.6	12.0	0.6	16.5	0.6	32.0	1.3	56.5	0.6	78.5	0.6	38.5	1.6
More than 20	13.5	0.6	15.0	0.6	19.5	0.6	38.5	0.6	59.5	0.6	81.5	0.6	46.5	0.6

Note: All numbers are in percentages



Figure 3.1: Comparison of Stresses of Senior STS Securitisations



In general, our results for Senior STS are quite close to the actual Solvency II charges, for some durations and credit quality steps slightly higher and in some cases slightly lower than those contained in the rules. For CQS 0 and 1 as well as unrated tranches, the estimated capital charges are lower than Solvency II requirements, except for CQS 1 tranches with durations longer than 20 years. For CQS 2 to 6, our estimates are mostly higher than Solvency II although not by much. The largest difference is for CQS 3 tranches with 20 years duration where our calculated charge is 5% higher than Solvency II.

Figure 3.1 confirms the conclusion drawn from Table 3.4 that the inferred capital charges are very close to the actual ones for Senior STS ABS.

Turning to Non-senior STS tranches, the inference of their stress parameters is the same as those steps described in Equation 3.4 to 3.8, but using the ratio of 1.84 (See Table 3.1, Panel A) instead. We find very different results, with inferred capital charges being distinctly lower than Solvency II charges in all cases (highlighted  $b_i$  is being compared to zero  $b_i$  in Solvency II as their corresponding  $a_i$  reach the 100% ceiling). Again, the results are displayed in the form of plots for particular credit quality steps, see Figure 3.2. This finding is highly material as insurers, given their yield expectations, are more naturally investors in senior mezzanine tranches of ABS than senior. In broad terms, the capital charges are double what is implied by our calibration exercise.

Table 3.5: Non-Senior STS Securitisations Stress in Solvency II and Inferred Stress Parameters

Panel (A): Solvency II

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$
Up to 5	-	2.8	-	3.4	-	4.6	-	7.9	-	15.8	-	26.7	-	26.7
5 to 10	14	1.6	17	1.9	23	2.3	39.5	4.7	79	8.8	100	-	100	-
10 to 15	22	1.6	26.5	1.5	34.5	1.6	63	3.2	100	-	100	-	100	-
15 to 20	30	1.6	34	1.5	42.5	1.6	79	3.2	100	-	100	-	100	-
More than 20	38	1.6	41.5	1.5	50.5	1.6	95	1.6	100	-	100	-	100	-

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$	$a_i$	$b_i$
Up to 5	-	1.3	-	1.7	-	2.6	-	4.6	-	8.3	-	13.8	-	5.5
5 to 10	6.5	0.9	8.3	0.9	12.9	1.3	23.1	2.8	41.5	4.6	69.2	7.8	27.7	3.1
10 to 15	11.0	0.9	12.8	0.9	19.4	0.9	37.1	1.8	64.5	3.3	100.0	-	43.4	2.2
15 to 20	15.5	0.9	17.3	0.9	23.9	0.9	46.1	1.8	81.0	0.9	100.0	-	54.4	2.2
More than 20	20.0	0.9	21.8	0.9	28.4	0.9	55.1	0.9	85.5	0.9	100.0	-	65.5	0.9

Note: All numbers are in percentages

Figure 3.2: Comparison of Stresses of Non-senior STS Securitisations

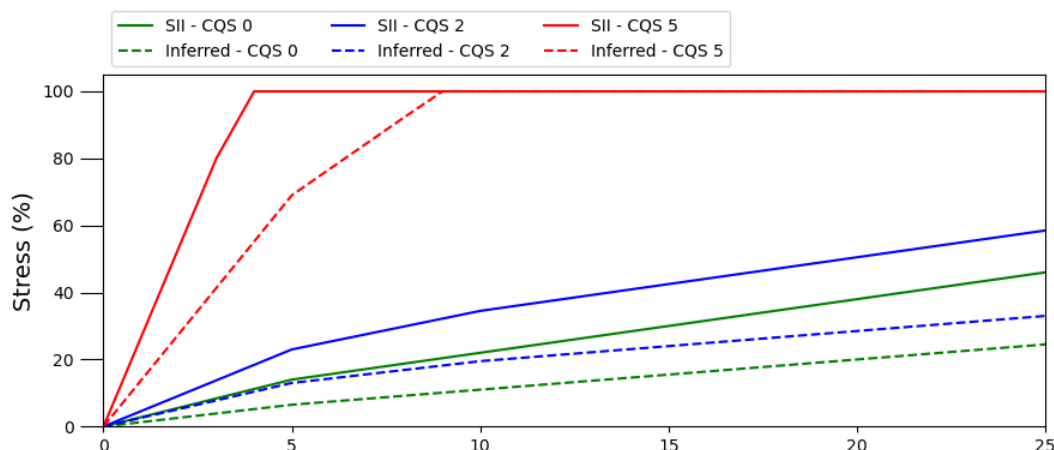


Table 3.6: Other Securitisations Stress in Solvency II and Inferred Stress Parameters

