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Evaluation of European Deposit Insurance Scheme funding based on risk analysis

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ABSTRACT

We carry out a quantitative analysis of the financing measures proposed for the European Deposit Insurance Scheme (EDIS) regarding the target level of the fund and the contribution scheme of member entities. We estimate the loss distribution of the EDIS considering different sources of systemic risk associated with the correlations between bank assets and we analyse the sensitivity of the results to bank portfolio risk. Our findings show how the interconnection between banks of different countries has an important influence on accumulated losses in the tail of the distribution. Likewise deterioration in the quality of bank portfolios produces a significant reduction in the fund's loss-absorbing capacity, which calls into question its soundness in times of economic recession. Finally, the contribution scheme provides more equitable risk measures and may be an appropriate incentive to reduce moral hazard in the Banking Union.

1. Introduction

Regulatory reforms in recent years in the Banking Union have allowed European banks to enter the crisis generated by the COVID-19 pandemic with ample reserves of capital and liquidity that initially contributed to the stability of the system. However, the impact study carried out by the European Banking Authority (EBA) (2020) foresees an increase in banking risk as a consequence of a decrease in asset quality due to macroeconomic deterioration and an increase in volatility in financial markets. The strength of banks will depend on their capital levels and the degree of exposure to the sectors most affected by the crisis. The current situation prompts the need to complete the third pillar of the Banking Union, the European Deposit Insurance Scheme (EDIS), fully mutualized to reinforce the protection of depositors and contribute to financial stability.

In response to the previous crisis of 2008–2009, the European Union carried out an unprecedented harmonization and a reform of the rules and procedures in the protection of depositors, included in the Directive on Deposit Guarantee Schemes[1] (DGSD) of 2014. In November 2015, the European Commission presented the proposal for the establishment of the EDIS made up of national DISs and a European deposit insurance fund through a progressive mutualisation of resources in three stages. In the first stage of reinsurance, until 2020, the EDIS was expected to provide liquidity assistance and absorb a certain amount of loss when the payment or resolution

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[1] Directive 2014/49/EU of the European Parliament and of the Council of 16 April 2014 on Deposit Guarantee Schemes.

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procedure exceeds the financial means available from the national insurance plan. During the second stage of coinsurance, which would apply for four years until 2024, it would progressively absorb an increasing portion of the liquidity needs and losses, regardless of whether national insurance resources are exhausted. National and European plans would co-finance the intervention. As of 2024, it would be fully mutualized, replacing national plans, and would be the only deposit insurance in banks in the eurozone. The EDIS must have a fund of at least 0.8% of the covered deposits, following the current reference established in the DGSD. However, the contribution system changes at different stages. During the reinsurance stage, banks' contributions will be calculated with reference to their level of risk in the national banking system, in line with the provisions of the DGSD. In the co-insurance and mutualisation stages, contributions will be made with reference to the risk of all banks in the Banking Union. The European Commission (2016) foresees that the risk-sharing methodology for contributions in the co-insurance and mutualisation stages will reduce these disciplinary problems. When banks are compared globally in the banking union, there will be a more equitable redistribution of contributions. Local banks that better manage their risks will be treated in the same way as similar banks across Europe, regardless of nationality.

Negotiations on the EDIS are currently ongoing. Some countries show disagreement, considering that the pooling of resources can generate cross-subsidisation, that is, with some banking systems contributing structurally and benefiting less from the endowment fund than others, potentially with greater risk. There is concern among governments with stronger banking sectors that under EDIS, they will have to bear the cost of the failures of other member states, considering that mutualisation leads to an unequal distribution of costs and benefits (Carmassi et al., 2018; Jokivuolle y Pennacchi, 2019; Kuznichenko et al., 2021).

Another argument against the current EDIS framework is the possible increase in the number of moral hazards it could bring about, not only for banks but also for individual states. The existence of more resources could encourage more risk-taking behaviour by banks (Howarth y Quaglia, 2018; Cerrone, 2018; Chiaramonte et al., 2020). Moreover, the sovereign bank nexus causes banks' interests to merge, and the behaviour of member states may change in undesirable ways. Participating countries may be less strict in their control of national banking policies as a consequence of the socialisation of bankruptcy (Kuznichenko et al., 2021).

Current proposals to advance the development of EDIS focus on a design where national DISs or national compartments would step in first to cover losses, and only above a certain threshold would these losses be shared at the supranational level (Gros, 2015; Benassy-Queré et al., 2018; Schnabel & Véron, 2019). The European fund would act as a second line of defence, limiting cross-subsidisation. In contrast, other authors believe that national boxes could destabilise national banking systems and undermine the uniformity of euro area depositor protection, contrary to the spirit of EDIS, and propose other measures to address disciplinary problems. Schoenmaker (2019) proposes a reduction in sovereign risk on bank balance sheets and NPLs before carrying out the mutualisation of risks in the EDIS framework. Alternatively, a country risk component could be incorporated into the contributions to be made to EDIS (Benassy-Queré et al., 2018; Schnabel & Véron, 2019). EDIS continues to generate reluctance among some states, especially in Germany, which fears that it will end up paying for the risks of other partners in the banking sector, which was evident at a recent Eurogroup meeting, where they agreed to negotiate in parallel with measures to reduce banking risks, notably concerning national insolvency rules and the treatment of sovereign debt on balance sheets.

The design of the funding framework of a DIS is key to promoting financial stability and addressing disciplinary problems. In this regard, the target fund should be sufficient to cover the losses associated with deposit insurance, without recourse to the public, and the contribution system needs to discriminate effectively on the basis of risk to encourage market discipline.

This paper presents a quantitative analysis of EDIS financing in a risk management framework in order to assess the adequacy and potential impact of the proposed measures on the target level and the fund contribution scheme. To do this, we use a sample of 806 banks in the euro area, representing 81% of the deposits covered in 2018.

In the first part, we estimate the EDIS loss distribution to analyse financial needs and assess the loss-absorbing capacity of the target fund. We used the SYMBOL (SYstemic Model of Bank Originated Losses) microsimulation model proposed by De Lisa et al. (2011). The model makes it possible to estimate the distribution of losses in a banking system, for example, for a country or a set of financial institutions that share common characteristics, using the risk assessment framework of Basel Committee on Banking Supervision (BCBS) (2006). This model was used by the European Commission to measure the target level of European DIFs (European Commission, 2012) and to carry out ex ante evaluations of the legislative proposals for the Banking Union (European Commission, 2014, 2016). The European Commission considers that the conceptual framework of the SYMBOL model is based on innovative theoretical knowledge and that the methodology follows solid scientific principles; it also suggests exploring new extensions of the model to expand it or integrate it with other dynamic models (Hordijk et al., 2018). Our work extends this methodology to risk analysis in EDIS and explores the incidence of systemic risk and bank risk on losses associated with deposit insurance.

