

# **IMPACT OF SOFTWARE EXPENSES ON FINANCIAL STATEMENTS AND CAPITAL RATIOS IN THE FINANCIAL SECTOR EMPIRICAL: EVIDENCE FROM GERMANY AND AUSTRIA**

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## **ABSTRACT**

*In a world of digital technologies, software solutions become increasingly important for financial institutions and the amount of expenses for intangible assets are increasing. However, expenses for digital financial technologies are capitalized only if the requirements of the International Financial Reporting Standards (IFRS) are met. Even if the expenses for digital financial technologies are capitalized, for calculating Key Performance Indicators (KPIs) under the Capital Requirements Regulation (575/2013) (CRR), the capitalized intangible assets must be deducted from Common Equity Tier 1 (CET1) capital as a prudential filter. This deduction leads to a reduction of capital ratios and therefore to a disadvantage for financial institutions with investments in software solutions. In June 2019, the European Parliament amended regulations of CRR so that in the future capitalized software as intangible assets will not be deducted from the CET1 capital. This paper examines the impact of this amendment on the capital ratios of German and Austrian firms classified as other-systemically important institutions (O-SIIs). The paper shows the growing relevance of software capitalization in the financial sector. However, based on the 2018 data, the impact of the amendment on capital ratios is not material for German and Austrian financial institutions.*

**JEL:** G21, G38, M41, M48

**KEYWORDS:** Intangible Assets, Software, Digitalization, Capital Ratio, CRR, IFRS

## **INTRODUCTION**

**F**inancial institutions are dependent on digital financial technology and software solutions to deliver value to their customers, reach higher performance levels (Cuesta et al., 2015; Lu et al., 2010; AFME, 2018; Hassani et al., 2018) and to compete with FinTech companies. FinTech companies offer financial services providing customer-oriented solutions in the most efficient way, with the lowest cost possible. FinTech firms focus on payment-related services, wealth management, peer-to-peer lending and ensuring this via innovation and technologies. These innovations and technologies change the behavior of customers and the understanding of financial services (Vasiljeva & Lukanova, 2016). Changing habits of customers are forcing financial institutions to use digital technologies to compete with FinTech companies (Cuesta et al., 2015). Digitalization will not only change the nature of interaction with the client, it will also facilitate implementation and embedding of regulatory requirements in the fight against fraud (Sharma & Panigrahi, 2013) and cybercrime.

For financial institutions, investment in intangible assets, such as software, are indispensable to compete and to increase returns. However, the IFRS and the CRR (European Parliament 26/06/2013) do not reflect

returns of digital technologies and software solutions. This is especially the case with internally generated intangible assets, where the recognition requirements under IAS 38 are strict. Because of these stricter regulations under the IFRS, financial institutions with internally generated software do not report the value of these intangible assets on their balance sheets. These accounting regulations reduce the book value of the equity.

Even if internally generated software solutions fulfill the requirements for recognition as an intangible asset under IAS 38, for the calculation of the KPIs such as capital ratios, capitalized intangible assets are deducted from the numerator CET1, which leads to decreasing KPIs. The calculation of capital ratios is based on CRR. Consequently, the recent CRR amendment changes the treatment of intangible assets, such as software, for the calculation of the capital ratios (European Parliament 20/05/2019). The intention of the new CRR regulation for these KPIs is to treat tangible and selected intangible assets, such as software, equally in future. The non-deduction of capitalized software in the balance sheet, will lead, in the future, to increased capital ratios of the financial institutions. At the same time, tangible assets and intangible asset 'software', are treated equally within calculation of the KPIs 'capital ratios'.

The aim of this paper is to examine the impact of capitalized intangible assets, especially capitalized software, in the IFRS financial statements. We further examine the development of investments in intangible assets, especially software, over time. Our paper also describes the impact of the CRR amendment on capital ratios of German and Austrian O-SIIs. Thus, this paper supports European companies as well as users of the IFRS financial statements and CRR Pillar III reports, auditors, financial analysts, and investors, the first evidence of these expected effects. It also supports and improves the discussion about existing accounting and prudential regulations in the field of financial institutions.

