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Regulatory Capital Management: Fair Value Measurement and Regulatory Capital Ratios

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Abstract

The calculation of the regulatory capital ratios according to the Capital Requirements Regulation (CRR) is based on the IFRS consolidated financial statements. Therefore, banks are able to influence their regulatory capital ratios through discretionary powers when measuring with fair values according to IFRS 13. This paper analyzes the effects that discretionary fair value changes have on the regulatory capital ratios. Furthermore, the impact of the prudent valuation according to article 105 CRR on the regulatory capital ratios is examined. While the results depend on a multitude of factors and vary from case to case, there are situations in which the same fair value change of an identical financial asset can have opposing effects on certain regulatory capital ratios depending on bank specific factors like its regulatory capitalization or its tax rate. As a result, decreasing fair values can in some circumstances lead to higher regulatory capital ratios and thus, indicate a greater solvency. In order to identify possible conflicts of interest, the effects of fair value changes on the comprehensive income are also included in the analysis because the comprehensive income serves as an important target figure for banks in addition to the regulatory capital ratios.

Keywords: IFRS accounting, fair value, IFRS 13, regulatory capital ratios, regulatory capital management, Capital Requirements Regulation.

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I. Introduction

The Capital Requirements Regulation (CRR)[1] defines uniform minimum requirements for the capitalization of banks.[2] The calculation of the regulatory

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[1] Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012, OJ No L 176/1, 27.06.2013.

[2] In regard to the scope of the CRR, see *Dürselen* (2016), m. n. 4–6.

capital ratios is based on the IFRS consolidated financial statements.[3] Therefore, banks are able to influence their regulatory capital ratios by exercising accounting discretion.[4] This is why banks consider their regulatory capital ratios as important target figures when applying IFRS.[5] Fair value measurement according to IFRS 13 offers a particularly wide margin of discretion.[6] Because the exercise of such discretion only affects accounting numbers and not the underlying economic conditions, a resulting increase of the regulatory capital ratios does not represent a decrease of risk or an increase of capital from an economic perspective.[7] It is no surprise that the regulatory authorities are critical of such practices.[8] At the same time, it is unclear whether the regulatory authorities are able to identify regulatory capital management and the effects it has on regulatory numbers.[9]

In the light of the above, the following analysis examines in what cases the exercise of accounting discretion associated with fair values leads to an increase of regulatory capital ratios and in what cases it does not.[10] Although the results vary depending on the underlying assumptions, some important insights can be drawn from the analysis. The findings suggest for example that in certain scenarios, the same fair value change of two identical financial assets can have opposing effects on specific regulatory capital ratios for either two different banks

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[3] In regard to Germany, see § 10a para. 5 Kreditwesengesetz (The German Banking Act). Thus, the IFRS play an important role within the regulatory framework; see *Waschbusch/Rolle/Biewer* (2018), p. 108; *Flick/Neisen* (2015), p. 234; *Maier* (2012), p. 78; *Bushman/Landsman* (2010), pp. 267–268; *Bieg/Sopp* (2009), p. 487.

[4] See *Waschbusch/Rolle/Biewer* (2017), p. 219.

[5] See *Krauß* (2018a), pp. 58–59.

[6] Some consider fair values not suitable for regulatory purposes due to their limited reliability; see for example *Waschbusch/Rolle/Biewer* (2017), pp. 210–212; *Paetzmann* (2014), pp. 174–175; *Rapp* (2014), pp. 131–132; *Bieg/Bofinger/Küting/Kußmaul/Waschbusch/Weber* (2008), p. 2551; *Waschbusch/Krämer* (2005), pp. 438–440; *Meister/Hillen* (2004), pp. 343–344.

[7] See *Greenberg/Helland/Clancy/Dertouzos* (2013), pp. 30, 37; *Agarwal/Chomsisengphet/Liu/Rhee* (2007), p. 430.

[8] See *Krauß* (2018a), p. 61.

[9] See *Healy/Wahlen* (1999), p. 378. See also *Fields/Lys/Vincent* (2001), p. 288. In general, it is possible to revise regulatory capital management within the supervisory review and evaluation process by imposing additional capital requirements; see also *Becker/Voigt* (2018), p. 1271; *Flick/Thelen-Pischke* (2018), p. 428; *Becker* (2017), p. 632; *Novotny-Farkas* (2016), p. 208. In regard to the supervisory review and evaluation process, see *Schuster/Pitz* (2016), pp. 342–348; *Brixner/Schaber* (2016), pp. 28–30. *Beatty/Liao* (2014), p. 348, argue that regulatory authorities are not able to revise regulatory capital management.

[10] In the following, the term regulatory capital management shall describe the exercise of discretion in the IFRS when measuring with fair values in order to influence regulatory capital ratios unless specified otherwise.

or for the same bank at different points in time. Furthermore, there are circumstances in which the change of the regulatory capital ratios indicates a greater solvency although it was triggered by a fair value decrease, which seems to be somewhat counterintuitive regardless of whether the fair value decrease is a result of regulatory capital management or of an actual loss in value.[11]

Overall, it can be said that banks are able to manipulate their regulatory capital ratios through regulatory capital management concerning fair values. However, the effects differ from case to case and are difficult to predict. This is why banks need to carefully consider the many different factors that influence the outcome of regulatory capital management in order to achieve the desired results. Furthermore, it is necessary for the regulatory authorities to be able to assess the consequences of regulatory capital management in an appropriate way in order to estimate the solvency of banks accurately.[12] Thus, shedding some light on the link between fair value accounting and the calculation of regulatory capital ratios should be of interest not only to banks but also to the regulatory authorities. In addition, a deeper understanding of this matter can help external recipients of regulatory information, like analysts, investors, or the interested public, to interpret regulatory capital ratios and movements thereof.[13] Last but not least, understanding regulatory capital management and the effects it has on regulatory capital ratios is necessary for lawmakers in order to evaluate the advantages and disadvantages that are associated with the different ways of using fair value accounting numbers for regulatory purposes. Regulatory capital management usually affects the comprehensive income as well which serves as another important target figure for banks. In order to show possible conflicts of interest for banks in regard to the effects on the regulatory capital ratios and the comprehensive income that arise from regulatory capital management, the comprehensive income is also added to the analysis.

The regulatory capital ratios are calculated for banks in their entirety. Starting point of the analysis are the regulatory capital ratios before regulatory capital management consisting of own funds (common equity tier 1 capital, additional tier 1 capital, tier 2 capital) in the numerator and the total risk exposure amount in the denominator.[14] The regulatory capital ratios after regulatory capital management are then formed by considering the changes of own funds and of the

[11] See section VI.1. for a discussion of the main findings.

[12] See fn. 9 in regard to the potentially limited ability of regulatory authorities to detect regulatory capital management.

[13] The regulatory framework includes disclosure requirements that are supposed to expose banks to market forces and thus, discipline their risk seeking behavior; see prefix 76 CRR; *Bushman/Williams* (2012), pp. 4–5. In regard to market discipline in general, see *Bushman* (2016), p. 136.

[14] In regard to the regulatory capital ratios, see art. 92 para. 2 CRR.

total risk exposure amount that result from regulatory capital management concerning a single financial asset in the numerator and the denominator respectively.[15] Subsequently, the ratios are differentiated with respect to the financial asset's fair value and prudent value in order to identify the directions in which the different regulatory capital ratios change as a result of fair value changes and prudent value changes.[16] In this context, it is necessary to differentiate between financial assets that substantiate deferred tax assets on the one hand (section IV.) and financial assets that substantiate deferred tax liabilities on the other hand (section V.).[17] Based on some key assumptions that are laid out in section III., the changes of own funds and of the total risk exposure amount stemming from regulatory capital management are then presented separately for financial assets with deferred tax assets (sections IV.1. and IV.2.) and financial assets with deferred tax liabilities (section V.1.). Ultimately, the effects on the regulatory capital ratios as a whole are elaborated (sections IV.3. and V.2. respectively).

II. Review of Empirical Literature

There is a wide range of empirical studies on the exercise of accounting discretion in order to influence regulatory numbers. Most of these studies address the impairment accounting behavior of banks;[18] only a few of them deal with fair value measurement. The majority of these studies find evidence for the discretionary application of accounting rules by banks due to regulatory supervision.

Results presented by *Huizinga/Laeven* (2012) indicate that banks overstated the book values of real estate related assets during the last mortgage crisis in the US in order to satisfy regulatory requirements. Other findings suggest that during the same time window, Brazilian banks exercised discretion in the context of impairment accounting to a greater extent if their regulatory capitalization was low [*Schechtman/Takeda* (2018)]. *Dong/Liu/Hu* (2012) present similar results for Chinese banks. According to another study done by *Bischof/Brüggemann/Daske* (2019), banks made use of the new reclassification option that was implemented during the financial crisis for fair valued financial assets in order to prevent reg-

[15] See similarly *Ellul/Jotikasthira/Lundblad/Wang* (2015), p. 2495.

[16] This describes a (local) Taylor approximation of the first order; see *Albrecht/Maurer* (2016), pp. 778–779. The smaller the value change, the more precise is the approximation; see *Albrecht/Maurer* (2016), p. 779. In regard to (partial) differentiations, see *Bronstein/Semendjajew/Musiol/Mühlig* (2016), pp. 458–459. In regard to the prudent value determined in accordance with art. 105 CRR, see section III.

[17] See section III. in detail.

[18] For an overview of empirical literature concerning discretionary impairment accounting in general, see *Ozili/Outa* (2017).

ulatory intervention, which in turn caused significant positive market reactions.[19]

By analyzing data of the Japanese banking sector, *Shrieves/Dahl* (2003) find evidence that discretionary impairment accounting was used as a measure to satisfy regulatory requirements in the years from 1989 to 1996. Similarly, *Moyer* (1990) finds evidence for the US banking sector that banks with regulatory capital ratios that are close to the minimum requirements exercise impairment accounting discretion to ease regulatory pressure. Comparable results suggest that low capitalized banks apply impairment accounting rules deliberately in order to show higher regulatory capital [*Ahmed/Takeda/Thomas* (1999) and *Kim/Kross* (1998)]. Along the same lines, the findings presented by *Beatty/Chamberlain/Magliolo* (1995) and *Barth/Gomez-Biscarri/López-Espinosa* (2017) point to the exercise of impairment accounting discretion for influencing regulatory capital ratios. *Chen/Daley* (1996) show similar results for Canadian and *Anandarajan/Hasan/McCarthy* (2017) for Australian banks. For banks in Bahrein, Jordan and Qatar, findings suggest that impairment accounting discretion is exercised in order to satisfy regulatory capital requirements especially in years in which banks are reporting losses [*El Nahass/Izzeldin/Steele* (2018)]. For the Nigerian banking sector, results show on the one hand that banks are inclined to use discretionary power concerning impairment accounting to influence regulatory capital and on the other hand that the incentive to do so became stronger after the introduction of the Basel regulatory framework [*Ozili* (2015)].

Bierey/Schmidt (2017) analyzed the impairment accounting behavior of European banks in regard to devalued Greek government bonds during the year of 2011. They conclude that banks with high investments in Greek government bonds delayed impairments. It is suggested that by doing so, regulatory authorities were enabled to practice forbearance until state aid was provided. Another study by *Bouvatier/Lepetit/Strobel* (2014) suggests that a strict regulatory environment can counteract the exercise of impairment accounting discretion. *Fonseca/González* (2008) also conclude that the regulatory environment is a relevant factor for impairment accounting behavior after having analyzed banks from 40 countries.