Deposit insurance losses come not only from the risk of bankruptcy of individual and independent banks but also from the risks of joint bank failures (Lee et al., 2015). Consideration of systemic risk in the assessment of the financial means required in DIFs is a key aspect. The SYMBOL model considers the correlation between bank asset portfolios as a source of systemic risk[2] and imposes a fixed correlation of 0.5. However, the correlation between banks has a significant impact on the extreme tail percentiles of the distribution (De Lisa et al., 2011), and a single correlation structure may not be adequate in assessing losses associated with systems that encompass different countries (Benczur et al., 2017). In our work, we use different correlation matrices that reflect different degrees of

[2] The correlation among banks' asset portfolios captures the exposure to common factors, i.e., common borrowers, macro variables, or, more generally, the business cycle.

interdependence between banks belonging to the same country and between banks belonging to other countries in the eurozone. On the other hand, considering the possible deterioration in the quality of bank assets as a result of the COVID-19 pandemic (European Banking Authority(EBA), 2018),[3] we analyse the sensitivity of the EDIS to the risk of the bank portfolio considering different scenarios. The results make it possible to determine financial needs based on the degree of risk aversion and to evaluate the coverage offered by the target level, considering different risk factors that affect EDIS losses.

In the second part of the paper, we analyse whether the EDIS contribution scheme is fair and generates adequate incentives to promote market discipline. We use the different calculation methodologies proposed by the European Banking Authority(EBA) (2018) to determine the level of risk of eurozone countries and their respective contributions to the EDIS. First, we analyse the relationship between risk and contribution to assess the fairness of the system. Second, we compare the EDIS contributions with the contributions to the national insurance scheme to determine the impact on the cost of insurance. Finally, we determine the loss absorption capacity of the contributions made by countries using the loss distributions estimated in the first part of the paper.

The results make it possible to determine the influence of the new contribution scheme on moral hazard and the possibility of cross-subsidisation between the countries of the Banking Union.

The rest of this document is structured as follows. Section 2 reviews the scientific literature on risk management in DGS. Section 3 describes the data and the sample used. Section 4 includes the methodology for estimating the loss distribution of the EDIS (4.1) and the results of the analysis of the fund (4.2). Section 5 presents the methodological aspects of the contribution scheme (5.1) and the results of the analysis (5.2). Finally, section 6 concludes.

2. Risk management in the financing of deposit guarantee schemes

The effectiveness of a DIS depends on the fund strength to cover the losses associated with the repayment of insured deposits. In a risk management framework, DIS losses will depend on the probability of insolvency situations occurring in the participating entities, the volume of deposits covered and the dependency structure between the insolvencies of the member entities. These elements clearly parallel the determinants of credit risk, which is the approach used to determine the contributions of the member entities based on the risk and the financing objective of the DIFs.

Traditionally, academic research has focused on determining contributions to DISs based on the probability of bankruptcy of institutions, using different models to estimate them. The most developed approach is the structural model proposed by Merton (1977), which determines the price of insurance as the value of a put option underlain by the entity's assets, the exercise price, the value of the insured deposits and the exercise date set by the date of the next audit. Subsequently, numerous studies have determined contributions to DISs with more complex option valuation models using perpetual options (Allen & Saunders, 1993), barrier options (Chiang & Tsai, 2020; Episcopos, 2008) or both (Hwang et al., 2009), assuming hypotheses of stochastic interest rates (Cooperstein et al. 1995; Duan et al., 1995; Duan & Simonato, 2002; Chuang et al., 2009), volatility as a function of time (Duan & Yu, 1999; Liu et al., 2018), and dependency structure on the default of entities and/or systemic risk (Lee et al., 2015). These instruments have made it possible to analyse different aspects: the establishment of limits on the amount of insured deposits (Dreyfus et al., 1994), the joint effect of deposit insurance and capital requirements (Flannery, 1991; Pennacchi, 2005) or the exposure of the bank's shareholders to the credit risk of the DIS (Episcopos, 2004; Ho et al., 2014). As an alternative to structural models, the use of intensity models for insurance pricing is more limited. These models make it possible to extract the probability of default of the risk premium of those instruments issued by the bank with exposure to credit risk. The default event depends on different covariates, such as leverage, credit rating or macroeconomic variables (Duffie et al., 2003).

In the regulatory arena, insurance pricing follows simpler approaches that allow application to different types of entities and greater transparency. Since 1993, the Federal Deposit Insurance Corporation of the United States (FDIC) has used financial indicators to differentiate between contributions, with separate methodologies based on the size of the entity (Ellis, 2013). At the European level, the adaptation of the DGSD (2014) establishes contributions adjusted to the risk profile of the entity defined by different financial indicators following the CAMEL[4] methodology (European Banking Authority(EBA), 2018).

Research on funding needs and target level determination in DIFs is more recent and less developed. These studies are based on simulation models to estimate the distribution of losses and employ a value-at-risk or economic capital approach to determine the adequacy of the fund. The first work developed by Bennett (2001) to evaluate the financing of the FDIC estimates losses with Monte Carlo simulations with the binomial distribution and determines the solvency of the fund in different scenarios. Campos et al. (2007) develop this approach to analyse the sufficiency of different DIFs in Spain. Kuritzkes et al. (2005) determine the loss distribution of the FDIC using two variants of the Merton model and find that the reserves are sufficient to cover approximately 99.85% of the loss distribution, although under certain stress scenarios, that level would be lower. Sironi and Zazzara (2004) use Moody's KMV model to develop the empirical distribution of losses in Italian deposit insurance, and they conclude that the capital committed is significantly less than the risk of losses. Maccaferri et al. (2013) with the Gamma Lévy model of a single factor, find that the target level of the Italian DIF (equal to 2% of the amount of deposits) covers 99.17% of losses.

[3] The EBA, in the report "The EU banking sector: First insights into the covid-19 impacts" of July 2020, states that the impact of the crisis on asset quality is a key concern. In the medium term, asset quality is expected to deteriorate considerably due to the increase in exposures in potentially riskier portfolios (SMEs and consumers) registered in recent years.

[4] CAMEL is an acronym for the following five components of bank safety and soundness: capital adequacy, asset quality, management quality, earning ability and liquidity.

Previous works determine the distribution of losses using market information from the credit ratings of entities or from credit default swaps (CDSs). This information, as it is not available in the majority of entities adhering to the DIS, represents a limitation for generalized use. In developing a new approach to estimate the loss distribution using balance sheet and regulatory information, De Lisa et al. (2011) consider the link between deposit insurance and the Basel capital requirements framework. Subsequently, the European Commission (2012) used the model currently known as SYMBOL to calibrate the target level of European DIFs. In addition, the model has served to evaluate the impact of the financial reforms adopted by the EU included in the Economic Review of the Financial Regulation Agenda: the modification of the Basel III capital standards (Marchesi et al., 2012; Pagano et al., 2012) and the incorporation of the directive on bank recovery and resolution (Cariboni et al., 2015; Galliani & Zedda, 2015; Benczur, 2017). Parrado-Martínez, Gómez-Fernández-Aguado, and Partal-Ureña (2019) find a direct relationship between the probabilities of default of European banks estimated with SYMBOL and CAMEL indicators. These results show the connection between the risk measures used to determine the target level and the contribution scheme in European DIFs.

