Comparison of Credit Risk Measurement in Central European Banking

Xiaoshan FENG [a*]

[a] *Department of Finance, Faculty of Economics, VŠB -Technical Univeresity of Ostrava, Sokolská třída 33, 702 00 Ostrava, Czech Republic.*

Abstract

This paper focuses on credit risk measurements in the financial institutions of Central Europe. The objective is to compare IRB approaches and a standardised approach to measuring credit risk in the Czech Republic, Germany and Poland. We compare these risk measurement process and the risk-weighted distribution of the banking industry in the three countries via two approaches. Analysis is based on valid data for the three countries' banking industries from 2013 to 2017. We find that the banking industry using the IRB model as the main method represents the majority, but a rather big difference exists in the risk weights of using the standard model. Germany applies the highest risk weights in central governments under SA, while the Czech Republic and Poland apply the highest risk weights in retail claims. Under the A-IRB Approach, retail secured by real estate non-SME has the greatest level of risk exposure for the Czech Republic, while the most common exposure classes of Poland are corporate claims.

Keywords

Banking regulation, credit risk, exposure classes, IRB, standardised approach.

ISSN 1212-3951 (Print), 1805-9481 (Online)

ER-CEREI, Volume 21: 43–50 (2018).
doi: 10.7327/cerei.2018.06.02

Comparison of Credit Risk Measurement in Central European Banking

Xiaoshan FENG

1. Introduction

The Basel Committee on Banking Supervision (BCBS, 1988) has stated that for most banks, the major risk is credit risk. In general, credit risk is associated with the traditional lending activity of banks and is simply described as the risk of a loan not being repaid in part or in full (Casu et al., 2006). Banks essentially make money from lending activity. Therefore, banks are more aware of the risks they are taking, hence credit risk needs to be measured.

Since the 1990s, both commercial banks and regulatory authorities have placed risk management in an increasingly important position. At present, domestic financial supervisory authorities and international regulatory organisations have reached a consensus on risk management, regarding risk management as the core of financial supervision.

To measure credit risk, banks calculate their minimum capital requirements under Pillar I use risk weights provided by either the standardised approach (SA) or the internal ratings-based approach (IRB). However, these approaches are highly flawed. Hakenes and Schnabel (2011) published an analysis of bank size and risk-taking under Basel II, finding that banks can choose between SA and IRB, giving larger banks a competitive advantage while compelling smaller banks to take higher risks. This may even lead to greater aggregate risk-taking. Moreover, Cucinelli et al. (2018) noted that banks using IRB were able to curb the increase in credit risk driven by the macroeconomic slowdown more successfully than banks under the standardised approach, hence IRB demonstrates superior performance to SA. Therefore, we are eager to ascertain the measurement differential in selected countries and to identify which method is more appropriate.

In December 2017, the Basel Committee endorsed the outstanding Basel III post-crisis regulatory reforms, which seek to restore credibility in the calculation of risk-weighted assets (RWAs) and improve the comparability of banks' capital ratios (BCBS, 2017). With the introduction of these reforms, two main revisions are required concerning credit risk management: an amendment to the SA for credit risk, enhancing its robustness and risk sensitivity; and setting a new SA for credit valuation adjustment (CVA) risk. Setting constraints on the use of the internal ratings-based approach for credit risk is also important (BCBS, 2016).

Based on analysis of the comparability of RWAs conducted by the BCBS on banks worldwide and by the European Banking Authority (EBA) on European banks alone, the committee found that the IRB approach results in excessive variability in RWAs and demonstrates limited reliability of parameter estimates such as the probability of default (PD) and loss-given-default (LGD). These results have highlighted the importance of introducing new constraints on the parameters estimated by banks that use internal models.

The 2017 reforms also prohibit the use of the A-IRB approach to estimating RWAs, which credits to banks, financial institutions, large corporations and firms with more than 500-million-euro revenues. Due to the low number of defaults, it is difficult to accurately estimate LGD. Therefore, these portfolios will be evaluated depending on the SA or F-IRB approach (BCBS, 2017).