Contrary to the above results, *Bishop* (2015) cannot find evidence for regulatory capital management through impairment accounting for American banks. The same applies to the Spanish banking sector according to *Pérez/Salas-Fumás/Saurina* (2008). Likewise, neither *Adzis/Anuar/Hishamuddin* (2015) nor *Chang/Sheng/Fang* (2008) can find such evidence for banks from Malaysia or Taiwan respectively. Further findings indicate no discretionary impairment accounting by banks from the Middle East and North Africa due to the regulatory framework [*Olson/Zoubi* (2014)].

[19] Also see *Laux* (2012), p. 248.

Studies done by *Mohrmann/Riepe* (2019) and *Yao/Percy/Stewart/Hu* (2018) suggest that banks with low regulatory capital exercise discretion when measuring level 3 assets with fair values.[20] *Nissim* (2003) finds evidence that banks overstate fair values that are disclosed in the notes by a greater margin if they are low on regulatory capital. *Barth/Beaver/Landsman* (1996) detect a lower value-relevance of disclosed fair values for banks with lower regulatory capital, which indicates that market participants anticipate the exercise of fair value increasing discretion in times of low regulatory capital.[21] The results presented by *Kolev* (2019), *Goh/Li/Ng/Ow Yong* (2015), and *Song/Thomas/Yi* (2010) suggest a lower fair value-relevance of level 3 assets in general.[22]

Despite the large number of empirical studies concerning the discretionary application of accounting rules as a result of regulatory capital requirements, the specific way accounting numbers and especially fair values are processed within the regulatory framework for the calculation of the regulatory capital ratios has to my knowledge not yet been described comprehensively on the basis of a formal model. This may be due to the fact that the calculation of the regulatory capital ratios is very complex and differs from case to case. This paper deals with that issue by making different assumptions regarding the underlying assets and the relevant banks. This also allows for an analysis on an instrument specific level. However, the amount of assumptions and the assumptions themselves are chosen in such a way that the results are still of a certain general relevance.[23]

III. Key Assumptions

The considered financial asset is measured in line with IFRS 9 with fair value either through profit or loss or through other comprehensive income.[24] Interim or year-end profits that have not yet been approved by the annual general meeting of shareholders must not be added to common equity tier 1 capital, whereas interim losses must be subtracted.[25] As a result, situations may occur

[20] Furthermore, *Mohrmann/Riepe* (2019) find a positive correlation between the percentage of level 3 assets and the probability of default concerning banks as a whole. See already *Bushman/Landsman* (2010), S. 270.

[21] *Kolev* (2019) finds similar results for banks that disclose lower equity capital.

[22] Also see *Laux* (2012), pp. 246–247.

[23] Also see the discussion in section VI.2.

[24] See IFRS 9.4.1.2; IFRS 9.4.1.2A.

[25] See art. 26 para. 2, art. 36 para. 1 lit. a) CRR. See also art. 13 Commission delegated Regulation (EU) No 241/2014. Furthermore, see *Konesny/Glaser* (2016a), m. n. 10; *EBA* (2013), Single Rulebook Q&A, 2013_208. The term profit (loss) describes a positive (negative) comprehensive income; see *Brixner/Schaber* (2016), p. 181; *Schmiedel/Hois* (2014), pp. 71–72; art. 13 para. 4 Commission delegated Regulation (EU) No. 241/2014.

over the year where fair value changes of financial assets are not considered in common equity tier 1 capital although they are taken into account when calculating the total risk exposure amount.[26] In order to circumvent the recognition imparity of fair value changes in the common equity tier 1 capital and the total risk exposure amount within the year, it is assumed that the comprehensive income is always recognized in common equity tier 1 capital. This implies that banks are either showing a loss or have an explicit permission from the competent authorities to recognize interim profits in their common equity tier 1 capital.[27]

It is necessary to differentiate between financial assets that substantiate deferred tax assets and financial assets that substantiate deferred tax liabilities because only deferred tax assets are subject to a special regulatory treatment in form of the dual threshold procedure according to art. 48 CRR.[28] The amount of deferred tax assets that exceeds 10 % of common equity tier 1 capital is deducted from common equity tier 1 capital;[29] the same applies to significant investments.[30] Thereafter, the sum of deferred tax assets and significant investments that are not deducted from common equity tier 1 capital is compared to a threshold of 17.65 % of common equity tier 1 capital.[31] The amount of the sum that exceeds the threshold is deducted from common equity tier 1 capital, whereas the remaining amount is charged with a risk weight of 250 %.[32] It is assumed that the deferred tax assets are exceeding the 10 % or 17.65 % threshold so that – adding the assumption that regulatory capital management does not affect the tax accounting values of the financial assets – fair value changes of financial assets that substantiate deferred tax assets also result in a change of the deduction amount from common equity tier 1 capital. In contrast, deferred tax

[26] Therefore, the calculation of the total risk exposure amount is considered to be dynamic, whereas the recognition of profits in common equity tier 1 capital is of static nature. See also *Konesny/Glaser* (2016a), m. n. 2.

[27] See art. 26 para. 2 CRR. See also *Konesny/Glaser* (2016a), m. n. 10; *EBA* (2013), Single Rulebook Q&A, 2013_208. In regard to the different recognition scenarios, see *EBA* (2018), Single Rulebook Q&A, 2017_3330; *BaFin* (2016), Kreditrisiko – Berücksichtigung unterjährig erfasster Risikovorsorge als Kreditrisikoanpassungen, 52-16/001.

[28] See art. 36 para. 1 lit. c) and art. 48 CRR. In regard to the procedure, see *Konesny/Glaser* (2016b), m. n. 1-8; *Andrae/Krösl* (2016), pp. 520–522; *Brixner/Schaber* (2016), pp. 212–215.

[29] See *Konesny/Glaser* (2016b), m. n. 3. The threshold is calculated according to art. 48 para. 1 lit. a) CRR.

[30] In regard to significant investments, see art. 43 CRR; art. 15g Commission delegated Regulation (EU) No 241/2014. In their case, the threshold is calculated according to art. 48 para. 1 lit. b) CRR.

[31] See art. 48 para. 2 CRR. The threshold is now calculated according to art. 48 para. 2 lit. a) CRR.

[32] See art. 48 para. 3–4 CRR.

liabilities of financial assets which are also supposed to have constant tax accounting values do not undergo a special regulatory treatment.[33]

Another modification of common equity tier 1 capital stems from the prudent valuation according to art. 105 CRR.[34] The additional value adjustments equal the difference between the fair value measured according to IFRS 13 and the prudent value of a financial asset and are deducted from common equity tier 1 capital. The prudent value should be influenced by the method that is used to measure the fair value.[35] Fair values that are measured on a higher level of the IFRS 13 hierarchy and thus, provide more reliable measures should entail higher prudent values.[36] For example, using a valuation model should lead to higher model risk and a lower prudent value compared to using prices from active markets,[37] whereas the method of fair value measurement alone does not provide information about the fair value itself. Furthermore, there can be fair value changes that do not affect the prudent value at all. For example, banks are able to choose to a certain extent the different values within a bid-ask-spread when measuring fair values, while the prudent valuation requires a value from the prudent side of the spread.[38] Against this background, it can be argued that the prudent value is also subject to regulatory capital management if banks apply consistent valuation approaches within the accounting framework and the regulatory framework.[39] For the above reasons, it is assumed that the fair value and the prudent value are independent from each other having no functional interrelationship.[40] This also allows for an isolation of the effects that occur as a result of fair value changes on the one hand and prudent value changes on the other hand.

Banks have to recognize an impairment amount for financial assets that are measured with fair value through other comprehensive income.[41] It should be noted that fair (prudent) value measurement and the calculation of the impairment amounts have different requirements. Fair values and prudent values are

[33] Netting of deferred tax assets and deferred tax liabilities according to art. 38 para. 3 CRR is not considered.

[34] In regard to the prudent valuation, see *Sopp* (2016), pp. 1230–1236.

[35] See also for the next sentence *Krauß* (2018c), p. 1318.

[36] This is why higher prudent values should imply smaller margins of discretion for fair value measurement all other things being equal; see *Krauß* (2018c), p. 1318.

[37] In regard to model risk in the context of the prudent valuation, see art. 11 Commission delegated Regulation (EU) 2016/101. See also *Sopp* (2016), p. 1235.

[38] See IFRS 13.70-71 and art. 105 para. 5 CRR.

[39] Apart from that, banks may also exercise discretion solely in the regulatory framework when determining prudent values, which should be independent from fair value measurement according to IFRS 13; see also *Brück/Christ/Wächter* (2016), pp. 29, 31.

[40] For a discussion of this assumption, see section VI.2.

[41] See IFRS 9.5.5.1.

measured from a market perspective, whereas the calculation of impairment amounts is mostly based on data provided by the internal risk management.[42] As a result, fair value and prudent value changes of a financial asset should not necessarily have an immediate effect on the impairment amount of that financial asset. Because the analysis focuses on artificially produced fair value and prudent value changes, the impairment amount is considered to be constant.[43]

In regard to the total risk exposure amount, only credit risk and operational risk show explicit references to accounting numbers. Credit risk usually accounts for the largest portion of the total risk exposure amount and is calculated for positions of the banking book.[44] Acknowledging this fact, the following analysis only addresses the banking book. Positions are assigned to the banking book if they do not fall into the trading book. The trading book consists of all financial instruments and commodities that are held by banks with trading intent or in order to hedge positions with trading intent.[45] Financial assets that are measured with fair value through other comprehensive income are held within a business model whose objective is achieved by collecting contractual cash flows and by selling the financial assets.[46] Therefore, it should be possible to assign these financial assets to the banking book.[47] In contrast, financial assets that are measured with fair value through profit or loss because they are held for trading according to IFRS 9 should fall into the trading book.[48] At the same time, it is conceivable that financial assets that are measured with fair value through profit or loss due to the fair value option may belong to the banking book because in this case, trading intent is not a necessary prerequisite. Furthermore, there are differences in the accounting and regulatory reclassification requirements.[49] In the end, financial assets measured with fair value through profit or loss as well as through other comprehensive income may be part of the banking book, although financial assets measured with fair value through other comprehensive income should account for the majority of fair valued positions

[42] See also in regard to the following sentence *Krauß* (2018b), p. 386.

[43] For a discussion of this assumption, see section VI.2. as well.

[44] In regard to credit risk in the banking book, see art. 92 para. 3 lit. a) CRR. Also see *Hartmann-Wendels/Pfingsten/Weber* (2019), p. 359. In regard to the significance of credit risk, see *Buchmüller/Engelbach/Elbracht/Beekmann/Puppe* (2018), m. n. 136; *Waschbusch/Rolle/Biewer* (2017), p. 214; *Cech* (2017), p. 49.

[45] See art. 4 para. 1 subpara. 86 CRR. In regard to trading intent, see art. 4 para. 1 subpara. 85 CRR.

[46] See IFRS 9.4.1.2A lit. (a).

[47] The liquidity reserves of banks are usually measured with fair value through other comprehensive income and are assigned to the banking book; see IFRS 9.4.1.4C Example 6; *Vorbrink/Bakiev/Kessler* (2014), p. 7.

[48] See similarly IFRS 9.B4.1.5; *Thelen-Pischke* (2006), p. 141.