3. Data and sample

For our study, we use unconsolidated financial and supervisory information originating from the Orbis Bank Focus Database referring to the year 2018. The information on covered deposits is not directly observable, and we estimate the data from the information on the European deposit guarantee systems published by the European Banking Authority(EBA) (2018). The sample includes a total of 806 eurozone banks (commercial banks, savings banks and credit cooperatives), with a total volume of € 4.9 billion of covered deposits, which represents 81% of the deposits covered in the eurozone (see Table 1).

4. EDIS loss distribution

4.1. Methodological aspects

We use the SYMBOL model to simulate the EDIS loss distribution. The distribution of losses is obtained by adding the covered deposits of the banks that present a default. A bank defaults when the simulated losses exceed the capital available to absorb shocks. Bank losses depend upon an estimated (average) implied obligor probability of default (IOPD) in each bank's portfolio. Through Monte Carlo simulation, bank losses are generated considering as a source of systemic risk the common influence of the economic cycle on the correlation between bank assets. The methodological phases and considerations in our study are described below.

STEP 1 Estimation of the implied obligor probability of default of the portfolio of each individual bank ($IOPD_i$).

The implied obligor probability of default ($IOPD_i$) represents the risk of each bank's credit portfolio and is calculated by the formula that the Basel IRB approach uses to set minimum capital requirements for credit risk (FIRB approach).

The IRB formula uses publicly available information (capital requirements and total assets) and the regulatory values of the pa-

Table 1
Representativeness of the sample.

Country	Total Covered deposit population (bn €)	Covered deposit population (%)	Total Covered deposit sample (bn €)	Representativenss of de sample (%)	Number of Banks in the sample
Austria (AT)	219	3.6	179	82	45
Belgium (BE)	293	4.8	275	94	13
Cyprus (CY)	26	0.4	26	99	18
Germany (DE)	1815	30.0	1053	58	138
Estonia (EE)	9	0.1	8	87	7
Spain (ES)	726	12.0	719	99	27
Finland (FI)	129	2.1	125	97	138
France (FR)	1168	19.3	1028	88	82
Greece (GR)	104	1.7	96	92	5
Ireland (IE)	106	1.8	105	99	7
Italy (IT)	699	11.5	601	86	186
Lithuania (LT)	14	0.2	13	91	5
Luxembourg (LU)	32	0.5	17	54	17
Latvia (LV)	8	0.1	8	95	10
Malta (MT)	12	0.2	10	86	6
Netherland (NL)	499	8.2	494	99	15
Portugal (PT)	144	2.4	108	75	70
Slovenia (SI)	19	0.3	16	85	9
Slovakia (SK)	32	0.5	30	93	8
Total	6056	100.0	4913	81	806

Source: Orbis Bank Focus Database and European Banking Authority(EBA) (2018).

rameters to derive the capital requirements of exposure l of bank i, $CR_{i,l}$. These requirements cover unexpected losses using a time horizon of one year and a confidence level of 99.9% and are given by Eq. (1):

$$CR_{i,l}(PD_{i,l}) = \left[LGD \cdot N\left(\sqrt{\frac{1}{1-R(PD_{i,l})}} \cdot N^{-1}(PD_{i,l}) + \sqrt{\frac{R(PD_{i,l})}{1-R(PD_{i,l})}} \cdot N^{-1}(0.999)\right) - PD_{i,l} \cdot LGD\right] \cdot M(PD_{i,l}) \tag{1}$$

where:

- $PD_{i,l}$ is the default probability of exposure l.
- R is the correlation among the exposures in the portfolio, which is defined as:

$$R(PD_{i,l}) = 0,12 \cdot \frac{1-e^{-50 \cdot PD_{i,l}}}{1-e^{-50}} + 0,24 \cdot \left(1 - \frac{1-e^{-50 \cdot PD_{i,l}}}{1-e^{-50}}\right) \tag{2}$$

- LGD is the loss given default (considered to be 45% in the FIRB approach).
- $M(PD_{i,l})$ is an adjustment term, which is defined as:

$$M(PD_{i,l}) = \frac{(1+(M-2.5) \cdot b_{i,l}) \cdot 1.06}{1-1.5 \cdot b_{i,l}}. \tag{3}$$

In this last formula, M is the time to maturity (considered to be 2.5 years in the FIRB approach), and $b_{i,l}$ is the maturity adjustment, which is computed as:

$$b_{i,l} = (0.11856 - 0.05478 \cdot ln(PD_{i,l}))^2 \tag{4}$$

The minimum capital requirement of bank i, $MCRi$, is obtained by adding the capital requirement of exposure l, of amount Ai,l, for each of the bank's exposures:

$$MCR_i = \sum_l CR_{i,l} \cdot A_{i,l} \tag{5}$$

As there are no available data on banks' exposures towards each obligor, the model considers only one debtor that is equivalent to the total portfolio, and it estimates $IOPD_i$ by solving the following equation:

$$CR(IOPD_i) \cdot \sum_l A_{i,l} = MCR_i \tag{6}$$

where MCR_i is the minimum capital requirement based on the Basel regulation (equal to 8% of risk-weighted assets), and $\sum_l A_{i,l}$ is the total assets of the bank.

STEP 2 Simulation of correlated losses for banks in the system

In a second step, correlated losses for banks are simulated via Monte Carlo using the same IRB formula. In each simulation run j, the losses for bank i are simulated as follows:

$$L_{i,j} = LGD \cdot N\left[\sqrt{\frac{1}{1-R(IOPD_i)}} \cdot N^{-1}(IOPD_i) + \sqrt{\frac{R(IOPD_i)}{1-R(IOPD_i)}} \cdot N^{-1}(\alpha_{i,j})\right] \tag{7}$$

where $IOPD_i$ is the debtor's implicit probability of default for the *i-th* bank, which is estimated through the procedure detailed in the first step, and LGD is the loss in case of default, which is 45%, as in the Basel regulation. Likewise, N is the normal distribution function, and $N^{-1}(\alpha_{i,j})$ are normal pseudo-random numbers with a defined correlation structure.

