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**Introduction of Additional Tier 1
Capital**

by Thomas Heidorn, Andreas Pottmeyer

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Abstract

The aim of this working paper is to introduce the reader to the relatively new instrument of AT 1 bonds. For this purpose, the strict regulatory requirements for the instrument class are explained and the capital requirements of banks are outlined. Afterwards, the market for AT 1 bonds is analyzed and the interests of the respective market participants are discussed. Finally, the Credit Derivatives Model, the Equity Derivatives Model and the Value at Risk model are applied to 20 AT 1 bonds issued by various European banks in order to find the extra credit spread and to determine the risk associated with this bond class.

Key words: AT1, Additional Tier 1, Regulatory Requirements, Bank Capital Management, Capital Buffer, Capital Requirements Regulation (CRR), Capital Requirements Directive IV, Hybrid Tier 1, Pillar 1 Requirements

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1. Introduction

After the US subprime mortgage defaults, and the global financial crisis the regulatory framework for banks was criticized by many economists, policy-makers and market operators. Especially the capital requirements resulting from Basel II were judged as inadequate. As a result, the Basel Committee on Banking Supervision introduced Basel III to stabilize the financial system.¹

Basel III was implemented into European law with the Capital Requirements Regulation (CRR) and the Capital Requirements Directive IV (CRD IV).² Amongst others, this resulted in higher and more sophisticated requirements on the total capital and leverage of European banks, to strengthen the bank's ability to absorb potential losses. With its implementation the new bond class Additional Tier 1 (AT1) was created and replaced the previous Hybrid Tier 1 bonds (HT1). Banks can issue AT1 bonds to partly cover the increased requirement on their total capital as well as on their total leverage.³

AT1 bonds are contingent convertibles (CoCos), i.e. bonds either converted into equity or written down in case the predefined trigger event occurs. The bonds have hybrid features and are treated as debt from an investors' perspective, but as Tier 1 capital from an issuers' perspective. Since AT1 bonds are relatively new, the market is comparatively unexplored, and there is no prevailing opinion on the pricing of these bonds.⁴ As a result, this paper deals intensively with AT1 bonds and examines the following components.

First, the strict requirements for AT1 bonds, combined with higher and more sophisticated regulatory minimum requirements for total capital and total leverage as well as the regulatory sanctions will be discussed.

Second, advantages and disadvantages for the most relevant stakeholders, the issuer, the regulator, and the investor, will be analyzed, to give a comprehensive overview of the European market and to explain pros and cons.

Third, two pricing models are tested over a sample of 20 AT1 bonds. As these bonds are treated as debt capital from the investor's point of view and as Tier 1 capital from the issuer's, a credit derivative model and an equity derivative model were used, however the results were quite weak. Additionally a Value at Risk calculation was computed over the sample.

¹ Cannata, Francesco / Quagliariello, Mario (2009), p.1; Deutsche Bundesbank (2018), p.53; The Economist (2013)

² The CRR and the CRD IV came into force on June 26, 2013.

³ Luz, Günther et al. (2013), p. 9; Boermans, Martijn / van Wijnbergen, Sweder (2017), p.1; Deutsche Bank AG (2013), p. 20

⁴ Ritzema, Berend Pieter (2015), p. 1 – 2; Partanen, Bianca Dufour (2016), p. 1 – 3

2. Regulatory Requirements for Additional Tier 1

Contingent convertible bonds are subordinated notes which include all usual components of a bond, such as face value, coupon rate, and coupon payment dates. However, these bonds are often perpetual bonds with the right to call at a predefined date. Furthermore, contingent convertibles can be converted into equity or written down when a predefined trigger event occurs. Due to these special conditions, the payment profile of a contingent convertible bond differs to a considerable extent from a plain vanilla corporate bond. In regular times, the bond pays coupons until its call date and face value at its call date. However, if the trigger level is reached, the face value will be written down or will be converted into equity. Additionally the issuer can decide not to call the bond.

Additional Tier 1 bonds are a special class of contingent convertibles with a trigger on the issuers Common Equity Tier 1 (CET1) capital ratio. It can be argued that only AT1 bonds with equity conversion method are contingent convertibles since bonds using write-down do not convert. However, the literature treats both forms of this bond as contingent convertibles, as these bonds must meet the strict minimum requirements of the regulator to be qualified as AT1 capital. These stringent requirements highly influence the credit spread of these bonds, since payout profile is directly affected.⁵

The instruments must be issued and paid-up. The bank, a subsidiary or any other institution in which the bank has an economic or voting interest of at least 20 percent are not allowed to purchase them. Furthermore, the instruments are neither funded directly or indirectly by the issuer.⁶ If banks hold own AT1 bonds, this may either lead either to an increase in risk-weighted assets or to a deduction of equity, thus reducing the Tier 1 ratio.⁷

AT1 bonds must be ranked below Tier 2 (T2) capital, and no arrangement may enhance the seniority of the notes. The bonds are not secured or guaranteed by the issuer or by a company of the same group.⁸

AT1 is set up as a perpetual, and only the issuer has the exclusive right to call. The bonds cannot be called, redeemed, or repurchased at least within the first five years after issuance. The issuer should not have any incentive to redeem the bonds, and there is no implicit or explicit indication in the provisions that the bonds may be called, redeemed or repurchased as long as the bank is not in liquidation or the competent supervisory authorities have not given their appropriate approval.⁹

Coupons of the bond must be paid out of distributable items and will not be amended based on any credit standing. Furthermore, the bonds must be structured in a manner that coupons on the bonds can be canceled for an unlimited period and on a non-cumulative basis. Addi-

⁵ Ritzema, Berend Pieter (2015), p. 5

⁶ European Parliament (2013), Article 52 (1) a – c

⁷ Deutsche Bundesbank (2018), p. 63

⁸ European Parliament (2013), Article 52 (1) d – e

⁹ European Parliament (2013), Article 52 (1) f – j

tionally, the cancellation of coupons does neither lead to a default event nor any restrictions on the issuer.¹⁰

The bond provisions should not hinder the recapitalization of the bank. Thus, provisions should not contain requirements to pay coupons if the bank makes distributions to capital instruments of the same or of junior rank. Vice versa, provisions should not contain requirements that restrict distributions to other capital instruments qualified as CET1, AT1 or Tier 2 in case of a coupon cancellation. Furthermore, banks have no obligation to substitute coupon or dividend payments in any form.¹¹

The bonds must be permanently or temporarily written down or converted to CET1 capital if the trigger level is reached. The trigger level and the conversion or write-down method are specified in the bond provisions. The trigger level must be at least 5.125% of the CET1 capital ratio of the issuer. When using the equity conversion method, the provisions of the bond include the conversion rate and limits on the permitted amount of conversion or a range within the instruments will be converted into CET1. When using the write-down method, the claim of the bond, the amount to be paid in case of a call or redemption will be reduced. Besides, future coupon payments will only be paid on the amount written down and not on the nominal value of the bond.¹²

By write-down or conversion of the bond, the bank increases its CET1 capital. In doing so, the aggregated amount of AT1 bonds must be converted or written down until the CET1 ratio is above the trigger level or until the full principal amount is converted or written down. When using the write-down method, the conditions determine whether a write-up is possible (temporary write-down) or not (permanent write-down). For bonds with equity conversion, the conversion is irrevocable.¹³

Besides the conversion or write-down due to the occurrence of the trigger event, the supervisory authority can force the issuer to convert or write-down AT1 bonds to absorb losses at the point of non-viability. This is given when the supervisory authority either determines that the conditions for resolution are met or decides that the bank would cease to be viable if these bonds are not converted or written down.¹⁴

To sum up, the issuer of AT1 bonds must fulfill strict regulatory requirements. However, the issuer has some options with regard to the conversion method, the non-call period, and the trigger level. The issuer can choose to use equity conversion, temporary or permanent write-down. The non-call period must be at least five years, and the trigger level must be at least 5.125%, but both can be set on a higher level.