The objective is to compare the IRB and standardised approaches to measuring credit risk in different countries, namely the Czech Republic, Germany and Poland. We collect data from the central bank data system of each country, such as the Czech National Bank ARAD time series system.

This paper is divided into four sections. The first section provides the introduction and the final section presents the conclusion. The second section describes the methods to measure credit risk and data collection. The third section displays the results and discussion.

2. Methodology of research and data collection

First, to measure the credit risk of banks, BCBS has specified two broad approaches to calculating RWAs, as mentioned in section one: the standardized approach (SA) and the internal ratings-based (IRB) approach.

Most banks around the world use the SA for credit risk. Under this approach, supervisors set the risk weights that banks apply to their exposures to determine RWAs. Under the SA, banks use a prescribed risk weight schedule to calculate RWAs. In Basel II, the risk weights are contingent on asset classes that specify loans to sovereigns (countries), corporations and banks.

Simultaneously, the risk weights are generally linked to external ratings assigned to the borrower, while Basel III requires banks using credit ratings to conduct sufficient due diligence.

For claims on the Bank for International Settlements (BIS), the International Monetary Fund (IMF), the European Central Bank (ECB), the European Commission (EC) and the Multilateral Development Banks (MDBs), the risk weight is 0%.

For claims on banks, national supervisors can choose to base capital requirements on the ratings of the country in which the bank is incorporated.

Meanwhile, the standard rule for retail lending includes credit cards, overdraft, auto loans, personal finance and small business, at a risk weight of 75%. When claims are secured by residential mortgage, the risk weight is 50%. Claims secured by commercial real estate have a risk weight of 100% (Hull, 2012; BCBS, 2017).

The IRB approach for credit risk allows banks (under certain conditions) to use their internal models to estimate credit risk, and therefore RWAs. There are two main IRB approaches: Foundation IRB (F-IRB) and Advanced IRB (A-IRB).

Under the F-IRB Approach, a bank is required to estimate only the borrower's PD. To verify the PD, the bank must use at least five years of relevant loan performance data from various borrowers. The other risk factors of the credit model – such as LGD and exposure-at-default (EAD) – are provided and determined by the bank's supervisor.

Under the A-IRB approach, a bank uses its internal estimates of risk parameters such as PD, LGD, and EAD. At least seven years of historical data must be used for verification purposes. For all but large corporate exposures, a standard two and a half years may be assumed for maturity, subject to supervisor agreement. With the A-IRB approach, the bank must estimate all credit risk model components, including data collection, data management and modelling techniques. The process demands more sophisticated commitment by the bank (BCBS, 2005). Approximately 50% of bank capital requirements are generated through IRB, although it is not mandatory to use IRB in Europe (Resti, 2016).

We select three countries in Central Europe: the Czech Republic, Poland and Germany. The rationale is to compare countries with different economic statuses and currencies. Thus, in order to compare the SA and

IRB approaches, we need to collect the credit risk exposure classes and amounts under both methods from each central bank data series system. Furthermore, based on valid data, we will apply some metrics of risk and performance to compare the results more directly.

The RWA density ratio is the ratio of RWAs to total assets, according to the following equation:

$$\text{RWA density} = \frac{RWAs}{Total\ Assets} \qquad (1)$$

To provide a comparison of expected loss estimates with actual losses recorded for the financial year, we will calculate the net change via the following equation:

$$\text{Net change} = \text{Actual losses} - \text{Expected losses} \qquad (2)$$

The capital adequacy ratio, also known as the capital to risk-weighted assets ratio, measures a bank's financial strength by using its capital and assets. The equation is as follows:

$$\text{CAR} = \frac{Tier\ 1\ Capital + Tier\ 2\ Capital}{RWAs} \qquad (3)$$

Generally, a bank with a high capital adequacy ratio is considered safe and likely to meet its financial obligations.