The remainder of this paper is organized as follows. The next section describes the accounting regulations of IAS 38 concerning the recognition of intangible assets in the IFRS financial statement, we discuss current CRR regulations as well as the amendments of CRR regarding software as a prudential filter and the calculation of capital ratios. We then describe our data and methodology and discuss the results of our findings. The final section concludes.

## LITERATURE REVIEW

### Intangible Assets Under the IFRS

According to IAS 38.8 an intangible asset is defined as an identifiable non-monetary asset without physical substance (IASB, 2019). With reference to the same paragraph, an asset is a resource that is controlled by the entity because of past events, and it is expected that future economic benefits will flow to the entity. These benefits may lead to revenue from the sale of products or services, cost savings or other benefits, because of the use of the asset (KPMG IFRG Limited, 2018).

To report expenditures as an intangible asset on the balance sheet, the company must prove that the expenditures meet the definition of an asset and further requirements. In this context, IAS 38.21 requires that such items can show the probability that future economic benefits will flow to the entity and that the costs of the assets can be measured reliably. For the recognition of intangible assets on the balance sheet, IAS 38 distinguishes between separate acquisitions, acquisitions as part of a business combination and internally generated intangible assets.

For internally generated intangible assets, strict requirements prohibit in many cases the capitalization of intangible assets. IAS 38.51 sets out additional recognition requirements because of problems in identifying whether and when, there is an identifiable asset that will generate expected future economic benefits and in determining the cost of the asset reliably. For the recognition of internally generated intangible assets, the

entity must classify the generation of the asset into a research and development phase. According to IAS 38.8, research is defined as an ‘original and planned investigation undertaken with the prospect of gaining new scientific or technical knowledge and understanding’. Development is defined as ‘the application of research findings or other knowledge to a plan or design to produce new or substantially improved materials, devices, products, processes, systems or services before the start of commercial production or use’. Whilst expenditures in the research phase shall not be recognized, those in the development phase must be recognized when an entity can demonstrate all of IAS 38.57 (a–f).

For tangible assets such as property, plant and equipment (PPE), IFRS does not differentiate between acquired and internally generated assets. According to IAS 16.22, the cost of an internally generated tangible asset is determined using the same principles as for acquired tangible assets. To recognize internally generated tangible assets under IAS 16 (PPE), only the probability of a future economic benefit concerning the expectation of an inflow and reliable measurement is necessary. This corresponds with the requirements of recognizing acquired intangible assets under IAS 38. However, under IAS 16, no further requirements must be fulfilled for internally tangible assets such as PPE. The requirements for recognition of internally generated tangible assets are therefore considerably lower than for intangible assets, such as software.

The objective of the IFRS is to provide information that is useful for decision-making. One major question should be, does the capitalization of internally generated intangible assets under the rules of IAS 38, meet the criteria of decision usefulness? If intangible assets are not reported on the balance sheet, investors and analysts have to devote relatively more time to measure the value of intangible assets (Barth et al., 1997) and therefore it drives a wedge between the market value and the book value of the equity (Brynjolfsson et al., 2002). Penman (2009) points out that the omission on the balance sheet is not necessarily a deficiency and the value of intangible assets can be ascertained from the income statement. However, the recent study of Barth et al. (2018) proves the value relevance of capitalized intangible assets on the balance sheet. In this study, Barth et al. (2018) concluded, that by improving the accounting for intangible assets, the financial statements would include key inputs to the assessment of growth opportunities of investors, which could increase the relevance of accounting information. In summary, the literature points towards an economic impact and the decision usefulness of capitalized expenses of internally generated intangible assets, such as software.

### Intangible Assets Under CRR

The rules for calculating the KPIs ‘capital ratios’ are laid down in the CRR, which represents the transposition into European law of the Basel III standard. The capital standards and capital buffers under CRR, require banks to hold more and higher quality capital, to ensure that adequate funding is maintained in the case of a crisis. Therefore, capital ratios have been a valuable regulatory tool for the assessment of stability for a long time. For example, Chiaramonte & Casu (2017) found empirical evidence that capital ratios play a complementary role in fostering bank stability for the larger financial institutions.