¹⁰ European Parliament (2013), Article 52 (1) 1

¹¹ European Parliament (2013), Article 52 (1) o icw Article 53

¹² European Parliament (2013), Article 52 (1) n icw Article 54 (1)

¹³ European Parliament (2013), Article 54 (2) – (4); Deutsche Bundesbank (2018), p. 56

¹⁴ European Parliament (2014), Recital 81; Deutsche Bundesbank (2018), p. 57

3. Total Capital Requirements for Banks

3.1 Total Capital

The total capital of a bank includes Tier 1 and Tier 2 capital. Tier 1 capital consists of CET1 and AT1 capital. Banks must meet the minimum requirements for total capital. This basically depends on two measurements, the risk profile of the bank's assets and the total exposure measure. To account for the risk profile, the total assets of a bank will be converted into a total risk exposure amount considering credit risks, operational risks, and market risks. The resulting amount is then multiplied by the minimum capital requirements. Additionally to account for the total exposure measure, banks have to meet minimum requirements on total leverage, which is the proportion of the bank's Tier 1 capital to its total capital measure.

3.2 Common Equity Tier 1 (CET1)

CET1 capital includes the share premium as well as retained earnings, accumulated other comprehensive income, other reserves, and funds for general banking risks as long as these are available to cover risks and losses when they occur. Furthermore, the instruments are paid-up, issued directly, and are not directly or indirectly funded by the institution. Additionally, the instruments are perpetual and are only reduced or repaid when the institution is in liquidation. For repurchases, the approval of the competent authority is necessary. Dividends are only paid out of distributable items; the bank has no obligation to settle any distributions, and a cancellation is not considered as a default event and does not include any further restrictions. CET1 capital is ranked below all other claims and is in no way secured or subject to guarantees which enhance the seniority of the issuer or a part of its company group. Furthermore, it is the first and has the proportionally highest share in absorbing losses, unless instruments of the AT1 capital have been written down beforehand.¹⁵

To obtain the CET1 capital of a bank, some prudential filters and deductions must be taken into account. This may have a significant impact on the CET1 capital. As an example, Figure 1 shows that approximately 20 percent of Commerzbank's balance sheet equity is not qualified as CET1 capital.

Firstly, the bank has to deduct increases in its equity which result from securitized assets, including

- future margin income which resulted in a gain on sale and net gains of future income when they lead to credit enhancement,
- all fair value reserves related to gains or losses on cash flow hedges if they are not valued at fair value,
- income or losses resulting from changes on liabilities and on derivative liabilities that are valued at fair value if they result from changes in their credit standing,

¹⁵ European Parliament (2013), Article 26 icw Article 28

-
- any additional value adjustments¹⁶ to assets measured at fair value.¹⁷

However, this may not include profits or losses resulting from liabilities if they are in the form of bonds¹⁸ and if their value is closely related to the value of bank assets, if changes in assets and liabilities are originated from the same changes in own credit standing, and if the bond is financing mortgage loans, and the mortgage loans can be redeemed by buying back these bonds.¹⁹

Secondly, the bank must account for deductions from CET1 capital. These include

- any losses in the current financial year,
- any intangible assets, including goodwill from significant investments,
- deferred tax assets when they rely on future profitability,
- negative amounts resulting from the expected loss calculation if the bank uses the IRB Approach,²⁰
- defined benefit pension funds if they are on the bank's balance sheet,
- direct, indirect and synthetic positions in their CET1 capital, including purchase obligations, and including their reciprocal cross holding when the competent authority considers them to be designed to increase the bank's own fund,
- significant or insignificant direct, indirect and synthetic positions of CET1 capital of other financial institutions,
- the exposure amount of items which qualify for a risk weight of 1250%, where the institution decided to deduct the exposure from CET1 instead of including it to RWA,²¹
- any foreseeable tax charge on CET1 and AT1 items at the time of calculation,
- any related deductions from AT1 and Tier 2 items.²²

¹⁶ For the purpose of the Article 105 of Regulation (EU) 575/2013

¹⁷ European Parliament (2013), Article 32 – 35; Luz, Günther et al. (2013), p. 18

¹⁸ For the purposes of the Article 52(2) of Directive 2009/65/EC

¹⁹ European Parliament (2013), Article 33(3)

²⁰ The Internal Rating-Based Approach (IRB Approach) is an internal model to evaluate capital requirements for credit risk (Bank International of Settlement (2001), p.1)

²¹ According to Article 36(1) k of Regulation (EU) 575/2013, this is only possible for “[...] (i) qualifying holdings outside the financial sector, (ii) securitization positions, in accordance with Article 243(1)(b), Article 244(1)(b) and Article 258, (iii) free deliveries, in accordance with Article 379(3), (iv) positions in a basket for which an institution cannot determine the risk weight under the IRB approach, in accordance with Article 153(8), (v) equity exposures under an internal model approach, in accordance with Article 155(4).”

