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Does IFRS 9 increase banks' resilience?

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Abstract

IFRS 9 substantially affects the financial sector by changing the impairment methodology for credit losses. This paper analyzes the implications of the change from IAS 39 to IFRS 9 in the context of bank resilience. We shed light on two effects. First, the "cliff-effect", which refers to sudden increases in impairments. It occurred under IAS 39, as credit losses were only recognized with hindsight, and thus late and abruptly. IFRS 9 was designed to mitigate this issue through a staging approach, which gradually recognizes expected credit losses (ECL). These anticipated impairments, however, constitute a significant "front-loading", which is the second effect we investigate. The earlier recognition of losses may adversely impact bank resilience through lower capital levels. In the absence of archival data of IFRS 9 and their potential biases due to the COVID-19 pandemic, we use the European bank stress test results as a natural experiment, in which all banks are subject to the same regulations and exogenous shocks. This characteristic allows us to isolate otherwise immeasurable effects and empirically investigate, whether the conjunction of both effects constitutes a net benefit to banks' resilience. Furthermore, the vigorousness of procyclicality under IFRS 9 can be compared to IAS 39 by contrasting a hypothetical baseline and an adverse scenario.

JEL Classification: E58, G21, G28, M41, M48
Keywords: Bank Stress Test, CET1, Impairment, Procyclicality

Non-technical summary

This paper empirically assesses the implications of the change from the incurred loss accounting under IAS 39 to the expected credit loss (ECL) accounting under IFRS 9 in the context of bank resilience and hence financial stability. The International Accounting Standards Board (IASB) implemented the ECL approach after the previous backward-looking incurred loss model was widely criticised for delaying the credit loss recognition during the financial crisis that started in 2007 (Barth and Landsman, 2010; BCBS, 2016; G20, 2009). The change in the impairment methodology constitutes a paradigm shift in the recognition of credit losses. Two key elements of the new approach are particularly relevant in assessing whether IFRS 9 is an improvement over IAS 39 in terms of financial stability, as both trigger opposing procyclical forces with regard to capital adequacy and therewith bank resilience. On the one hand, the staging approach under IFRS 9, which gradually recognises the deterioration of a loan's credit quality: The three stages approach is expected to mitigate the procyclicality resulting from the cliff-effect, i.e. the sudden and abrupt increase of impairments in the course of an emerging crisis, which occurred under IAS 39. However, the transfer from Stage 1 to Stage 2 and the associated switch from the 12-month to the lifetime ECL calculation still results in a strong rise in loan loss provisions (LLPs) (EBA, 2016; Hashim et al., 2016). Accordingly, the cliff-effect is attenuated under IFRS 9, but remains present. On the other hand, IFRS 9 requires reporting entities to recognise an instruments' ECL immediately after initial recognition. While the earlier recognition of ECL reduces the cliff-effect, it also induces a second source of procyclicality, i.e. the front-loading effect. The front-loading of credit losses reduces banks' potential to retain earnings, which constitute an essential component of their highest quality capital under Basel III (i.e. Common Equity Tier 1, CET1). The expected notable increase in LLPs due to a timelier recognition of ECLs can thus result in a reduction in banks' regulatory capital. The increased pressure on banks for recapitalisation in order to meet their capital adequacy requirements could create novel procyclical effects. Empirical evidence demonstrates that banks predominantly scale back their lending activities and sell assets to strengthen their capital base (ESRB, 2017). However, doing so can potentially aggravate a crisis. Accordingly, the downsides of a weakened capital adequacy of banks must be set off against the benefits of a mitigated cliff-effect under the new model.

Only a few studies have examined the impact of IFRS 9 on banks' financial resilience. However, its implications for financial stability remained ambiguous. The aim of the paper is to fill this research gap and to find out whether the conjunction of both effects constitutes a net benefit for financial stability compared to the former IAS 39 model. This paper contributes to the literature by providing the first empirical evidence on the procyclical effects of IFRS 9 during a simulated crisis. In order to assess the implication of a reduced cliff-effect at the cost of the front-loading effect, the following three hypotheses are formulated.

- Hypothesis 1: The gradual recognition of impairments under the staging model of IFRS 9 reduces the volatility of impairments over time (i.e. the cliff-effect).
- Hypothesis 2: The front-loading effect impedes banks' ability to retain earnings.

The third hypothesis investigates the interplay of both effects. As the front-loading of credit losses compromises banks' capital adequacy, the associated increase of a banks' probability of default (PD) should be particularly strong at the onset of a crisis. In the long run, this impact should decrease due to the alleviation of the cliff-effect.

- Hypothesis 3: The introduction of the IFRS 9 ECL model diminishes capital adequacy through front-loading losses and hence increases banks' PD.

The European bank stress test results provide data on the impact of a simulated macroeconomic baseline and adverse scenario on the resilience of the largest EU banks (Acharya et al., 2014; Borio et al., 2012). To simulate a crisis, the stress test methodology defines exogenous shocks to a set of macroeconomic variables, which are included as control variables in our regression model. The sample consists of empirical data of 43 banks from 15 European countries from 2014 until 2018. Moreover, the data set contains forecasts until 2020, which allows for an early and unbiased (i.e. net of COVID-19 pandemic impacts) assessment of the two effects under IFRS 9 and IAS 39.

The results of the study confirm the three hypotheses. Regarding the first hypothesis, the results show a significant reduction in impairments volatility in the wake of the implementation of IFRS 9. This validates the presumed mitigation of the cliff-effect by means of the staging approach and indicates the advantage of the ECL approach to enhance financial stability. Consistent with the second hypothesis, impairments exhibit a strong increase at the beginning of a crisis scenario due to the front-loading of ECLs under IFRS 9. During this period, banks are impaired to retain earnings and strengthen their capital levels. However, this impact decreases as time progresses. The findings of the third hypothesis confirm the prediction that the procyclical effects are gradually reduced over time, indicating the improvement of the new model for banks' resilience in the long run. Impairments react less cyclically to economic fluctuation, making banks less vulnerable to an economic crisis.

The results are also relevant for the regulatory policy discussion. First, the findings suggest that the timelier loss recognition improves financial stability. Second, while IFRS 9 reduces the procyclical implications of the cliff-effect, they are not fully resolved. To this end, the countercyclical capital buffer (CCyB) as required under Basel III may need to be actively applied in order to absorb the remaining cliff-effect (ESRB, 2017). This is especially important since by now only a fraction of the 28 European countries enforced the buffer to 2.5 % of the bank's risk-weighted assets.

1 Introduction

In retrospect, the subprime crisis revealed fundamental drawbacks in the incurred loss accounting of IAS 39 (Barth and Landsman (2010); Gebhardt (2016); Hashim et al. (2016)). Particularly criticized for its late and incomplete recognition of impairments ("too little, too late"), regulators around the globe have called for changes (G20 (2009); BCBS (2016)). Responding to this criticism, the IASB urged a comprehensive revision of the accounting standard for financial instruments, which culminated in the release of IFRS 9 (IASB (2014b)). It constitutes a paradigm shift in the calculation of impairments for financial institutions by recognizing deteriorating credit quality in an expected credit loss (ECL) instead of an incurred loss model. Where impairments were previously only realized when a loss event had been identified (IAS 39.59), IFRS 9 introduced a forward looking staging model, which gradually realizes them over time (IFRS 9.5.5). This adjustment is intended to lessen the severity of sudden jumps in losses ("cliff-effect"), and to diminish procyclicality. That is the positive correlation between the economic cycle and the lending activity of banks. As a result, banks have excessive capital during the expansion, while they have a shortfall during contraction (Daníelsson (2019)). The changes from IFRS 9 are expected to address these concerns, and to increase financial stability, for which only broad definitions exist (Gadanecz and Jayaram (2009); Hakkio and Keeton (2009)). For the purpose of this paper, we will look at the interaction between capital adequacy and banks' probability of default (PD) in order to measure their resilience and discuss potential implications on financial stability.

Despite its expected positive implications for financial stability, the introduction of IFRS 9 exerts influence beyond a reduction of the "cliff-effect". The earlier recognition of impairments induces a significant "front-loading" of credit losses, which is expected to impede banks' ability to retain earnings. As they are a key component of Common Equity Tier 1 (CET1), not only banks' balance sheet equity, but also their regulatory capital presumably decreases. All else equal, this reduction of capital adequacy constitutes a noteworthy drawback for the individual bank's resilience and the financial sector as a whole. An impact study by the European Banking Authority (EBA) estimated an additional need for capital of 47 basis points of CET1 on average (EBA (2018d)), which translates to EUR 5.7 billion for the banks in the stress test. Another issue was raised by Abad and Suarez (2017), who analyze a portfolio of European corporate loans. They find that the impact of IFRS 9 will be most pronounced during an economic downturn, questioning the idea of reducing procyclicality as theorized by Beatty and Liao (2014).

These findings raise concerns, if the new impairment model of IFRS 9 represents an appropriate response to the experiences of the last financial crisis. We look at the European bank stress test results, which provide a first and unique opportunity to empirically investigate this research question. Moreover, they are beneficial for our identification strategy for four reasons in particular. First, they provide two macroeconomic scenarios, which enables us to assess the severity of the methodological changes. Comparing both scenarios further allows us to infer on the theorized reduction of procyclicality. Second, the assumptions of a static balance sheet and model stock isolate the effect we want to measure. Third, they are unbiased by the COVID-19 pandemic and governmental support that was enacted in response thereto. Fourth, they provide sufficiently granular data to address our research question in detail. In doing so, we set ourselves apart from Abad and Suarez (2017) who only analyze a portfolio of European corporate loans in a model-based setting.

Our approach to the problem necessitates the unification of two strands of literature: financial accounting in the context of capital adequacy and stress testing. Notable contributions are made by Novotny-Farkas (2016) and Krüger et al. (2018), who investigate the interaction between the novel impairment model and capital requirements under Basel III. Despite a manifold growth of the literature on stress testing, it is yet to address the intersection this paper identifies. Two major branches of the literature on stress testing can be discussed. One concerns stress testing as an essential part of the Basel framework (Foglia (2009)) and discusses the development of alternative risk measurement approaches (Hanson et al. (2011); Acharya et al. (2014); Schuermann (2014)) or methodological improvements (Borio et al. (2012)). The other branch empirically assesses how the publication of stress tests results influences the market value of equity or CDS spreads of banks (Flannery et al. (2017); Ahnert et al. (2018); Sahin et al. (2020)).

Despite valuable contributions from the literature, our research question concerning the effect of IFRS 9 on banks' resilience remains unanswered at large. Given the implications of sound banks for the real economy, it seems appropriate to fill this research gap. We construct a panel of banks from the EBA stress test exercises from 2014 to 2018 in order to address this issue. Doing so yields a sample, in which both accounting standards are present, such that we can contrast them for substantiated inference. Our analysis shows that IFRS 9 increases impairments in the short run due to the theorized "front-loading" effect. At the same time, banks benefit from the reduced "cliff-effect" in the long run. Drawbacks surrounding the "cliff-effect" and its contribution to procyclicality have not been fully addressed. We hence argue to increase regulatory buffers against them, as called for under Pillar 1 of Basel III.

The remainder of the paper is structured as follows. Section 2 provides an overview of the conceptual differences between IAS 39 and IFRS 9, and disentangles their interrelation with regulatory stress testing as conducted by the EBA. In line with it we devise hypotheses concerning the effects of IFRS 9 and elaborate on the intended tests in Section 3. We present the analyzed data set in Section 4 and show the results in Section 5. Section 6 verifies our results by means of robustness tests. This paper concludes in Section 7, where it also gives an outlook on future research.