First, we generate a matrix of dimensions IxJ of stochastically independent normal pseudo-random numbers.[5] Second, we apply the linear transformation property of multivariate normal distributions and the Cholesky decomposition (Glasserman, 2010) to obtain the matrices of normal pseudo-random numbers whose dependency structure is given by the correlation matrices Σ_k, $k = 1, 2, 3$, defined below. The process is carried out with the mvrnorm function available in the MASS package (Venables & Ripley, 2002) in the statistical software R (R Core Team, 2020).[6]

To examine the impact of the degree of correlation between entities on the distribution of losses, we consider three correlation

[5] The pseudo-random number generator algorithm was initiated based on the Mersenne Twister algorithm (Matsumoto & Nishimura, 1998) in order to guarantee that the results are reproducible and comparable.

[6] Additionally, the existence of model risk has been evaluated (Danielsson et al., 2016) using Cholesky, eigenvalues and singular value decompositions implemented with the rmvnorm function provided by the mvtnorm package (Genz et al., 2019). The results obtained are consistent, and ultimately, the mvrnorm function was used.

matrices ($\Sigma_k,\ k = 1,2,3$) that reflect different scenarios in the development of the EDIS:

$$[\Sigma_1]_{i,j} = \begin{cases} 1 & i = j \\ 0.5 & i \neq j \wedge c_i = c_j \\ 0 & i \neq j \wedge c_i \neq c_j \end{cases} \quad (8)$$

$$[\Sigma_2]_{i,j} = \begin{cases} 1 & i = j \\ 0.5 & i \neq j \end{cases} \quad (9)$$

$$[\Sigma_3]_{i,j} = \begin{cases} 1 & i = j \\ 0.6 & i \neq j \wedge c_i = c_j \\ 0.3 & i \neq j \wedge c_i \neq c_j \end{cases} \quad (10)$$

The matrix Σ_1 imposes a correlation equal to 0.5[7] between all entities belonging to the same country and zero with entities belonging to other countries. It assumes the nonexistence of a common component of banking disturbances in the different countries. This matrix represents the current scenario of independence among the national DIS. In the matrix Σ_2, the correlation between all entities is set at 0.5 regardless of the country of operation, considering the assumption base of the SYMBOL model for the mutualisation of the EDIS. The matrix Σ_3 considers a correlation of 0.6 between entities from the same country and 0.3 with entities that belong to a different country.[8] It reflects an intermediate scenario incorporating a common component between countries but one that is less strong than that to which entities within the same country are exposed.

STEP 3 Determination of bank failure

Given the simulated matrix of correlated bank losses, the SYMBOL model determines which banks fail. A bank failure happens when simulated obligor portfolio losses (L_{ij}) exceed the sum of the bank's expected losses (EL_i) and the total actual capital (K_i) given by the sum of its minimum capital requirements plus the bank's excess capital (if any):

$$Failure_i:\ L_{i,j} - EL_i - K_i > 0 \quad (11)$$

STEP 4 The EDIS Loss distribution

Finally, we obtain the EDIS loss distribution by summing the amount of deposits covered from the failed banks in each simulation. The process is carried out by setting the number of simulations (100,000, 500,000 and 1,000,000 iterations). The results presented for the analysis correspond to 1,000,000 simulations, since they make it possible to obtain a greater granularity of the tail of the loss distribution, which, due to the characteristics of the phenomenon studied, is long and thick.

4.2. Results

We analyse EDIS risk by focusing primarily on the tail of loss distributions generated by the different correlation structures between bank assets. Simulating the probability distribution, we calculate the value at risk (VaR) and expected shortfall[9] (ES) at the extreme percentiles. Although both measures are traditionally recognized for measuring financial risk, as a result of the 2008 financial crisis, criticism about VaR has intensified (Degiannakis et al., 2012), and in the regulatory field, the is recommended to measure risk and to determine capital requirements (Basel Committee on Banking Supervision (BCBS), 2019)[10]. The tail risk is dependent on the shape of the distribution, and in the case of non-normal or wide-tailed distributions, the loss increases, so the VaR underestimates the worst loss. ES is considered a more appropriate measure to assess tail risk related to systemic crises (Zedda & Cannas, 2020).

Table 2 shows the results of the EDIS loss distributions estimated with the different correlation matrices considered ($\sum_1$, $\sum_2$ and $\sum_3$). It collects the number of registered breaches; descriptive statistics for the distribution (mean, standard deviation, skewness and kurtosis); the target fund coverage level (TFCL) whose scale value of the sample amounts to € 39.3 billion; the risk measures VaR, ES; and fund needs (FN) to hedge the loss as a percentage of risk exposure (covered deposits) for different percentiles of the distribution.

The results show that the phenomenon studied is characterized by being rare but with very high severity. The EDIS loss distribution

[7] The SYMBOL model considers a correlation factor of 0.5. This calibration is based on the analysis of Sironi and Zazzara (2004) for the Italian financial system, estimated from the evolution of bank assets.

[8] We consider the calibrations of the correlation factors between banks in the same country and banks in different countries used by Benczur et al. (2017) for the evaluation of financial reforms adopted in the Economic Report of the Financial Regulation Agenda (European Commission, 2014).

[9] The expected shortfall, also known as conditional VaR or the expected loss of the tail of the distribution, is the expected value of losses that are greater than or equal to the VaR (Hull, 2015).

[10] The Basel Committee on Banking Supervision (BCBS) (2019) affects the robustness of the risk management models and the backtesting of the results, which makes it desirable that the risk measures possess the properties of elicitability and robustness. In the new market risk measurement framework known as Fundamental Review of the Trading Book (FRTB), it recognizes that the ES metric mitigates the deficiencies of the VaR in terms of capturing the risk of extreme losses (tail risk) and proposes its use for a more robust and consistent measurement of risk in the calculation of capital requirements for market risk.

Table 2
EDIS loss distribution.

	$\sum_1$			$\sum_2$			$\sum_3$		
Defaults	11,124			10,806			11,214		
Mean (bn €)	0.78			0.79			0.73		
St. Dev. (bn €)	3.89			3.78			3.41		
Skewness	0.16			0.15			0.15		
Kurtosis	28.22			28.20			26.24		
TFCL (%)	99.97			99.97			99.97		
Percentile (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)
99.00	0.00	7.81	0.00	0.00	8.12	0.00	0.00	8.43	0.00
99.50	0.00	15.63	0.00	0.00	16.24	0.00	0.00	16.87	0.00
99.90	0.97	77.57	0.02	0.97	80.69	0.02	0.83	83.95	0.02
99.95	6.74	152.37	0.14	6.34	158.92	0.13	4.92	165.99	0.10
99.96	12.60	188.34	0.26	12.32	196.42	0.25	11.13	205.71	0.23
99.97	23.49	244.93	0.48	22.50	255.94	0.46	22.48	268.76	0.46
99.98	56.21	347.63	1.14	59.00	365.33	1.20	58.98	385.22	1.20
99.99	156.78	599.75	3.19	167.21	633.17	3.40	222.29	667.83	4.52
100.00	1954.96	1954.96	39.79	2112.34	2112.34	43.00	2205.49	2205.49	44.89

is skewed and has a very thick tail. Although the average loss is small, high losses of different magnitudes are recorded in the distribution queue depending on the dependency structure between banks (see Annex 1).