Panel (A): Solvency II

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>
Any modified duration	-	12.5	-	13.4	-	16.6	-	19.7	-	82	-	100	100	-

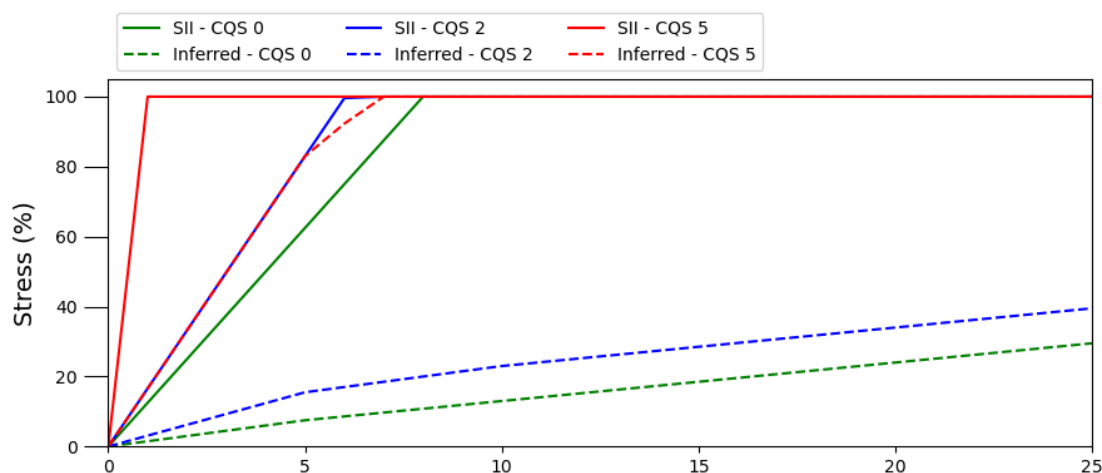
Panel (B): Our calibration

Credit quality step	0		1		2		3		4		5 and 6		Unrated	
Modified duration (years)	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>	a <sub>i</sub>	b <sub>i</sub>
Up to 5	-	1.5	-	2.0	-	3.1	-	5.5	-	9.9	-	16.6	-	6.6
5 to 10	7.5	1.1	10	1.1	15.5	1.5	27.5	3.3	49.5	5.5	83	9.3	-	3.8
10 to 15	13	1.1	15.5	1.1	23	1.1	44	2.2	77	4.0	100	-	36.0	2.6
15 to 20	19	1.1	21	1.1	28.5	1.1	55	2.2	97	1.1	100	-	56.3	2.6
More than 20	24	1.1	26.5	1.1	34	1.1	66	1.1	100	-	100	-	71.0	1.1

Note: All numbers are in percentages. The 'others' category does not include re-securitisations.

In Table 3.6, we present results for Other Securitisations, specifically Non-STS ABS excluding resecuritisations. These inferred capital charges are calculated by scaling the results by the ratio between the VaR for Non-STS ABS and the VaR for CB in the recent part of the sample period. This ratio is calculated to be 2.21, as shown in Panel B of Table 3.1. For credit quality steps 1, 2 and 3, the Solvency II capital charges are substantially higher than those implied by the current calibration.

Figure 3.3: Comparison of Stresses of Other Securitisations



## 4. Representative Balance Sheet Capital Results

### 4.1 Portfolio Overview

In this section we examine the implication of the securitisation capital charges discussed in the last section on a typical European-based life insurer, as described in HÖring (2012).

As mentioned in the introduction, under Solvency II, stress-based capital charges are applied to individual asset classes and then are subject to a diversification adjustment. Hence, the capital charges reported in Table 3.4 to 3.6 and Figures 3.1 to 3.3 must be adjusted for diversification before one can evaluate their true marginal impact on the capital that an insurer is required to hold. Since the diversification adjustment depends on the whole balance sheet of the insurer, the only way to do this is to analyse the marginal capital cost of investment impact for a representative insurer.

Sub-module	Subtype	Duration (years)	Rating							Total
			AAA	AA	A	BBB	BB	≤B	Unrated	
Equity	Type 1	-	-	-	-	-	-	-	-	4.5
	Type 2	-	-	-	-	-	-	-	-	2.5
Property		-	-	-	-	-	-	-	-	11.0
Spread	Bonds	5.4	5.2	4.4	11.8	5.9	0.6	0.1	1.5	29.5
	Covered bonds	6.2	11.5	0.5	0.3	0.1	-	-	0.1	12.5
	Sovereign debt (EEA)	6.9	18.8	6.6	5.8	0.2	0.6	-	-	32.0
	Sovereign debt (Non-EEA)	6.9	5.2	1.4	0.2	0.8	-	0.2	0.2	8.0

Note: The market risk portfolio is broken down by Solvency II sub-module, and further broken down by the subtypes considered in each sub-module and the credit rating of exposures considered in the spread risk sub-module. The entries are given as a percentage of the total EUR 3 billion value of the market risk portfolio.