2 Theoretical Background

2.1 Differences between IAS 39 and IFRS 9

Under IAS 39, the recognition of expected losses was explicitly precluded by the standard setter. Instead, impairment losses were only incurred as of the balance sheet date, if there was objective evidence for them resulting from an event that succeeded the initial recognition of the asset (a "loss event") (IAS 39.58 f.). This definition has left plenty of leeway for judgmental factors, concerning what constitutes objective evidence (Dugan (2009)). Furthermore, it delayed the recognition of so called "day-1-losses", which occurred immediately after origination, yet were only realized as of the balance sheet date (IAS 39.AG92, IAS 39.E.4.2).

The latest financial crisis drew attention to this undue timely discrepancy between the loss event and its recognition (Barth and Landsman (2010); Gebhardt (2016); Hashim et al. (2016)). Moreover, the backward-looking nature of the impairment model was criticized for potentially aggravating the crisis situation (Vyas (2011); Kothari and Lester (2012); Marton and Runesson (2017)). Amongst others, the G20 raised concerns that loan loss provisioning of credit losses under the incurred loss method of IAS 39 was achieving "too little, too late" (G20 (2009); Hoogervorst (2014); BCBS (2016)). Although Bischof et al. (2019) challenge this view, by showing that banks' loss recognition was not constrained under IAS 39, there is substantial empirical evidence concerning the negative effects of an undue delay in loan loss provisioning (Beatty and Liao (2011); Bushman and Williams (2015)). Figure (1) below illustrates the disparity in loan loss provisioning.

Annual Impairments for U.S. and International Banks

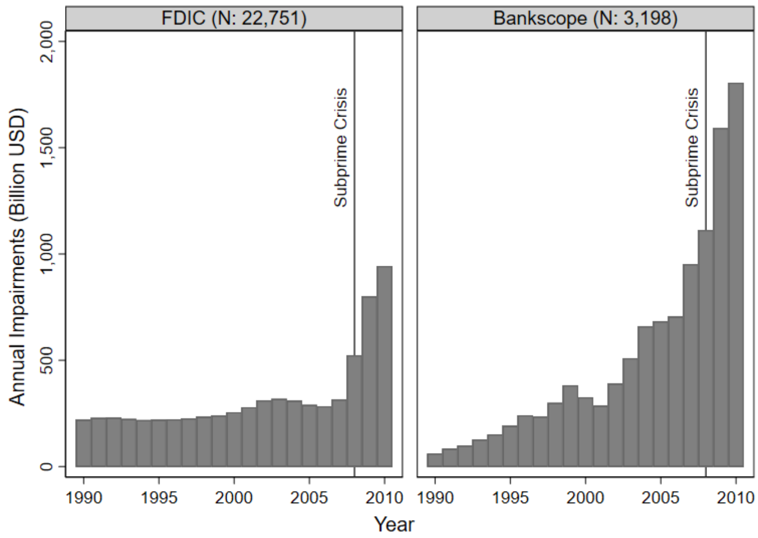

Figure 1: Development of impairments over time for different jurisdictions.

Based on U.S. data from the Federal Deposit Insurance Corporation, the left graph of Figure (1) shows that while impairments increased around the subprime crisis, they only partially reflected the actual losses. The annual loss provisioning in the subsequent years exceeds that of the subprime crisis by a factor of almost two. The right graph of Figure (1) draws a similar image using global bank data from Bankscope. Again, impairments related to the last financial crisis grow twofold after the actual crisis, indicating the incomplete accounting of incurred losses. Responding to this criticism, the IASB urged a comprehensive revision of the accounting standard for financial instruments, resulting in the release of IFRS 9 (BCBS (2015)).

With the new impairment methodology of IFRS 9 the IASB introduced a forward looking expected credit loss model (IFRS 9.5.5), requiring a more timely recognition of impairments (Landini et al. (2018)). This change was supposed to counteract the weakness of delayed credit loss recognition under IAS 39 (IFRS 9.BC.IN.2). As a consequence, the scope for the recognition of credit losses was extended beyond the static requirement of an incurred loss event as a trigger (Gebhardt (2016); Novotny-Farkas (2016)). Instead, IFRS 9 is predicated on a recognition of ECL immediately after a financial instrument's initial recognition (IFRS 9.5.5). The IASB defines ECL as probability-weighted estimates of credit losses (i.e., the present value of cash shortfalls) (IFRS 9.5.5.17).

Estimations of ECL shall consider all relevant information, including historical data, current conditions as well as supportable forecasts of future events and macroeconomic conditions (IFRS 9.5.5.17). Thus, IFRS 9 significantly extends the information set required to determine credit losses. The scope of the IFRS 9 impairment model includes financial assets measured at amortized cost or fair value through other comprehensive income (FVOCI). Moreover, the ECL model is applied to lease receivables, trade receivables or contract assets as well as all loan commitments and financial guarantee contracts that are not measured at fair value through profit or loss (FVPL) (IFRS 9, 4.1.2, 4.1.2a, 5.5.1, 5.5.2, BC5.118).

A key element of the IFRS 9 impairment model is the so-called three stages approach, which categorizes financial instruments according to their credit quality (i.e. 'Stage 1', 'Stage 2' and 'Stage 3'). It lessens the severity of the "cliff-effect" by gradually recognizing the ECL over the lifetime of the loan and thus reduces procyclical effects. The assignment to the stages depends on the change in credit risk since initial recognition (IASB (2013, 2014c)), and prescribes which methodology must be applied for calculating the ECL.

Stage 1 includes financial assets that were not subject to a significant increase in credit risk since initial recognition or exhibit a low credit risk as of the reporting date (IFRS 9.5.5.5). Their loan loss allowance is recognized as the 12-month ECL, which is defined as the share of the lifetime expected credit losses resulting from default events, which are possible within 12 months of the reporting date (IFRS 9 Appendix A). Interest revenue is calculated based on the gross carrying amount of the asset that is without deduction of the loan loss allowance (IFRS 9.B5.5.43).

Stage 2 includes under-performing financial assets, which exhibit a significant increase in credit risk since initial recognition. In this stage, the lifetime ECL has to be recognized (IASB (2014a); IFRS 9.5.5.3-4). It is defined as the expected credit loss from all possible default events over the expected residual life of the financial instrument (IFRS 9 Appendix A). The calculation of interest revenue remains the same as for Stage 1 (IASB (2014c); IFRS 9.5.5.3-4). At each reporting date, the reporting entities are required to evaluate whether a potentially significant increase in credit risk has occurred (IFRS 9.5.5.9). Besides the "rebuttable presumption that the credit risk on a financial asset has increased significantly since initial recognition when contractual payments are more than 30 days past due" (IFRS 9.5.5.11), the IASB provides a list of information that may be used for the assessment of a significant credit risk deterioration (IFRS 9.B5.5.17). In addition to that, the standard setter grants a "low credit risk exemption", which excludes financial assets from the continuous credit-risk assessment and allows them to remain in Stage 1, as long as they exhibit a low credit risk (IFRS 9.5.5.10). An investment grade rating by a major rating agency may serve as such an indicator (IFRS 9.B5.5.22 ff.; IFRS 9.BC5.188 f.).

In case of a further increase in credit risk up to the status of non-performing or credit-impaired assets, the respective financial instrument must be allocated to Stage 3 (IASB (2014a)). The criteria for a financial asset to be considered as such are listed in Appendix A of IFRS 9, and largely match the objective evidences of a loss event according to the former IAS 39.59. As in Stage 2, the ECL of Stage 3 is recognized on a lifetime basis. Interest revenue is calculated based on the net carrying amount of the asset, which is the gross carrying amount less loan loss allowance (IFRS 9.5.4.1). ECL recognized in Stage 3 will likely be larger compared to Stage 2, reflecting the default position of the underlying assets. Table (1) provides a short overview over key implications of the three stages.

Besides this three stages approach, IFRS 9 provides a separate impairment model for financial assets purchased or originated credit impaired (POCI). They must be categorized directly in Stage 3, and their accumulated impairments only include the cumulative changes in lifetime ECL since initial recognition (IFRS 9.5.5.13-14)

	Stage 1	**Stage 2**	**Stage 3**
Classification	performing	under-performing	non-performing
Expected Loss	12 months	lifetime	lifetime
Interest Rate Calculation	gross book value	gross book value	net book value

Table 1: Stages according to IFRS 9.

This new impairment model appears to be a major concern for the banking industry as the initial set-up costs, as well as the adjustments to loan loss allowances are expected to increase compared to the former IAS 39 model. Since they are recognized through the P&L of the bank (IFRS 9.5.5.8), its ability to retain earnings is initially impeded (Deloitte (2013); Reitgruber et al. (2015); EBA (2016)). This interrelation negatively influences regulatory capital levels in banks (Hashim et al. (2015); Gebhardt (2016); Novotny-Farkas (2016)). Empirical evidence suggests that banks may counteract this pressure by asset sales or scaling back their loan supply (Abad and Suarez (2017); ESRB (2017); Sánchez Serrano (2018)). However, doing so during a crisis would be diametrical to fostering financial stability, as asset prices would be further depressed and thus exacerbate the economic downturn. While the ECL model does mitigate procyclicality from the "cliff-effect", it does not fully resolve the issue. As shown in the full line of Figure (2), the transfer from Stage 1 to Stage 2 and the associated transition from the 12 month to the lifetime ECL still constitute an abrupt increase in loan loss allowances (Hashim et al. (2016); EBA (2016); Novotny-Farkas (2016)). At the same time, this rise is less pronounced in comparison to IAS 39 in the dashed line, which exhibits a delayed but substantial jump in impairments, up to the point where the loan would be charged out. While IFRS 9 is thus an improvement in relative terms, the threat of a downward spiral in asset prices in conjunction with unresolved procyclicality necessitates the presence of countercyclical capital buffers as required under Pillar 1 of Basel III to provide a backstop against this cascade (EBA (2017); ESRB (2017)).