Article 92 CRR defines own funds requirements for financial institutions and includes definitions of Common Equity Tier 1, Additional Tier 1, Total Capital as well as Risk-weighted Assets. Common Equity Tier 1 (CET1) capital includes paid-up capital and its associated share premium accounts, retained earnings, accumulated other comprehensive income, other reserves as well as funds for general banking risk. CET1 capital must be available to the institution for unrestricted and immediate use, to cover risks or losses as soon as they occur. Additional Tier 1 (AT1) capital consists of paid-up capital instruments and their associated share premium accounts and are issued as hybrid debt instruments (contingent convertibles), which are able to be written down or converted to CET1 instruments, upon the occurrence of a trigger event. T1 capital is the sum of CET1 and AT1 capital. Tier 2 (T2) capital consists of capital instruments and subordinated loans and associated premium accounts. The claim on the instrument or loan must be wholly

subordinated to the claims of all non-subordinated creditors and should not be secured or subject to a guarantee that enhances the seniority of its claim. Total capital for an institution is the sum of its T1 and T2 capital. Additionally, CET1, AT1 and T2 capital is reduced by prudential filters. For more details, see Articles 26 et seq. of the CRR. Risk-weighted Assets are the accounting value of the financial institution's assets and credit exposures, according to an assessment of the potential to suffer loss of each exposure. Financial institutions can calculate risk-weighted exposures using either the Standardized Approach or the Internal Ratings-Based (IRB) approach. For more details, see chapter 2 and 3 of the CRR. For these financial institutions, the minimum CET1 capital ratio, Tier 1(T1) capital ratio and Total Capital (TC) capital ratios are defined.

Article 92 (2) CRR defines the capital ratios as follows:

The CET1 capital ratio is the CET1 capital of the institution expressed as a percentage of the total risk exposure amount.

The T1 capital ratio is the T1 capital of the financial institution expressed as a percentage of the total risk exposure amount.

The TC capital ratio is the TC capital of the financial institution expressed as a percentage of the total risk exposure amount.

Currently, capital ratios do not reflect the profitability associated with the competitive factor 'digitalization' (Cuesta et al., 2015). According to current regulations of Article 36 (1b) of the CRR, intangible assets capitalized on the balance sheet must be deducted from the CET1 capital. The regulation ensures that software expenses that do not meet the criteria under IAS 38 and are therefore recognized on the income statement are treated equally to software expenses that are capitalized on the balance sheet. In both cases, the CET1 capital is reduced. When recorded on the income statement, retained earnings are reduced as part of equity and therefore also the CET1 capital. Even in this case, where the criteria to capitalize intangible assets according to IAS 38 are fulfilled, financial institutions must deduct the amount of capitalized intangible assets from the CET1 capital. Consequently, financial institutions investing in software solutions show lower capital ratios than financial institutions that do not make such investments in digitalization. As shown above, investments in software are essential for financial institutions, but the regulations lead to a disadvantage for financial institutions investing in software (AFME, 2018).

However, Article 36 (1b) CRR was amended in 2019, so that software assets capitalized on the balance sheet, shall not be deducted from the CET1 capital as a prudential filter any longer and are treated equally to tangible assets. The amendment considers the evolution of the financial sector in the era of digitalization. Furthermore, in other jurisdictions such as the USA, investments in software are not deducted from the CET1 capital. However, software expenses that do not fulfil the criteria of capitalization on the balance sheet, still reduce retained earnings and therefore the CET1 capital. In addition, even if the amount of capitalized software is not deducted from the CET1 capital as a prudential filter, the amount of software expenses capitalized on the balance sheet will be reduced via depreciation and potential impairments. Therefore, the CET1 capital will be reduced over the useful life of the software. The amount reduced over the useful life of the software (cumulative depreciation and impairments) equals the actual deduction of the prudential filter from the CET1 capital.