²² European Parliament (2013), Article 36; Luz, Günther et al. (2013), p. 19

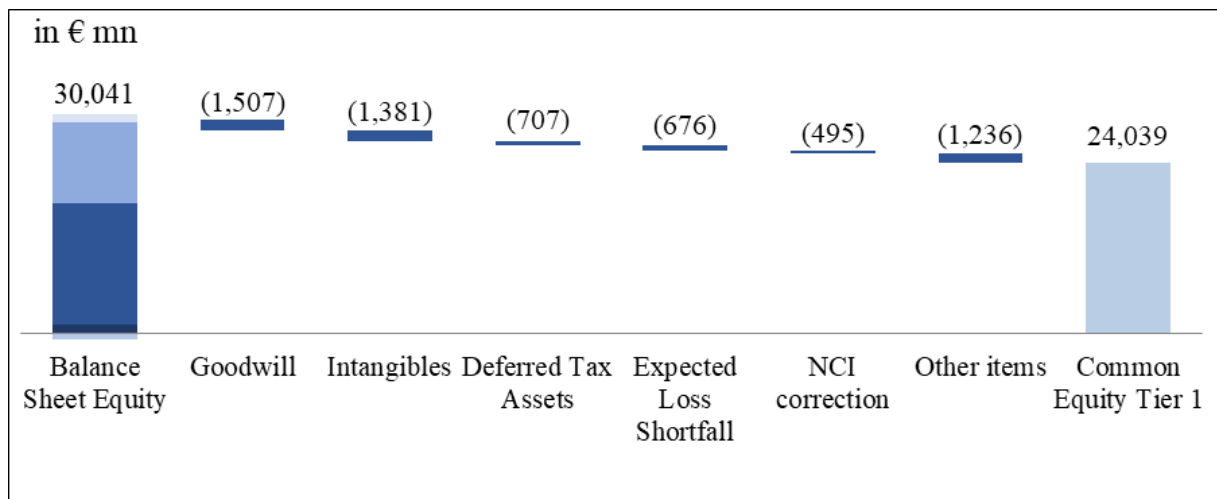


Figure 1: Equity-CET1-Bridge of Commerzbank AG as of 31.12.2017²³

3.3 Additional Tier 1 (AT1)

The regulatory requirements for capital instruments to be qualified as AT1 capital are already explained in Chapter 2. However, the regulation also includes deductible items:

- direct, indirect and synthetic positions in the own AT1 capital, including purchase obligations, and including their reciprocal cross holding when the competent authority considers them to be designed to increase the bank's own fund,
- significant or insignificant direct, indirect and synthetic positions of AT1 capital of other financial institutions,
- any foreseeable tax charge on CET1 and AT1 items at the time of calculation,
- any related deductions from Tier 2 items, which will be explained in Chapter 3.4.²⁴

3.4 Tier 2 (AT2)

Instruments or subordinated loans are qualified as Tier 2 capital if the instruments or loans are raised and fully paid-in. Furthermore, the instruments or loans are not purchased or granted by the bank or by a subsidiary or any institution in which the bank has an economic or voting interest of at least 20 percent and are not funded directly or indirectly by the institution. The instruments or loans must be wholly subordinated to all non-subordinated creditors, no claims are included which increase seniority, and they are not secured or subject to guarantees that enhance the seniority of the bank's group. The maturity is at least five years, and only the bank is entitled to call or repay. The provisions do not include any incentive to redeem or re-

²³ Commerzbank AG (2018), p.142 and p. 243; All figures are fully phased-in; Balance sheet equity includes subscribed capital, capital reserves, retained earnings, other reserves, and noncontrolling interest (NCI) in the amounts of €1,252mn, €17,192mn, €11,249mn, (€817mn), and €1,164mn; Other items are each lower than €500mn.

²⁴ European Parliament (2013), Article 36; Luz, Günther et al. (2013), p. 19

pay prior to maturity and do not indicate any explicit or implicit early calls, redemptions or repayments. Additionally, early repayments are only possible after five years²⁵ and need the approval of the regulatory authority. Future interest or principal payments can only be accelerated by the holders of the instrument or loan in case of insolvency or liquidation, and the level of interests is not changeable due to changes in the credit standing of the bank.²⁶

Deductibles from Tier 2 capital are

- direct, indirect and synthetic positions in the own AT1 capital, including purchase obligations, and including the reciprocal cross holding of those when the competent authority considers them to be designed to increase the banks own fund,
- significant or insignificant direct, indirect and synthetic positions of AT1 capital of other financial institutions.²⁷

²⁵ Exemptions are laid down in Article 78(4) (see European Parliament (2013))

²⁶ European Parliament (2013), Article 63

²⁷ European Parliament (2013), Article 66; Luz, Günther et al. (2013), p. 19

4. Relevant Stakeholders of Additional Tier 1 Bonds

This chapter discusses the stakeholders of AT1 bonds.

4.1 The Market of Additional Tier 1 Bonds

On the European market, there are currently 355 AT1 bonds outstanding with a total face value of €200.4 bn. The average amount issued was €564 mn., the lowest issuance being only €1 mn. by Bausparkasse der österreichischen Sparkassen AG and the highest being €2.6 bn. by HSBC.²⁸ With 57.7% and 29.2% of the face value, most bonds were issued in USD and EUR, respectively. The bonds pay an average coupon of 6.6%, with bonds issued in CHF only paying 2.75 percent and bonds issued in GBP pay a coupon of 6.99%.²⁹ The bond with the highest coupon was issued on December 14, 2018 by the Bank of Cyprus³⁰ with a face value of €27.5 mn., a coupon of 12.5% and five years until the first call date. The bond with the lowest coupon was issued on September 8, 2017 by Banco Santander³¹ with a face value of €981 mn., a coupon of 1% and seven years until the first call date.³²

Currency	Bonds issued	Total Amount (mn. / local currency)	Total Amount (in EUR mn.) ³³	Avg. Coupon
EUR	98	58,459	58.459	6.14%
GBP	22	16,018	18.344	6.99%
USD	94	132,261	115,532	6.97%
SGD	5	3,225	2,093	5.30%
DKK	10	4,768	638	4.92%
SEK	9	7,750	748	3.93%
NOK	83	14,635	1,517	5.01%

²⁸ ISIN: AT0000A1Q014 (Bausparkasse) and US404280BL25 (HSBC). Converted into EUR. Original amount for HSBC's bond is USD 3bn.

²⁹ Averages are weighted by the respective nominal values of the bonds

³⁰ ISIN: XS1865594870

³¹ ISIN: ES0213900220

³² If not otherwise stated, all figures are from Bloomberg as of January 31, 2019 in this chapter

³³ EUR in GBP (0.87321), USD (1.1448), SGD (1.54059), DKK (7.4683), SEK (10.3567), NOK (9.6503), CHF (1.13814) (Bloomberg as of January 31, 2019)

CHF	14	3,460	3,040	2.75%
Total	355	n.a.	200,371	6.61%

Table 1: Overview of the European Market of AT1 Bonds

Measured by the number of outstanding bonds, the top five issuers of AT1 bonds in Europe are HSBC (13), Societe Generale (13), BNP Paribas (11), Credit Suisse (11), and UBS (10).

The holders of AT1 bonds are quite unknown, but this type of bonds usually fits for institutional investors. There are two indications on the holders of AT1 bonds. First, a DNB Working Paper analyzed that approximately 74 percent of European contingent convertibles are held by non-euro area investors. Within the euro area, 20.4 percent are held by investment funds, followed by insurers (1.8 percent) and banks (1.4 percent).³⁴ Second, TwentyFour Asset Management estimates that the vast majority of AT1 bonds are held by long-only asset management companies and family offices / wealth firms with 50 and 20 percent, respectively.³⁵

Unfortunately, no valid statements can be made about trading volumes but the liquidity on the market is probably quite weak. AT1 bonds are traded OTC and the denomination is usually 100,000 EUR or above. Additionally, there are trading barriers, such as direct selling to retail investors.³⁶