3. Compared results and discussion

In this part, we will analyse the credit risk measurement of selected countries one by one, before comparing the three countries and discussing the results.

3.1 Czech Republic

The Czech National Bank (CNB) is a supervisory authority of the financial market in the Czech Republic. CNB is permitted to use an A-IRB approach under Art. 143-145 of Regulation (EU) No. 575/201,[1] which requires documentation about governance, organisational aspects, roll-out plan and qualitative and quantitative aspects. Moreover, the data used to estimate IRB parameters (PD, LGD, EAD) and calculate RWAs are requested, and the national guidance of the IRB approach should base on Decree No. 123/2007 Coll.[2]

The evaluation process is primarily based on on-site examination conducted by the CNB. The examination has mainly qualitative and quantitative aspects, using test and own data analysis and calculation based on the requested data (Brož et al., 2017).

The risk exposures of banking were obtained from the ARAD-data series system of CNB, in which we can see the basic indicators of the financial market. The data base includes exposure under both SA and IRB approaches. Since the financial crisis it has become more

---

pertinent to measure credit risk, hence we choose data from 31 December 2008–2017.

Under SA, the exposure classes are central governments or central banks, multilateral development banks, international organisations and other items, excluding securitisation positions.

Figure 1 shows the SA exposure classes of Czech banking from the CNB ARAD data series system. Here we can see that exposure in loans to retail after 2008 has decreased, while retaining the greatest proportion among the other classes. Due to the risk weights generally linked to external ratings assigned to the borrower, retail loans represent the most complex and difficult aspect for a bank to manage the credit risk. Moreover, loans secured by mortgages on immovable property have increased since 2013, and exposures secured by immovable property might be deemed collateral on immovable property under the member states' pertinent legislation.
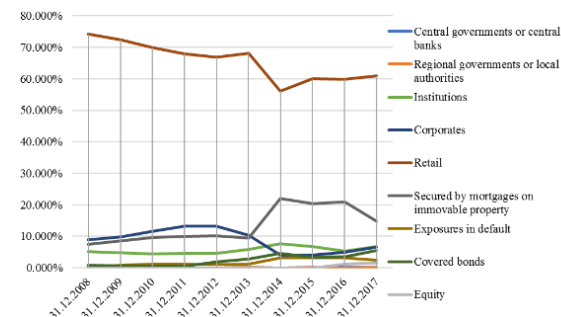
Figure 1 SA exposure classes in percentage during 2008–2017

Under F-IRB approaches, exposure classes are central governments and central banks, institutions, corporations and retail, while in the A-IRB approach, classification is more detailed.

Due to the data limit, we can only find IRB approaches from 2014. Figure 2 and 3 show risk exposure under F-IRB and A-IRB in the Czech Republic. Under F-IRB, to calculate risk exposure, neither own estimates of LGD nor conversion factors are used, and loans to corporations have a lower risk exposure than loan to institution. Under A-IRB, the classification of loans to retail and corporations is more detailed. Figure 3 shows retail that secured by real estate non-SME has the largest risk exposure, followed by loan to retail which is not SME and then loan to institutions.
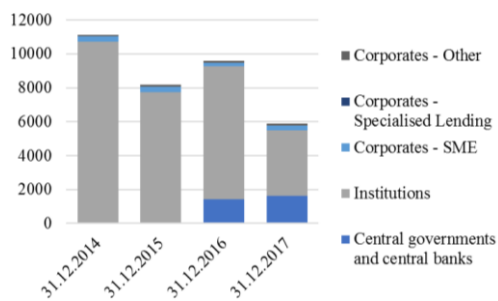
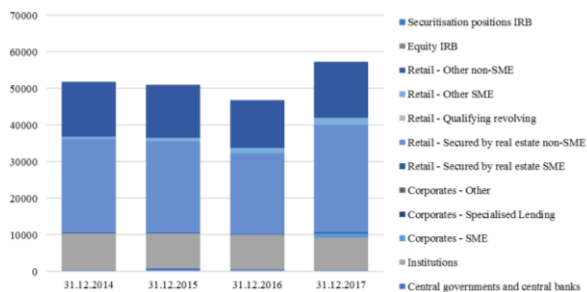**Figure 2** F-IRB exposure classes during 2014–2017