Moreover, the term 'software' covers many different types of intangible assets. Therefore, the European Banking Authority (EBA) shall develop regulatory technical standards to specify the term 'software', which seems to be a synonym for digital technologies. The amendment of Article 36 (1b) CRR shall apply from twelve months after the date of entry into force of the regulatory technical standards. The earliest this could be, is by 2021.

## DATA AND METHODOLOGY

This study provides a detailed descriptive overview and quantifies the impact in practice using data from German and Austrian financial institutions. The list of O-SII institutions included in this study follows the European Banking Authority (EBA) Guidelines on the criteria for the assessment of O-SIIs – pursuant to Article 131 (3) of Directive 2013/36/EU and was downloaded from the EBA official website (European Banking Authority, 2018).

As Table 1 shows the study consists of twenty financial institutions, divided into six ‘Systematically Important Institutions’ (SIIs) and fourteen ‘Other Systemically Important Institutions’ (O-SIIs) of the EBA O-SII list of 2018. Due to their systemic importance, these financial institutions may bring negative externalities into the system and contribute to market distortions. Therefore, it is also expected that an impact on KPIs such as the capital ratios, would cause a market reaction.

Table 1: Sample Selection

<b>SIIs*</b>	
Austria	1
Germany	5
<b>O-SIIs**</b>	
Austria	6
Germany	8
<b>Sample size</b>	<b>20</b>

*Based on the EBA O-SII list, table 1 includes all German and Austrian SIIs and O-SIIs included in the study. \*SIIs means ‘Systemically Important Institutions’ and \*\* O-SIIs means ‘Other Systemically Important Institutions.’*

To examine the relevance of capitalized software expenses, we collected relevant data from the balance sheet and disclosures of the years 2013 to 2018 published on the website of the financial institutions included in the study. To show the relevance of capitalized software over the years 2013 to 2018, we analyzed 120 financial statements. As under IFRS, capitalized software is not shown in the balance sheet, we analyzed the IFRS notes. Furthermore, we analyzed whether capitalized software as internally generated or acquired. However, not all financial institutions provided the information necessary in the IFRS notes. Therefore, we observed 142 data over the period 2013 to 2018.

To calculate the impact on capital ratios in the year 2018, we used data from the Pillar III reports of the selected financial institutions. Therefore, we analyzed 15 Pillar III reports. The study includes only Pillar III data for financial institutions which provided the information about software expenses capitalized. We collected the data of Total Risk-weighted Assets, Common Equity Tier 1, Additional Tier 1, Total Capital and observe 60 data from the Pillar III reports of the year 2018.

### Methodology of the Empirical Research

The following study is characterized as a deductive analysis, which means that hypotheses introduced will be confirmed or rejected. Descriptive deviation analysis is elected as the methodology, whereby KPIs, such as the CET1, T1 and TC capital ratio are calculated twice. For actual ratios, we collected by hand the capital ratios published in the Pillar III report of the financial institutions. Based on the actual capital, we calculated the fictitious capital ratios. The calculation of fictitious capital ratios includes that software is recognized and therefore not deducted as a prudential filter from the CET1 capital. Whereas, under the actual CRR treatment, software is deducted as a prudential filter from the CET1 capital. To calculate the CET1, T1 and

TC capital under the CRR amendment of Article 36 (b) of the CRR, the amount of capitalized software disclosed in the financial statements is added to calculate the fictitious CET1, T1 and TC capital.

Furthermore, we added the amount of capitalized software to the total risk-weighted assets. Therefore, the denominator ‘total risk-weighted assets’ is adjusted. Accordingly, we risk-weighted the software such as PPE, which means that the capitalized software on the balance sheet is risk-weighted as 100% in the denominator. In addition, the calculation does not include adjustments to thresholds due to the lower CET1 capital. The capital ratios are calculated as follows:

$$\begin{aligned} \text{CET1 capital ratio}_{\text{CRR}} &= \text{CET1 capital}_{\text{CRR}} / \text{total risk-weighted assets}_{\text{CRR}} \\ \text{CET1 capital ratio}_{\text{fictitious}} &= (\text{CET1 capital}_{\text{CRR}} + \text{software}_{\text{capitalized}}) / (\text{total risk-weighted assets}_{\text{CRR}} + \text{software}_{\text{capitalized}}) \\ \text{T1 capital ratio}_{\text{CRR}} &= \text{T2 capital}_{\text{CRR}} / \text{total risk-weighted assets}_{\text{CRR}} \\ \text{T1 capital ratio}_{\text{fictitious}} &= (\text{T2 capital}_{\text{CRR}} + \text{software}_{\text{capitalized}}) / (\text{total risk-weighted assets}_{\text{CRR}} + \text{software}_{\text{capitalized}}) \\ \text{TC capital ratio}_{\text{CRR}} &= \text{TC capital}_{\text{CRR}} / \text{total risk-weighted assets}_{\text{CRR}} \\ \text{TC capital ratio}_{\text{fictitious}} &= (\text{TC capital}_{\text{CRR}} + \text{software}_{\text{capitalized}}) / (\text{total risk-weighted assets}_{\text{CRR}} + \text{software}_{\text{capitalized}}) \end{aligned}$$

Abbreviations:

CET1 = Common Equity Tier 1  
 CRR = Actual amount recorded in CRR  
 Fictitious = Amount calculated according to the amendment of CRR  
 T1 = Tier1  
 TC = Total Capital

For the fictitious calculation of the capital ratios, only the amount of intangible assets can be seen directly on the balance sheet. The amount of software expenses capitalized within the financial position of ‘intangibles assets’ is a disclosure in the notes of the IFRS financial statements. However, these disclosures depend on the level of detail a financial institution provides. A high level of detail means internally generated and acquired software are disclosed in the notes of the financial statements of the financial institutions. In the case of a low level of detail, explanatory information about capitalized software is missing. Therefore, in cases with a low level of detail, the calculation of fictitious capital ratios is not possible.

The aim of the study is to answer the following questions:

- 1) What is the impact of the increasing digitalization on the amount of intangible assets capitalized (especially software) in the financial statements of Austrian and German financial institutions?
- 2) Based on the financial statements of Austrian and German financial institutions, are intangible assets (especially software) getting more relevant over time than tangible assets?
- 3) What are the quantitative impacts that the amendment of Article 36 (1b) of the CRR has on KPIs such as capital ratios, i.e. what is the impact of the non-deduction of software on the CET1, T1 and TC capital ratio?

### Development of Hypotheses

IAS 1.9 states that ‘...the objective of financial statements is to provide information about the financial position, financial performance and cash flows of an entity that is useful to a wide range of users in making economic decisions. We expect that the digitalization affects financial positions such as intangible assets

and consequently, key financial ratios such as capital ratios material. In the accounting literature, an annual increase in a financial position of more than 5 percent is defined as material. An annual increase of 5 percent over the period 2013 to 2018 would cause an increase of about 28 percent. Therefore, we analyze whether there has been a material increase of more than 28 percent for capitalized software over the last five years.

According to our research questions, we checked the following hypotheses:

*H1: For German and Austrian O-SIIs, the average amount of capitalized software increases material over the period 2013 to 2018.*

Moreover, the study analyzes the development of investments of tangible assets and software. An investment in tangible assets or software is assumed, if the carrying amount of software or the financial position PPE increases.

*H2: Over the period 2013 to 2018, for German and Austrian O-SIIs, the investment in software increases on average more than in tangible assets.*

The study also indicates how the amendment of Article 36 (1b) CRR influences capital ratios. To strengthen the regulation of the financial institutions, the new regulations for calculation capital ratios came into force on 1st January 2014, however, with various transitional arrangements applying until 2019. Because of these transitional arrangements, we compare the latest capital ratios available.