4.2 Issuer's Perspective

The issuance of AT1 bonds has several advantages. The capitalization of banks increases, while the related costs are – theoretically – lower than the additional issuance of CET1 capital and, as long as the AT1 bond is not converted into equity, no dilution occurs. Furthermore, a bank can avoid the reduction of its total risk exposure when capital requirements increase, or it can finance a growth strategy with AT1 bonds. Additionally, the coupon payments of AT1 bonds are tax-deductible in many jurisdictions, while dividend payments on CET1 capital are not. A better capitalization decreases the fragility of a bank and thus decreases CDS spreads, yields for bonds with higher seniority, and increases the credit rating.³⁷

If banks see the necessity for increasing their Tier 1 capital base, they can either issue AT1 bonds or new shares. The issuance of AT1 bonds increases the interest expenditures while the issuance of new shares increases the cost of equity. Thus, a bank should weigh up the costs of issuing new shares against the costs of issuing AT1 bonds. Ideally, banks decide to choose the option which generates higher shareholder value. In theory, the issuance of AT1 bonds is cheaper since the coupon is generally lower than the cost of equity. However, there are different views on the accuracy of this assumption since banks are not distributing the theoretical cost of equity but are distributing dividends. Furthermore, banks generate a return on CET1,

³⁴ Boermans, Martijn / van Wijnbergen, Sweder (2017), p. 10

³⁵ TwentyFour Asset Management (2017), p. 8

³⁶ TwentyFour Asset Management (2017), p. 8

³⁷ De Rooij, Bram (2017), p. 35

which is attributable to shareholders and in addition reflect the total, distributable and non-distributable, income of shareholders. Thus, to compare the costs of AT1 bonds with the costs of issuing new shares, it can be argued that either dividend payments or return on CET1 are the best comparison parameters.

When comparing dividend payments with the coupon of AT1 bonds, there is no cost advantage of AT1 issuances.³⁸ However, when comparing AT1 coupons with RoCET1, there is a clear advantage for the issuance of AT1 bonds, which increases the shareholder value. While the average dividend yield of 20 selected European banks is currently at 4.79%, the RoCET1 is at 9.53%, and the cost of equity is at 11.37%. The corresponding AT1 bonds are having a current yield of 6.76%. Issuing AT1 bonds increases shareholder value, especially when tax advantages are taken into consideration. Figure 2 presents a comparison of the dividend yield, the AT1 yield, and the RoCET1 for each bank in the sample.

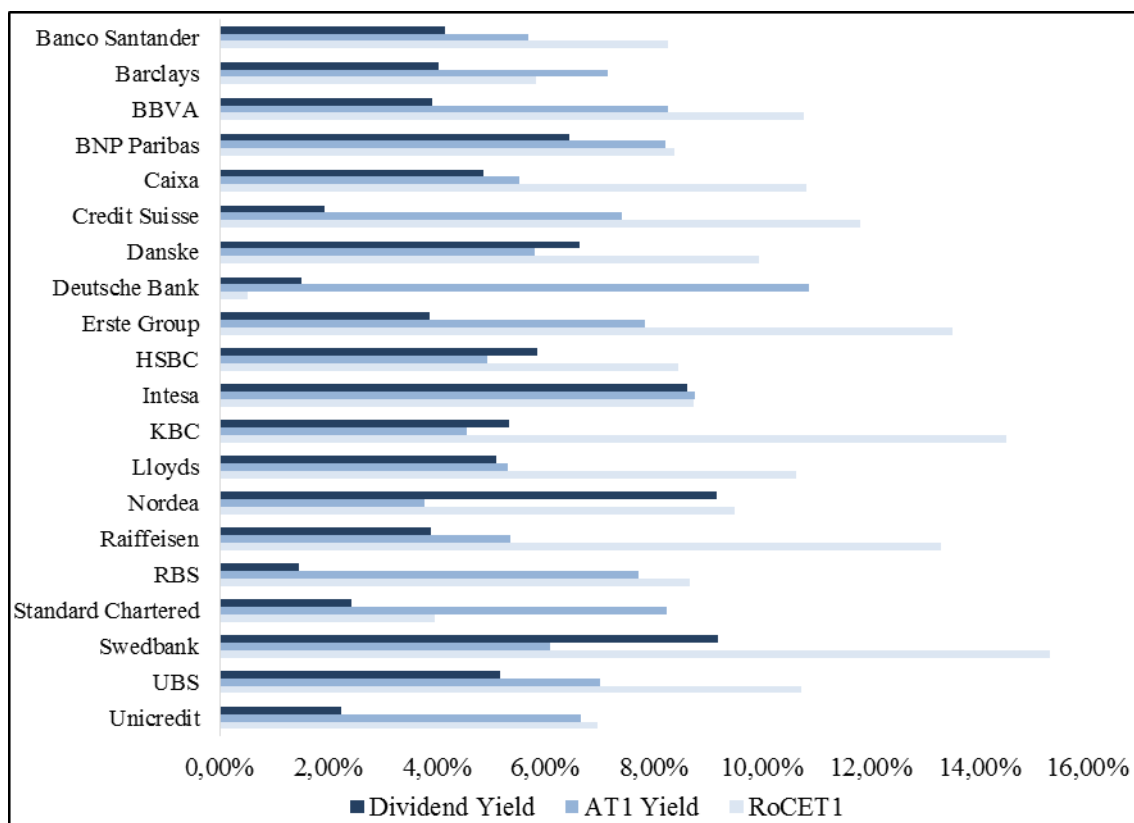


Figure 2: Comparison of Dividend Yield, AT1 Yield, and RoCET1³⁹

³⁸ Deutsche Bundesbank (2018), p. 62 with reference to a comparison by Bank of America Meryll Lynch with average yields of contingent convertible bonds and bank dividends.

³⁹ All figures are from Bloomberg as of February 11, 2019. For the banks in the sample and the corresponding AT1 bonds see **Fehler! Verweisquelle konnte nicht gefunden werden.**. The used data are dividend yield (EQY_DVD_YLD_IND_NET), AT1 yields (YLD_YTM_MID), RoCET1 (RETURN_ON_COMMON_EQUITY_ADJUSTED), and cost of equity (WACC_COST_EQUITY).

The issuance of AT1 bonds strengthens the capitalization of a bank reducing the bank's risk of default. This is particularly reflected in declining CDS spreads and lower yields for bonds with higher seniority. Therefore, the issuance of AT1 bonds can reduce the funding costs. A strengthened risk profile can also increase shareholder value. Statistically, the issuance of AT1 bonds has a positive impact on the share price if the principle is written down at a high trigger level. Otherwise, there is no statistical impact.⁴⁰

Additionally, the issuance of AT1 bonds incentivizes the bank's management to seek a well-balanced capital basis. There cannot be an interest in using AT1 bonds to absorb losses or to cancel a coupon payment. The variable remuneration of the bank's management will be cut until the bank's total capital requirements are met. Furthermore, it reduces trust in the credit-worthiness of a bank and the opportunities of managing the bank. Once a bank, for example, reaches the MDA, any business decisions are taken against the shortage of capital and the management must either carry out a relatively expensive capital increase or adjust the bank's total risk exposure, which ultimately leads to fewer lending activities.