Figure 3 A-IRB exposure classes during 2014–2017

In general, Figure 4 shows the total credit risk exposure amount calculated by SA, F-IRB and A-IRB. We can see that banks in the Czech Republic primarily use the A-IRB approach, followed by SA. As mentioned before, the 2017 reforms prohibit the use of the A-IRB approach to estimate RWAs, which credits to banks, financial institutions, large corporations and firms more than 500 million euros of revenue. Hence, this issue creates a new problem that can be discussed in a future study.
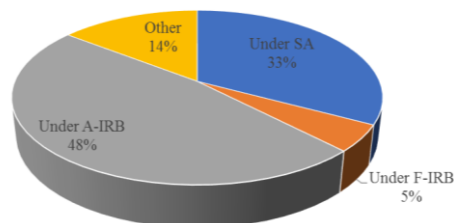
Figure 4 Percentage of measuring credit risk exposure by different methods

3.2 Poland

Polish banks follow Resolution 1/2007[3] implemented by the Polish Financial Supervision Authority (KNF). For all other underlying exposures the SA of calculating the capital requirement for credit risk shall be applied, the risk weight of exposures which are assigned the weight corresponding to the exposures without rat-

---

[3] http://www.nbp.pl/en/crd/tab/r1.pdf

ing or qualified to the degree of credit quality corresponding to the highest risk weight, need to be multiplied by a factor 2, however, it cannot be higher than 1,250%. Furthermore, the risk weight of all other exposures is multiplied by a factor of 1.1 and assigned a minimum value of 5%.

Based on Figures 1 and 5, we can see the obvious difference between the Czech Republic and Poland: the biggest proportion of risk exposure under SA is loan secured by mortgages on immovable property, although Czech banking has also starkly increased in recent years. MBA has stated that for exposures secured on commercial immovable property, the competent authority shall set the risk weight at a percentage from 50% through 150%.
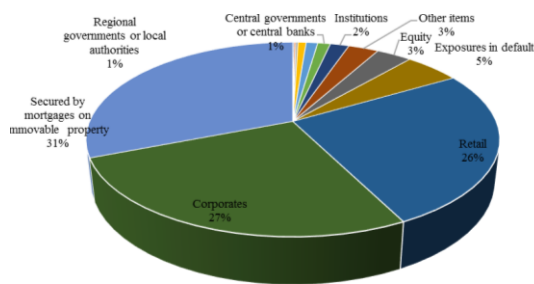

Figure 5 SA exposure classes in percentage at 31st December 2017

Based on Directive 2006, exposure classes are divided into governments and central banks, institutions, enterprises (including small and medium-sized enterprises, specialised lending and purchased corporate receivables), retail exposures and equity exposures.

Therefore, for claims to governments and central banks, institutions and enterprises, the bank applies its own methods of estimating LGD and its own CCF to calculate risk exposure, and amounts are published separately from the exposures, for which such estimations are not used. Until 31 December 2010, the exposure-weighted average value of the LGD for all retail exposures secured by residential real properties and not covered by guarantees of central governments could not amount to less than 10%.