[49] See *Hartmann-Wendels/Pfingsten/Weber* (2019), p. 359.

in the banking book. The impairment amounts recognized for financial assets measured with fair value through other comprehensive income are considered as specific credit risk adjustments.[50]

The banking book is also subject to the calculation of operational risk. The basic indicator that is used in the context of the basic indicator approach and the standardized approach refers to accounting numbers concerning the profit or loss statement,[51] an explicit reference to the IFRS is missing though. German banks that publish their comprehensive income statement in accordance with the FINREP framework can fall back to the recommendations of the expert committee for operational risk.[52] The committee considers fair value changes as part of the basic indicator only if the underlying financial assets are held for trading.[53] Although the term held for trading in the FINREP framework refers to IFRS 9,[54] financial assets that are held for trading should also be part of the regulatory trading book.[55] In reverse, this means that fair value changes of financial assets in the banking book do not have any effect on the basic indicator and on operational risk. Consequently, operational risk is not considered due to the focus on the banking book. Additionally, because most derivatives are held in the trading book, the following analysis is limited to non-derivative financial assets that are not part of an accounting hedging relationship. It should also be noted that a possible application of the transitional arrangements for mitigating the impact of the introduction of IFRS 9 according to Regulation (EU) 2017/2395 is not considered.[56]

[50] See also section IV.2.b).

[51] In regard to the different approaches, see art. 315–320 CRR. The accounting references are orientated towards the Council Directive 86/635/EEC; see. art. 316 para. 1 CRR.

[52] In regard to the regulatory reporting format FINREP (Financial Reporting), see for example *Rudorfer/Egger* (2017), pp. 16–17, 20–21; *Gültekin/Krakuhn/Loch* (2013), pp. 109–115.

[53] See *Fachgremium operationelles Risiko* (2007), p. 5.

[54] See *EBA* (2016a), p. 42.

[55] See fn. 48.

[56] For example, Banks in Germany do not apply the transitional arrangements for mitigating the impact of the introduction of IFRS 9; see *Deutsche Bundesbank* (2019), p. 96.

IV. Financial Assets with Deferred Tax Assets

1. Comprehensive Income and Prudent Valuation According to Art. 105 CRR

Subject to the following analysis is a financial asset that is measured with fair value and substantiates deferred tax assets.[57] On the one hand, an increase (decrease) of the fair value results in an equal increase (decrease) of the comprehensive income. On the other hand, it also leads to a comparably smaller negative (positive) change of the comprehensive income due to the deferred tax impact.[58] The comprehensive income after regulatory capital management (I^a) can be shown as follows:

$$\begin{aligned} I^a\left(FV_i^{new}\right) &= I^b + \left(FV_i^{new} - FV_i^{old}\right) - s \cdot \left(FV_i^{new} - FV_i^{old}\right) \\ &= I^b + \left(FV_i^{new} - FV_i^{old}\right) \cdot (1 - s) \end{aligned} \tag{1}$$

FV_i^{new} represents the fair value that is a product of regulatory capital management and FV_i^{old} the corresponding initial fair value without regulatory capital management of the financial asset i respectively. FV_i^{old}, I^b (the comprehensive income before regulatory capital management) and s are assumed to be constants, whereas FV_i^{new} constitutes a variable that can be changed to a certain extent by banks' accounting practices. Because the relevant tax rate is lower than one, an increase of the fair value always results in an increase of the comprehensive income and vice versa.

Due to the fact that the comprehensive income counts as common equity tier 1 capital, the following change of common equity tier 1 capital ($\Delta\, T1_{income}$) arises:

$$\Delta\, T1_{income}\left(FV_i^{new}\right) = FV_i^{new} - FV_i^{old} \tag{2}$$

Compared to (1), the deferred tax effect is not existent anymore because it is equalized by a negative change of the deduction amount that results from the dual threshold procedure for deferred tax assets.[59]

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[57] In regard to financial assets that substantiate deferred tax liabilities, see section V. It is assumed that after the fair value change, the IFRS accounting value is still lower than the tax value. The following holds true for the relevant tax rate: $0 < s < 1$.

[58] Also see *Glaschke* (2006), p. 74.

[59] See section III. in detail.

Apart from that, another modification of common equity tier 1 capital in form of the prudent valuation according to art. 105 CRR needs to be considered. This leads to the following change in common equity tier 1 capital ($\Delta T1_{prud.}$):

$$\Delta T1_{prud.}\left(FV_i^{new}, FV_{prud.,i}^{new}\right) = -\left[\left(FV_i^{new} - FV_{prud.,i}^{new}\right) - \left(FV_i^{old} - FV_{prud.,i}^{old}\right)\right] \tag{3}$$

The prudent value needs to be differentiated in regards to the exercise of regulatory capital management analogously to the fair value.[60] Accordingly, $FV_{prud.,i}^{new}$ constitutes a variable that can be changed to a certain extent by banks, whereas $FV_{prud.,i}^{old}$ is regarded as a given reference value. The left term within the square brackets describes the additional value adjustments that arise from the new fair value and the new prudent value. From these, the original additional value adjustments are subtracted.

The total change of common equity tier 1 capital $\Delta T1_{tot.}$ results from the sum of (2) and (3):

$$\begin{aligned}&\Delta T1_{tot.}\left(FV_{prud.,i}^{new}\right)\\ &= \left(FV_i^{new} - FV_i^{old}\right) - \left[\left(FV_i^{new} - FV_{prud.,i}^{new}\right) - \left(FV_i^{old} - FV_{prud.,i}^{old}\right)\right] = FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\end{aligned} \tag{4}$$

Only the change of the prudent value has an effect on common equity tier 1 capital because in the assumed situation, the deferred tax impact is leveled by the dual threshold procedure. As the standardized approach (STA) for measuring credit risk does not incorporate any other modifications of common equity tier 1 capital, (4) already shows the complete change for that approach.[61] In this case, maximizing the prudent value also leads to a maximization of common equity tier 1 capital, whereas changing the fair value alone in order to influence common equity tier 1 capital is of no effect.[62]

[60] Also see section III. in detail.

[61] In the context of the internal ratings based approach (IRBA), additional modifications of common equity tier 1 capital may become necessary based on the comparison of regulatory expected credit losses with credit risk adjustments and other additional value adjustments in accordance with art. 159 CRR; see section IV.2.b) in detail.

[62] In regard to the regulatory capital ratios, see section IV.3.a).

2. Credit Risk

a) Standardized Approach

The denominator of the regulatory capital ratios equates to the total risk exposure amount which includes credit risk. With the standardized approach, the credit risk exposure amount of a financial asset is calculated by multiplying its exposure value with an appropriate risk weight.[63] The exposure value of an on-balance sheet position is the remaining gross accounting value – in this case, the fair value – after it has been corrected for specific credit risk adjustments and additional value adjustments of the prudent valuation.[64] Because the fair value already reflects specific credit risk adjustments, the exposure value is calculated by reducing the accounting value only by additional value adjustments of the prudent valuation.[65] As a result, the exposure value is defined by the prudent value. Based thereupon, the credit risk exposure amount of a financial asset (CR_i^{STA}) can be calculated in the STA as follows:

$$(5) \quad CR_i^{STA}\left(FV_{prud.,i}^{new}\right) = \left[FV_i^{new} - \left(FV_i^{new} - FV_{prud.,i}^{new}\right)\right] \cdot RW_i^{STA} = FV_{prud.,i}^{new} \cdot RW_i^{STA}$$

Besides the risk weight (RW_i^{STA}), the prudent value after regulatory capital management is the only factor that the credit risk exposure amount depends on. The risk weight is determined by different characteristics of the underlying financial asset and is assumed to be constant.[66] In order to obtain the change of the credit risk exposure amount as a result of regulatory capital management (CR_i^{STA}), the credit risk exposure amount before regulatory capital management is deducted from (5):

$$(6) \quad \Delta\, CR_i^{STA}\left(FV_{prud.,i}^{new}\right) = \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right) \cdot RW_i^{STA}$$

The prudent value is the only factor that can be influenced by banks to a certain extent. A lower prudent value results in a reduction of credit risk, while at the same time, it also leads to a reduction of common equity tier 1 capital according to (4).[67]

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[63] See art. 113 para. 2 CRR. In regard to the calculation on an instrument level, see *Cech* (2017), p. 50; *Albrecht/Huggenberger* (2015), pp. 362–363. Also see *Hartmann-Wendels/Pfingsten/Weber* (2019), p. 553. Financial collateral shall not be considered.

[64] See art. 111 para. 1 and art. 34 CRR. See also *Luz* (2015), m. n. 14–15.

[65] See *Krauß* (2018b), p. 385.

[66] In regard to determining risk weights in the STA, see art. 114–141 CRR.

[67] In regard to the regulatory capital ratios, see section IV.3.a).

b) Internal Ratings Based Approach

In the IRBA, the risk weight (RW_i^{IRBA}) is calculated from the probability of default and the loss given default.[68] The exposure value for on-balance sheet positions is defined by the gross accounting value before the reduction of specific credit risk adjustments and additional value adjustments. Because financial assets that are measured with fair value through profit or loss do not substantiate specific credit risk adjustments, the exposure value equals the accounting value which is the fair value.[69] For financial assets that are measured with fair value through other comprehensive income on the other hand, specific credit risk adjustments are relevant in form of recognized impairment amounts which equate to expected credit losses calculated in accordance with IFRS 9 (EL_i). It follows that by adding the impairment amount on top of the fair value, an exposure value before any specific credit risk adjustments is attained.[70] As a conclusion, the credit risk exposure amount of a financial asset (CR_i^{IRBA}) can be described by using the Kronecker symbol δ_{FVOCI} which assumes values of zero and one for financial assets that are measured with fair value through profit or loss and other comprehensive income respectively:[71]

$$CR_i^{IRBA}\left(FV_i^{new}\right) = \left(FV_i^{new} + EL_i \cdot \delta_{FVOCI}\right) \cdot RW_i^{IRBA} \tag{7}$$

The change of credit risk as a result of regulatory capital management ($\Delta\, CR_i^{IRBA}$) for a financial asset i can then be described by the following term:

$$\begin{aligned} &\Delta\, CR_i^{IRBA}\left(FV_i^{new}\right) \\ &= \left(FV_i^{new} + EL_i \cdot \delta_{FVOCI}\right) \cdot RW_i^{IRBA} - \left(FV_i^{old} + EL_i \cdot \delta_{FVOCI}\right) \cdot RW_i^{IRBA} \\ &= \left(FV_i^{new} - FV_i^{old}\right) \cdot RW_i^{IRBA} \end{aligned} \tag{8}$$

Because specific credit risk adjustments are assumed to be constant, it is irrelevant for the change of credit risk whether fair value changes are presented in profit or loss or in other comprehensive income.

Art. 159 CRR describes a comparison of regulatory expected credit losses with the reductions of own funds that already consider credit losses. In this context, the regulatory expected credit losses are deducted from specific credit risk

[68] See for example art. 153 CRR.

[69] Also in regard to the following sentence, see *Krauß* (2018b), p. 386.

[70] Due to a regulatory gap, it can also be argued that all fair valued financial assets do not substantiate specific credit risk adjustments; see *Krauß* (2018b), p. 386.