The comparison of the results of matrix $\sum_2$ in relation to matrix $\sum_1$ determines the influence of the correlations between banks belonging to different countries on losses. The $\sum_2$ matrix registers higher ES values than the $\sum_1$ matrix in all the percentiles considered. The correlation between banks in different countries has an important effect on the accumulated losses in the tail of the distribution. With the magnitude of the VaR, this effect can be seen from the 99.98% percentile. On the other hand, the comparison of the results with $\sum_2$ and $\sum_3$ determines which correlation structure between banks is more influential in terms of risk. The matrix $\sum_3$, relative to $\sum_2$, reflects a higher correlation within the country and a lower correlation between countries. The highest values of ES registered with $\sum_3$ show the dominant effect of the correlation within the country in all percentiles of the tail. With VaR, this effect is recognized from the 99.99% percentile.

Financial needs intensify as the level of coverage of the loss increases, with significant differences in the extreme percentiles according to the correlation structure. Thus, to cover 99.99% of the losses, the necessary funding would be 3.19% of the deposits covered with matrix $\sum_1$, 3.40% with matrix $\sum_2$, and 4.52% with matrix $\sum_3$. The target fund would guarantee very similar coverage levels in the three distributions, 99.97% of the losses.

Finally, we analyse the sensitivity of the results to the risk of the banking portfolio. In times of crisis, the risk of the portfolio increases more than usual before any capital adjustment, jeopardizing the viability of the entity and consequently increasing the risk of losses in deposit insurance. For the analysis, we used the IOPD variable, considered a proxy for the quality of the bank's portfolio in the model. Taking into account that the data used in the study correspond to a year in which the bank portfolios presented a moderate risk, we stress the initially estimated value by two (IOPDx2) and five times (IOPDx5). We again estimate the EDIS loss distribution using the different correlation structures (see Annex 1).

The results of the sensitivity analysis reflect how the deterioration of the quality of bank portfolios has a direct impact on bank defaults and causes a notable increase in losses in the tail of the distribution (see Tables 3 and 4). Although the correlation between countries produces an increase in risk, the correlation within a country is more dominant. This effect is intensified by the increasing risk in portfolios. The financial needs of the EDIS to cover losses at the different confidence levels considered increase, and consequently, the level of coverage offered by the target fund is significantly reduced. In the most extreme scenario (IOPDx5), the target fund would cover 99.34%, 99.35% and 99.41% of the losses estimated with matrices $\sum_1$, $\sum_2$ and $\sum_3$, respectively.

5. Risk-based premiums

5.1. Methodological aspects

The European Banking Authority (EBA) (2015) developed the methodology for calculating risk-adjusted contributions for national deposit guarantee systems. The member states have developed their own calculation methods using the established guidelines. To identify practical problems or obstacles in the current framework, the EBA conducts periodic reviews of the calculation methods used in the different European DGSs.[11] In the latest review, it is concluded that no changes to the current guidelines are necessary (European Banking Authority(EBA), 2018). Taking into account that a methodology for contributions to the EDIS has not yet been developed and considering the foreseeable maintenance of this framework, our study follows the guidelines of the current proposal. We use the

[11] In accordance with Article 13 (2) of the DGSD, member states must inform the EBA about the contribution methods that have been approved. This requirement provides the EBA with an overview of how member states have implemented risk-based contributions in their jurisdictions.

Table 3
IOPDX2 sensitivity analysis.

	$\sum_1$			$\sum_2$			$\sum_3$		
Defaults	48,939			48,257			49,029		
Mean (bn €)	0.88			0.92			1.06		
St. Dev. (bn €)	3.98			4.14			4.86		
Skewness	0.07			0.07			0.08		
Kurtosis	5.74			6.39			7.05		
TFCL (%)	99.88			99.89			99.89		
Percentile (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)
99.00	0.00	39.16	0.00	0.00	37.89	0.00	0.00	39.63	0.00
99.50	0.70	78.04	0.01	0.67	75.52	0.01	0.44	79.15	0.01
99.90	53.58	360.41	1.09	52.10	349.00	1.06	49.27	373.27	1.00
99.95	173.61	629.87	3.53	162.19	608.97	3.30	163.01	660.47	3.32
99.96	234.29	708.18	4.77	235.69	733.63	4.80	244.57	772.58	4.98
99.97	336.07	843.80	6.84	385.34	874.76	7.84	394.91	924.22	8.04
99.98	483.76	1054.38	9.85	586.96	1077.14	11.95	597.85	1150.90	12.17
99.99	899.41	1385.44	18.31	985.37	1410.40	20.06	1040.64	1513.96	21.18
100.00	2499.98	2499.98	50.89	2751.52	2751.52	56.01	3316.35	3316.35	67.50

Table 4
IOPDX5 sensitivity analysis.

	$\sum_1$			$\sum_2$			$\sum_3$		
Defaults	275,851			274,632			276,524		
Mean (bn €)	1.25			1.26			1.60		
St. Dev. (bn €)	4.94			5.11			6.48		
Skewness	0.03			0.03			0.03		
Kurtosis	1.11			1.13			1.37		
TFCL (%)	99.34			99.35			99.42		
Percentile (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)	VaR (bn €)	ES (bn €)	FN (%)
99.00	13.90	242.45	0.28	14.22	240.79	0.29	10.79	245.17	0.22
99.50	67.68	451.94	1.38	67.83	448.86	1.38	62.53	464.90	1.27
99.90	708.09	1290.55	14.41	696.88	1285.99	14.18	722.47	1380.01	14.71
99.95	1245.28	1622.61	25.35	1278.30	1620.30	26.02	1309.99	1766.24	26.66
99.96	1362.78	1693.22	27.74	1433.71	1694.76	29.18	1456.40	1869.25	29.64
99.97	1472.73	1770.74	29.98	1476.32	1774.49	30.05	1520.59	1996.72	30.95
99.98	1562.30	1897.31	31.80	1568.73	1901.94	31.93	1692.69	2193.39	34.45
99.99	1746.47	2151.85	35.55	1737.80	2166.25	35.37	2008.22	2563.84	40.88
100.00	3881.91	3881.91	79.02	3883.59	3883.59	79.05	4264.09	4264.09	86.79

different methods to calculate the contributions: the bucket method and the linear and exponential variable scale method. The methodological considerations for this research are detailed below.

Each bank's risk-adjusted contribution is calculated as follows:

$$C_i = CR \times ARW_i \times CD_i \times \mu \tag{12}$$

where:

C_i: Annual contribution from member institution *i*.

CR: Contribution rate (identical for all member institutions and equal to 0.8%).

ARW_i: Aggregate risk weight for member institution *i*.