Due to unattainable data, we only obtain data for the latest year. Figure 6 shows the risk exposure classes under A-IRB. The share of exposures classified into exposures classes with the lowest risk weight (e.g., exposures to central government and central bank) is much smaller, while in the remaining most numerous exposure classes (exposures to corporate, exposures to retail secured by real estate non-SME) the highest risk weights are often applied.
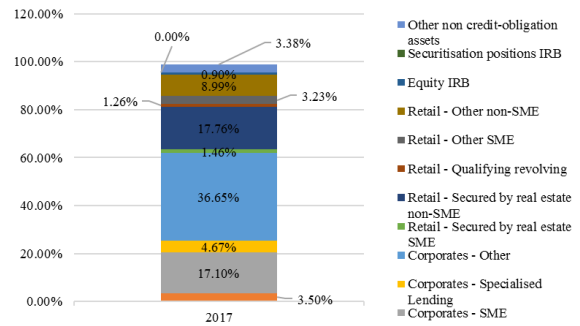

Figure 6 A-IRB risk exposure classes in 2017

3.3 Germany

Banks in Germany fall under the supervision of Federal Financial Supervisory Authority (BaFin), Deutsche Bundesbank and ECB. We can obtain the data of risk exposure from Deutsche Bank Pillar 3 Report 2017, in which Pillar 3 disclosures are provided at the consolidated level of Deutsche Bank Group as required by the global regulatory framework for capital and liquidity, established by the Basel Committee on Banking Supervision, also known as Basel 3.

Under the SA, for certain exposure classes, institutions may determine the risk-weighting of credit risk positions based on external credit ratings. One condition is that these ratings are published by recognised rating agencies or export credit insurance agencies. Figure 7 displays the share of risk classification under SA. Other than the Czech Republic and Poland, Germany applied the highest risk weights in central governments or central banks, including exposures to regional governments or local authorities, public sector entities, multilateral developments banks and international organisations.
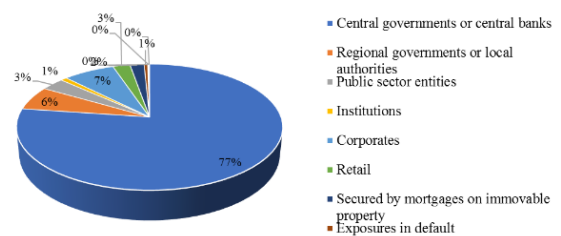
Figure 7 SA exposure classes in 2017

Institutions that opt to use the IRB approach require authorisation from BaFin. For institutions that opt to use an internal rating system or an equity risk model to determine the institution's capital requirements for credit risk under the IRB approach, prior approval from BaFin is additionally required. BaFin grants this approval based on the results of a suitability examination. Any major changes or amendments to the scope of the application must also be authorised by BaFin.

Nineteen institutions are approved to use F-IRB approaches with their own estimate of the PD in the exposure classes such as central governments, institutions and corporate, and simultaneously 17 institutions including Deutsche Bank AG use an A-IRB approach with their own estimates of the PD, LGD, EAD and effective maturity in the exposure classes as mentioned before. In addition, only seven institutions can use the IRB approach to calculate the retail exposure class.

Table 1 provides a comparison of EL estimates for loans as of year-end 2016 through 2012, with actual losses recorded for the financial years 2017 through 2013, by regulatory exposure class for A-IRB exposures, presented by the net change between EL and actual losses.

The actual loss in 2013 exceeded the expected loss by € 261 million. This was primarily due to higher-than-expected levels of provisions in corporate portfolios.

Actual losses in 2014 were below expectations, mainly driven by significant outperformance in corporate exposures as well as in retail exposures secured by real estate property.

Actual losses in 2015 were lower than expected, primarily driven by retail exposures secured by real estate property.

Actual losses in 2016 exceeded expected losses by € 543 million, largely due to exposures in corporations as well as in other retail.

Actual losses in 2017 were lower than expected, driven by corporate as well as retail exposures, reflecting the strong reduction in actual losses compared to the prior year in the respective exposure classes.

3.4   Comparison among selected countries

Although selected countries has basically similar method to measure credit risk, there still exists big difference of the performance.

First, given the approaches of the selected countries, Figure 8 displays the credit risk exposure constituted by the standardised F-IRB and A-IRB approaches, collected from the proportion of the SA and IRB in each country. We selected 2017 as the benchmark year to clarify the feasibility of Basel IV.