[71] In regard to the Kronecker symbol, see *Maurer* (1981), p. 123.

adjustment and additional value adjustments of the prudent valuation.[72] The regulatory expected credit losses of a financial asset are the product of the probability of default, the loss given default and the exposure value of the financial asset in question.[73] The probability of default (PD_i^1) and the loss given default (LGD_i^1) are the same that are used for calculating its risk weight.[74] The probability of default amounts to a minimum of 0.03 %; for the loss given default, the following holds true: $LGD_i^1 \in [0;1]$.[75] The amount that results from the described comparison (COM_i) is the following:

$$\begin{aligned} & COM_i\left(FV_i^{new}, FV_{prud.,i}^{new}\right) \\ & = EL_i \cdot \delta_{FVOCI} + \left(FV_i^{new} - FV_{prud.,i}^{new}\right) - \left[\left(FV_i^{new} + EL_i \cdot \delta_{FVOCI}\right) \cdot PD_i^1 \cdot LGD_i^1\right] \end{aligned} \tag{9}$$

In contrast to financial assets that are measured with fair value through profit or loss for which the exposure value equals the fair value, the exposure value for financial assets that are measured with fair value through other comprehensive income is defined by the term $\left(FV_i^{new} + EL_i\right)$. In return, specific credit risk adjustments amounting to EL_i are considered within the comparison with a positive sign.

Regulatory capital management concerning the fair value and the prudent value also changes the comparison amount ($\Delta\, COM_i$). This change is given by the difference of the comparison amount once after and once before regulatory capital management:

---

[72] The general idea of recognizing the additional value adjustments of the prudent valuation as part of the comparison is to avoid a double hit to own funds that would occur if additional value adjustments reduce own funds but also substantiate credit risk; see also *EBA* (2014a), Single Rulebook Q&A, 2014_933. Against this argumentation however, *EBA* (2019), Single Rulebook Q&A, 2017_3426, states that only additional value adjustments of the prudent valuation that are calculated for derivative positions according to art. 12 Commission delegated Regulation (EU) 2016/101 shall be considered as part of the comparison. As a result, a fair value increase would not only raise credit risk [see (8)] but also decrease own funds via an allocation of the comparison amount [the term $\left(FV_i^{new} - FV_{prud.,i}^{new}\right)$ would be dropped in (9)], which would always lead to decreasing regulatory capital ratios assuming a constant prudent value. See section VI.1. in regard to the counterintuitive effect of decreasing regulatory capital ratios as a result of higher fair values. For the purpose of this analysis, it is assumed that all additional value adjustments are considered as part of the comparison; also see *EBA* (2014a), Single Rulebook Q&A, 2014_933, and *EBA* (2014b), Single Rulebook Q&A, 2014_950.

[73] See art. 158 para. 5 CRR.

[74] See art. 158 para. 1 CRR.

[75] See art. 160 para. 1 CRR; art. 163 para. 1 CRR. The maximum probability of default is one.

$$
\begin{aligned}
&\Delta\, COM_i\left(FV_i^{new}, FV_{prud.,i}^{new}\right)\\
&=\begin{bmatrix} EL_i \cdot \delta_{FVOCI} + \left(FV_i^{new} - FV_{prud.,i}^{new}\right)\\ -\left(\left(FV_i^{new} + EL_i \cdot \delta_{FVOCI}\right) \cdot PD_i^1 \cdot LGD_i^1\right)\end{bmatrix}\\
&-\begin{bmatrix} EL_i \cdot \delta_{FVOCI} + \left(FV_i^{old} - FV_{prud.,i}^{old}\right)\\ -\left(\left(FV_i^{old} + EL_i \cdot \delta_{FVOCI}\right) \cdot PD_i^1 \cdot LGD_i^1\right)\end{bmatrix} \qquad (10)\\
&=\left(FV_i^{new} - FV_{prud.,i}^{new}\right) - \left(FV_i^{old} - FV_{prud.,i}^{old}\right) - \left(FV_i^{new} - FV_i^{old}\right) \cdot PD_i^1 \cdot LGD_i^1\\
&=\left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)
\end{aligned}
$$

It shows that the change in the comparison amount is the same for all fair valued financial assets.

If on a cumulative level, banks show a surplus (deficit) from the comparison, that amount is allocated to tier 2 capital (common equity tier 1 capital).[76] Assuming a surplus which corresponds to an allocation to tier 2 capital, the change of common equity tier 1 capital can be derived directly from (4) and the change of tier 2 capital from (10). If banks show a deficit on the other hand, the change of common equity tier 1 capital ($\Delta\, T1_{tot.}^{IRBA}$) is determined by the sum of (4) and (10) while tier 2 capital remains unchanged:

$$
\begin{aligned}
&\Delta\, T1_{tot.}^{IRBA}\left(FV_i^{new}\right)\\
&= FV_{prud.,i}^{new} - FV_{prud.,i}^{old} + \left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right) \qquad (11)\\
&=\left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right)
\end{aligned}
$$

The CRR does not constitute any changes of additional tier 1 capital that are based on regulatory capital management. The same applies to tier 2 capital unless there is a surplus allocation when applying the IRBA.[77] Table 1 summarizes the changes of own funds and of credit risk as a result of regulatory capital management concerning the fair value and the prudent value. The table differentiates between the STA and the IRBA. In regard to the IRBA, there is another dis-

[76] See art. 36 para. 1 lit. d) and art. 62 lit. d) CRR. It is assumed that the threshold for tier 2 capital recognition of 0.6 % of the credit risk amount is not exceeded. Furthermore, regulatory capital management shall not change the allocation of the comparison amount to common equity tier 1 capital or tier 2 capital. In regard to the different treatments of defaulted and non-defaulted positions within the comparison, see *EBA* (2016b), pp. 16–17.

[77] However, changes of additional tier 1 capital and tier 2 capital can for example occur as a result of capital measures.

tinction between an allocation of the comparison amount to common equity tier 1 capital and tier 2 capital.

Table 1

Changes of Own Funds and of Credit Risk as a Result of Regulatory Capital Management for Financial Assets with Deferred Tax Assets

Changes of own funds and of credit risk	STA	IRBA	
		Allocation to common equity tier 1 capital	Allocation to tier 2 capital
Common equity tier 1 capital	$FV^{new}_{prud.,i} - FV^{old}_{prud.,i}$	$\left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right)$	$FV^{new}_{prud.,i} - FV^{old}_{prud.,i}$
Additional tier 1 capital	0		
Tier 2 capital	0		$\left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV^{new}_{prud.,i} - FV^{old}_{prud.,i}\right)$
Credit risk exposure amount	$\left(FV^{new}_{prud.,i} - FV^{old}_{prud.,i}\right) \cdot RW_i^{STA}$	$\left(FV_i^{new} - FV_i^{old}\right) \cdot RW_i^{IRBA}$	

3. Regulatory Capital Ratios

a) Standardized Approach

The regulatory capital ratios that exist before regulatory capital management are the starting point of the analysis. They consist of own funds in form of common equity tier 1 capital, additional tier 1 capital or tier 2 capital ($T1^b$, $AT1^b$, $T2^b$), and the total risk exposure amount (TR^b).[78] The common equity tier 1

[78] It is assumed that the different variables $T1^b$, $AT1^b$, $T2^b$, and TR^b are always positive. Furthermore, the total risk exposure amount (TR^b) shall always exceed own funds ($T1^b + AT1^b + T2^b$). As a result the regulatory capital ratios before regulatory capital management assume values in an open interval of $]0;1[$. The total risk exposure amount exceeds own funds in such a way that after considering the changes of own funds and of the total risk exposure amount shown in table 1 in the nominator and the denominator respec-

capital ratio after regulatory capital management ($T1\text{-}r^a$) can be derived on the basis of table 1 as follows:

$$T1-r^a\left(FV^{new}_{prud.,i}\right)=\frac{T1^b+FV^{new}_{prud.,i}-FV^{old}_{prud.,i}}{TR^b+\left(FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)\cdot RW^{STA}_i} \tag{12}$$

The fair value has no immediate impact on the common equity tier 1 capital ratio. In contrast, an increase (decrease) of the prudent value results in a higher (lower) common equity tier 1 capital ratio if banks have a common equity tier 1 capital ratio before regulatory capital management that is lower than 66.66 % which is a condition that should apply in reality.[79] The additional tier 1 capital ratio and the tier 2 capital ratio ($AT1-r^a$, $T2-r^a$) are also not affected by the fair value; an increase of the prudent value however results in a reduction of the additional tier 1 capital ratio and the tier 2 capital ratio.[80] This means that banks can change the fair value in order to influence other target figures without creating conflicts of objectives. Table 2 shows the directions in which the regulatory capital ratios and the comprehensive income change as a result of regulatory capital management that increases or decreases the fair value and the prudent value.

Table 2

Directions of Change in the STA for Financial Assets with Deferred Tax Assets

Regulatory capital management		Directions of change		
		$T1-r^a$	$AT1-r^a$ and $T2-r^a$	I^a
FV^{new}_i	↑	–		↑
	↓			↓
$FV^{new}_{prud.,i}$	↑	↑	↓	–
	↓	↓	↑	

tively, the regulatory capital ratios after regulatory capital management remain in an open interval of]0;1[. Also see the respective appendixes.

[79] The derivative of (12) with respect to $FV^{new}_{prud.,i}$ is positive for common equity tier 1 capital ratios before regulatory capital management below 66.66 %; see appendix 1.

[80] See table 1.

b) Internal Ratings Based Approach with the Allocation of the Comparison Amount to Common Equity Tier 1 Capital

When allocating the comparison amount in the IRBA to common equity tier 1 capital, the following common equity tier 1 capital ratio can be derived:[81]

$$T1 - r^a\left(FV_i^{new}\right) = \frac{T1^b + \left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1\right)}{TR^b + \left(FV_i^{new} - FV_i^{old}\right) \cdot RW_i^{IRBA}} \tag{13}$$

The derivative of (13) with respect to FV_i^{new} is positive only if the following condition is satisfied:[82]

$$\frac{1 - PD_i^1 \cdot LGD_i^1}{RW_i^{IRBA}} > \frac{T1^b}{TR^b} \tag{14}$$

Assuming the underlying exposure is to corporates, institutions, central governments, or central banks, the risk weight can be substituted by the formula given in art. 153 para. 1 lit. iii) CRR. Inequality (14) can then be written as follows:[83]

$$\frac{1 - PD_i^1 \cdot LGD_i^1}{\left[N\left(\frac{1}{\sqrt{1 - R_i\left(PD_i^1\right)}} \cdot G\left(PD_i^1\right) + \sqrt{\frac{R_i\left(PD_i^1\right)}{1 - R_i\left(PD_i^1\right)}} \cdot G(0.999)\right) - PD_i^1\right]} > \frac{T1^b}{TR^b} \cdot LGD_i^1 \cdot \frac{1 + \left(M_i - 2.5\right) \cdot b_i\left(PD_i^1\right)}{1 - 1.5 \cdot b_i\left(PD_i^1\right)} \cdot 12.5 \cdot 1.06 \tag{15}$$

The right side of the inequality shows the common equity tier 1 capital ratio before regulatory capital management which refers to banks as a whole. The left side on the other hand refers to the characteristics of an individual financial asset. It is determined by a PD_i^1-LGD_i^1-M_i-tuple that is specific to every financial asset.[84] If inequality (15) is (not) satisfied, an increase of the fair value results in an increase (decrease) of the common equity tier 1 ratio.

Every financial asset has a specific PD_i^1-LGD_i^1-M_i-tuple that is stipulated directly by regulatory requirements and/or is gained by internal modelling.[85] The

[81] See table 1.

[82] See appendix 2.

[83] In regard to the different functions and variables, see art. 153 para. 1 lit. iii) CRR.

[84] M_i describes the effective maturity; see also fn. 86.