CD_i: Covered deposits for member institution *i*.

μ: Adjustment coefficient.[12]

The aggregate risk weight (ARW_i) is determined as follows:

1. Definition of risk indicators (IR):

[12] The purpose of the adjustment coefficient is to avoid the procyclicality of contributions (an increase in contributions in phases of recession and a decrease in contributions in phases of economic growth as a result of variations in the risk recorded in the cycle). The coefficient is determined as the ratio of the total non-risk-adjusted contributions to the total risk-adjusted contributions for the corresponding year.

For the different risk categories established, we use the following core indicators: 1) concerning capital, the leverage ratio (C1) and the capital coverage ratio (C2); 2) concerning liquidity and financing, the liquidity ratio (L1) and loan-to-deposit ratio[13] (L2); 3) concerning asset quality, the non-performing loans (NPL) ratio (AQ1); 4) concerning business model and management, the ratio of risk-weighted assets to total assets (B1) and the return on assets (B2); and 5) concerning potential losses for deposit insurance, the ratio of unencumbered assets to covered deposits (P1). Table 5 contains the description of the risk indicators used and their relationship with risk.

2. Transformation of indicator values into an individual risk score (*IRS*):

With the bucket method, we differentiate 5 buckets delimited by the percentiles of the distribution of indicators (P_{20}, P_{40}, P_{60}, P_{80}). Bucket 1 is the lowest risk level, and bucket 5 is the highest risk level. As we assume a linear mapping of the *IRS* to the buckets, the *IRSs* assigned to the buckets are 0 (bucket 1), 25 (bucket 2), 50 (bucket 3), 75 (bucket 4) and 100 (bucket 5). With the sliding scale method, we consider P_{80} as the upper limit (a_j) and P_{20} as the lower limit (b_j). If the risk indicator is positive (e.g., the higher the value, the higher the risk), the score is obtained with expression (12), and if the indicator is negative (e.g., the higher the value, the lower the risk), expression (13) is used.

$$IRS_j = \begin{cases} 100 & if\ RI_j > a_j \\ 0 & if\ RI_j < b_j \\ \dfrac{A_j - b_j}{a_j - b_j} \cdot 100 & if\ b_j \leq\ RI_j\ \leq a_j \end{cases} \tag{13}$$

$$IRS_j = \begin{cases} 0 & if\ RI_j > a_j \\ 100 & if\ RI_j < b_j \\ \dfrac{A_j - b_j}{a_j - b_j} \cdot 100 & if\ b_j \leq\ RI_j\ \leq a_j \end{cases} \tag{14}$$

3. Calculation of the aggregate risk score (*ARS*)

The weights assigned to the risk categories follow the European Banking Authority(EBA) (2018) guidelines when only basic indicators are used: capital, 24%; liquidity and funding, 24%; asset quality, 18%; business model and management, 17%; and potential use of DGS funds, 17%. The weight of each indicator (IW_j) is established proportionally according to the weight of its category. The aggregate risk score (*ARS*) for bank *i* is calculated as follows:

$$ARS_i = \sum_{j=1}^{n} IW_j \cdot IRS_{i,\,j} \tag{15}$$

4. Determination of the aggregate risk weight (*ARW*)

With the bucket method, 5 buckets delimited by the percentiles of the distribution of ARS_i values (P_{20}, P_{40}, P_{60}, P_{80}) are considered. Bucket 1 represents the lowest risk level, and bucket 5 the highest. The *ARWs* assigned to the buckets are 50% (bucket 1), 75% (bucket 2), 100% (bucket 3), 125% (bucket 4) and 150% (bucket 5). With the sliding scale method, we consider a maximum weight (α) equal to 150% and a minimum weight (β) of 75%, coinciding with the weights assigned to the bucket of highest risk and lowest risk, respectively. The *ARW* fits with the linear and exponential functions:

$$\text{Linear} \cdot \text{function:} \cdot ARW_i = \beta + (\alpha - \beta) \cdot ARS_i/100 \tag{16}$$

$$\text{Exponential} \cdot \text{function:} \cdot ARW_i = \beta + (\alpha - \beta) \cdot [1 - log_{10}(10 - 9 \cdot ARS_i)] \tag{17}$$

Following the methodology and the considerations outlined, we calculate the contribution to the EDIS for each bank in the sample based on the risk profile in the euro area. Finally, we work with the information added by countries for the analysis of the results. Annex 2 contains the results of the intermediate variables (*IRS* and *ARS*) for the calculation of *ARW*.

5.2. Results

In this section, we analyse how the calibration of contributions against the relative risk of banks in the EDIS influences the cost of insurance and can promote a level playing field between countries. To do this, we consider the following variables based on the results

[13] The information on the liquidity indicators (LCR and NSFR) proposed by the European Banking Authority(EBA) (2018) was quite incomplete in the database. The loan-to-deposit ratio is used instead as proxies in this study.

Table 5
Core risk indicators.

Category	Indicator	Notation	Description	Expected sign on bank risk
Capital	Leverage ratio	C1	Tier 1 capital/Total assets	Negative
	Capital coverage ratio	C2	Actual own funds/Required own funds	Negative
Liquidity and Funding	Liquidity ratio	L1	Liquid assets/Total assets	Negative
	Loans-to-deposits ratio	L2	Loans/Deposit	Positive
Asset quality	Non-performing loans ratio	AQ1	NPL/Total loans and debt instruments	Positive
Business model and management	Risk weighted assets (RWA) to total assets ratio	B1	RWA/Total assets	Positive
	Return on assets	B2	Net Income/Total assets	Negative
Potential losses for the DGS	Unencumbered assets/covered deposits	P1	Liquid assets/Covered deposits	Negative

Source: European Banking Authority (2015 and 2018).

obtained with banks registered in each country: aggregate risk weight (*ARW*) representative of the relative risk level of the country in the euro area; contribution to the EDIS (C^{EDIS}), reflecting the average cost of deposit insurance in the EDIS; rate of change ($RC^{EDIS/DGS}$) of the contribution to the EDIS with respect to the national DGS, measuring the impact of the risk references used in each system on the cost of insurance; and loss absorption capacity (*LAC*) of the contribution made to the EDIS by the country, represented by the level of confidence obtained in the distribution of losses in the country.[14] Table 6 shows the results obtained for the different contribution calculation methods (bucket method, sliding scale linear and exponential methods).