There is quite a big difference between Poland and the other two countries.
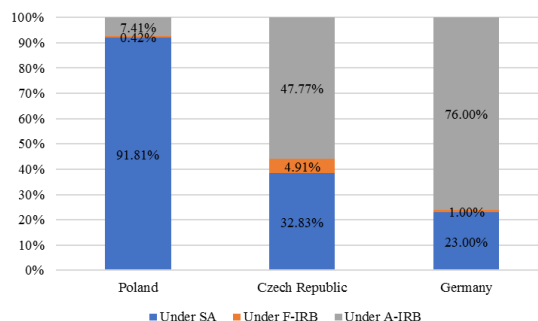
**Figure 8** Approaches under selected countries (2017)

The largest proportion of the measuring method is SA. For Germany and the Czech Republic, the A-IRB approach is more commonly used.

However, as mentioned the issue is that Basel IV has new reforms concerning prohibiting using the A-IRB approach, which may create a new challenge for both countries. Poland may have less impact, but the amendment of the SA, robustness and risk sensitivity needs to be enhanced as it may create a new barrier.

Figure 9 shows the capital adequacy ratio of the three countries at the end of 2017. Generally a bank with a high capital adequacy ratio is considered safe and likely to meet its financial obligations. The Czech Republic has the highest CAR, implying that Czech banking has a relatively high safety level to meet its financial obligations. The same is true of Poland, while Germany has a relatively low level, albeit still above average European banks at 18.14%.

Table 1 Net change between EL and actual losses

	2013	2014	2015	2016	2017
Central governments and central banks	15.00	(3.00)	(3.00)	1.00	1.00
Institutions	(9.00)	(9.00)	(12.00)	(12.00)	(16.00)
Corporates	366.00	(126.00)	34.00	328.00	(314.00)
Retail exposures secured by real estate property	(61.00)	(112.00)	(99.00)	(128.00)	(187.00)
Qualifying revolving retail exposures	(16.00)	(13.00)	(13.00)	(9.00)	1.00
Other retail exposures	(34.00)	(23.00)	20.00	365.00	(56.00)
Net change between EL and actual losses	*261.00*	*(287.00)*	*(71.00)*	*543.00*	*(571.00)*
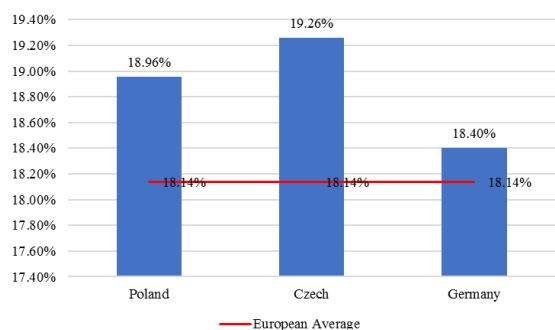
Figure 9 Capital Adequacy Ratio of selected countries (2017.12.31)

The following table displays the RWA density ratio, defined as the ratio of RWAs to total assets. As mentioned in section 2, it is based on equation 1.

Table 2 RWA density ratio among selected countries (2017)

Country	Ratio
Poland	61.20%
Czech Republic	51.70%
Germany	37.90%

Beltratti and Paladino (2016) use RWA density to find that banks use internal models to optimise their financial structures. Of the three countries, Germany has a relatively low ratio, meaning that about 37.90% of total assets are considered at risk. German bank assets are overall much safer than counterparts in Poland and the Czech Republic. However, some investors and regulators are starting to treat low-risk weightings as red flags. Le Leslé and Avramova (2012) have investigated how higher RWA density is now deemed an indicator of more prudent risk measurements, where banks are less likely to optimise the computation of their risk-based capital ratios. Regardless, differences in RWAs can be explained in large part by differences in business models, asset mixes, methodology, modelling inputs and supervisory regimes.