[85] In the following, it is assumed that the probability of default and the loss given default are modelled internally in an advanced IRBA.

tuple defines whether the change of the fair value results in an increase or decrease of the common equity tier 1 capital ratio. Accordingly, all financial assets can be assigned to one of two groups with the help of their respective PD_i^1-LGD_i^1-M_i-tuple. For financial assets in the first group (group 1a), an increase of the fair value results also in an increase of the common equity tier 1 capital ratio, whereas in the second group (group 2a), the fair value increase results in a decrease of the common equity tier 1 capital ratio. The common equity tier 1 capital ratio before regulatory capital management serves as a separating criterion to differentiate the groups according to (15). Choosing financial assets for regulatory capital management from the right group is essential to achieve the desired impact on the common equity tier 1 capital ratio. If banks want to for example increase their comprehensive income, they should use financial assets of group 1a so that an increase of the fair value serves two purposes simultaneously. In the case of a desired decrease of the comprehensive income, banks should favor financial assets of group 2a as lowering the fair value leads to an increase of the common equity tier 1 capital ratio.

The left side of inequality (15) can be regarded as a function in dependence of PD_i^1 und LGD_i^1:[86]

$$
\begin{aligned}
& f_1\left(PD_i^1, LGD_i^1\right) \\
& = \frac{1 - PD_i^1 \cdot LGD_i^1}{\left[N\left(\frac{1}{\sqrt{1 - R_i\left(PD_i^1\right)}} \cdot G\left(PD_i^1\right) + \sqrt{\frac{R_i\left(PD_i^1\right)}{1 - R_i\left(PD_i^1\right)}} \cdot G(0.999)\right) - PD_i^1\right]} \\
& \cdot LGD_i^1 \cdot \frac{1}{1 - 1.5 \cdot b_i\left(PD_i^1\right)} \cdot 12.5 \cdot 1.06
\end{aligned} \tag{16}
$$

The function $f_1(PD_i^1, LGD_i^1)$ is plotted in a three-dimensional coordinate system (figure 1).[87] Due to the interval boundaries for $PD_i^1 \in [0.03;1]$ and $LGD_i^1 \in [0;1]$, the nominator cannot assume negative values. The risk weight in the denominator is always positive so that the functional value is always zero or greater than zero. A common equity tier 1 capital ratio before regulatory capital management of 10 % is assumed for illustration purposes, which is indicated by the color separation of the shown area in figure 1. Financial assets whose PD_i^1-LGD_i^1-tuple results in a functional value below 10 % are situated on the light gray area.

[86] M_i shall be fixed to 2.5 years according to art. 162 para. 1 CRR. As a result, financial assets are characterized only by a PD_i^1-LGD_i^1-tuple.

[87] The function would depend only on the probability of default if the bank used values for the loss given default that are given by regulatory requirements so that the graph would then be displayable in a two-dimensional coordinate system. In regard to the given values for the loss given default, see art. 161 para. 1 CRR.

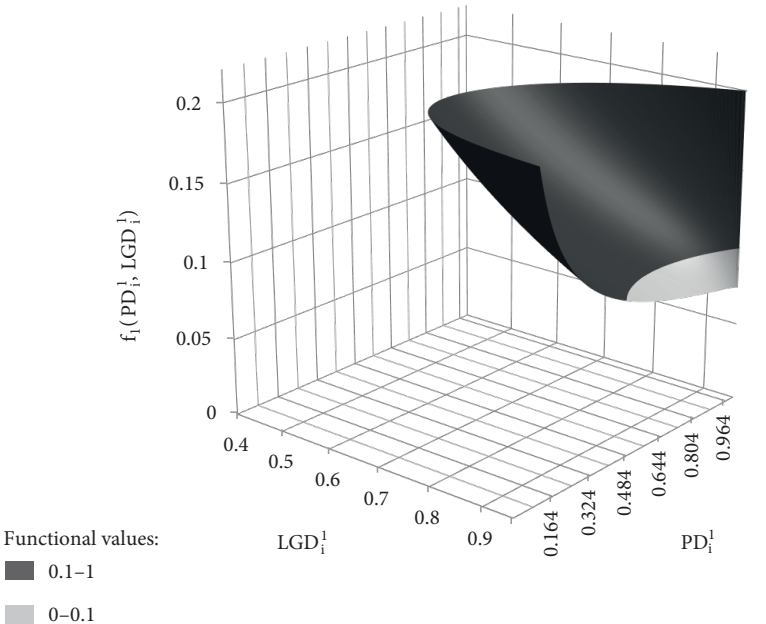

Figure 1: Implications of the Probability of Default and the Loss Given Default for the Direction of Change of the Common Equity Tier 1 Capital Ratio as a Result of Fair Value Changes in the IRBA with the Allocation of the Comparison Amount to Common Equity Tier 1 Capital for Financial Assets with Deferred Tax Assets

These financial assets do not fulfill inequality (15); in this case, a fair value increase results in a reduction of the common equity tier 1 capital ratio (group 2a). Financial assets on the dark gray area are assigned to group 1a; an increase of the fair value of these financial assets also leads to a higher common equity tier 1 capital ratio because inequality (15) is fulfilled by these financial assets. Financial assets that have losses given default lower than 40 % and are not shown in figure 1 belong to this group as well. The majority of financial assets in the possession of banks should have lower probabilities of default than for example 20 %. This is why most financial assets should be allocated to the first group as shown in figure 1.[88] Only financial assets with high probabilities of default and losses given default substantiate functional values below realistic common equity tier 1 capital ratios. Given higher common equity tier 1 capital ratios before regulatory capital management – the dividing line moves into a positive direc-

[88] The Deutsche Bank (Commerzbank) for example has a percentage of 72 % (84 %) of credit exposures with an investment grade; see *Deutsche Bank* (2018), p. 47; *Commerzbank* (2018), p. 18.

tion on the vertical axis –, a higher quantity of financial assets exist that do not satisfy inequality (15) all other things being equal (group 2a, light gray area), which implies that there is a smaller quantity of financial assets that do satisfy the inequality in question (group 1a, dark gray area), and vice versa. In fact, for banks with a common equity tier 1 capital ratio of 7.4 % or lower, financial assets always belong to group 1a.

Fair value changes of an individual financial asset with a constant PD_i^1 -LGD_i^1 -tuple can cause divergent directions of change of the common equity tier 1 capital ratio in two separate fiscal years if the relevant bank operates with two different common equity tier 1 capital ratios in those years. Similarly, fair value changes of two identical financial assets can cause different directions of change if they are held by separate banks with different common equity tier 1 capital ratios. This is why the a priori common equity tier 1 capital ratio is another important factor besides the risk parameters of the financial asset to consider when exercising regular capital management.

(13) shows that the prudent value has no immediate impact on the common equity tier 1 capital ratio. Only fair value changes lead to changes of the common equity tier 1 capital ratio as described above.

In the majority of cases, a fair value increase should also cause an increase of the common equity tier 1 capital ratio (group 1a).[89] This leads to a simultaneous reduction of the additional tier 1 capital ratio and the tier 2 capital ratio.[90] Furthermore, an increase of the total capital ratio can be observed.[91] Hence, fair value increasing regulatory capital management should be regarded as more beneficial than fair value decreasing regulatory capital management for financial assets in group 1a.

Only for a small number of financial assets with high probabilities of default and high losses of default, a fair value decrease results in a higher common equity tier 1 capital ratio (group 2a). It is noteworthy that a negative fair value change also leads to a higher additional tier 1 capital ratio and a higher tier 2 capital ratio. However, limitations arise due to the fact that only few if any financial assets should be available for this kind of regulatory capital management. The various directions of change of the regulatory capital ratios and the comprehensive income as a result of fair value changes can be seen in table 3. The cells for the common equity tier 1 capital ratio show two different directions, the first (second) of which refers to financial assets in group 1a (group 2a) as described above.

[89] See fn. 88.

[90] See table 1.

[91] The total capital ratio describes the relation of own funds to the total risk exposure amount. It shows the same direction of change as the common equity tier 1 capital ratio because additional tier 1 capital and tier 2 capital remain unchanged.

Table 3

Directions of Change in the IRBA with the Allocation of the Comparison Amount to Common Equity Tier 1 Capital for Financial Assets with Deferred Tax Assets

Regulatory capital management		Directions of change		
		$T1-r^a$	$AT1-r^a$ and $T2-r^a$	I^a
FV_i^{new}	↑	group 1a: ↑	↓	↑
		group 2a: ↓		
	↓	group 1a: ↓	↑	↓
		group 2a: ↑		

* Financial assets of group 1a (group 2a) do (not) satisfy inequality (14).

c) Internal Ratings Based Approach with the Allocation of the Comparison Amount to Tier 2 Capital

A fair value increase results in a reduction of the common equity tier 1 capital ratio if the comparison amount is allocated to tier 2 capital.[92] This can be traced back to the fact that on the one hand, the prudent valuation removes all effects of fair value changes in common equity tier 1 capital while on the other hand, credit risk is still affected by these changes. Apart from that, an increase of the prudent value results in a higher common equity tier 1 capital ratio. In the case of a simultaneous increase (decrease) of the fair value and the prudent value, the common equity tier 1 capital ratio only increases if the entire relative change of the nominator is greater than the entire relative change of the denominator. Considering the same scenario, the prudent value plays no role in regard to the additional tier 1 capital ratio while a fair value change causes directions of change in analogy to the common equity tier 1 capital ratio.

The tier 2 capital ratio can be derived with the help of table 1 as follows:

$$T2-r^a\left(FV_i^{new}, FV_{prud.,i}^{new}\right) = \frac{T2^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}} \tag{17}$$

[92] In regards to the whole paragraph, also see table 1.

The partial derivative with respect to FV_i^{new} is positive only if the following inequality holds true:[93]

$$\frac{1 - PD_i^1 \cdot LGD_i^1}{RW_i^{IRBA}} > \frac{T2^b - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{TR^b} \tag{18}$$

In comparison to inequality (14), the right side of inequality (18) is not only described by a regulatory capital ratio before regulatory capital management but does also include the subtrahend $\frac{\left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{TR^b}$ which is defined, inter alia, by the prudent value. If there is no prudent value change, the subtrahend assumes the value of zero. This leads to a synchronization of (14) and (18) when neglecting the difference of own funds. In this case, the elaborations in regard to the common equity tier 1 capital ratio in section IV.3.b.) are also relevant in this context. Therefore, only the differences that arise from a prudent value change are addressed in the following.

Looking at inequality (18), two scopes for decision-making occur to influence the direction of change of the tier 2 capital ratio as a result of fair value changes. On the one hand, banks can choose the financial asset whose fair value is supposed to be changed. By doing so, it determines the parameters PD_i^1 and LGD_i^1 and thus, the parameter RW_i^{IRBA} on the left side of inequality (18). On the other hand, banks can shape the prudent value of the financial asset in question which is a component of the right side.