*H3: The amendment of Article 36 (1b) CRR changes capital ratios of German and Austrian O-SIIs by more than 5 percent in 2018.*

## **RESULTS AND DISCUSSION**

Based on the data of the twenty financial institutions in the sample, the proportion of intangible assets on the balance sheet total remains relatively stable over the period 2013 to 2018. The relation of the financial position 'intangible assets' to equity is not material for the majority. The impact on equity is only material in 2013. The results also show that on average there is a decline in the materiality of intangible assets in comparison with equity, whilst half of the institutions have a proportion of intangible assets on equity of less than 1.9 percent over the period 2013 to 2018. However, results show that the proportion of intangible assets in comparison with equity is on average higher than 5 % over the years 2013 to 2018 for SIIs. Whereas these results depend on the high amount of capitalized intangible assets in three SIIs. Based on the data of 2018, the proportion of intangible assets on equity is 14.63 percent in the Deutsche Bank AG, 11.04 percent in the Commerzbank AG and 7.99 percent in the Erste Group Bank AG.

Even according to the significance of the institution, or according to the country, the intangible assets decrease on average over the years. However, as mentioned above, the capitalized intangible assets also include goodwill, brand names and customer relationships, which are not necessarily related to digitalization. In many cases, for example the Deutsche Bank AG (9,074 million Euros in 2013 to 3,876 million in 2018 Euros), the capitalized goodwill decreases sharply.

To show the increasing significance of intangible assets caused by digitalization, we analyzed the capitalized software as an intangible asset. Therefore, we analyzed the carrying amount of software disclosed within the Notes of the IFRS financial statements. In 2018, fifteen of the twenty German and Austrian financial institutions disclosed the amount of software in the Notes. For the financial institutions, which show the amount of capitalized software, the amount rises constantly. The average amount of capitalized software is 348 million Euros on average in 2013 and 547 million Euros in 2018. This includes an average increase of 57.19 percent over the period 2013 to 2018 and H1 is confirmed. Results also indicate

that the amount of capitalized software in SIIs increases sharply. Figures show an average increase in software of 93.29 percent in SIIs over the period 2013 to 2018. There is a gradual annual increase of more than 10 percent over the period 2013 to 2017 and even from 2017 to 2018, there is an average annual increase of 2.62 percent. These figures may be an indicator that SIIs started to invest in digitalization much earlier than O-SIIs and have recognized the importance of.

The figures in Table 2 also prove that the carrying amount of software generated internally, is on average higher than the carrying amount of software acquired. Furthermore, while the carrying amount of software generated internally increases on average by 109.09 percent over the period 2013 to 2018, the amount of software acquired decreases on average about 5.30 percent. In only two of the financial institutions, the amount of capitalized software is equal to software acquired and software is not internally generated. The results also show the high importance of internally generated software and a material increase over the period 2013 to 2018 in SIIs. For example, the amount of internally generated software in the Deutsche Bank AG is 97.6 percent (4,372 million Euros) of the total amount of capitalized software (4,481 million Euros).

Table 2: Descriptive Statistics on the Total Carrying Amount of the Software Internally Generated and Software Acquired

<b>Software Internally Generated in Million Euros</b>						
	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
n*	10	11	12	12	11	11
Number of SIIs and O-SIIs included						
SIIs	6	7	8	8	7	7
O-SIIs	4	4	4	4	4	4
Mean	264	312	349	424	524	552
Std. Deviation	552	702	843	1,050	1,176	1,250
Maximum	1,867	2,466	3,064	3,817	4,110	4,372
Impact according to the significance of the institution						
SIIs		material	material	material	material	material
O-SIIs		immaterial	immaterial	immaterial	immaterial	Immaterial
<b>Software Acquired in Million Euros</b>						
	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
n**	11	12	13	13	13	13
Number of SII-S and O-SIIs included						
SIIs****	6	7	8	8	7	7
O-SIIs*****	4	4	4	4	4	4
Mean	151	134	129	136	147	143
Std. Deviation	157	144	150	153	165	156
Maximum	464	422	411	423	466	424
Impact according to the significance of the institution						
SIIs		immaterial ***	material****	material	material	immaterial
O-SIIs		immaterial	immaterial	material	material	immaterial

Based on the data for the years 2013 to 2018, Table 2 points out the increase of internally generated software (in million Euros) and shows that the amount of software acquired (in million Euros) decreases slightly over the years. Furthermore, the table shows the number of SIIs and O-SIIs included in the study. \*n means the number of financial institutions disclosing the carrying amount of the software internally generated. \*\*n means the number of financial institutions disclosing the carrying amount of the purchased software, \*\*\*immaterial means a yearly decline of less than 5 percent or a decrease, \*\*\*\*material means a yearly decline of more than 5 percent, \*\*\*\*\* SIIs means 'Systemically Important Institutions' and \*\*\*\*\* O-SIIs means 'Other Systemically Important Institutions.'