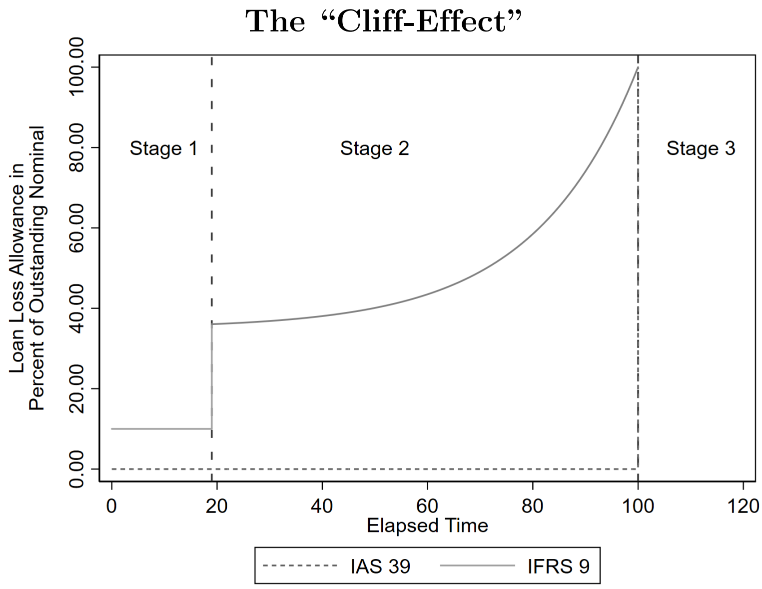

Figure 2: Illustration of the "cliff-effect" in conjunction with "front-loading" - adapted from IASB (2013)

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While the discussed "too little, too late" (G20 (2009); Hoogervorst (2014); BCBS (2016)) problematic of IAS 39 has been addressed by the ECL model, not all issues of IAS 39 have been resolved (Lloyd (2018)). Another shortcoming concerns the critique that the backward-looking approach may have amplified the subprime crisis (Barth and Landsman (2010); Gebhardt (2016); Hashim et al. (2016)). Since the estimation of the PD under IFRS 9 reflects a more point-in-time (PIT) nature (EBA (2021)) and requires the incorporation of reasonable and supportable information "[...] to reflect current observable data and forecasts of future conditions [...]" (IFRS 9 BC 5.281), IFRS 9 might still be susceptible to criticism of a crisis-reinforcing effect. The IFRS 9 approach can be related to the general goal of financial reporting that is to provide useful information, which are relevant to the decision making of outsiders of the reporting entity (IASB (2010, 2018)). In fact, although the objectives of financial reporting and prudential regulation partially overlap, the IASB emphasized that prudential aims such as financial stability and achieving counter-cyclical effects are not the objectives of the IFRS 9 impairment requirements, but rather the timely reflection of credit losses and economic reality (IFRS 9 BC 5.285-6). However, the IFRS 9 approach entails profound consequences, as the estimated PD may be inflated during crises, respectively deflated during economic expansion (Borio and Lowe (2001)). Consequently, these estimates, which tend to be PIT in nature and incorporate a broad range of information, are subject to cyclical amplifications, and may even contribute to procyclical behavior, which is especially problematic as the PD influences the assignment to the three stages of IFRS 9 (Novotny-Farkas (2016); Vaněk et al. (2017)).

Taking this characteristic into account, the internal ratings-based approach (IRB) under Basel III uses through-the-cycle (TTC) estimates for the calculation of the PD. Instead, under IFRS 9 this approach is explicitly excluded for the estimation of the PD (IFRS 9 BC 5.282). The TTC approach relies on long-run averages of multiple historic data points, which results in stable estimates and counteracts procyclicality. This estimation methodology better serves the goal of financial regulation, which strives to prevent bank failures and to safeguard the entire financial system (Laux and Leuz (2009)). Figure (3) illustrates the differences between the two approaches and raises in line with our research question the concern, whether IFRS 9 has contributed to the goal of the FSF (2009) to foster financial stability by reducing the procyclical effects of IAS 39.

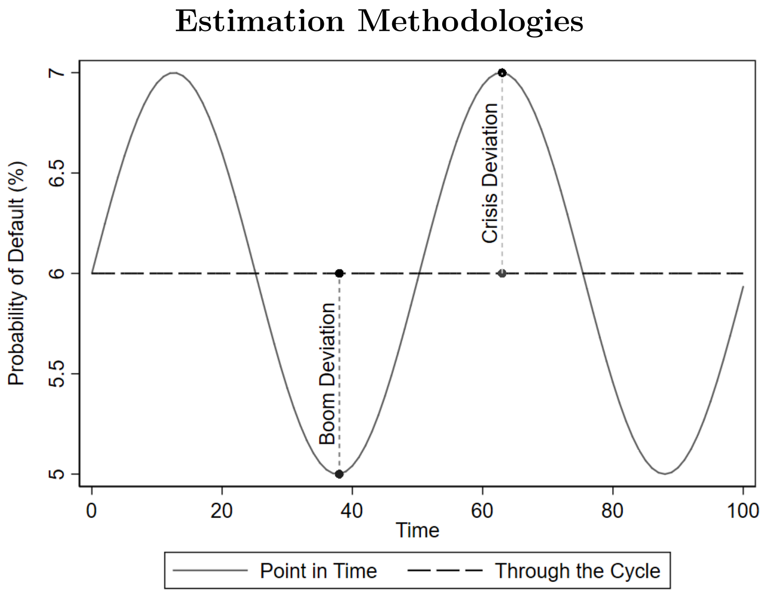

Figure 3: Illustration of the differences between through the cycle (TTC) and point in time (PIT) estimation.

Taken together, IFRS 9 presumingly reduces the "cliff-effect" by introducing a forward looking staging model. Doing so has reduced jumps in impairments, which may have procyclically enforced economic downturns. However, estimators under IFRS 9 have a more PIT nature, and may thus not have gone far enough in addressing the concerns of the FSF (2009) regarding procyclicality. One way of mitigating this drawback is through designated capital buffers. Namely, the capital conservation buffer (CCB) and countercyclical capital buffer (CCyB) were designed with this intent. They amount to up to 2.5 % of the bank's risk-weighted assets (RWA). Special attention should be drawn to the CCyB, which was explicitly designed as a macroprudential tool to this end. Its required paid in capital is at the discretion of national competent authorities and thereby predestine to alleviate procyclicality in select jurisdictions. Out of 28 reporting countries, only one fully enforces the requirements (BIS (2018); ESRB (2019)) at the time of this paper, hence questioning their adequacy in times of crises. A more detailed discussion of the capital types and buffers can be found in Figure (11) in the Appendix. Against this background, it should be noted that capital requirements are not the sole macroprudential policy tool. Instead, the list is rather extensive and includes additional tools. Liquidity requirements such as the liquidity coverage ratio (LCR), or constraints with regard to loan origination (e.g. loan-to-value (LTV) or debt service ratios (DSR)) serve as examples to this end (Orsmond and Price (2016)). However, as the focus of this paper is on the estimation of credit losses and the impact of the aforementioned tools thereto is rather low, they were not further analyzed.

Another benefit of IFRS 9 concerns the more timely recognition of losses due to the ECL model. These advantages though came at the cost of "front-loading" credit losses. Section 3 will shed further light on these effects and empirically assess, whether the net benefit of IFRS 9 is positive.

2.2 Introduction to Stress Testing

Stress tests are forward-looking assessments of banks' capitalization (i.e. microprudential stress test) or the stability of the financial system as a whole (i.e. macroprudential stress test) under simulated adverse economic conditions (Hanson et al. (2011); Borio et al. (2012); Acharya et al. (2014); Ahnert et al. (2018); Duffie (2018)). One of their major objectives is to assert bank solvency (Acharya et al. (2014); Schuermann (2014)), after the last financial crisis had revealed severe (qualitative and quantitative) shortcomings in this regard (Ahnert et al. (2018)). Moreover, they facilitate supervisors to assess, whether banks comply with their regulatory capital requirements and are one tool, which European supervisors employ as part of the second pillar Supervisory Review and Evaluation Process (SREP) (BIS (2006); EBA (2018a); Paisley (2017); Ahnert et al. (2018); Riebl and Gutierrez (2018)). Additionally, regulators can test key risks such as credit, market, and liquidity risks under predefined stress scenarios to identify potential needs for capital of individual banks or to assess systemic risks, which may compromise the financial systems' stability (Ahnert et al. (2018)). Ultimately, the final disclosure of regulatory stress testing intents to improve market discipline of financial institutions and alongside increases transparency to the market (de la Lastra and Ramón (2012); Acharya et al. (2014); EBA (2018a,b)).

The first European regulatory stress test exercises were launched in 2009 and 2010 by the Committee of European Banking Supervisors (CEBS). From 2011 onwards, its successor, the EBA, conducted further exercises in the year 2011, and biennially from 2014 forth. Initially, the EBA's stress tests included capital hurdle rates to assess a bank's passing or failing of the test to consider further recapitalization actions in case of a failure (Riebl and Gutierrez (2018)). In the 2014 exercise, this "pass or fail threshold" was abolished. Instead, the results henceforth served as an input to the

SREP (EBA (2018a,b); Riebl and Gutierrez (2018)). The effects of the stress test scenarios on banks' capital are reported in terms of the capital ratios required by Basel III (Acharya et al. (2014); EBA (2018b)). One focal item is CET1 capital, lying at the intersection of financial accounting, which this paper discusses.

Overall, the stress test coordinated by the EBA is a comprehensive exercise undertaken in close cooperation with national and EU authorities to assess the resilience of EU banks to severe market developments (de la Lastra and Ramón (2012); EBA (2018a,b); ESRB (2018)). It is conducted as a constrained bottom-up exercise, in which the participating banks apply their own internal models to project the effects of the scenarios, but are limited to the common methodology of the EBA (EBA (2018a,b)). Furthermore, it is conducted at the highest level of consolidation (i.e. group level) to assess the resilience of the largest EU banks to a (simulated) common macroeconomic baseline as well as adverse scenario over a period of three years. While there is no severely adverse scenario, as in the stress tests of the Federal Reserve, the adverse scenario of the EBA methodology can be ranked in between the adverse and severely adverse scenario of the Federal Reserve (Haselmann and Wahrenburg (2018); EBA (2018a)). Along with other divergent assumptions, such as a dynamic balance sheet, a general comparability between the two stress tests is not given. The EBA is responsible for the development of a common methodology, which all examined banks have to adhere. Furthermore, it collects the final data and disseminates it to the public to foster transparency. In devising the methodology, it is aided by the Directorate General for Economic and Financial Affairs of the European Commission, which provides the baseline scenario. The European Systemic Risk Board (ESRB) is responsible for developing the adverse macroeconomic scenarios (EBA (2018b)), while scenarios for Norwegian banks are developed by the local central bank (Norges Bank) in conjunction with the Financial Supervisory Authority of Norway (Finanstilsynet).

In November 2017 the EBA published its final methodology for the 2018 stress test, which was launched in conjunction with the release of the macroeconomic scenarios on 31st January 2018. It lays out predefined exogenous shocks to macroeconomic variables, such as gross domestic product (GDP) and consumer price inflation (CPI), which we include as controls in our following regression model. As in previous iterations, the bottom-up exercise is subject to strict constraints. The methodological note specifies to conduct the stress test on a static balance sheet. This assumption mandates a replacement of assets and liabilities that mature during the exercises' time horizon "with similar financial instruments in terms of type, currency, credit quality at date of maturity, and original maturity as at the start of the exercise" (EBA (2018c)). In relation to the static balance sheet assumption, the EBA stress test interdicts the incorporation of anticipated capital increases by means of raises or conversions (EBA (2018a,b)). Doing so constitutes a noteworthy difference compared to other stress tests, as for example from the Bank of England, which allows capital actions (BOE (2016)). Furthermore, the static balance sheet assumption prevents our data from being distorted by regulatory interventions in response to the COVID-19 pandemic. More specifically, the granting of moratoria has influenced the counting of days past-due, thereby distorting the staging of IFRS 9. This interaction constitutes a possible bias not only for the underlying data, but also the subsequent results. Additionally, the recent IFRS 9 monitoring report by the EBA found that banks made extensive use of management overlays during the COVID-19 pandemic, which similarly contradicts an unbiased measurement of transitory effects and hence favors the usage of stress test data (EBA (2021)). In order to gain a higher degree of transparency and comparability among banks, it is moreover assumed that participating banks maintain the same business mix and model throughout the time horizon. Ultimately, banks are subject to a model stock and can only use the internal models they have devised at the beginning of the simulation (EBA (2018c)).