The results show a significant impact of the countries' risk on the cost of insurance, which varies according to the method of calculating the contributions. Using the bucket method, countries with lower risk would have significant reductions in the cost of insurance within the EDIS. In the case of Estonia, it would mean a reduction of 54.5% compared to the contribution in the national DGS. In contrast, the countries with the highest risk would register an increase with a maximum of 16.5% (Portugal). The scaling methods vary the risk levels of some countries with respect to the bucket method, as well as the impact on contributions. They produce a greater cost increase for the countries with the highest risk, with a maximum of 23.6% (Greece) on the linear scale and 27.4% (Italy) on the exponential scale. However, for lower-risk countries, it has a lesser impact on the reduction of contributions, reaching a maximum reduction of 33.3% on the linear scale and 25.4% on the exponential scale (Estonia). These results show that under national compartments (DGS), banks in certain countries can benefit from a lower cost in the coverage of deposits, although they present a higher level of risk than their European peers. At the same time, banks with lower risk would be paying an unjustified overcharge in national insurance. The relative risk measures proposed to establish contributions to EDIS will provide greater equity among Banking Union countries.

In relation to the capacity to absorb losses, the results generally show adequate coverage of the contributions made by the banks in different countries (99.98%, on average). Nevertheless, there is some heterogeneity between countries; the country that offers the highest loss coverage is Estonia at 99.998%, and the country with the lowest coverage is Slovakia (99.957%). To the extent that country contributions do not guarantee the same coverage of loss, it could generate cross-subsidisation in the EDIS.

6. Conclusions

The resolutions adopted during the last decade for the consolidation of the Banking Union have enabled greater resilience of banks at the beginning of the current crisis caused by COVID-19. However, there is great uncertainty regarding whether economic deterioration will spread and trigger a more severe scenario for the European banking system. This supervening situation shows the need to conclude the EU framework with the full development of the EDIS. It is essential to resolve the distrust that some countries show due to the fear that moral hazard increases and causes cross-subsidisation.

Our work presents a quantitative analysis of EDIS financing that makes it possible to evaluate the adequacy and impact of the currently proposed measures. The results obtained provide relevant contributions regarding the factors that affect the soundness of deposit insurance, have useful implications for risk management and control in the EDIS, and clarify the disciplinary problems associated with its operation.

Based on the SYMBOL microsimulation model, we simulate the loss distribution of the EDIS considering different correlation structures between banks from the same country and banks from different countries as sources of systemic risk. The results show how the phenomenon studied is characterized by being rare, but with a very high severity materializing in the tail risk. We find that the magnitude of losses is dependent on the degree of correlation between banks in the same country. However, the correlations between banks in different countries have a significant effect on the accumulated losses in the tail of the distribution. In the calibration of the target level of national DIFs, only the degree of correlation between shocks that affect banks in the same country was considered. The EDIS should incorporate the interconnection between banks in different countries to avoid underestimating financing needs. On the

[14] The results shown have been obtained with the loss distribution generated with the correlation matrix $\sum^1$; the results for the rest of the specifications do not show significant differences and are available on request.

Table 6
Effect of risk-adjusted contributions in EDIS by country.

Country	Bucket method				Sliding scale method (linear)				Sliding scale method (exponential)			
	ARW (%)	C^{EDIS} (%)	$RC^{EDIS/DGS}$ (%)	LAC (%)	ARW (%)	C^{EDIS} (%)	$RC^{EDIS/DGS}$ (%)	LAC (%)	ARW (%)	C^{EDIS} (%)	$RC^{EDIS/DGS}$ (%)	LAC (%)
AT	106.5	0.676	−15.48	99.979	96.1	0.784	−1.98	99.980	74.2	0.778	−2.81	99.980
BE	114.7	0.728	−8.99	99.991	95.4	0.778	−2.69	99.991	73.0	0.765	−4.35	99.991
CY	107.4	0.682	−14.77	99.996	87.7	0.716	−10.54	99.996	68.6	0.719	−10.09	99.996
DE	122.1	0.775	−3.14	99.976	92.8	0.758	−5.30	99.976	71.9	0.753	−5.87	99.976
EE	57.3	0.364	−54.50	99.998	65.4	0.533	−33.32	99.998	56.9	0.597	−25.40	99.998
ES	146.3	0.929	16.07	99.976	101.9	0.832	3.97	99.975	78.6	0.824	3.02	99.975
FI	81.8	0.520	−35.05	99.995	91.7	0.748	−6.45	99.995	71.2	0.746	−6.70	99.995
FR	134.7	0.855	6.90	99.975	90.7	0.740	−7.46	99.975	70.1	0.734	−8.20	99.975
GR	138.4	0.879	9.88	99.995	121.2	0.989	23.65	99.995	95.4	0.999	25.03	99.995
IE	123.1	0.782	−2.30	99.996	115.6	0.944	17.94	99.996	89.5	0.938	17.31	99.996
IT	144.0	0.915	14.32	99.971	120.9	0.986	23.30	99.974	97.3	1.020	27.44	99.975
LT	84.6	0.537	−32.83	99.997	85.2	0.696	−13.05	99.997	67.5	0.707	−11.63	99.997
LU	75.4	0.479	−40.14	99.987	83.3	0.680	−15.01	99.994	65.8	0.690	−13.81	99.994
LV	83.3	0.529	−33.91	99.995	84.5	0.689	−13.84	99.995	67.8	0.710	−11.23	99.995
MT	87.2	0.553	−30.83	99.993	89.3	0.729	−8.91	99.996	69.2	0.725	−9.39	99.996
NL	89.7	0.570	−28.80	99.997	84.9	0.693	−13.42	99.998	66.5	0.697	−12.89	99.998
PT	146.7	0.932	16.45	99.983	109.4	0.893	11.63	99.983	83.9	0.879	9.88	99.983
SI	128.0	0.813	1.60	99.992	109.8	0.896	12.04	99.992	84.2	0.883	10.34	99.992
SK	123.6	0.785	−1.88	99.957	114.0	0.930	16.26	99.957	87.5	0.917	14.68	99.957