The strongest disadvantages of issuing AT1 bonds are the interest expenses and the disclosure requirements. AT1 bonds are yielding far above senior bonds and the increased disclosures, required by investors or by regulators, can be expensive to compile and give third parties an even deeper insight into the bank.⁴¹

The issuer can also fear the risk of lawsuits once it comes to coupon cancellation, write-down, or equity conversion. For example, HSH Nordbank is accused of having improperly lowered the book value of hybrid capital instruments, leading to a damage of EUR 1.4bn.⁴²

4.3 Regulatory Perspective

The strongest advantage for AT1 bonds from a regulatory perspective is that the loss absorption function reduces overall risk in the banking industry. The regulatory acceptance of AT1 bonds qualifying as Tier 1 capital provides a capital-efficient method to maintain enough buffers when it comes to stress situations. The protection of creditors, especially of unsecured client deposits, can be strengthened in case of a bail-in and thus reduce the risk of contagion in a financial crisis. However, it remains to be seen how well these regulations will work and how advantageous the issuance of AT1 bonds will be.⁴³

A disadvantage of Additional Tier 1 bonds is that the issuance may increase systemic risks due to the interconnectedness between banks. This is given when it comes to cross holdings within the banking sector. Alternatively, systemic risks can shift when insurances excessively hold AT1 bonds. However, this disadvantage seems to be theoretical since the cross-holdings of European contingent convertibles by European insurance companies and European banks were both lower than 2 percent of all outstanding European bonds by the end of 2015. None-

⁴⁰ Avdjiev, Stefan / Bogdanova, Bilyana / Bolton, Patrick / Jiang, Wei / Kartasheva, Anastasia (2017), p. 2; De Rooij, Bram (2017), p. 35

⁴¹ For example, the International Securities Market (ISM) published a rulebook for specific guidance around disclosure requirements for contingent convertibles and AT1 bonds (cf. London Stock Exchange (2019)).

⁴² Financial Times (2019)

⁴³ Maes, Stan / Schoutens, Wim (2010), p. 5 – 6; Deutsche Bundesbank (2016), p. 72

theless, global risks might occur, since the majority of contingent convertible bonds is held by foreign investors.⁴⁴

The issuance of AT1 capital may also be unfavorable for the overall risk in the banking industry if banks are using the increased Tier 1 capital to either increase their total risk exposure or decrease their CET1 capital, leading to a reduction in the bank's Tier 1 ratios. However, as the latest EBA stress test observed, European banks increased their CET1 ratio by 150 bps between 2016 and 2018 and reduced their inherited liabilities. Nevertheless, this might be a prospective risk which should not be dismissed.⁴⁵

4.4 Investors' Perspective

Investors get comparatively high coupons on AT1 bonds in exchange for higher risks. Bondholders usually face three types of risk, namely default, interest rate, and inflation risk. The bondholder faces the risk of an issuers default, leading to a full or partial loss of coupon and principal payments. Additionally, the bondholder faces the risk of interest rate changes. This risk factor can be split into two types. The bond price will be, *ceteris paribus*, affected by changes in the overall interest rate environment and by firm-specific changes in credit standing. This risk reduces the fair value of the future payments of a bond. Furthermore, bondholders face the risk of inflation, since higher inflation reduces the real value of future payments.⁴⁶

For AT1 bondholders, these three risk factors also apply. However, the overall risks associated with AT1 bonds are higher. There are four reasons for this. First, AT1 bonds are subordinated to all other bonds of a bank. In case of a default, the holders of AT1 bonds are the last to be served. Second, bondholders face the risk that coupons will be irrevocably canceled and the principal amount might be written down or converted into equity even if the bank is not at default. Third, changes in the credit spread generally have a stronger impact on subordinated bonds, leading to stronger fair value losses in case of widening credit spreads. Fourth, the investor faces the risk of uncertainty, e.g. of a non-call event or regulatory changes. A non-call event, for example, leads to a longer maturity. This reduces the bond price since required interest rates and associated discount factors are usually higher for longer maturities.⁴⁷

The use of the CET1 ratio as a trigger leads to a lack of transparency since the ratio is only disclosed on a quarterly basis and the investor receives relevant information only four times a year with delay. In addition, the investor has no access to the underlying models of the bank and cannot evaluate implications arising therefrom. This can also lead to distortions if a bank is "creative" in calculating their total risk exposure and thus triggering too late.⁴⁸

Investors might fear possible regulatory changes, especially when those lead to higher capital requirements or stricter requirements for the total risk exposure. It was observed that the implementation of Basel IV / the completion of Basel III will lead to an average 29% reduction

⁴⁴ Boermans, Martijn / van Wijnbergen, Sweder (2017), p. 10; De Spiegeleer, Jan / Schoutens, Wim / van Hulle, Cynthia (2014), p. 114 – 115

⁴⁵ European Central Bank (2018), p. 1

⁴⁶ Cecchetti, Stephen / Schoenholtz, Kermit (2015 / 4th Edition), p. 150

⁴⁷ Böger, Andreas / Heidorn, Thomas / Waldstein, Graf Philipp (2000), p. 15; Schmid, Michael (2014), p. 21

⁴⁸ De Spiegeleer, Jan / Schoutens, Wim / van Hulle, Cynthia (2014), p. 115

of European banks CET1 ratio if no mitigation is made. This might increase trigger probability and thus can lead to a reduction in bond prices, once banks are not or not sufficiently mitigating the effects from regulatory changes.⁴⁹

⁴⁹ McKinsey&Company (2017), p. 9

5. Pricing Models and Value at Risk

5.1 Pricing Models

The pricing of AT1 bonds is difficult, due to the complexity of the notes, and relatively unexplored, due to the comparatively short existence. Nevertheless, there are different approaches. Generally, these models are existing models for other financial assets, which are adjusted to account for the special features of contingent convertible bonds and, thus, are applicable for AT1 bonds. From the perspective of a fixed income investor, the AT1 bond has to pay an extra credit spread above the risk-free rate for taking higher risk of losses. From an equity perspective, the special features of the bond must be replicated by using equity derivatives. Some elements of the AT1 bond as coupon payments (if not cancelled), and a fixed maturity if the bond is called and the trigger level is not reached resemble the fixed income perspective. However, write downs, conversion, and possible perpetual maturity resemble the equity derivative perspective.⁵⁰

Using the bonds displayed in table 2 both models are tested.