The left side of inequality (18) can be plotted in a three-dimensional coordinate system where the area is identical to the one shown in figure 1. In contrast to figure 1 though, the vertical axis represents the term of the right side of inequality (18). Again, this term corresponds to a threshold for the direction of change. In the case of a functional value greater (less) than the threshold, a positive fair value change results in a higher (lower) tier 2 capital ratio. Due to the fact that the threshold also incorporates the prudent value, all financial assets have an individual threshold in dependence of their respective prudent value change. Although the tier 2 capital ratio can be used as a starting point to determine the threshold, it can be moved by changing the prudent value. An increase of the prudent value makes the dividing line between the dark gray and light gray area wander in a negative direction on the vertical axis in figure 1 and vice versa. This means that in borderline cases, a prudent value change can cause a reversal of the direction of change of the tier 2 capital ratio. When given a tier 2 capital ratio before regulatory capital management of 10 %, the individual threshold for every financial asset equals

[93] See appendix 3.

$$0.1 - \frac{\left(FV^{new}_{prud.,\,i} - FV^{old}_{prud.,\,i}\right)}{TR^{b}}.$$

The change of the threshold that is caused by a single financial asset's prudent value change should be very small compared to the residual threshold that amounts to the tier 2 capital ratio before regulatory capital management. Therefore, a prudent value change should result in only marginal threshold shifts. All other things being equal, a higher tier 2 capital ratio before regulatory capital management leads to a smaller group of financial assets that fulfill inequality (18) [analogously to section IV.3.b.) defined as group 1b] and to a bigger group of financial assets that do not fulfill the inequality [analogously to section V.3.b.) defined as group 2b] and vice versa. Concerning this matter, there is no difference to the corresponding case of the common equity tier 1 capital ratio in section IV.3.b.).[94]

Furthermore, (17) shows that the tier 2 capital ratio is influenced by the prudent value directly. The amount that tier 2 capital changes as a result of a prudent value change is the same amount – but with a different sign and thus, with an opposite direction of change – for common equity tier 1.[95] Provided that banks influence the fair value as well as the prudent value, the tier 2 capital ratio increases if the relative change of the whole numerator is greater than the relative change of the whole denominator.

An increase of the fair value leads to a reduction of the common equity tier 1 capital ratio and the additional tier 1 capital ratio. At the same time, an increase of the tier 2 capital ratio can be observed for certain financial assets of group 1b. Only for financial assets with high probabilities of default and high losses given default, a reduction of the tier 2 capital ratio occurs (group 2b). In this case, banks can achieve an elevation of all regulatory capital ratios by reducing the fair value. In borderline cases, the direction of change of the tier 2 capital ratio can switch due to a prudent value change, which may be initiated by banks. In addition, a prudent value increase has a positive effect on the common equity tier 1 capital ratio and a negative effect on the tier 2 capital ratio.

Table 4 shows the different directions of change of the regulatory capital ratios and the comprehensive income. The cells for the tier 2 capital ratio contain two different directions, the first (second) of which refers to financial assets in group 1b (group 2b) as described above.

[94] It should be noted however that the groups 1a and 1b as well as the groups 2a and 2b should show different compositions of financial assets.

[95] See table 1.

Table 4

Directions of Change in the IRBA with the Allocation of the Comparison Amount to Tier 2 Capital for Financial Assets with Deferred Tax Assets

Regulatory capital management		Directions of change			
		$T1-r^a$	$AT1-r^a$	$T2-r^a$	I^a
FV_i^{new}	↑	↓		group 1b: ↑	↑
				group 2b: ↓	
	↓	↑		group 1b: ↓	↓
				group 2b: ↑	
$FV_{prud.,i}^{new}$	↑	↑	–	↓	–
	↓	↓		↑	

* Financial assets of group 1b (group 2b) do (not) satisfy inequality (18).

V. Financial Assets with Deferred Tax Liabilities

1. Comprehensive Income, Prudent Valuation According to Art. 105 CRR, and Credit Risk

In contrast to deferred tax assets, deferred tax liabilities undergo no special regulatory treatment so that they are represented in common equity tier 1 capital via the recognition of the comprehensive income. A positive fair value change results in an increase of the deferred tax liabilities and vice versa.[96] Falling back on (1), the following change of common equity tier 1 capital can be derived when recognizing the comprehensive income:

$$\Delta T1_{income}\left(FV_i^{new}\right) = \left(FV_i^{new} - FV_i^{old}\right) \cdot (1-s) \tag{19}$$

Considering the deduction amount of the prudent valuation, the full change of common equity tier 1 capital can be shown as follows:

[96] If the fair value drops below the tax value of the financial asset, the deferred tax liabilities are derecognized and deferred tax assets are recognized. These borderline cases are not covered in the following.

$$
\begin{aligned}
&\Delta T1_{tot.}\left(FV_i^{new}, FV_{prud.,i}^{new}\right)\\
&=\left(FV_i^{new}-FV_i^{old}\right)\cdot(1-s)-\left[\left(FV_i^{new}-FV_{prud.,i}^{new}\right)-\left(FV_i^{old}-FV_{prud.,i}^{old}\right)\right]\\
&=\left(FV_{prud.,i}^{new}-FV_{prud.,i}^{old}\right)-s\cdot\left(FV_i^{new}-FV_i^{old}\right)
\end{aligned}
\tag{20}
$$

For financial assets with deferred tax liabilities, (20) shows an additional deduction amount of $s\cdot\left(FV_i^{new}-FV_i^{old}\right)$ in the STA. This leads in some degree to a counterintuitive effect that shows a higher comprehensive income and at the same time lower common equity tier 1 capital when reducing the fair value.[97]

In the IRBA, the comparison amount that is independent from deferred tax effects has to be allocated to common equity tier 1 capital or tier 2 capital. The sum of (20) and (10) shows the full change of common equity tier 1 capital in case of the first-mentioned allocation:

$$
\begin{aligned}
&\Delta T1_{tot.}^{IRBA}\left(FV_i^{new}\right)\\
&=\left(FV_{prud.,i}^{new}-FV_{prud.,i}^{old}\right)-s\cdot\left(FV_i^{new}-FV_i^{old}\right)\\
&+\left(FV_i^{new}-FV_i^{old}\right)\cdot\left(1-PD_i^1\cdot LGD_i^1\right)-\left(FV_{prud.,i}^{new}-FV_{prud.,i}^{old}\right)\\
&=\left(FV_i^{new}-FV_i^{old}\right)\cdot\left(1-PD_i^1\cdot LGD_i^1-s\right)
\end{aligned}
\tag{21}
$$

Given an allocation to tier 2 capital, the change of common equity tier 1 capital is shown by (20), while the tier 2 capital remains unchanged compared to table 1.

The following only considers the common equity tier 1 capital ratio explicitly because common equity tier 1 capital is the only figure that is affected by the change of deferred tax liabilities. Table 5 shows the changes of common equity tier 1 capital that arise from regulatory capital management for financial assets with deferred tax liabilities. The changes of additional tier 1 capital, tier 2 capital and the total risk exposure amount shown in table 1 still apply.

[97] This can also be seen in the IRBA when allocating the comparison amount to tier 2 capital; see the following and table 5.

Table 5

Change of Common Equity Tier 1 Capital as a Result of Regulatory Capital Management for Financial Assets with Deferred Tax Liabilities

	STA	IRBA	
		Allocation to common equity tier 1 capital	Allocation to tier 2 capital
Change of common equity tier 1 capital	$FV^{new}_{prud.,i} - FV^{old}_{prud.,i} - s \cdot \left(FV_i^{new} - FV_i^{old}\right)$	$\left(FV_i^{new} - FV_i^{old}\right) \cdot \left(1 - PD_i^1 \cdot LGD_i^1 - s\right)$	$FV^{new}_{prud.,i} - FV^{old}_{prud.,i} - s \cdot \left(FV_i^{new} - FV_i^{old}\right)$

2. Regulatory Capital Ratios

a) Standardized Approach

In contrast to financial assets with deferred tax assets, a fair value change of an underlying asset with deferred tax liabilities has an influence on the common equity tier 1 capital ratio: an increase of the fair value results in a lower ratio and vice versa.[98] The additional tier 1 capital ratio and the tier 2 capital ratio are still unaffected by deferred tax effects and thus, by fair value changes. Therefore, the common equity tier 1 capital ratio can be increased by banks through fair value changes without causing any (undesired) movements of the other regulatory capital ratios. If regulatory authorities required banks to net deferred tax assets and deferred tax liabilities in the context of the dual threshold procedure,[99] fair value changes would not have an impact on the common equity tier 1 capital ratio so that banks could not influence the ratio through regulatory capital management regarding the fair value. However, this would come at the cost of higher common equity tier 1 capital because deferred tax liabilities would be added back to common equity tier 1 capital, which, in principle, could be addressed by stricter capital requirements.

[98] See tables 1 and 5.

[99] See section III. in detail.

b) Internal Ratings Based Approach with the Allocation of the Comparison Amount to Common Equity Tier 1 Capital

The common equity tier 1 capital ratio can be written as follows:[100]

$$T1 - r^a\left(FV_i^{new}\right) = \frac{T1^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)}{TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}} \tag{22}$$

The derivative of (22) with respect to FV_i^{new} is positive only if the following inequality holds true:[101]

$$\frac{1 - PD_i^1 \cdot LGD_i^1 - s}{RW_i^{IRBA}} > \frac{T1^b}{TR^b} \tag{23}$$

The subtrahend s in the nominator on the left side of the inequality is the only new element in comparison to inequality (14). The risk weight can be substituted again analogously to inequality (15). Furthermore, a relevant tax rate of 30 % is assumed.[102] The left side of inequality (23) can then once more be defined as a function in dependence of PD_i^1 and LGD_i^1:

$$\begin{aligned} & f_2\left(PD_i^1, LGD_i^1\right) \\ & = \frac{1 - PD_i^1 \cdot LGD_i^1 - s}{\left[N\left(\frac{1}{\sqrt{1 - R_i\left(PD_i^1\right)}}\cdot G\left(PD_i^1\right) + \sqrt{\frac{R_i\left(PD_i^1\right)}{1 - R_i\left(PD_i^1\right)}}\cdot G(0.999)\right) - PD_i^1\right]} \\ & \cdot LGD_i^1 \cdot \frac{1}{1 - 1.5\cdot b_i\left(PD_i^1\right)}\cdot 12.5 \cdot 1.06 \end{aligned} \tag{24}$$

$f_2\left(PD_i^1,\ LGD_i^1\right)$ is plotted in a three-dimensional coordinate system (figure 2). Figure 2 shows a larger light gray area compared to figure 1. This means that in comparison to financial assets with deferred tax assets, there is a larger portion of financial assets with deferred tax liabilities that cause a drop in the common equity tier 1 capital ratio if their fair values increase [analogously to section IV.3.b.) defined as group 2c]. For example, financial assets with probabilities of default of below 20 % can potentially be assigned to this group now. Accordingly, there exists a smaller group of financial assets whose fair value increases also

100 See tables 1 and 5.

101 See appendix 4.

102 According to IAS 12.47, the tax rate that is expected to apply to the period when the financial asset is realized shall be used for measuring deferred tax assets and liabilities. For corporations in Germany, this currently equates to a tax rate of 29.825 % under the condition of an assessment rate of 400 %; see *Schulz-Danso* (2016), m. n. 164.

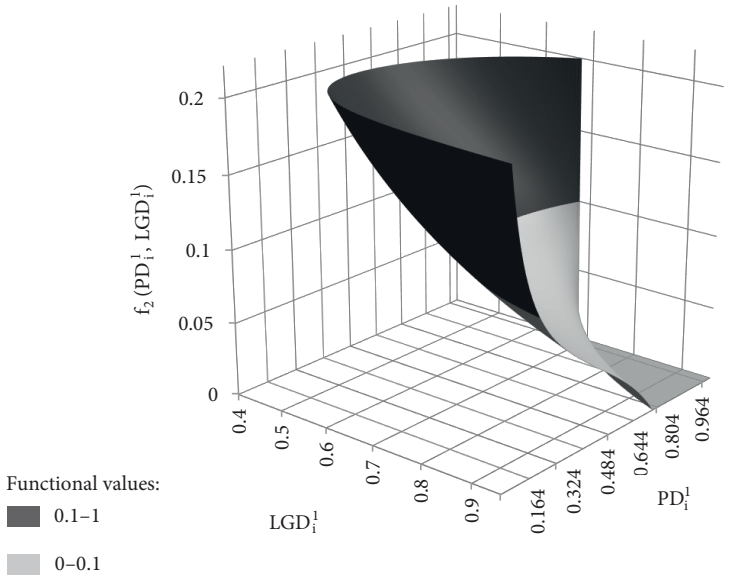

Figure 2: Implications of the Probability of Default and the Loss Given Default for the Direction of Change of the Common Equity Tier 1 Capital Ratio as a Result of Fair Value Changes in the IRBA with the Allocation of the Comparison Amount to Common Equity Tier 1 Capital for Financial Assets with Deferred Tax Liabilities

lead to a higher common equity tier 1 capital ratio [analogous to section IV.3.b) group 1c]. Furthermore, the relevant tax rate influences the respective group composition. Group 2c (group 1c) enlarges (downsizes) with a rising relevant tax rate and vice versa. This is why besides the common equity tier 1 capital ratio before regulatory capital management and the credit risk parameters of the financial assets banks also have to consider the tax rate that applies to its deferred tax liabilities.