Table 4.2: Modified duration by asset class

Asset class	Modified duration (years)
Bonds	5.4
Covered bonds	6.2
Sovereign debt	6.9

HÖring (2012) employs such an approach and we follow his study in using a representative European life insurer balance sheet. The total assets of the life insurer are taken to be EUR 4 billion, with the total value of the market risk portfolio amounting to EUR 3 billion. A breakdown of this part of the portfolio is shown in Table 4.1. To calculate the capital requirement for the spread risk sub-module, the modified duration of each exposure is needed. Table 4.2 shows the average modified duration for each asset class.

According to HÖring (2012), the durations of the assets and liabilities of a representative European-based life insurer are 6.8 and 8.9 years respectively. In order to calculate the capital requirement for the interest rate risk sub-module, an average downward interest rate shock is calculated using the March 2016 risk free curves provided by EIOPA. This is multiplied by the duration disparity of 2.1 and the result is multiplied by the asset total of EUR 4 billion.

### 4.2 Capital Charges

We add securitisation exposures to the portfolio of European life insurer described in the last subsection and calculate the incremental capital charge, using capital charges from (i) Solvency II and (ii) our inferred capital charges. In each case, we add a new securitisation portfolio with the value EUR 100 to the existing portfolio and calculate the marginal increment of required capital generated by the new position. The new securitisation positions are those in our data described in Section 2.1 that have STS/Non-STs identifiers. These are 354 tranches consisting of 54 senior STS tranches, 81 non-senior STS tranches and 219 others. A summary of these securitisation positions is provided in Table 4.3.

Panel (A) shows the securitisation positions broken down by modified durations. Senior STS positions generally have shorter modified durations than non-senior tranches, which makes the capital charges of senior STS tranches even lower as their stress parameters are already lower than other types. Panel (B) displays the breakdown of securitisations by ratings. As one may expect, the senior tranches have higher ratings than non-senior tranches. The senior STS tranches are also more likely to receive a rating than other types. Panel (C)

shows that the STS securitisations are mostly located in Germany and the Netherlands, and the Non-STS securitisations are mostly in the UK.

**Table 4.3: Securitisation Positions**

**Panel (A): Distribution by modified duration**

	Less than 1	1 to 2 years	2 to 5 years	5 to 10 years	10 to 20 years	More than 20	Total
Senior STS	16	19	19	0	0	0	54
Non-senior STS	7	10	50	2	2	10	81
Non-STS	49	67	88	4	8	2	219

**Panel (B): Distribution by ratings**

Rating	AAA	AA	A	BBB	BB	B	CCC/C	D	Unrated
Senior STS	42	3	0	0	0	0	0	0	1
Non-senior STS	4	25	16	7	7	7	1	0	0
Non-STS	33	32	37	15	7	6	5	0	84

**Panel (C): Distribution by countries**

Country	Germany	Spain	Finland	France	UK	Ireland	Italy	Netherlands	Portugal
Senior STS	24	2	1	6	0	2	1	18	0
Non-senior STS	29	2	0	0	0	6	0	44	0
Non-STS	0	9	0	4	149	35	1	19	2

The incremental capital charge generated by the additional securitisation position is not exactly the standalone stress calculated in Section 3.2. It is affected by the portfolio composition because of the diversification adjustment.

Table 4.4 shows the capital requirement as a percentage of the value of the additional exposure. The left-side block of this table presents the average (across securitisation types) of Solvency II capital as a percentage of the value of the additional exposure. We perform the same calculation with our own calibrated or inferred stress parameters.

**Table 4.4: Capital Differences between Solvency II and Our Calibration**

Settings	Solvency II (% of par)				Our calibration minus Solvency II (% of par)			
	Senior STS	Non-senior STS	Non-STS	All	Senior STS	Non-senior STS	Non-STS	All
Actual modified duration, before diversification	2.9%	37.0%	61.9%	47.2%	-0.3%	-21.8%	-48.8%	-35.2%
Actual modified duration, diversified	1.6%	20.4%	34.1%	26.0%	-0.2%	-12.0%	-26.9%	-19.4%
Modified duration = 1, diversified	1.0%	6.3%	29.8%	20.0%	-0.1%	-4.2%	-26.9%	-17.6%
Modified duration = 5, diversified	4.7%	26.4%	47.7%	36.3%	-0.5%	-15.9%	-33.6%	-24.5%
Modified duration = 10, diversified	7.4%	31.6%	55.1%	42.4%	-0.6%	-15.3%	-33.8%	-24.5%
Modified duration = 15, diversified	9.5%	34.7%	55.1%	43.5%	-0.7%	-14.2%	-28.9%	-21.2%
Modified duration = 20, diversified	11.1%	37.8%	55.1%	44.4%	-0.2%	-13.8%	-24.3%	-18.2%
Modified duration = 25, diversified	12.7%	40.4%	55.1%	45.3%	-0.2%	-13.9%	-21.5%	-16.5%