For the estimation of the capital and P&L impact, the credit risk stress testing framework covers only amortized cost positions and explicitly excludes FVOCI and FVPL positions from the estimation of credit risk losses (EBA (2018a)). Especially the new impairment model of IFRS 9 implicated profound adjustments to the stress test credit risk methodology. These adjustments, which partly diverge from IFRS 9 requirements, largely concern the single scenario assumption and perfect foresight as well as the stage definitions and transfer specifications.

Under the single scenario assumption, the EBA requires banks to calculate the ECL based on one scenario (i.e. the baseline and the adverse macroeconomic scenario), instead of multiple probability-weighted cases (IFRS 9.5.5.17 (a)). Furthermore, it is assumed that banks know the precise development of the macroeconomic scenarios when calculating the lifetime ECL. It implies that all loan loss provisions for Stage 2 and Stage 3 exposures are accrued in 2018. Provisions in the following years will only be due to stage migration (EBA (2018c)). While the bidirectional transfer between Stages 1 and 2 is allowed, cures from Stage 3 are prohibited (EBA (2018a)). As under IFRS 9.5.5.5, financial instruments, whose credit risk has not increased significantly since initial recognition, are allocated to Stage 1. In line with IFRS 9, the criterion of a significant increase in credit risk (SICR) serves as a transfer criterion to Stage 2. The methodological note clarifies that the same classification criteria may be used as under the IFRS 9 model. Furthermore, the EBA defined an additional SICR-trigger, which transfers exposures with a threefold increase over their initial lifetime PD to Stage 2. Similar to IFRS 9, a low credit risk exemption may be applied. However, the EBA specification diverges from IFRS 9 requirements, as the threshold is independent of a credit-rating. Instead, an instrument can be considered to exhibit a low credit risk, if its probability to move from Stage 1 to Stage 3 within 12 months is less than 0.3 %. Finally, exposures are allocated to Stage 3, if their credit quality decreases further to the point that they are considered to be credit-impaired as defined under IFRS 9. Moreover, following the uniform application of Basel III in all EU Member States under the so-called Single Rulebook, exposures are allocated to Stage 3, if they are defaulted as per Art. 178 of the capital requirements regulation (CRR) or classified as non-performing as per EBA Implementing Technical Standard. Banks are permitted to apply their own internal accounting practices and definitions as long as they yield more conservative results (EBA (2018a); Riebl and Gutierrez (2018)).

3 Hypotheses and Evaluation Methodology

The previous chapter has covered the theoretical background of the two accounting standards extensively and clearly identified their differences. The introduction of gradual loss recognition under the three stages model of IFRS 9 is expected to reduce the "cliff-effect" at the cost of introducing a "front-loading" of losses. We verify these mechanics in hypothesis one and two, before investigating the conjunction of the two effects in the third hypothesis.

Hypothesis 1 *The gradual recognition of impairments under the staging model of IFRS 9 reduces the volatility of impairments over time (i.e. the "cliff-effect").*

We test this hypothesis by comparing the variance of impairments under IAS 39 and IFRS 9. If our hypothesis is correct, we expect variance heterogeneity as the variance under IFRS 9 will be lower than under IAS 39. At the same time, the "front-loading" component should reduce the potential of banks to retain earnings, which constitute amongst other paid up instruments CET1 (Art. 28 CRR). Hence, we assume that banks cannot strengthen their regulatory capital base as measured by CET1, through retained earnings and posit:

Hypothesis 2 *The "front-loading" effect impedes banks' ability to retain earnings.*

Furthermore, we investigate how the introduction of IFRS 9 has influenced the dynamics between impairments and financial stability. While a plurality of liquidity and capital ratios exists in order to prevent bank failure, we focus in particular on the latter, as it is the stronger transmission channel to our understanding. More specifically, impairments constitute losses, which deteriorate the capital adequacy of a bank and hence increase its likelihood of failure. Against this background, we hypothesize that the "front-loading" effect will deplete the banks' capitalization and hence increase their PD.

Hypothesis 3 *The introduction of the IFRS 9 ECL model diminishes capital adequacy through "front-loading" losses and hence increases banks' PD.*

We test this hypothesis by computing the bank-level PD using the z-Score as in Goetz (2018). In line with the seminal work of Roy (1952), our values are normally distributed. Hence, we do not apply the standardization as suggested in Laeven and Levine (2009) or Houston et al. (2010).

$$z_{i,t} = \frac{ROA_{i,t} + CA_{i,t}}{\sigma(ROA_{i,t})} \tag{1}$$

The nominator of the equation above consists of the return on assets (ROA) and the capital adequacy (CA), which is measured as the ratio of own funds (i.e. the sum of Tier 1 and Tier 2 capital as defined in Articles 4(118) and 72 of the CRR), to total assets. The denominator of Equation (1) is the standard deviation of the ROA. The subscript t denotes time, while i refers to the bank.

We use the z-Score as our dependent variable in a subsequent fixed-effects regression model, where we investigate the impact that impairments have on our proxy for bank PD under IAS 39, and the new IFRS 9 standard. The relationship between the likelihood of bank failure and the z-Score is inverse, such that we expect a negative coefficient on our variable of interest, impairments (IMP). We standardize impairments by total assets, in order to prevent a size bias, as large banks will naturally incur more impairments. The detailed model can be obtained from Equation (2).

$$\begin{aligned} z_{i,t} = {} & \beta_1 IMP_{i,t} + \underbrace{\beta_2 LR_{i,t} + \beta_3 RISKDIV_{i,t} + \beta_4 ROID_{i,t}}_{\text{bank controls}} \\ & + \underbrace{\gamma_1 HPI_{c,t} + \gamma_2 CPI_{c,t} + \gamma_3 UNEMP_{c,t} + \gamma_4 GDP_{c,t}}_{\text{macro controls}} + \alpha_i + \mu_t + \epsilon_{i,t} \end{aligned} \tag{2}$$

We incorporate multiple explanatory variables in our model. Our control variables for bank characteristics include the leverage ratio (LR), the risk diversification (RISKDIV), and the income diversification (ROID). Controls for bank size are obsolete for two reasons in particular: First, the static balance sheet assumption replaces maturing assets and liabilities with comparable assets and liabilities and thus keeps total assets fixed, which would make it conceptually difficult to incorporate them in a fixed-effects model. Second, the significance assumption of the EBA makes sure that only comparably large banks are part of the stress test (SSM (2013)). Hence, the interquartile range of total assets is rather small and has little variation in the cross section. The LR is defined as the ratio of Tier 1 capital to total assets, while RISKDIV is a Herfindahl-Hirschman-Index, where the squared sum of the respective risk category is scaled by total RWA as shown in Equation (3):

$$\begin{aligned} \text{RISKDIV}_{i,t} = {} & \Big(\frac{\text{RWA(Credit Risk)}_{i,t}}{\text{RWA(Total)}_{i,t}}\Big)^2 + \Big(\frac{\text{RWA(Market Risk)}_{i,t}}{\text{RWA(Total)}_{i,t}}\Big)^2 \\ & + \Big(\frac{\text{RWA(OpRisk)}_{i,t}}{\text{RWA(Total)}_{i,t}}\Big)^2 \end{aligned} \tag{3}$$

In order to measure the degree of income diversification (ROID), we employ the technique of Laeven and Levine (2007) and derive an index that assumes values between zero and one. It captures the distribution between net interest income (NII) and net non-interest income (NNII), relative to their sum, the total net operation income (NOPI). The higher the value, the higher the income diversification.

$$\text{ROID}_{i,t} = 1 - \left| \frac{\text{NII}_{i,t} - \text{NNII}_{i,t}}{\text{NOPI}_{i,t}} \right| \tag{4}$$

Our second set of control variables includes four variables from the macroeconomic scenario, whose influence is measured by γ_i. As they are on a country-level, we introduce the subscript c to differentiate between the respective countries. We include them in order to account for the different macroeconomic scenarios, as well as structural differences between the heterogeneous countries, in which the assessed banks operate. Doing so renders the usage of country-fixed effects obsolete, as they would induce multicollinearity. Furthermore, all of them influence repayment behavior and thus the likeliness of a loan to be impaired. Especially rising unemployment (UNEMP) should severely increase the probability of delinquency, respectively default, and thus negatively influence CET1. Contrarily, a high level of GDP can be associated with a sound economic environment, in which late payments or the absence of payments occur seldom. As a result, CET1 should be high, when GDP is high. The same relationship can be attested for the House Price Index (HPI). When housing prices are high, default rates should be low, as consumers can easily refinance existing loans by borrowing against the higher value of their real estate. The influence of Consumer Price Inflation (CPI) is ambiguous. Given that wages adjust in parallel to inflation, impairment rates should decrease because the debt payments on fixed interest loans become more affordable to the consumer. To the contrary, if wage growth cannot keep up with inflation, people have less available income to allocate to debt service. We thus refrain from making an a priori assumption about the possible influence of CPI. A comprehensive list of the variables can be found in Table (2) in the Appendix.

Since we are interested in explaining the differences of an observed bank over time, a fixed-effects model is appealing from an econometric perspective. In particular, we apply bank and time fixed-effects, which are denoted by α, respectively μ in Equation (2). Applying the Hausman test deems the usage of such a model appropriate. Standard errors are clustered on the bank-level in order to account for heteroscedasticity. We evaluate the equation four different times, for all combinations of IAS 39 and IFRS 9 and the baseline, respectively adverse scenario. We look at the estimated coefficients in order to validate our hypothesis.

We employ the eigenvalue test of Belsley (1991) to test for multicollinearity, and disperse this concern as all condition indices are below ten. We chose this test, as it performs better for fixed-effect models, and allows to conclude on the drivers of multicollinearity, unlike e.g. the variance inflation factor (VIF). Furthermore, discarding either of the variables in our model could potentially constitute an econometrically more severe endogeneity problem due to an omitted variable. We thus proceed with the initial model, as shown in Equation (2). Lastly, we investigate whether the variables in our panel are stationary, using the advanced Dickey-Fuller test and generate evidence against the presence of a unit root.

The proposed methodology benefits from the stress test framework. Under the static balance sheet assumption, exposures are fixed and replaced with comparable assets at maturity. Hence, there is no inference to control for. Likewise, the prohibition of changes to the business model and capital structure exclude immeasurable effects from the model. We control for the different macroeconomic scenarios by incorporating them in our estimation model. Our methodology is thus compliant with Appendix B5.5.17 (f) of IFRS 9, which stipulates that the transition between the stages of IFRS 9 can be justified by the expectation of negative economic conditions. Moreover, the model stock assumption enables us to compare IFRS 9 models as of their inception, thus depleting the model of further biases. Consequently, we argue that, ceteris paribus, deviations in the results should be attributable to the enactment of IFRS 9.

4 Data set

Our data set covers all publicly available stress test results from the EBA, respectively the European Central Bank (ECB). We merge the individual results to obtain a joint data set with 43 banks from 15 different European countries. The panel consists of empirical data from 2014 until 2018, as well as forecasts until 2020. We do not intend a counterfactual analysis, but instead contrast IAS 39 and IFRS 9, in order to assess the implications of the change in accounting. Although earlier stress tests are available, they were not incorporated in this paper, as they only disclose whether a regulatory hurdle rate has been exceeded or not. Our full sample represents approximately 70 % of all exposures in the Eurozone and can thus be considered representative. Two notable mergers occurred during the analyzed time. Banco Santander acquired Banco Popular Español, so that the latter was dropped from our panel. Moreover, Banco Popolare - Società Cooperativa and Banco Popolare di Milano merged. Although information for Banco Popolare are included in all three stress tests, we discontinue the time series, as Banco Popolare di Milano was not subject to previous iterations of the stress test and would thus bias the results.