Overall, financial assets with deferred tax liabilities do not justify new directions of change of the regulatory capital ratios. However, the group of financial assets that cause an increase (a decrease) of the common equity tier 1 capital ratio if their fair values are increased is smaller (larger) in comparison to financial assets with deferred tax assets. Additionally, the relevant tax rate is another parameter that influences the respective group composition and size.

c) Internal Ratings Based Approach with the Allocation of the Comparison Amount to Tier 2 Capital

A fair value increase results in a reduction of the common equity tier 1 capital ratio and vice versa.[103] Therefore, there are no deviations to section IV.3.c.). The same applies to the directions of change caused by prudent value changes.

VI. Discussion

1. Implications of the Results

According to the analysis, banks can influence their regulatory capital ratios through regulatory capital management. This is by no means surprising. As long as the calculation of the regulatory capital ratios is based on fair values measured according to IFRS 13, changes of these fair values should be reflected in the regulatory capital ratios as well. After all, fair value changes do not have to be the result of regulatory capital management but could also arise if the actual intrinsic value of the underlying financial asset changes. Against this background, it would make sense if the regulatory capital ratios increase (decline) if the underlying fair values increase (decrease) as well. However, there are scenarios in which fair value reductions lead to increased regulatory capital ratios.[104] It seems counterintuitive that the regulatory capital ratios indicate a greater solvency as a result of lower fair values. Although this applies in the context of the IRBA only to a very small amount of financial assets with very high probabilities of default and losses given default, banks could be tempted to hold an increased amount of these financial assets (with an appropriate risk premium) in order to be more flexible when choosing financial assets for regulatory capital management. This is because having the option to either increase or decrease fair values in order to achieve higher regulatory capital ratios makes it easier for banks to reconcile the simultaneous pursuit of different objectives (for example increasing the regulatory capital ratios while decreasing the comprehensive income). In the fore-mentioned IRBA-scenarios, the direction of change of certain regulatory capital ratios that is caused by fair value changes also depends on banks' regulatory capitalization and in some cases on their relevant tax rate. This means that the possible effects of regulatory capital management in regard to an identical financial asset can change over time or can vary from bank to bank. It can

[103] See tables 1 and 5.

[104] See sections IV.3.b) and V.2.b) in regard to the IRBA and section V.2.a) in regard to the STA. If the additional value adjustments of the prudent valuation would not be recognized as part of the comparison according to art. 159 CRR, a fair value increase would always lead to decreasing regulatory capital ratios in the IRBA; see also fn. 72.

be argued that there should be no reason why the same fair value changes of identical financial assets should cause changes of the regulatory capital ratios into different directions.

In contrast to the above, fair value changes of financial assets that substantiate deferred tax assets do not have any effect on the regulatory capital ratios in the STA; only prudent value changes affect the regulatory capital ratios.[105] This should be a rather preferred case by the regulatory authorities because accounting numbers have no direct influence on the regulatory capital ratios, while the prudent value that has an effect is determined in accordance with the regulatory framework. In all other cases however, changes of the regulatory capital ratios are determined by fair values changes at least to some extent. In these situations, the effects that are caused by regulatory capital management can depend on a variety of factors (for example the treatment of deferred tax assets and deferred tax liabilities, the credit risk model, the allocation of the comparison amount, the regulatory capitalization, the credit risk parameters, and the relevant tax rate). Due to this fact, it may be difficult for regulatory authorities to identify the effects of regulatory capital management even if the exercise thereof is well known. Less complex rules for calculating the regulatory capital ratios could make the way accounting numbers effect regulatory capital ratios more transparent to regulatory authorities as well as market participants, which in turn could improve regulatory supervision as a whole.[106]

One possible way of making the calculation of the regulatory capital ratios more transparent is to redesign the comparison of regulatory expected credit losses with credit risk adjustments and additional value adjustments according to art. 159 CRR. It has been suggested to allocate the comparison amount to common equity tier 1 capital regardless of a surplus or a deficit.[107] As a result, the common equity tier 1 capital should always be debited with the regulatory expected credit losses. Such a design would lead to higher transparency because the allocation of the comparison amount to tier 2 capital is dropped completely. Furthermore, banks would have no incentive to deviate from the regulatory expected credit losses with the accounting impairment amounts.[108] For the many banks that show a surplus, this form of allocation would imply a significant relief of regulatory pressure which is why the impacts of such a revision would require careful consideration. A more prudent approach would be to lower the threshold for allocating the comparison amount to tier 2 capital or completely abolish said allocation.[109] As a result, more banks would exceed the threshold.

[105] See section IV.3.a).

[106] See similarly *Becker* (2017), p. 632.

[107] See *Menk/Eisheuer* (2017), p. 8.

[108] See also *Basel Committee on Banking Supervision* (2016), p. 13.

[109] In regard to the threshold, see fn. 76.

Because the amount that exceeds the threshold cannot be allocated to tier 2 capital, the effects of regulatory capital management on the tier 2 capital ratio are more transparent as they only stem from changes in the total risk exposure amount. In compensation, the comparison amount could also be considered within the supervisory review and evaluation process.[110]

The fact that banks can influence their regulatory capital ratios through regulatory capital management is inherent to a regulatory framework that is based on accounting numbers. In order to abolish regulatory capital management in its entirety, all references to accounting numbers would have to be replaced with regulatory specifications.[111] This would require banks to comply with new regulatory rules and remodel their IT-infrastructure to collect and process additional data, which could also have a transparency reducing effect.[112] A positive aspect of separating the accounting and regulatory framework is that the IASB as well as the regulatory lawmakers can focus on their respective objectives without having to consider possible interferences between the different frameworks.[113] Although the room for discretion that is currently an element of the accounting framework would migrate to the regulatory framework and continue to exist to some degree, the supervision of how banks make use of discretionary powers would be the regulatory authorities' responsibility.[114] By extending the regulatory area of supervision, regulatory authorities could ensure a more appropriate calculation of the regulatory capital ratios.[115] Furthermore, banks could not apply regulatory capital management any more so that they would need to increasingly rely on traditional ways of increasing their regulatory capital ratios that actually have a positive effect on their solvency such as raising new capital or decreasing risk positions. Under the current regulatory framework, (stricter) regulatory requirements should pose an incentive for banks to exercise regulatory capital management to ease the additional regulatory pressure.[116] With a regulatory framework that is independent from the accounting framework, such regulatory capital management that not only undermines the

[110] See *Basel Committee on Banking Supervision* (2016), p. 13. In regard to the supervisory review and evaluation process, see fn. 9.

[111] See also *Bieg* (1983), p. 126, in regard to a strict separation of the accounting and regulatory framework. *Neus/Riepe* (2018), m. n. 60, are in favor of a regulatory framework that is connected to the accounting framework because in their view, it increases transparency.

[112] See also *Bellavite-Hövermann* (2004), p. 454.

[113] In regard to differences in objectives, see *Flick/Neisen* (2015), pp. 234–236; *Barth/Landsman* (2010), pp. 401–403. See also IFRS 9.BC5.285.

[114] See similarly *Kirchner* (2009), p. 462.

[115] See similarly *Greenberg/Helland/Clancy/Dertouzos* (2013), p. 71; *Laux/Leutz* (2009), p. 830.

[116] See *Greenberg/Helland/Clancy/Dertouzos* (2013), pp. 37, 70.

intended strengthening of banks' financial stability but also reduces the quality of accounting numbers could in theory be prevented.

2. Limitations of the Model and Restrictions of the Underlying Assumptions

The model presented in sections IV. and V. is based on a set of different assumptions regarding the characteristics of the underlying financial assets and the relevant banks. One of these assumptions is that the fair value and the prudent value can move independently from each other because it can be argued that there are situations in which fair value changes occur that have no effect on the prudent value and vice versa.[117] However, this may not always be the case. Alternatively, it is possible that fair value changes that are based on changes in parameter specifications also change the prudent value in the same direction if the parameters in question are also included in the calculation of the prudent value. As a result, it may also be reasonable to define the prudent value as a positive function of the fair value, which could be easily implemented in the current model. However, in scenarios in which the fair value as well as the prudent value have an effect on the regulatory capital ratios individually, it is necessary to define the concrete function of the prudent value in order to assess the cumulated effect unless the respective change of the regulatory capital ratios is into the same direction.

Another assumption is that the impairment amounts for the underlying financial assets remain constant although the fair values of the financial assets change.[118] The impairment amount is determined by banks on the basis of their internal risk management, whereas fair value measurement requires the adoption of a market perspective.[119] In the ideal case, the fair value is determined on the basis of an active market.[120] It is possible that market participants have a different estimation of credit risk compared to the banks' internal risk management. Besides, a market price on an active market usually includes more risk factors than just credit risk like market risk or liquidity risk.[121] In addition, speculative or irrational decisions of market participants that do not reflect credit risk can have an effect on market prices.[122] Thus, changes of fair values that are determined on the basis of market prices do not have to be linked to changes in credit risk and thus, may not lead to a corresponding change of the impairment amount.

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[117] See section III.

[118] See section III.

[119] See IFRS 9.B5.5.41; IFRS 13.3.

[120] See IFRS 13.69; IFRS 13.76–77.

[121] Regarding liquidity risk, see for example *Wüsteman/Iselborn* (2016), pp. 510–511.

[122] See for example *Schildbach* (2006), p. 22.

Alternatively, fair values could be determined on the basis of different valuation methods.[123] In this case, the fair value measurement and the determination of the impairment amount could overlap to some extent. For example, it may be necessary for measuring the fair value as well as for determining the impairment amount to forecast cash flows or choose an appropriate discount rate when applying a discounted cash flow model. However, while some input factors such as the contractual cash flows and expected cash shortfalls may be identical,[124] other input factors should vary. This is because the impairment amount only reflects losses due to credit risk, whereas the fair value considers all expected losses.[125] As a result, fair value changes that have no effect on the impairment amount could occur if they stem from risk factors other than credit risk. Therefore, fair value changes that are caused by regulatory capital management and do not have a simultaneous impact on the respective impairment amount could in theory be justified by banks accordingly.