Issuer	ISIN	Structure	Issuance Date	Size	Currency	Coupon	Trigger Level	Loss absorption
BBVA	XS1394911496	PerpNC5	07.04.2016	1,000,000,000	EUR	8.875	5.125	Equity Conversion
Banco Santander	XS1107291541	PerpNC7	02.09.2014	1,500,000,000	EUR	6.250	5.125	Equity Conversion
Barclays	XS1274156097	PerpNC7	04.08.2015	1,000,000,000	GBP	7.875	7.000	Equity Conversion
BNP Paribas	XS1247508903	PerpNC7	10.06.2015	750,000,000	EUR	6.125	5.125	Write-Down
Caixabank	ES0840609012	PerpNC8	13.03.2018	1,250,000,000	EUR	5.250	5.125	Equity Conversion
Credit Suisse	CH0352765157	PerpNC6	23.01.2017	1,500,000,000	USD	7.125	7.000	Equity Conversion
Danske Bank	XS1190987427	PerpNC7	11.02.2015	750,000,000	EUR	5.875	7.000	Write-Down
Deutsche Bank	DE000DB7XHP3	PerpNC8	20.05.2014	1,750,000,000	EUR	6.000	5.125	Write-Down
Erste Group	XS1425367494	PerpNC5	25.05.2016	500,000,000	EUR	8.875	5.125	Write-Down
HSBC	XS1298431104	PerpNC8	22.09.2015	1,000,000,000	EUR	6.000	7.000	Equity Conversion
Intesa Sanpaolo	US46115HAU14	PerpNC10	10.09.2015	1,000,000,000	USD	7.700	5.125	Write-Down
KBC Group	BE0002592708	PerpNC8	17.04.2018	1,000,000,000	EUR	4.250	5.125	Write-Down
Lloyds	XS1043545059	PerpNC6	20.03.2014	750,000,000	EUR	6.375	7.000	Equity Conversion
Nordea	XS1725580465	PerpNC7	21.11.2017	750,000,000	EUR	3.500	5.125	Write-Down
Raiffeisen	XS1756703275	PerpNC7	16.01.2018	500,000,000	EUR	4.500	5.125	Write-Down
Royal Bank of Scotland	US780099CK11	PerpNC10	05.08.2015	1,150,000,000	USD	8.000	7.000	Equity Conversion
Standard Chartered	US853254BA77	PerpNC6	11.08.2016	2,000,000,000	USD	7.500	7.000	Equity Conversion
Swedbank	XS1190655776	PerpNC5	12.02.2015	750,000,000	USD	5.500	5.125	Equity Conversion
UBS	CH0286864027	PerpNC10	31.07.2015	1,575,000,000	USD	6.875	7.000	Write-Down
Unicredit	XS1107890847	PerpNC7	03.09.2014	1,000,000,000	EUR	6.750	5.125	Write-Down

Table 2: Overview of AT1 Bonds used for the Models

⁵⁰ De Spiegeleer, Jan / Schoutens, Wim (2011), p.13

5.2 Credit Derivative Model

The credit derivative model is based on the reduced form approach by Duffy. The adjustments to make it applicable for AT1 bonds were made by De Spiegeleer and Schoutens (2011/2014). In this case the extra credit spread representing the risk of facing a default is modelled.

The approach calculates a default intensity λ , by modeling the default probability as the first jump of a Poisson process, for a given time horizon. The default intensity and the recovery rate of a bond result in the credit spread.

Thereby, the model assumes that the share price is the fair value of the CET1 capital, and changes in CET1 capital are leading to equivalent changes in the share price. The probability that the trigger level will be reached is thus calculated by the probability that the share price will drop as much as the CET1 capital must drop to reach the trigger.

5.3 Equity Model

The equity derivative model was proposed by De Spiegeleer / Schoutens (2011/2014) and tries to replicate the payoff structure of an AT1 bond. Therefore, the bond is split into three components. The first component is the risk-free payout of the bond.

The second component is a short position in a binary down-and-in cash-or-nothing option and replicates the case of a non-payment of coupons. This binary option pays a predefined amount of cash at maturity if a predefined barrier is breached during the option's lifetime. Since a short position is used, the option premium is paid to the investor and, in case of a barrier breach, the predefined amount of cash must be paid. This is comparable with an AT1 bond. The investor gets a premium in the form of a lower bond price, and therefore takes the risk that coupon payments will be cancelled when the trigger level is breached. Thus, the current value of the option must be deduced from the risk-free bond.

The third component is a long position in a down-and-in forward. Thereby, the investor receives a long position in a forward once a predefined barrier is breached and participates in the recovery as well as in further deterioration of the share price. This is comparable with the principal of an AT1 bond. Once the trigger level is breached, the bond will be either converted into equity, and the investor will thus fully participate in share price movements, or will be written-down until the trigger level is attained and, at least in case of a temporary write-down, will be written back when the bank recovers or further written down if the bank further deteriorates. Since the investor has a long position, the value of the current forward must be paid and will thus be added to the risk-free bond.

5.4 Testing the Models

To use the models described various relevant data is needed. The daily closing price should be compared with the daily calculated price therefore the yields of the 20 European AT1 bonds were modeled. Within the sample, ten bonds are using write-down and ten equity conversion method. Twelve of the bonds have a low trigger (5.125%), and eight of the bonds have a high trigger (7.000%). The banks are all public companies in Europe with total assets of at least €100bn.⁵¹ Each bond is modeled from the issuance date until February 11, 2019.

Applying the credit derivative model to the entire sample, using a recovery rate of 20%, leads to comparatively weak results. Figure 3 shows the Nordea bond the spread between the calculated yield and the market yield is, on average, 435 bps.

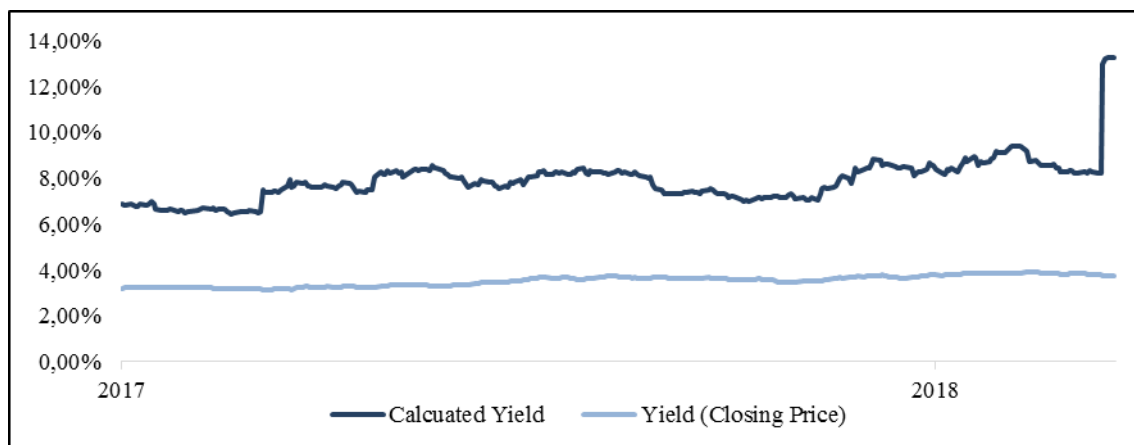


Figure 3: Nordea Bank – ISIN: XS1725580465 – Recovery Rate: 20 Percent

Comparatively large differences to the market price apply to the entire sample. The observed daily pricing spread is, on average 728 bps and varies between 134 and 1414 bps. Interestingly, the spread of Nordea's bond is on a consistent high but little volatile basis, besides the jump in February 2019. This is the result of a regulatory-driven reduction of the CET1 ratio by 480 bps, to which the model is highly sensitive, but the market does not react at all. The consistent high spread can be observed in Figure 4.⁵²

⁵¹ Although all AT1 bonds are issued by European banks, there might be differences in the handling due to different national requirements.