Because of overlapping time frames, we have two observations for the year 2016, which is included in the 2014 and 2016 stress test. Untabulated results show that the values are equal to a confidence level of 99.9 %, when regressed on another. We thus kept the value from the 2014 stress test, in order to keep the time series intact for as long as possible. The data set also contains information on transitory adjustments that might arise from the new accounting standards or other regulatory influences. We decided to not incorporate them in our model for two reasons. First, only a limited number of banks makes use of them. Second, if they are being used, they are negligibly small. Because the stress test is calculated for a baseline and an adverse scenario, we have two observations in the time dimension on the bank-level. We address this issue by conducting our analyses individually for the respective scenarios. The descriptive statistics for the baseline scenario are tabulated in Table (4), whereas the results for the adverse scenario can be found in Table (5). Both tables have been further disaggregated, with the upper panel showing IAS 39 and the lower panel depicting IFRS 9.

5 Results

5.1 Discussion of Hypothesis 1

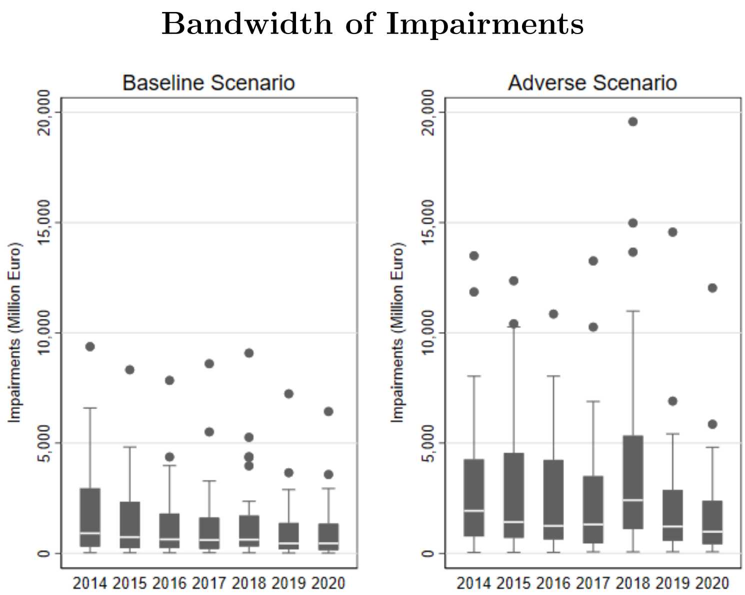

Figure 4: Visualization of Impairments over the analyzed time frame.

Figure (4) depicts the bandwidth of impairments over the analyzed stress test horizon. We chose a box-plot in order to visualize multiple dimensions of our data in an easily understandable way. The position of the 25^{th} (75^{th}) percentile corresponds to the lower (upper) end of the box, whereas the median is indicated by the white line within the box. The adjacent lines refer to values that are not considered outliers, as they are 1.5 times the interquartile range away from the lower and upper percentiles of our box-plot. Values exceeding this distance metric are indicated by full dots. The small box size in the baseline scenario makes it obvious to the eye, that the impairments lie narrowly together, with only little variance, as postulated by our first hypothesis. A small jump in the absolute number of outliers can be observed with the introduction of IFRS 9 at the beginning of 2018 and is in line with the theorized "front-loading", which we will discuss in more detail in the subsequent chapter. The variance under the adverse scenario is noteworthy higher. The larger body is illustrative of a wider interquartile range, which in turn further extends the adjacent lines. In accordance with our prediction, one can observe a significant reduction in volatility after the introduction of IFRS 9 in 2018, which corroborates the "front-loading" hypothesis.

We proceed to empirically investigate the graphical evidence in favor of our first hypothesis by testing for variance homogeneity with Levene's test. Under our hypothesis, we expect the null hypothesis of equal variances to be rejected, as the volatilities of IAS 39 and IFRS 9 differ significantly.

Table (6) about here

Table (6) shows the differences between the baseline (Panel A) and adverse (Panel B) scenario for all three periods during which IFRS 9 is applicable. Using Levene's test, we calculated a test statistic in column four and computed the probability of the test statistic under variance homogeneity in column five. We find for the baseline scenario, that the initial variance homogeneity transitions into heterogeneity as time progresses. At the same time the inverse is true for the adverse scenario. We thus conclude that the impact of the new accounting standard is most pronounced under the adverse scenario, where the variances under IAS 39 and IFRS 9 converge as a result of the initial "front-loading".

5.2 Discussion of Hypothesis 2

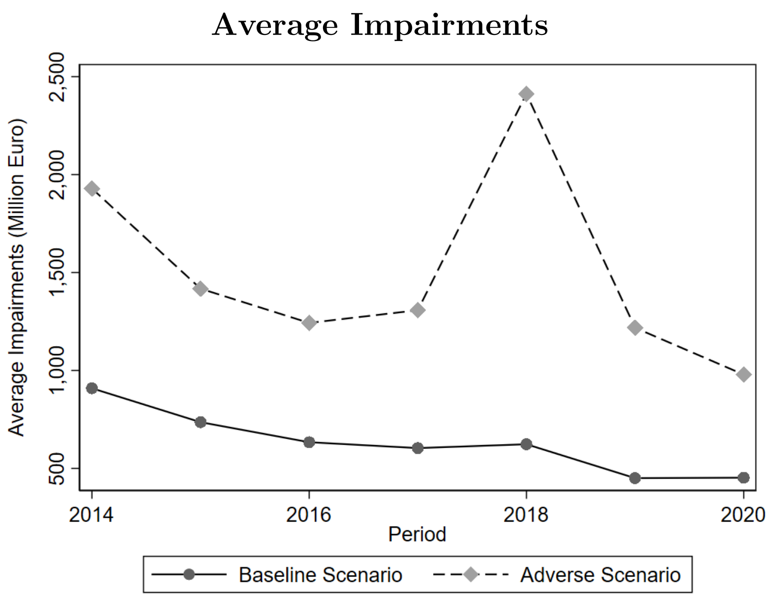

Figure 5: Evolution of the average height of Impairments.

Figure (5) yields graphic evidence of our second hypothesis. It shows that the introduction of IFRS 9 in 2018 has coincided with a massive "front-loading" of impairments. While this observation may partially be explained by the perfect foresight approach from the stress test, it also shows that the immediate loss recognition yielded high initial impairments, yet smooths out with increasing time. In line with our second hypothesis, we proceed to empirically test the impact of this distortion on retained earnings and depict the results in Table (7).

Table (7) about here

As can be inferred from the table above, the “front-loading” effect is not statistically significant for the baseline scenario. Through all analyzed time frames, banks are able to retain earnings in order to foster their capital levels. However, in case of an economic downturn, as depicted by the adverse scenario in Panel B, a very pronounced difference occurs at the onset of the crisis. Throughout the economic contraction banks are impeded in their ability to build up capital. It is only over the course of the economic contraction, that the difference narrows, and roughly vanished in the last year of observations. This finding is in line with the graphical evidence of Figure (5) and illustrates the severity of the “front-loading” effect, which is most pronounced during the economic downturn. We thus conclude in line with our second hypothesis that structural differences between IAS 39 and IFRS 9 exist, and that they are most pronounced at the beginning of the conversion period.

5.3 Discussion of Hypothesis 3

Table (8) about here

Concerning our third hypothesis, we have tabulated the results of the regression in Table (8). They are separated by the two accounting standards, which are divided into the baseline and adverse scenario. Our findings regarding impairments are in line with our predictions. When comparing the baseline scenarios, we find that the coefficient of impairments has grown under IFRS 9. It suggests that impairments exert a stronger influence on bank PD under the new accounting standard. A possible transmission channel opens up from the theorized capital adequacy hypothesis. Due to the “front-loading” effect, banks’ capitalization is negatively impacted, which in turn increases their PD as proxied through the z-Score. Figure (6) illustrates these deliberations by showing that banks are initially profitable in 2017, and then take a substantial hit with the introduction of IFRS 9 in the following year. This finding confirms our third hypothesis, and is in line with the results from our second hypothesis.

Aggregate Impairments and their Impact on Profitability

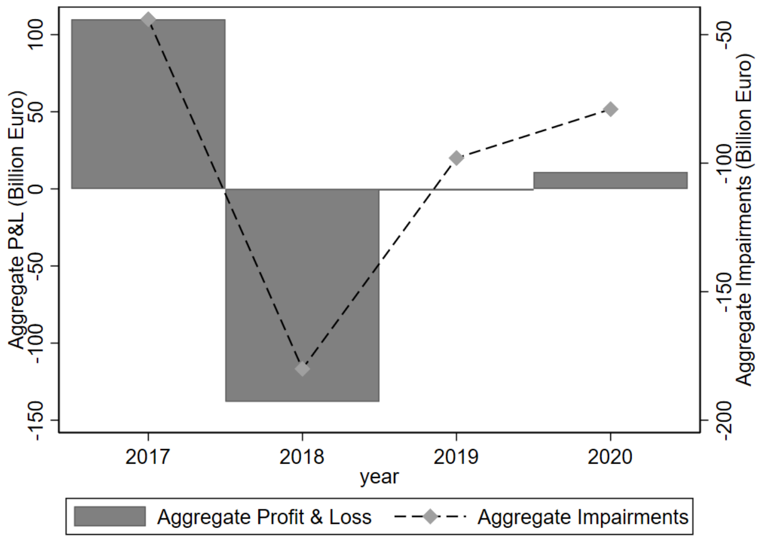

Figure 6: Aggregate Impairments not measured at Fair Value through P&L.

At the same time, we find evidence in favor of the mitigation of the "cliff-effect". The gap between the baseline and adverse scenario has narrowed under IFRS 9, compared to IAS 39. As a result, banks are less vulnerable during economic downturns, as their impairments are less cyclical, and hence do no longer amplify market fluctuations. Again, this observation compliments the findings from our first hypothesis. Another notable observation concerns the leverage ratio, which is only significant under IAS 39. Our results thus suggest, that the mere importance of capitalization has been reduced under IFRS 9, while the importance of profitability in light of the z-Score has grown.

Taken together, we find that IFRS 9 has an ambiguous influence on financial stability. While undesired procyclicality in the form of the "cliff-effect" has been reduced, this was achieved at the cost of "front-loading" expected losses. Impairments thus become more important for bank stability in normal times (baseline scenario), while their importance grows less under distress (adverse scenario). Our findings complement early conjectures made by the EBA (2018b).

6 Robustness

6.1 Outlier Analysis

Due to the research setting, it was not feasible to conduct some common robustness checks. We employ subsampling as part of our identification strategy in order to differentiate between the baseline and the adverse scenario. Therefore, a further disaggregation would only lead to inconclusive subsets with no meaningful data. Likewise, the limited sample size has depleted winsorization or truncation of meaning. To the contrary, the volatile observations under macroeconomic stress actually contain significant information for our research question in light of the "cliff-effect". It may seem appealing to understand the introduction of IFRS 9 as a treatment effect, and to hence employ a difference in difference approach for the identification strategy. However, since there are no banks in the stress test that are not subject to the new accounting standard, the required control group cannot be constructed. Likewise, an event study appears appealing, but is not feasible as the event is clustered around the introduction of IFRS 9 (MacKinlay (1997)).