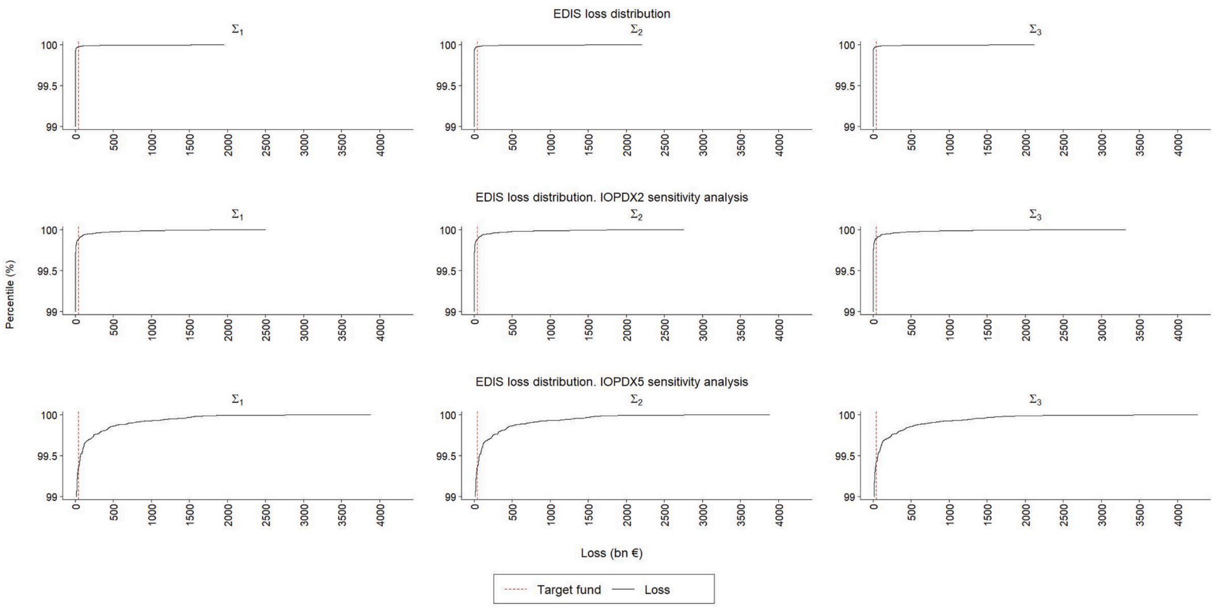
other hand, losses show high sensitivity to the risk of bank portfolios. Consequently, the loss-absorbing capacity of the target level and the strength of the fund would be reduced in times of economic recession. Problems can arise in defining the fund as a fixed percentage of deposits without considering the degree of risk aversion and the level of solvency that is intended to be guaranteed. In our opinion, the target level calibration for the EDIS should consider these aspects and be developed with a more advanced risk management framework. In this sense, the Basel capital regulations and the incorporation of counter-cyclical buffers could be an appropriate reference.

Regarding the contribution scheme, we find important variations in the cost of insurance in some countries when the risk profile of their banks is determined based on the overall risk in the Banking Union. Within the national DIS, some banks could benefit from a lower cost even though their level of risk is higher than that of European banks. In this sense, the proposed risk-sharing methodology for EDIS provides more equitable risk measures and may be an appropriate incentive to improve risk management. Nevertheless, we find differences in the loss-absorbing capacity with the contributions of the different countries, which can lead to cross-subsidisation if these differences persist in the same countries in the long term.

Author statement

On behalf of all authors, the corresponding author states that there is no conflict of interest. This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal.

Annex 1



Annex 2.

Individual Risk Score (IRS) and Aggregate Risk Score (ARS). Average.

Country	Method	IRS								ARS
		C1	C2	L1	L2	CA1	G1	G2	P1	
AT	Bucket	56.67	59.44	33.33	55.56	46.67	64.44	32.78	28.89	46.18
	Sliding scale	61.77	74.41	38.05	53.72	22.33	65.70	29.60	35.69	45.54
BE	Bucket	84.62	63.46	51.92	34.62	44.23	36.54	28.85	57.69	51.48
	Sliding scale	89.32	78.80	59.53	32.95	27.16	37.19	32.08	61.45	52.49
CY	Bucket	43.06	63.89	6.94	16.67	81.94	73.61	23.61	15.28	41.28
	Sliding scale	47.40	77.61	3.49	10.35	69.80	80.15	24.56	13.26	40.38
DE	Bucket	44.93	57.97	68.48	32.07	20.65	75.72	73.55	72.28	53.11
	Sliding scale	52.16	76.37	78.31	29.06	4.05	79.25	80.04	81.44	56.42
EE	Bucket	17.86	28.57	21.43	50.00	28.57	67.86	3.57	25.00	29.61
	Sliding scale	15.19	44.60	21.53	49.74	13.77	67.61	0.06	24.56	28.13
ES	Bucket	74.07	72.22	42.59	37.96	62.04	49.07	41.67	41.67	53.19
	Sliding scale	80.20	83.19	47.58	36.13	45.95	49.79	38.12	46.87	53.36
FI	Bucket	13.59	6.52	56.88	59.60	29.71	14.86	42.21	62.14	37.15
	Sliding scale	13.14	10.21	66.55	59.04	14.02	12.35	41.13	71.04	37.02
FR	Bucket	71.34	53.96	41.16	75.30	42.07	34.15	38.72	25.00	47.03
	Sliding scale	78.35	72.75	49.83	75.36	21.92	31.31	39.70	27.96	47.89
GR	Bucket	30.00	80.00	25.00	65.00	100.00	95.00	95.00	30.00	63.25
	Sliding scale	33.74	93.14	34.33	57.44	100.00	96.04	97.83	34.92	66.65
IE	Bucket	50.00	53.57	50.00	46.43	85.71	57.14	42.86	50.00	56.43
	Sliding scale	50.78	59.73	59.89	38.56	85.71	61.73	43.15	60.26	59.66
IT	Bucket	64.92	69.09	68.95	69.62	83.74	56.59	64.11	66.67	69.38
	Sliding scale	69.45	80.37	77.85	70.48	80.74	57.56	65.98	75.02	73.57
LT	Bucket	45.00	50.00	30.00	30.00	55.00	70.00	0.00	45.00	42.10
	Sliding scale	56.05	80.13	34.71	25.37	29.18	65.65	0.00	44.24	41.91
LU	Bucket	51.47	30.88	10.29	42.65	39.71	27.94	50.00	5.88	31.01
	Sliding scale	56.42	39.49	11.24	42.10	22.51	28.94	51.07	7.26	30.00
LV	Bucket	35.00	47.50	15.00	15.00	70.00	82.50	30.00	17.50	38.64
	Sliding scale	35.44	61.03	11.99	15.41	69.86	86.31	30.00	21.34	40.95
MT	Bucket	50.00	58.33	16.67	4.17	79.17	50.00	37.50	29.17	42.15
	Sliding scale	56.74	67.80	22.14	1.05	80.62	51.07	34.02	28.38	44.30
NL	Bucket	66.67	35.00	20.00	50.00	21.67	36.67	40.00	25.00	35.27
	Sliding scale	68.58	51.50	27.36	49.66	11.45	34.19	38.87	26.41	36.41

(continued on next page)

(*continued*)

Country	Method	IRS								ARS
		C1	C2	L1	L2	CA1	G1	G2	P1	
PT	Bucket	47.86	45.36	8.93	11.07	60.36	45.71	39.29	11.43	33.62
	Sliding scale	51.04	55.76	8.39	7.90	44.69	46.80	37.32	10.06	31.68
SI	Bucket	36.11	69.44	55.56	36.11	69.44	91.67	5.56	63.89	55.29
	Sliding scale	36.79	84.22	68.06	34.50	51.92	94.48	4.14	72.92	56.95
SK	Bucket	53.13	71.88	81.25	50.00	59.38	78.13	18.75	87.50	64.55
	Sliding scale	63.96	88.73	87.99	47.51	44.82	79.66	17.06	91.01	66.34

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