4. Conclusion

Based on simple analysis, we can conclude that there exist rather large differences across three countries, although their measurement of credit risk is basically similar. The goal of this paper has been to compare the credit risk measurement of three countries. Regarding credit risk exposure classes under SA, Germany has the most obvious difference, applying the highest risk weights in central governments or central banks. In contrast, the Czech Republic and Poland apply the highest risk weights in retail claims. Under the A-IRB approach, retail secured by real estate non-SMEs has the largest risk exposure for the Czech Republic, while most numerous exposure classes of Poland are corpo-

rate claims. For Germany, as Table 1 shows, retail exposure secured by real estate property is the main factor leading to large difference between actual losses and expected losses. Through a comparison of RWAs' density ratio, German banks' assets are overall much safer than those in Poland and the Czech Republic. Poland uses different approaches from the other two countries, the largest proportion of its measuring method being SA. For Germany and the Czech Republic, in contrast, the A-IRB approach is used more often than SA. Corresponding to Basel IV, banks' calculations of RWAs generated by internal models cannot fall below 72.5% of the RWAs computed by the SA (Implementation date: 2027), and this may lead to some challenges in Central European banking.

References

BELTRATTI, A., PALADINO, G. (2016). Basel II and regulatory arbitrage. Evidence from financial crises. *Journal of Empirical Finance* 39(PB): 180–196.

BROŽ, V. et al. (2017). Are the risk weights of banks in the Czech Republic procyclical? Evidence from Wavelet analysis. *The Working Paper Series of the Czech National Bank*, No 15. Czech National Bank. Available from: <http://www.cnb.cz.>.

CASU, B. et al. (2006). Introduction to banking. *Banking risks: Credit Risk* 259–277. Harlow: Pearson Education.

CUCINELLI, D. et al. (2018). Credit risk in European banks: The bright side of the internal ratings-based approach. *Journal of Banking & Finance* 93(C): 213–229.
https://doi.org/10.1016/j.jbankfin.2018.06.014.

HAKENES, H., SCHNABEL, I. (2011). Bank size and risk-taking under Basel II. *Journal of Banking and Finance* 35(6): 1436–1449.
https://doi.org/10.1016/j.jbankfin.2010.10.031.

HULL, J.C. (2012). *Risk Management and Financial Institutions + Website* (3rd ed.), 347–373. New York: John Wiley & Sons, Inc.

LE LESLÉ, V., AVRAMOVA, S.Y. (2012). Revisiting risk-weighted assets. *IMF Working Paper*, No. 12/90. Available from: <https://ssrn.com/abstract=2050263.>

RESTI, A. (2016). *Banks' Internal Rating Models – Time for a Change? The "System of Floors" as Proposed by the Basel Committee.* Brussels: European Parliament's Economic and Monetary Affairs Committee.

Additional sources

BASEL COMMITTEE ON BANKING SUPERVISION (2017). *Basel III: Finalising Post-crisis Reforms.* Basel Committee on Banking Supervision. [Online]. Available from: <https://www.bis.org/bcbs/publ/d424.pdf.>.

BASEL COMMITTEE ON BANKING SUPERVISION (2016). *Reducing Variation in Credit Risk-weighted Assets – Constraints on the Use of Internal Model Approaches.* Basel Committee on Banking Supervision. [Online]. Available from: <https://www.bis.org/bcbs/publ/comments/d362/ britishbankersa.pdf.>.

BASEL COMMITTEE ON BANKING SUPERVISION (2005). *An Explanatory Note on the Basel II IRB Risk Weight Functions.* Basel Committee on Banking Supervision. [Online]. Available from: <https://www.docdroid.net/file/.../basel-rwa-formula-final-agh-final.pdf.>.

BASEL COMMITTEE ON BANKING SUPERVISION (1988). *International convergence of capital measurement and capital standards.* Bank for International Settlements, Basel. [Online]. Available from: <https://www.bis.org/publ/bcbs04a.pdf.>.