Against this background we revert to the Jackknife method in order to assess how individual banks drive our underlying results. We successively re-estimate our model from Equation (2), leaving out one bank at a time. We then proceed to plot the coefficient of interest (here: the impact of impairments on bank resilience as proxied with the z-Score) for each of the subsets. Doing so allows us to identify banks that bias our results by driving the observed results single-handedly.

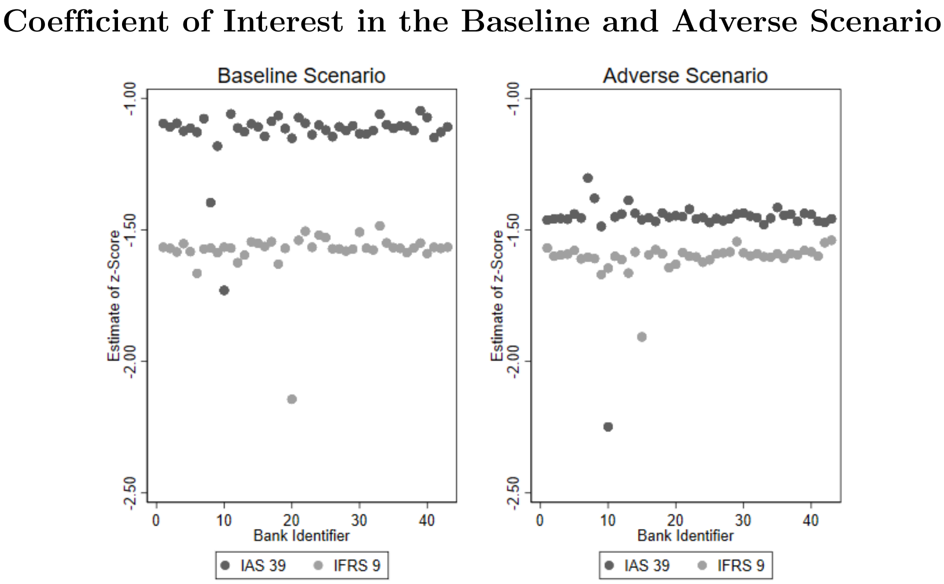

Figure 7: Results after applying the Jackknife Method.

Figure (7) shows the magnitude of our coefficient of interest on the ordinate, vis-à-vis the bank that was left out in the estimation on the abscissa. We differentiate between the baseline scenario on the left hand side of the figure, and the adverse scenario on the right hand side. Each subfigure is further divided in the effect under IAS 39 in dark grey, respectively IFRS 9 in light grey. In this regard, we find that the observed effect is not driven by individual outliers in the data set. To the contrary, the effect size remains within a very narrow band for both IAS 39 and IFRS 9. Taken together, the exclusion of individual banks does not drive our results. Instead, we cannot only demonstrate the robustness of results, but also visualizes in unparalleled ways the shift we discuss in our third hypothesis.

6.2 Alternative Measurements

Another approach of testing our results stems from Art. 159 CRR. In order to ensure consistency between regulatory and economic capital, it mandates IRB banks, which constitute 92 % of our sample, to compare the calculated ECL for general and specific credit risk adjustments in line with IFRS 9 to the regulatory ECL according to the CRR. From this comparison, two scenarios can arise, as shown in Figure (8). Either, an ECL shortfall, when IFRS 9 provisions are short of CRR provisions, or a surplus in the reciprocal case.

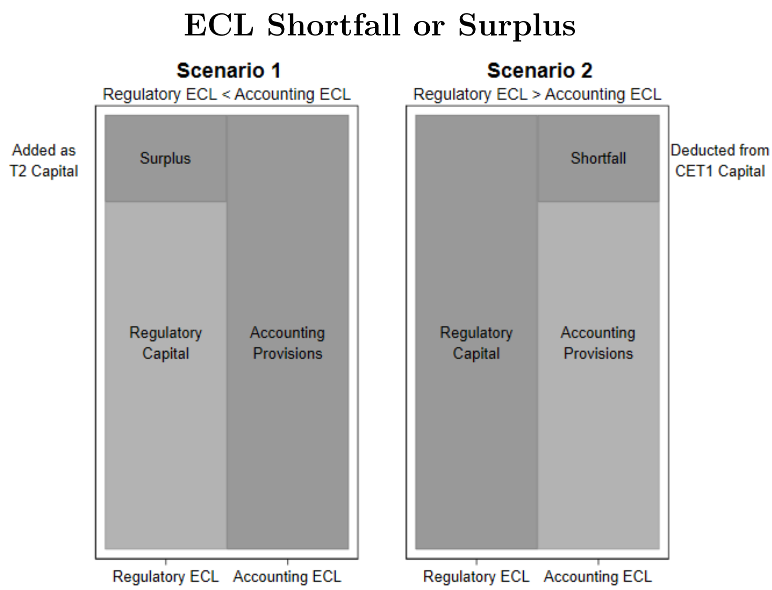

Figure 8: Possible constellations when comparing the ECL.

Under real world conditions, surpluses as in the second scenario of Figure (8) can be considered Tier 2 capital up to a maximum of 0.6 % of RWA. However, the methodological note of the European stress test interdicts this attribution, in order to yield more conservative results (EBA (2018c)). In line with Art. 36(1)(d) CRR, a shortfall will be deducted from the Tier 1 capital and thus relates to a section of the equity, which also contains the focal point of our analysis: retained earnings. A detailed numerical example can be found in Krüger et al. (2018), while the economic reasoning behind it is explained in Figure (12) in the Appendix. We consider our first and second hypothesis robust, if we can observe with this proxy that IFRS 9 initially yields higher loan loss provisions than IAS 39 due to the "front-loading" effect. As a result, the number of observed shortfalls should decrease. Furthermore, we expect the nominal amount of the shortfall to lessen due to the expected loss framework.

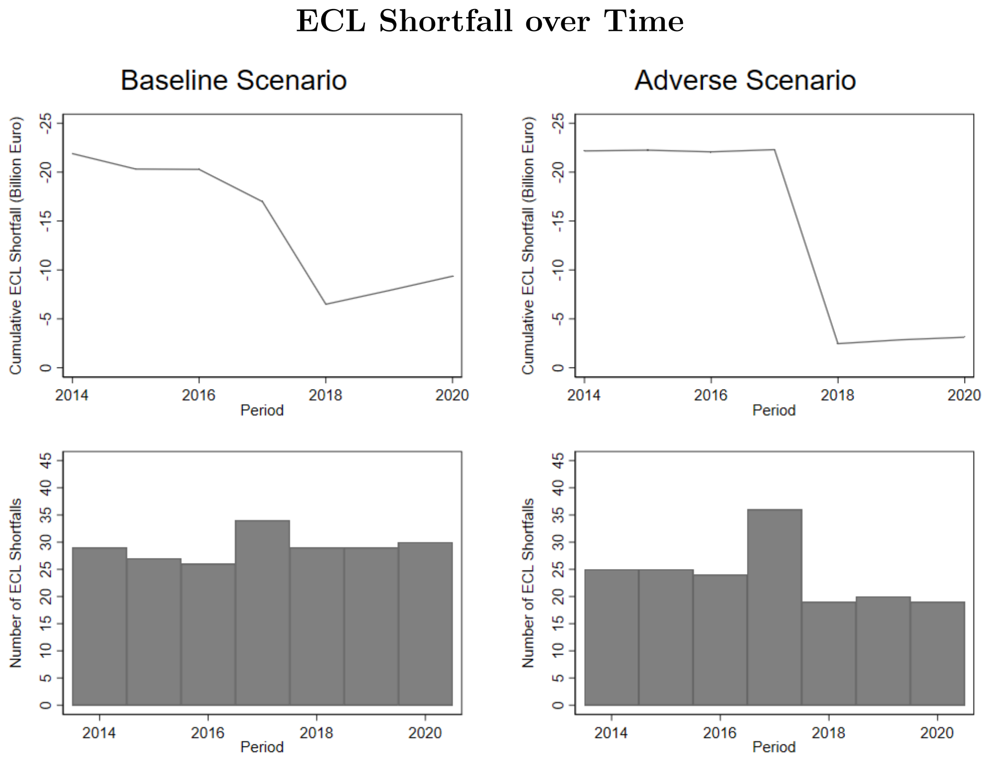

Figure 9: Evolution of the ECL shortfall in the baseline and adverse scenario.

Figure (9) depicts the cumulative nominal shortfall in the first row of the panel, and the absolute number of shortfalls in the second row. The graphs in the first column relate to the baseline scenario, whereas the second column contains the adverse scenario. The aggregate shortfall drops sharply with the introduction of IFRS 9 in 2018. This drop can arguably be attributed to the discussed "front-loading" effect, which has increased impairments, and hence narrowed the gap between both ECL measures. We thus interpret it as further evidence for our second hypothesis. The impact is most pronounced for the adverse scenario, where a steep decline can be observed in contrast to the steady reduction under the baseline scenario. Likewise, the number of banks with an ECL shortfall is elevated for both scenarios prior to 2018, giving further credibility to the "front-loading" explanation. Furthermore, it can be seen that the number of banks with a shortfall under IFRS 9 is almost 20 % below the number reported under IAS 39. In relation to the question of reduced procyclicality, this observation might be understood as an indication that under macroeconomic stress banks are no longer subject to self-enforcing amplifications.

6.3 Transitional Effects

Our results may finally be driven by heterogeneity between the reporting of impairments under the continuous phase-in of the ECL model. To address this critique, we look to both, the transitional and fully-loaded values for our analysis.

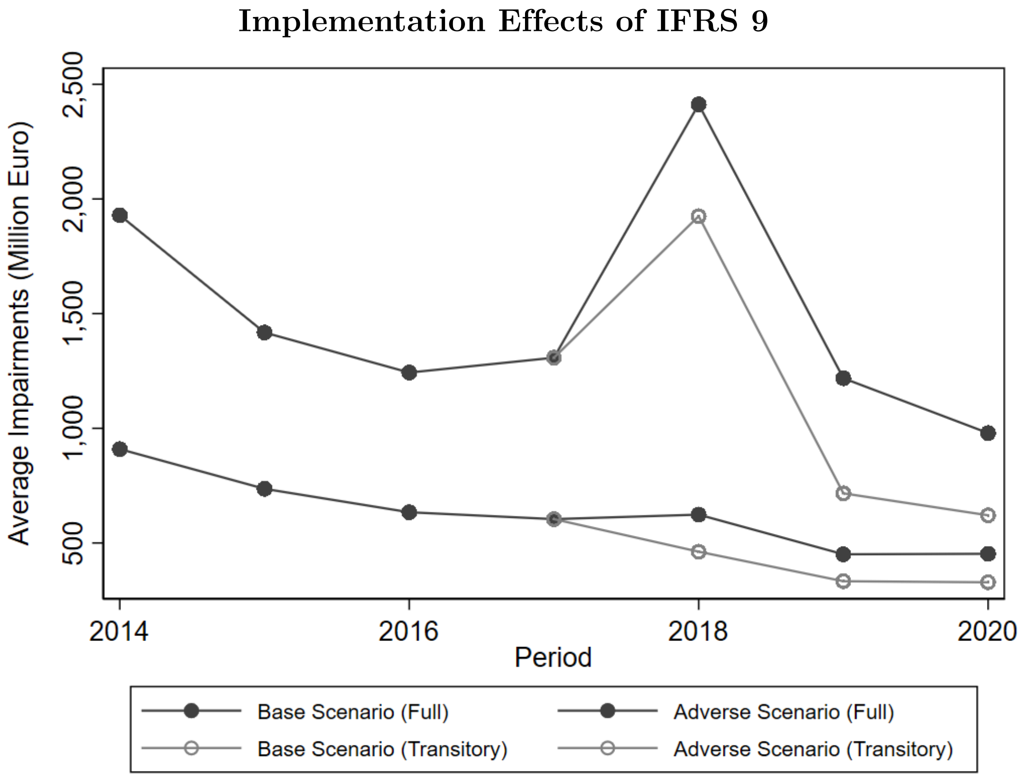

Figure 10: Comparison of the implementation effects in the baseline and adverse scenario.