The European law-making process concerning banking supervision is in a large part based on the publications of the Basel Committee on Banking Supervision.[126] In December 2017, the Basel Committee on Banking Supervision published amendments to the STA, the IRBA as well as to the calculation of operational risk.[127] Although these amendments are not legally binding, they may be considered by lawmakers. The Basel Committee on Banking Supervision expects an implementation of these amendments by the first of January 2022.[128] The changes made to the STA are mainly concerned with the calibration of the risk weights,[129] which is why the results of the analysis regarding the STA should remain valid. The changes made to the IRBA on the other hand come in a greater number and should be more significant to the robustness of the respective results. These changes include the omission of the factor of 1.06 for the calculation of the risk weight,[130] the raise of the minimum probability of default to 0.05 %, and the implementation of certain floors for the loss given default.[131] While the last two changes should only affect the interval for the probability of default and the loss given default, the first-mentioned change alters the formula for calculating the risk weight, which in turn should also affect the way fair val-

123 See IFRS 13.61–62; IFRS 13.B5-B33.

124 Also see IFRS 9.B5.5.28; IFRS 9.B5.5.44; IFRS 13.B15-B16.

125 In regard to the relationship of fair values and impairment amounts, see also *Gaber/Gräupl* (2018), p. 91; *Novotny-Farkas* (2016), p. 199.

126 See for example prefix 1 CRR.

127 See *Basel Committee on Banking Supervision* (2017).

128 See *Basel Committee on Banking Supervision* (2017), p. 2.

129 See *Basel Committee on Banking Supervision* (2017), pp. 4–33.

130 See for example the denominator on the left side of inequality (15).

131 See for each change respectively *Basel Committee on Banking Supervision* (2017), pp. 63, 65, 68–69.

ue changes influence regulatory capital ratios. With the factor of 1.06 gone, the left side of inequalities (14), (18), and (23) should in general show higher values so that the respective first (second) groups become greater (smaller).[132] The amendments also include a new approach for calculating operational risk. According to this approach, a relevant parameter for calculating operational risk is the so called business indicator which consists of a variety of different components including profit and loss positions. One of these positions is net profit or loss on financial assets measured at fair value through profit and loss held in the banking book.[133] Integrating these changes of the calculation of operational risk into the model would require an additional term in the denominator of the regulatory capital ratios that considers the changes of operational risk caused by fair value changes. Furthermore, it would make a differentiation between assets that are measured with fair valued through profit and loss and assets that are measured with fair value through other comprehensive income necessary if the amendments are to be interpreted in such a way that only fair value changes of the first-mentioned are included in the calculation of the business indicator. It is unclear to what extent all these changes will be adopted by lawmakers. However, banks may be advised to consider these possible future changes already at an earlier stage.[134]

VII. Summary

Due to the intersections of IFRS accounting and the CRR, banks can exercise regulatory capital management regarding fair value measurement according to IFRS 13 in order to influence their regulatory capital ratios. When analyzing the effects of such practices, it is necessary to differentiate between the regulatory treatment of deferred tax assets and deferred tax liabilities. Furthermore, the regulatory credit risk model plays an important role in regard to the effects of regulatory capital management and in the case of the IRBA, the allocation of the comparison amount as well. It can be highlighted that in the STA, a fair value change of financial assets with deferred tax assets does not have any effect and a fair value increase (decrease) of financial assets with deferred tax liabilities even has a negative (positive) effect on the common equity tier 1 capital ratio without causing opposite changes of the additional tier 1 capital ratio and the tier 2 capital ratio. The possibility to increase all regulatory capital ratios in the IRBA through fair value changes of certain financial assets with high probabilities of default and losses given default can be emphasized as well. The directions of change observed in the IRBA that are caused by individual financial assets de-

[132] See section IV.3.b), IV.3.c), and V.2.b) in regard to the respective groups.

[133] See *Basel Committee on Banking Supervision* (2017), p. 135.

[134] Also see *Büttel/Sawahn* (2019), pp. 176–177.

pend on, inter alia, the credit risk parameters and the regulatory capital ratios before regulatory capital management, and possibly the relevant tax rate. Besides the fair value, the prudent value can be used to influence regulatory capital ratios as well. Nevertheless, a prudent value increase should imply a smaller margin of discretion for fair value measurement. Fair value changes always go hand in hand with changes of the comprehensive income, which may not be in line with the banks' income goals. Even though regulatory authorities may be able to identify the exercise of regulatory capital management, it can be argued that due to the many influencing factors the specific effects are hardly obvious. Thus, less complex and more transparent rules for calculating regulatory capital ratios could not only be beneficial to the involved banks but could also improve regulatory supervision either directly through regulatory authorities or indirectly through the disciplinary power of market participants.

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Appendix

Appendix 1

$$T1-r^a\left(FV^{new}_{prud.,i}\right)=\frac{T1^b+FV^{new}_{prud.,i}-FV^{old}_{prud.,i}}{TR^b+\left(FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)\cdot RW^{STA}_i}$$

$TR^b \gg T1^b$ and $FV^{new}_{prud.,i} \in \left[FV^{new,\,\min.}_{prud.,i};FV^{new,\,\max.}_{prud.,i}\right]$ apply so that $T1-r^a\left(FV^{new}_{prud.,i}\right)\in\,]0;1[$.

Thus, $T1-r^a\left(FV^{new}_{prud.,i}\right)$ is continuous in an open interval of $]0;1[$. Using the quotient rule,[135] the derivative with respect to $FV^{new}_{prud.,i}$ can be written as follows:

$$\frac{\delta\, T1-r^a\left(FV^{new}_{prud.,i}\right)}{\delta\, FV^{new}_{prud.,i}}$$

$$=\frac{TR^b+\left(FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)\cdot RW^{STA}_i-RW^{STA}_i\cdot\left(T1^b+FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)}{\left[TR^b+\left(FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)\cdot RW^{STA}_i\right]^2}$$

$$=\frac{TR^b-RW^{STA}_i\cdot T1^b}{\left[TR^b+\left(FV^{new}_{prud.,i}-FV^{old}_{prud.,i}\right)\cdot RW^{STA}_i\right]^2}$$

The denominator is always positive so that the overall expression is positive only if the nominator is positive as well implying the following condition:

$$TR^b-RW^{STA}_i\cdot T1^b>0\Leftrightarrow\frac{1}{RW^{STA}_i}>\frac{T1^b}{TR^b}$$

Even with the maximum STA risk weight of 150 %,[136] the inequality holds true up to a common equity tier 1 capital ratio before regulatory capital management of $\frac{2}{3}$.

[135] In regard to the quotient rule, see *Bronstein/Semendjajew/Musiol/Mühlig* (2016), p. 447.

[136] See for example art. 128 para. 1 CRR.

Appendix 2

$$T1-r^a\left(FV_i^{new}\right)=\frac{T1^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot\left(1-PD_i^1\cdot LGD_i^1\right)}{TR^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot RW_i^{IRBA}}$$

$TR^b \gg T1^b$ and $FV_i^{new}\in\left[FV_i^{new,\,\min.};FV_i^{new,\,\max.}\right]$ apply so that $T1-r^a\left(FV_i^{new}\right)\in\,]0;1[$.

Thus, $T1-r^a\left(FV_i^{new}\right)$ is continuous in an open interval of $]0;1[$. Using the quotient rule, the derivative with respect to FV_i^{new} can be written as follows:

$$\frac{\partial\, T1-r^a\left(FV_i^{new}\right)}{\partial\, FV_i^{new}}$$

$$=\frac{\left(1-PD_i^1\cdot LGD_i^1\right)\cdot\left[TR^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot RW_i^{IRBA}\right]}{\left[TR^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$-\frac{\left[T1^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot\left(1-PD_i^1\cdot LGD_i^1\right)\right]\cdot RW_i^{IRBA}}{\left[TR^b+\left(FV_i^{new}\cdot FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$=\frac{\left(1-PD_i^1\cdot LGD_i^1\right)\cdot TR^b-T1^b\cdot RW_i^{IRBA}}{\left[TR^b+\left(FV_i^{new}-FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

The denominator is always positive so that the overall expression is positive only if the nominator is positive as well implying the following condition:

$$\left(1-PD_i^1\cdot LGD_i^1\right)\cdot TR^b-T1^b\cdot RW_i^{IRBA}>0\Leftrightarrow\frac{\left(1-PD_i^1\cdot LGD_i^1\right)}{RW_i^{IRBA}}>\frac{T1^b}{TR^b}$$

Appendix 3

$$T2 - r^a\left(FV_i^{new},\ FV_{prud.,i}^{new}\right)$$

$$= \frac{T2^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}}$$

$TR^b \quad T2^b$, $FV_i^{new} \in \left[FV_i^{new,\,\min.}; FV_i^{new,\,\max.}\right]$, and $FV_{prud.,i}^{new} \in \left[FV_{prud.,i}^{new,\,\min.}; FV_{prud.,i}^{new,\,\max.}\right]$ apply so that $T2 - r^a\left(FV_i^{new}, FV_{prud.,i}^{new}\right) \in\ ]0;1[$.

Thus, $T2 - r^a\left(FV_i^{new},\ FV_{prud.,i}^{new}\right)$ is continuous in an open interval of $]0;1[$. Using the quotient rule, the partial derivative with respect to FV_i^{new} can be written as follows:

$$\frac{\partial\, T2 - r^a\left(FV_i^{new},\ FV_{prud.,i}^{new}\right)}{\partial\, FV_i^{new}}$$

$$= \frac{\left(1 - PD_i^1 \cdot LGD_i^1\right)\cdot\left[TR^b + \left(FV_i^{new} \cdot FV_i^{old}\right)\cdot RW_i^{IRBA}\right]}{\left[TR^b + \left(FV_i^{new} \cdot FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$- \frac{RW_i^{IRBA}\cdot\left[T2^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1\right) - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)\right]}{\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$= \frac{\left(1 - PD_i^1 \cdot LGD_i^1\right)\cdot TR^b - RW_i^{IRBA}\cdot T2^b + RW_i^{IRBA}\cdot\left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

The denominator is always positive so that the overall expression is positive only if the nominator is positive as well implying the following condition:

$$\left(1 - PD_i^1 \cdot LGD_i^1\right)\cdot TR^b - RW_i^{IRBA}\cdot T2^b + RW_i^{IRBA}\cdot\left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right) > 0$$

$$\Leftrightarrow \frac{1 - PD_i^1 \cdot LGD_i^1}{RW_i^{IRBA}} > \frac{T2^b - \left(FV_{prud.,i}^{new} - FV_{prud.,i}^{old}\right)}{TR^b}$$

Appendix 4

$$T1 - r^a\left(FV_i^{new}\right) = \frac{T1^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)}{TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}}$$

$TR^b \gg T1^b$ and $FV_i^{new} \in \left[FV_i^{new,\,\min.}; FV_i^{new,\,\max.}\right]$ apply so that $T1 - r^a\left(FV_i^{new}\right) \in\,]0;1[$. Thus, $T1 - r^a\left(FV_i^{new}\right)$ is continuous in an open interval of $]0;1[$. Using the quotient rule, the derivative with respect to FV_i^{new} can be written as follows:

$$\frac{\partial\, T1 - r^a\left(FV_i^{new}\right)}{\partial\, FV_i^{new}}$$

$$= \frac{\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)\cdot\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]}{\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$- \frac{RW_i^{IRBA}\cdot\left[T1^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)\right]}{\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

$$= \frac{\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)\cdot TR^b - RW_i^{IRBA}\cdot T1^b}{\left[TR^b + \left(FV_i^{new} - FV_i^{old}\right)\cdot RW_i^{IRBA}\right]^2}$$

The denominator is always positive so that the overall expression is positive only if the nominator is positive as well implying the following condition:

$$\left(1 - PD_i^1 \cdot LGD_i^1 - s\right)\cdot TR^b - RW_i^{IRBA}\cdot T1^b > 0 \Leftrightarrow \frac{1 - PD_i^1 \cdot LGD_i^1 - s}{RW_i^{IRBA}} > \frac{T1^b}{TR^b}$$

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