Columns 2 to 5 in the table show the actual Solvency II marginal capital charges for the portfolio. The first rows show marginal capital for the actual portfolio which may be seen as a diversified investment in the European market as it is currency quoted on the Bloomberg system. The first row shows before diversification adjustment while the second row shows after adjustment.

One can observe the dramatic difference between Senior STS and the other categories of Non-senior STS and Other which is Non-STS. Before diversification, the first has a charge of 2.9% while this rises to 37.0% and 61.9% for the latter two categories. The second row shows the marginal capital charges after diversification adjustment. The Senior STS charges drop from 2.9% to 1.6% after adjustment. The Non-senior STS and Other (i.e., Non-STS) also drop by a little less than half their pre-diversification level.

The lower part of the table (rows 3 to 8) shows results in which the modified duration of the individual exposures in the portfolio are all replaced by a single value, ranging from 1 year in row 3 to 25 years in row 8. The idea here is to exhibit how the diversified marginal capital charges increase as modified duration rises. For Senior STS, one may observe that marginal capital charges rise from 1.0% for a 1-year modified duration to 12.7% for a 25-year modified duration. One may again see a dramatic increase for each row from Senior STS to the marginal capital charges of Non-senior STS and Other (Non-STS).

In the right-hand-side block of the table (columns 6 to 9), we present the difference between the actual Solvency II marginal capital charges and those obtained through our calibration exercise. Recall that the calibration consists of scaling the CB charges before diversification by the relative VaRs obtained from our analysis of the cumulative return indices.

Overall, the stress parameters we calibrate result in lower capital charges in all cases. While this difference is in a small scale (less than 1% of exposure amount) for senior STS tranches, it is significant for Non-senior STS tranches and substantial for Non-STS positions.

The results for different levels of modified duration show a non-monotonic dependency on duration. This reflects the fact that, as the modified duration increases, the capital charge approaches the 100% ceiling, especially for Non-senior STS and Other securitisations with high CQS. When the ceiling is reached for Solvency II charges, the difference between our calibration and Solvency II values narrows.

## 5. Conclusion

This study aims to present empirical evidence on the risk of ABS categories (Senior STS, Non-senior STS and Other, i.e., Non-STS) relative to that of Covered Bonds.

Our findings may be summarised as follows.

- A conservative estimate of the relative risk of Senior STS ABS to CB exposures suggests that the risk of the former is 30% higher. The result may be conservative since it is driven by data for the early part of the 2010-2021 sample period in which the number of ABS securities is very low. Also, the comparison is based on a comparison that employs all Senior ABS available, not just Senior STS. The increment in risk between Senior ABS and Non-senior ABS as measured by our VaR estimates for indices equals about a 30% increase, again if one considers the sample period as a whole.
  - Using data for the period April 2019 to June 2021 for which the STS status of individual ABS is observable, the risk of ABS appears much lower relative to that of CB. Senior STS ABS exhibit a VaR that is 5% lower than that of CB. Even more striking, the VaR for Non-senior STS ABS is 3% lower than that of CB. For Non-STS ABS, the VaR is slightly more than twice that of CB. This ratio is still much smaller than the relative Solvency II capital charges for these asset classes.
  - Using the results of the VaR estimation, we calibrate capital charges consistent with the Solvency II framework by scaling the existing CB capital charges. The inferred capital charges for Senior STS are quite close to the charges that Solvency II specifies for this ABS category. The calculation is doubly conservative in that (a) it employs ABS indices that have few underlying securities in the first half of the sample period and are therefore subject to idiosyncratic risk and (b) employs a scaling based on a Senior ABS index rather than a Senior STS ABS index which should exhibit less risk.
- Our calibration exercise finds a substantial gap between Solvency II capital charges and the inferred capital charges for Non-senior STS based on our statistical analysis of VaRs. This suggests that Solvency II is overly conservative for Non-senior ABS, a material finding since one might expect insurers to be natural investors in senior mezzanine ABS tranches (more so than senior). Overall, the actual Solvency II capital charges appear to be double what is implied by our calibration exercise. Our calibration of capital charges for Other (Non-STS) ABS again suggests that the capital charges in the current Solvency II rules are about twice what they should be.

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