As illustrated in Figure (10) we observe differences in the averages for impairments reported as either fully-loaded or transitory in both, the baseline and adverse scenario. Given the generally stronger impact of the adverse scenario, the differences between fully-loaded and transitory figures are consistently larger in the adverse scenario, vis-à-vis the baseline scenario. Albeit these differences, we find in untabulated results that our identified transmission mechanisms hold. More precisely, the "front-loading" effect continues to occur at the introduction of IFRS 9 and attenuates the "cliff-effect' in subsequent years. This observation also addresses potential concerns with regard to a tactical behavior of banks that would explicitly recognize impairments only in 2018, where the transitory effect could be directly booked in the bank's equity, net of an impact on the P&L.

Ultimately, we show that our results hold, by challenging the robustness of our model with a pseudo-treatment, where we estimate Equation (2) under the assumption that the introduction of IFRS 9 did not occur in 2018, but in any other year. We find in untabulated results that the observed mechanisms are only significant for the year of the de facto introduction. Again, these results are valid for fully-loaded, respectively transitory reported values.

7 Conclusion

This paper sets out to generate novel insights regarding the implications of the new IFRS 9 impairment model for bank resilience and thus financial stability. The shift from an incurred to an expected credit loss model has released two opposing forces, whose net effect remains ambiguous ex ante. While the more timely recognition of losses under IFRS 9 fosters financial stability by mitigating procyclical effects, it also weakens capital adequacy, potentially setting off this benefit. We investigate this impact, using the z-Score as a proxy for the likelihood of a bank to fail. It is an especially suitable measure in this context, as it emphasizes the transmission channel between capital adequacy, which is impacted by IFRS 9, and probability of default.

We posit three main hypotheses in connection with the advent of IFRS 9. First, the gradual loss recognition of the ECL model should decrease the volatility of impairments. The "cliff-effect" of the incurred loss model of former IAS 39 represented a major source of procyclicality, which should be mitigated by the gradual loss recognition under IFRS 9. Although a dampened version of the "cliff-effect" still persists in the shift from Stage 1 to Stage 2, it should be attenuated by the CCyB. Second, initially impairments under IFRS 9 should be higher compared to IAS 39 due to the earlier recognition of impairments under the ECL approach and the resulting "front-loading" effect. Third, the impact of impairments on capital adequacy and, subsequently, on the probability of bank failure, should be the strongest at the outset of the crisis. In the further course of the crisis, this impact should decrease.

In order to test our hypotheses, we draw on the empirical data of the ECB banking stress test results. They allow us to investigate the implications of the new ECL impairment model on bank resilience and financial stability based on the entire loan portfolios of major European banks and offer numerous advantages. They provide a first and unique opportunity to empirically explore the implications of IFRS 9 on banks' reported results. Furthermore, they are unbiased from loan repayment moratoria and do not suffer from the extensive usage of management overlays, which were both heavily used in response to the COVID-19 pandemic. Moreover, we can investigate whether procyclicality was indeed reduced by comparing the baseline and adverse scenario of the stress test. Lastly, all banks adhere to the same assumptions and methodologies. We could thus exclude noise from immeasurable effects and are confident to have measured the true implications of IFRS 9.

With regards to our first hypothesis, our analysis reveals that the "cliff-effect" of IAS 39 has been weakened under IFRS 9, which indicates the potential of the staging model to enhance financial stability of the banking sector in the future. We proceeded our investigation by assessing whether the reduction of the "cliff-effect" came at the theorized cost of "front-loading". Consistent with our second hypothesis, we find that impairments grow excessively at the beginning of the adverse scenario. However, the gap between the two accounting standards narrows as time progresses. The findings of our third hypothesis confirm the previous results. Impairments exert a stronger influence on financial stability, when proxied as banks' PD through the z-Score. The gap between an economic downturn and the status quo though has been reduced. This observation suggests that the procyclicality of impairments has been decreased, which in turn would benefit financial stability.

Although, the results of our paper indicate that the introduction of IFRS 9 has successfully diminished the severity of the "cliff-effect", this goal was achieved at the cost of "front-loading" expected credit losses. As a result, less secure loans incur higher costs at their initial recognition, which might constrain credit supply, and deter bank managers from acquiring such loans in the secondary market. Consequently, asset quality becomes more important under the new accounting standard. Our findings do not only concern the management of financial institutions, but can also be extended to regulatory and supervisory policy discussion. While the timelier recognition of expected credit losses under the IFRS 9 approach may have positive effects on financial stability and bank resilience, not all issues of the preceding IAS 39 have been resolved. Our results highlight the need to pay in the new regulatory capital buffers, in order to contain the remaining "cliff-effect" inherent in IFRS 9 during crises. Only then, the desired stabilization of the financial system will truly be achieved.

The combination of stress test results and accounting requirements opens up a plurality of new research questions. While the usage of forecasted data allows us to give an early assessment of the implications of IFRS 9, future research should try to assert our findings using actual data. Moreover, it seems prudent to repeat this study with coming stress test results, in order to increase the power of our tests. It also seems appropriate to assess how the differences between IAS 39 and IFRS 9 manifest under the standard and internal ratings based approach of the Basel accords. Lastly, it would be advisable to compare the ECL staging model to the upcoming current expected credit loss (CECL) model of the FASB. Unlike IFRS 9, all eligible exposures are immediately recognized with their lifetime ECL under the CECL model. Doing so eliminates the "cliff-effect" and thus further reduces procyclicality, which only stems from the usage of PIT estimates under the proposal of the FASB. However, at the same time, the "front-loading" effect will be even more pronounced, necessitating a further investigation into the implications in the context of financial stability.

8 Appendix

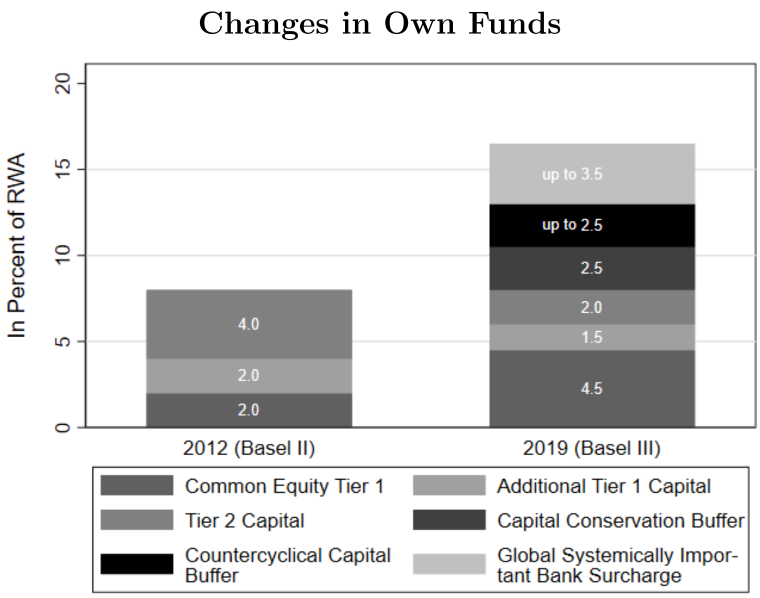

Figure 11: Illustration of the differences between Basel II and Basel III.

The introduction of Basel III has yielded significant changes to the own funds of banks. Not only has the composition of equity changed, but also have other items been added, in order to make banks more resilient. Large, systemically relevant banks (GSIB) for example are now subject to individual capital surcharges based on their perceived riskiness, as measured in so called buckets. A pivotal element in the context of this paper is the Countercyclical Capital Buffer (CCyB). It is intended to increase the resilience of the banking sector by means of an additional capital accumulation in periods of excessive credit growth. In downturns, when losses materialize, this buffer shall be used to mitigate impairments, reducing the risk of an extenuated credit supply constrained by regulatory capital requirements. To this day, only one out of 28 reporting countries fully enforces the requirements (BIS (2018); ESRB (2019)). The CCyBs adequacy in times of crises may consequently be questioned. Our study on the impact of the ECL model in a crisis scenario may thus be useful in the regulatory debate to actively use the additional loss-absorbing buffer and set the CCyB rate above 0.0 % to strengthen the capitalization of banks in good times.

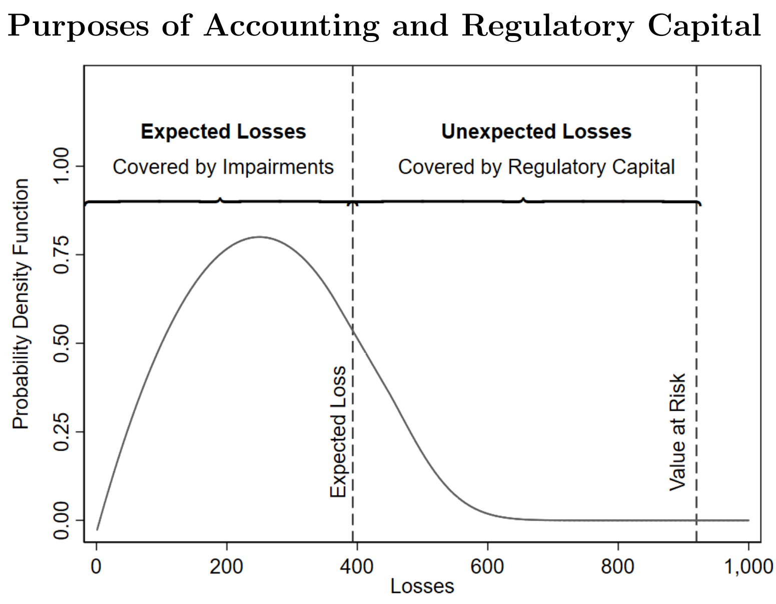

Figure 12: Illustration of expected and unexpected losses.

Figure (12) explains the economic intuition behind the ECL shortfall comparison in more detail. It was argued that two cases can occur: either a shortfall or a surplus. While the shortfall is deducted from CET1 capital, the surplus can be added as T2 capital. The reason for this unequal treatment becomes obvious, when constructing an example. Consider the first case, a shortfall. It occurs, when the impairments do not suffice to cover the expected losses. As a result, an area between expected and unexpected losses arises, where losses are not covered by neither accounting nor regulatory capital. Hence, the deduction from CET1 to cover these losses. In the contrary cases of a surplus, the losses covered by impairments extend into the losses covered by regulatory capital. As a result, a part of the losses is covered by both, impairments and regulatory capital. In order to prevent the bank from being charged twice, the idea is to offset the negative implications from this welcomed conservatism by allowing the addition of the double covered capital to T2 capital.