Table 3 shows a decrease in investments in PPE over the total period 2013 to 2018 for SIIs and O-SIIs, even though there has been an increase of 6.79 percent on average from 2016 to 2017. However, this increase is caused by the merger of the two financial institutions Raiffeisen Bank International AG (RBI) and Raiffeisen Zentralbank AG (RZB). Without this outlier, there would be a decrease of 0.47 percent on average. As mentioned above, investments in software decreases 57.19 percent on average over the period 2013 to 2018. Even with the outlier, the average tangible assets such as PPE decrease on average by about 26.95 percent. Therefore, H2 is confirmed over the period 2013 to 2018. The figures propose a higher relevance of investments in software than in tangible assets, such as PPE. Even in SIIs the amount of PPEs decrease over the period 2013 to 2018, whereas investments in software increase sharply, as mentioned above.

Table 3: Comparison of the Development of Investments in Software and PPE in Percent

	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	Total Increase/Decrease 2013-2018
<b>Average Decrease/Increase in Capitalised Software in Percent According to the Significance of the Institution</b>						
SIIs*	18.06	20.26	17.79	12.62	2.62	93.29
O-SIIs**	-9.99	-4.81	12.32	1.11	4.18	1.37
<b>Total</b>	<b>-4.33</b>	<b>29.89</b>	<b>17.09</b>	<b>5.08</b>	<b>2.81</b>	<b>57.19</b>
<b>Average Decrease/Increase in PPE*** in Percent According to the Significance of the Institution</b>						
SIIs	-9.96	-3.61	-6.46	-4.21	-5.36	-26.41
O-SIIs	-4.62	-15.96	-23.82	34.71	-5.53	-22.29
<b>Total</b>	<b>-10.52</b>	<b>-8.02</b>	<b>-12.12</b>	<b>6.79</b>	<b>-5.42</b>	<b>-26.95</b>

Table 3 compares the increase/decrease of software expenses capitalized and PPE over the period 2013 to 2018 for German and Austrian financial institutions. The figures show an increasing amount of software expenses capitalized. In comparison to software expenses capitalized, the amount of PPE is decreasing over the period 2013 to 2018. \*SIIs means 'Systemically Important Institutions', \*\* O-SIIs means 'Other Systemically Important Institutions', \*\*\* PPE means property, plant and equipment.

This section evaluates the impact on future capital ratios caused by the amendment of Article 36 (1b) CRR. A calculation of the impact on the CET1 capital ratio, T1 capital ratio and TC capital ratio based on the data of 2018 was possible for fifteen O-SIIs.

Table 4 shows an average increase on the CET1 capital ratio of 2.36, T1 capital ratio of 2.12 and TC capital ratio 1.73 percent. The results show an impact of less than 5 percent on average. This means that the impact on capital ratios are not material. Using a deductive approach, H3 is rejected for each of the capital ratios analyzed, as the impact is less than 5 percent.

Results also show that on average the impact on capital is higher for SIIs than for O-SIIs. By analyzing the capital ratios, we find an average impact on the CET1 capital ratio of 0.31, T1 capital ratio of 0.31 and TC capital ratio of 0.39 percentage points. However, in the case of Deutsche Bank AG, the CET1 capital ratio would increase by 1.09 percentage points. With a simplified calculation, which does not consider adjustments to thresholds and without the scenario of the amendment of CRR, an increase of the CET1-ratio by 1.09 percentage points would mean, for example, an increase of retained earnings of about 3.8 billion Euros. The consolidated statement of income of the Deutsche Bank AG in 2018 shows a net income after tax of 341 million Euros. An increase of about 3.8 billion Euros would mean an 11-fold increase of net income after tax in 2018. Our findings also show that for the sample, an equivalent increase in the CET1-ratio (without the non-deduction of software expenses) would mean on average an increase of 468 million Euros. Based on the figures for 2018, the amendment of CRR will be difficult to compensate through operating activities.