⁵² Cf. Nordea (2019), p. 16; Changes in the CET1 ratio came from the IRB floors and the Swedish mortgage risk weight floors.

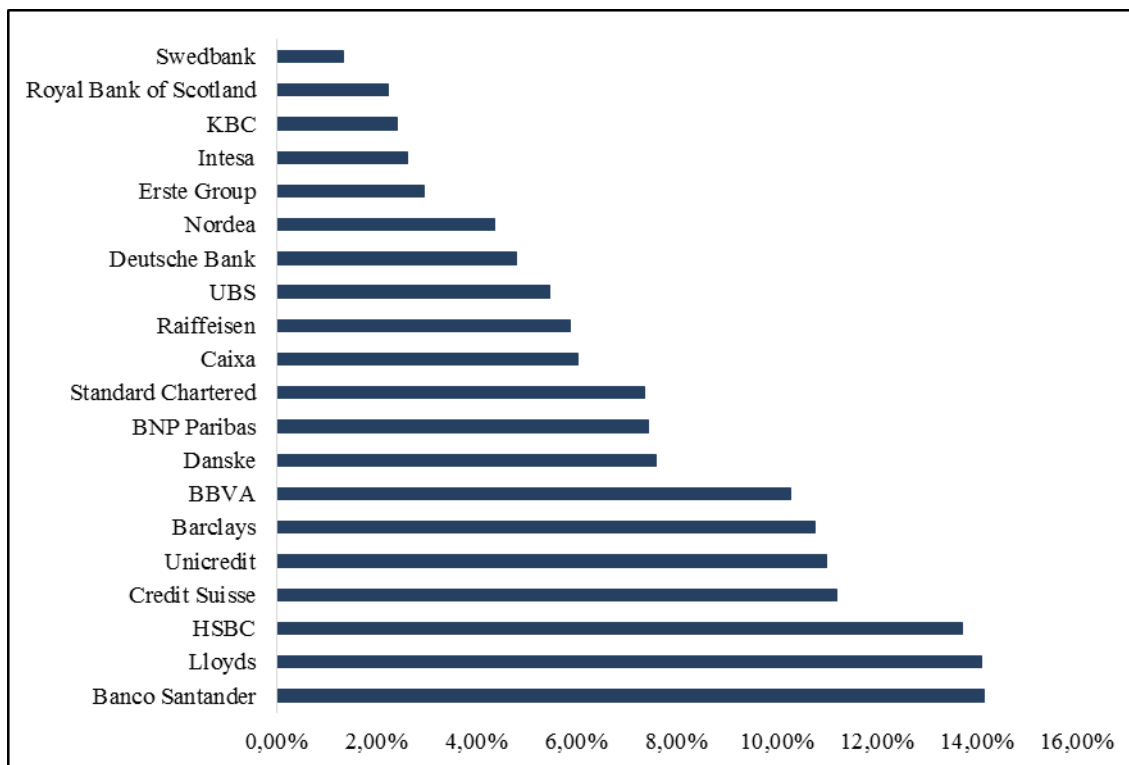


Figure 4: Spread between the Yield Calculated by the Credit Derivative Model with a Recovery Rate of 20 Percent and the Market Yield

Applying the equity derivative model to the sample of 20 AT1 bonds also leads to comparatively weak results. As figure 5 outlines, the average daily difference in the yield is 390 bps, where HSBC has the smallest spread of only 232 bps and Erste Group has the largest with a spread of 710 bps.

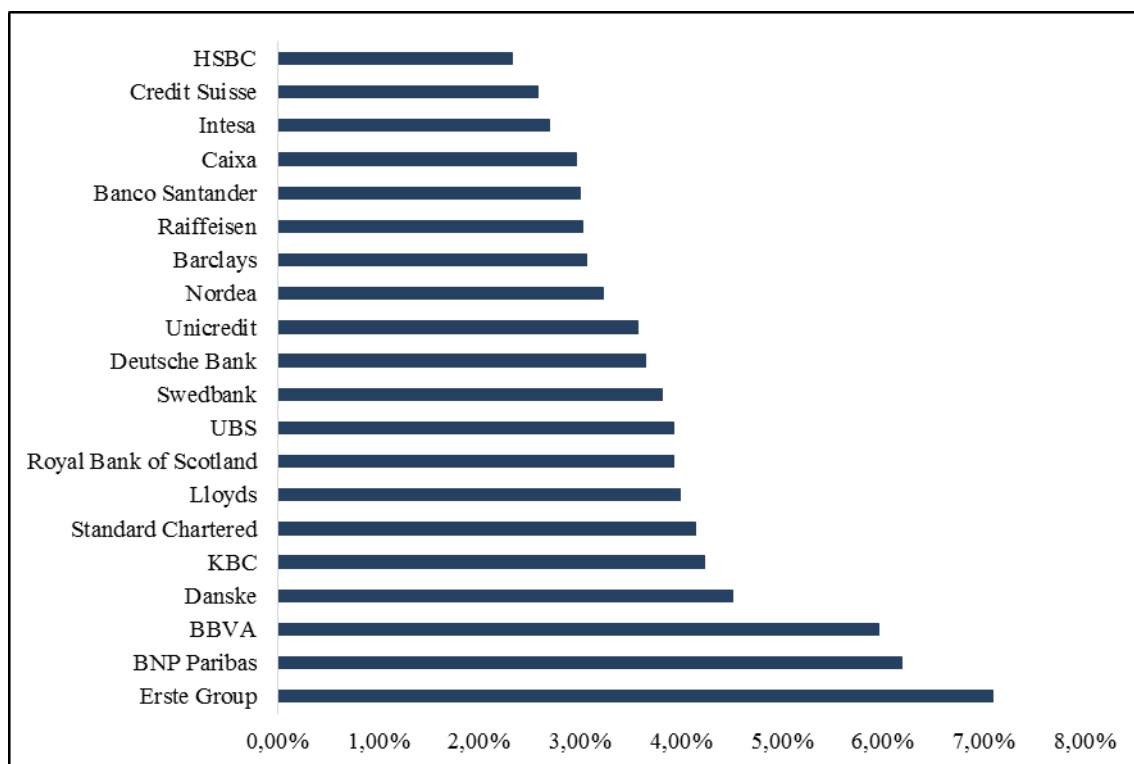


Figure 5: Yield Differences Applying the Equity Derivative Model

However, at this stage no adjustments were made. Therefore, the results are better than the credit derivative model. Nonetheless, the large gaps lead to the suggestion that assumptions in the model do not fully reflect market expectations. One possible assumption, which does not seem to be quite correct, is the trigger level. Although the bond terms provide for a trigger of 5.125 and 7%, respectively, an intervention by the competent supervisory authority may result in coupon non-payments and write-downs or conversions at a far higher level. Assuming the competent authority would intervene latest when a bank's CET1 ratio is at the level of the minimum requirements, including the capital conversion buffer and the pillar two requirement (P2R), would lead to a far higher effective trigger level. The minimum requirement is 4.5%, the capital conversions buffer is 2.5%, and the P2R was 2% on an aggregative level in 2017. Thus, the effective trigger level should lie at a level of about 9%. When this level is applied to the sample, the spread is significantly reduced to 241 bps.