Table 2: Used variables and their sources

Variable	Description	Source
ASSETS	Total Assets	Own Computation: ASSETS = $\frac{\text{T1 Capital}}{\text{Leverage Ratio}}$
CA	Capital Adequacy	Own Computation: CA = $\frac{\text{Own Funds}}{\text{Total Assets}}$
NI	Net Income	Item 993014[1], Item 1690715[2], Item 183615[3]
ROA	Return on Assets	Own Computation: ROA = $\frac{\text{Net Income}}{\text{Total Assets}}$
z	z-Score	Own Computation: $z = \frac{\text{ROA + CA}}{\sigma(\text{ROA})}$
IMP	Amortized Impairments	Item 993007[1], Item 1690710[2], Item 183610[3]
LR	Leverage Ratio	Item 1690858[2], Item 183112[3]
RISKDIV	Risk Diversification	Own Computation: RISKDIV = $\sum_{j=1}^{3} \text{Risk } (\%)^2_{itj}$
NII	Net Interest Income	Item 993001[1], Item 1690701[2], Item 183601[3]
NNII	Net Non-Interest Income	Item 993002[1], Item 1690705[2], Item 183605[3]
NOPI	Net Operating Income	Item 993005[1], Item 1690709[2], Item 183609[3]
ROID	Income Diversification	Own Computation: ROID = $1 - \left\lvert\frac{\text{NII}-\text{NNII}}{\text{NOPI}}\right\rvert$
ECL	ECL Shortfall	Item 993416[1], Item 1690815[2], Item 183716[3]
HPI	Housing Price Inflation	ESRB[4]
CPI	Consumer Price Inflation	ESRB[4]
UNEMP	Unemployment Rate	ESRB[4]
GDP	Gross Domestic Product	ESRB[4]

Note: (1) as obtained from the 2014 Stress Test Results website. (2) as obtained from the 2016 Stress Test Results website. (3) as obtained from the 2018 Stress Test Results website. (4) as obtained from the macroeconomic scenario diffused by the ESRB. Total Assets for 2014 were extrapolated from the actual values, in line with the "static balance sheet" assumption of the bank stress test.

Table 3: Correlation Matrix of Regressand and Regressor

	z-Score	IMP (%)	LR (%)	RISKDIV ($\in \{0,1\}$)	ROID ($\in \{0,1\}$)	HPI (%)	CPI (%)	UNEMP (%)	GDP (%)
z-Score	1.0000								
IMP (%)	-0.1119	1.0000							
LR (%)	0.7780	0.2688	1.0000						
RISKDIV ($\in \{0,1\}$)	0.1404	0.2272	0.2049	1.0000					
ROID ($\in \{0,1\}$)	0.0034	-0.1754	-0.0823	0.0519	1.0000				
HPI (%)	0.3466	-0.2290	0.0754	0.0621	0.0907	1.0000			
CPI (%)	0.1571	-0.1194	0.0244	-0.0075	0.0820	0.5741	1.0000		
UNEMP (%)	-0.0923	0.2871	-0.0831	0.2429	-0.0662	-0.1984	-0.3393	1.0000	
GDP (%)	0.2235	-0.1801	0.0247	0.0594	-0.0516	0.6971	0.4627	-0.0938	1.0000

Note: The table above shows the correlations between the regressand and regressors from Equation (2). The dimension of the respective variable has been added in parenthesis, where applicable. The strongest positive correlation can be observed between the leverage ratio and the z-Score. Given that a slight modification of the leverage ratio influences the numerator of the z-Score as a measure of capital adequacy, this observation appears unproblematic. Given the size of the correlations, no pair raises concerns for the empirical analysis of our paper.

Table 4: Descriptive Statistics of the Baseline Scenario

Panel A: IAS 39

	Obs.	*Min.*	$Q_{0.25}$	$Q_{0.50}$	$Q_{0.75}$	*Max.*	σ
z-Score	172	-0.55	0.70	1.14	1.63	14.36	1.88
IMP	172	0.02	0.13	0.20	0.37	2.07	0.31
LR	172	1.69	4.07	4.87	6.07	24.95	15.81
RISKDIV	172	0.38	0.63	0.68	0.74	0.86	0.10
ROID	172	0.00	0.00	0.00	0.00	0.98	0.31
HPI	172	-4.30	1.50	4.00	5.60	8.70	2.98
CPI	172	0.30	1.15	1.40	1.70	2.80	0.42
UNEMP	172	3.80	5.50	7.40	10.40	25.70	4.47
GDP	172	0.20	1.50	1.85	2.40	4.50	0.69

Panel B: IFRS 9

	Obs.	*Min.*	$Q_{0.25}$	$Q_{0.50}$	$Q_{0.75}$	*Max.*	σ
z-Score	129	-0.12	0.94	1.39	1.90	3.69	0.77
IMP	129	0.01	0.09	0.13	0.23	0.99	0.18
LR	129	3.31	4.86	5.55	6.61	12.14	1.95
RISKDIV	129	0.42	0.66	0.72	0.75	0.86	0.09
ROID	129	0.02	0.47	0.65	0.91	0.99	0.27
HPI	129	-1.60	2.90	3.80	4.80	12.60	1.94
CPI	129	0.70	1.40	1.70	2.00	2.90	0.42
UNEMP	129	2.90	3.90	5.00	8.80	14.80	3.09
GDP	129	1.30	1.60	1.70	2.30	4.30	0.66

Note: The table above depicts the descriptive statistics of IAS 39 (Panel A) and IFRS 9 (Panel B) in the baseline scenario. Notable variables include the income diversification (ROID), which is highly skewed, and shows that the banking sector in the EU is highly dependent on interest income.

Table 5: Descriptive Statistics of the Adverse Scenario

	Panel A: IAS 39						
	Obs.	*Min.*	$Q_{0.25}$	$Q_{0.50}$	$Q_{0.75}$	*Max.*	σ
z-Score	172	-3.49	-0.57	-0.09	0.39	14.36	2.06
IMP	172	0.03	0.31	0.40	0.83	3.53	0.57
LR	172	1.60	3.49	4.17	4.97	24.95	15.87
RISKDIV	172	0.36	0.61	0.67	0.73	0.86	0.10
ROID	172	0.00	0.00	0.00	0.76	1.00	0.31
HPI	172	-19.20	-9.90	-5.50	-3.50	9.20	4.42
CPI	172	-3.90	-0.50	0.35	0.90	2.40	1.14
UNEMP	172	4.60	7.20	9.50	11.10	26.80	4.48
GDP	172	-4.10	-1.60	-1.10	-0.70	0.90	0.79
	Panel B: IFRS 9						
	Obs.	*Min.*	$Q_{0.25}$	$Q_{0.50}$	$Q_{0.75}$	*Max.*	σ
z-Score	129	-3.01	-0.92	-0.16	0.36	1.96	1.08
IMP	129	0.05	0.23	0.40	0.65	2.23	0.41
LR	129	1.88	3.90	4.61	5.45	11.23	1.89
RISKDIV	129	0.40	0.65	0.70	0.75	0.86	0.09
ROID	129	0.00	0.37	0.60	0.82	1.00	0.31
HPI	129	-31.10	-11.60	-7.20	-2.40	10.00	7.92
CPI	129	-1.80	0.10	0.40	1.10	2.70	0.89
UNEMP	129	3.80	6.10	8.10	10.20	15.90	3.08
GDP	129	-31.00	-2.20	-1.20	0.00	1.90	5.48

Note: The table above shows the descriptive statistics of IAS 39 (Panel A) and IFRS 9 (Panel B) in the adverse scenario. We can reinstate the description from Table (4) at large. Again, the high skewness in terms of diversification characterizes the European banking market.

Table 6: Comparison of Variances

	Panel A: Baseline			
	IAS 39	IFRS 9	Levene	Prob.
2018	1,771.33	1,751.49	0.3397	0.5606
2018 – 2019	1,771.33	1,555.90	3.4738	0.0635
2018 – 2020	1,771.33	1,449.13	5.0408	0.0255

	Panel B: Adverse			
	IAS 39	IFRS 9	Levene	Prob.
2018	2,983.38	4,436.15	7.8529	0.0055
2018 – 2019	2,983.38	3,746.46	1.2456	0.2654
2018 – 2020	2,983.38	3,356.01	0.0348	0.8522

Note: The table above compares the variances of impairments under the two accounting standards. The first column depicts the length of the analyzed forecasting horizon, relative to IAS 39. Columns two and three show the variance of IAS 39, respectively IFRS 9. We statistically investigate this hypothesis by comparing Levene's test statistic and reporting the coefficient in the fourth column. Column five shows the probability of computing the value of the test statistic, if the hypothesis of variance homogeneity is true. We find that the variance is different in most instances. The gap widens under the baseline scenario, whereas it narrows under the adverse scenario. This observation is in line with our hypothesis. The gradual recognition of losses under the ECL model lessens the severity of the "cliff-effect", whereas "front-loading" seems to be more dominant in the adverse scenario, and initially superimposes the decline in volatility.

Table 7: Comparison of Average Change in Retained Earnings

	Panel A: Baseline			
	IAS 39	IFRS 9	Difference	Prob.
2018	875.75	1,098.74	222.99	0.3708
2018 – 2019	875.75	1,152.73	276.98	0.1452
2018 – 2020	875.75	1,164.58	288.82	0.0807
	Panel B: Adverse			
	IAS 39	IFRS 9	Difference	Prob.
2018	-517.30	-3,087.57	-2,570.27	0.0004
2018 – 2019	-517.30	-1,617.75	-1,100.48	0.0052
2018 – 2020	-517.30	-1,084.63	-567.33	0.0424

Note: The table above shows the mean change in retained earnings, under the assumption of unequal variances, in line with our insights from our first hypothesis. We find that the baseline scenario is quite optimistic, as it allows banks to increase their capital levels by retaining earnings. Surprisingly, this effect is more pronounced for IFRS 9 than IAS 39. In line with our second hypothesis, the average bank sustains losses in the adverse scenario, and hence cannot foster its capital base through retained earnings. The effect is especially strong for the first year of the analyzed horizon, which can be attributed to the discussed "front-loading". However, the longer the assessed period, the less severe the effect. This observation can be related to the gradual loss recognition, which eases the severity of initial losses over time, and is in line with our first hypothesis.

Table 8: Comparison of the Accounting Standards with y = z-Score

	IAS 39		**IFRS 9**	
	Baseline	Adverse	Baseline	Adverse
IMP (%)	-1.1186**	-1.4581**	-1.5720***	-1.6033***
LR (%)	-0.1287***	0.1545***	-0.2570	0.3279
RISKDIV (%)	0.5936	-0.8073	-4.6357	-6.7390
ROID ($\in \{0, 1\}$)	0.0033	-0.1118	1.2683	2.4033***
HPI (%)	0.6800	0.0206	-0.0088	0.0015
CPI (%)	0.5273	-0.1202**	-0.0228	-0.0811
UNEMP (%)	-0.4724	0.0013	0.0856	0.1598
GDP (%)	0.9091	-0.1305**	-0.0647	-0.7718
Cluster	Bank	Bank	Bank	Bank
N	172	172	129	129
R^2_{within}	0.9315	0.8912	0.4580	0.8027

Note: The table above shows the results of Equation (2). It can be seen that impairments (IMP) are highly significant in all models. While the importance has grown under IFRS 9, when measured in terms of the coefficient, the gap between the baseline and adverse scenario has been narrowed. Taken together, the two effects yield ambiguous implications for financial stability, which we have addressed for clarification in Section (6). Significance is denoted at the 5 %, 1 %, and 0.1 % level.

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