Table 4: Impact of the Amendment on the Capital Ratios in Percentage Points

n*	15	15	15
	<b>Actual CET1 Capital Ratio in Percent of 2018</b>	<b>Actual T1 Capital Ratio in Percent of 2018</b>	<b>Actual TC Capital Ratio in Percent of 2018</b>
SII**	13.78	14.74	17.27
O-SII***	15.96	16.78	19.58
<b>Total</b>	15.55	16.41	19.11
	<b>Fictitious CET1 Capital Ratio in Percent of 2018</b>	<b>Fictitious T1 Ratio in Percent of 2018</b>	<b>Fictitious TC Capital Ratio in Percent of 2018</b>
SII	14.32	15.27	17.78
O-SII	16.16	16.98	19.77
<b>Total</b>	15.55	16.41	19.11
	<b>Average Impact on CET1 Capital Ratio in Percent</b>	<b>Average Impact on T1 Capital Ratio in Percent</b>	<b>Average Impact on TC Capital Ratio in Percent</b>
<b>Mean</b>	2.36	2.12	1.73
<b>Std. Deviation</b>	2.54	2.23	1.89
<b>Median</b>	0.84	0.75	0.61
<b>Maximum</b>	8.05	6.77	5.96
<b>Hypothesis (H<sub>3</sub>)</b>	rejected	rejected	rejected

Based on the figures in the Pillar III reports of the year 2018 and our calculation of fictitious CET1, T1, TC, Table 4 shows the average impact on capital ratios (CET1, T1 and TC) for German and Austrian SIIs and O-SIIs by not deducting software expenses capitalized as a prudential filter from CET1, which corresponds with the amendments of CRR. Furthermore, table 4 shows statistical parameters for all financial institutions included in the study. The results show an impact of less than 5 percent on average, which means that the results are not material. Based on a deductive approach, H<sub>3</sub> is rejected as results are not material on average.\*n means the number of financial institutions showing the carrying amount of the software, \*\*SIIs means 'Systemically Important Institutions,' \*\*\* O-SIIs means 'Other Systemically Important Institutions.'

## CONCLUDING COMMENTS

In this paper we study the relevance of software expenses capitalized in the financial sector and how the amendment of CRR to non-deduct software expenses capitalized influences the capital ratios.

Our results of the study show that the amount of capitalized software on the balance sheets of German and Austrian O-SIIs has significantly increased over the last five years and shows the increasing importance of digitalization in the financial industry. However, based on the descriptive deviation analysis, the amount of capitalized software depends on the systematic significance of the financial institutions. Therefore, the amount of capitalized software increases strongly in SIIs, while in O-SIIs the increase is only slight. This might be an indicator that in a growing digital world, SIIs recognize the importance of software more than O-SIIs.

Therefore, the amendment of CRR is a step forward in compensating for the disadvantage the financial institutions in the European Union had so far, through the deduction of capitalized intangible assets in the CET1 capital. Due to the amendment, financial institutions do not have to deduct capitalized software from the CET1 capital any longer. Therefore, capital ratios increase. Our findings show an average increase of the CET1 capital ratio and the T1 capital ratio by 0.31 and TC capital ratio by 0.30 percentage points. This implies an increase of the CET1 capital by 468 million Euros on average. In times of low interest rates, it is hard to compensate for such an increase by operating activities.

The paper has a limitation in the selection of the sample size and therefore in statistical evidence. In a future study, we plan to extend the sample size and provide a regression model and statistical tests. In the light of the recent amendments of the conceptual framework of the IFRS, the regulations for internally generated software should be reconsidered. Finally, further research in the field of definition and the valuation of

software – as a synonym for investments in digital technologies – is necessary, to improve the decision usefulness of financial and regulatory reporting in a digital world.

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