To find a more accurate recovery rate, one consideration is to calculate a fixed implied recovery rate by calibrating the average spread between the market and the model price. This approach is somehow inadequate since it always requires a history and the used input parameter is set at a level to optimize the results. However, the results are much closer to the market yields. The Nordea bond only shows a spread of 24 bps. Over the whole sample, the minimum spread is for the KBC bond with 10 bps, and the most substantial spread is 157 bps for the Unicredit bond. On average, the pricing spread is 81 bps.

5.5 Value at Risk

An Equity Derivatives Model and a Credit Derivatives Model were tested on 20 European bonds. The sample shows that both models led to large deviations from the market credit spread. This was also valid after adjusting the assumptions of main input factors. Thus, it can be concluded that for the sample both pricing models are of a rather theoretical nature and cannot represent the pricing on capital markets. However, the movements of prices were reflected quite well, therefore it can be a helpful insight to calculate the risk of AT1 bonds.⁵³

Using multi-linear regressions both on a single asset basis and over the entire sample the respective input factors of the pricing models were tested for their statistical significance. Tier 2 CDS proved to be the best proxy to simulate price movements. However, the absolute level of credit spreads could not be significantly explained by any of the analyzed input factors.

For the AT 1 of the sample the value at risk has been calculated. A historical simulation and a calculation based on normal distribution with historical volatility of the single assets were compared. As Figure 6 shows, the empirical risk is systematically higher as the volatility based Value at Risk. The 1-day 99% value at risk average is 0.65% in the historical simulation, whereas it is only 0.31% in the volatility based computation. This is valid for all assets irrespective of the issuer. The results seem nonetheless plausible, since the normal distribution underestimates tail risks. It can be assumed that a different distribution curve leads results which are closer to the results of the historical simulation.⁵⁴

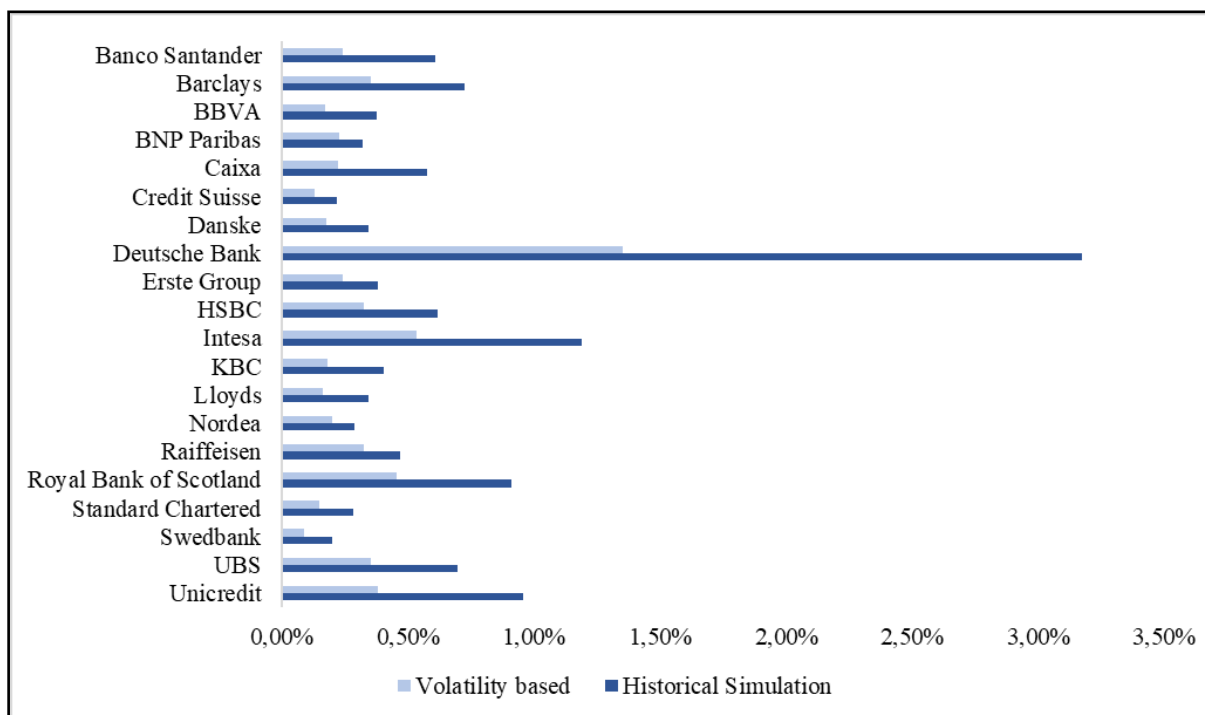


Figure 6: Comparison of volatility based and historical simulation Value at Risk

Further insights can be observed by regressions. It can be determined that changes in the subordinated CDS are nearly completely reflecting the changes in the credit spread of AT1 bonds. Additionally, the dividend yield, the share price volatility, and the CET1 ratio in proportion to the trigger level are positively correlated with the AT1 bonds. The share price has no significant influence and, surprisingly, the time to first call has a negative impact on the credit spread. However, this seems to be of technical nature

⁵³ C.f. Erismann, Marc (2015), p. 29 – 64

⁵⁴ C.f. Hull, John C. (2012), p. 471 – 479

Conclusion

The capital requirements for banks have been significantly increased by Basel III. In particular, more capital must be held if banks are classified as systemically important. In addition, the introduction of the leverage ratio has led to a ruling that is intended to prevent banks from not having too much leverage despite a sufficiently high total capital ratio. In general, the use of AT1 bonds seems to have a positive impact on the stabilization of financial institutions as well as the financial system. The question of how well the relatively new bonds will promote the bank's capital management functions in stress situations are of importance. First signs show that there probably will be a massive widening of spreads, but the basic idea of the loss absorption function of AT1 bonds should still hold even in those situations. Reservations against the introduction of AT1 bonds, e.g. the issuance of AT1 bonds to reduce CET1 capital, have not been observed yet. Neither can it be recognized that new systemic risks arising from the issuance of AT1 bonds or that such risks shift geographically or across industries. It remains to be seen how well the new regulations will function in the event of a new financial crisis.

Furthermore, AT1 bonds are attractive for both, issuers and investors. The issuing bank can increase its Tier 1, total capital, and leverage ratio without a share dilution. The associated interest expenses are often below the bank's RoCET1 and thus cheaper than the issuance of new shares, especially due to tax deductibility in many jurisdictions. Conversely, an investor can generate attractive returns and has enough diversification opportunities, since the market has over €200bn in outstanding bonds in different jurisdictions and currencies. However, every investor should be aware of the risks associated with AT1 bonds.

The empirical analysis observed that the best approach to proxy the bonds movement is to use subordinated CDSs. However neither an equity nor a debt derivatives model were able to calculate yields close to market prices.

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