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Deposit Insurance Schemes: target fund and risk-based contributions in line with Basel II regulation

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1. The model for computing the banks' loss distribution

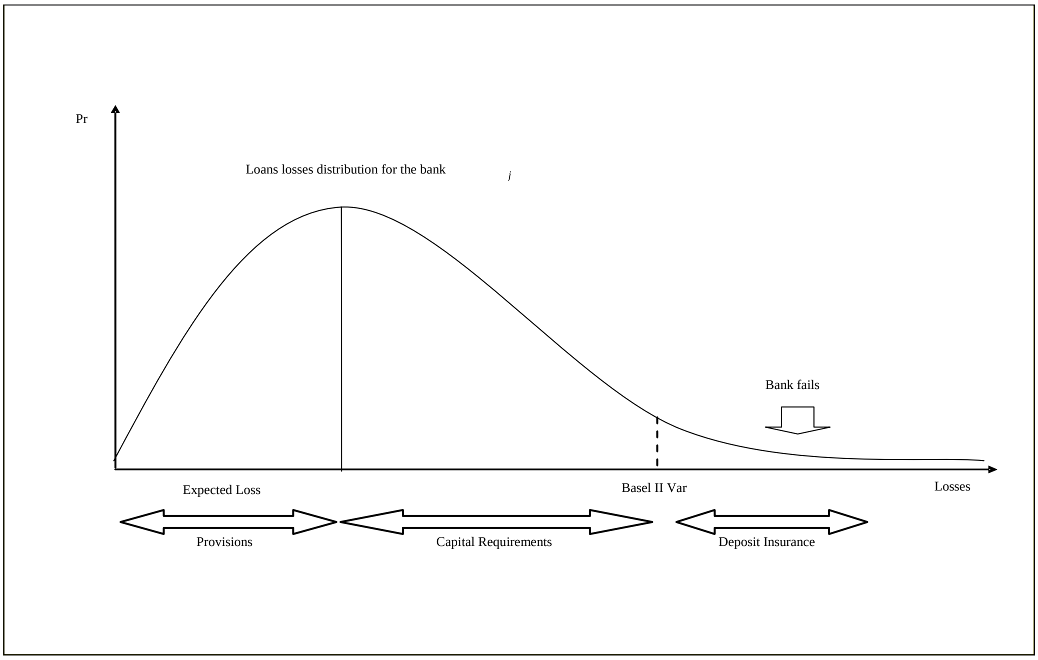
De Lisa et al. (2010)[1] recently developed a model for estimating the losses coming from banks' defaults in a Basel II regulatory framework.

In the Basel II framework each bank has to satisfy a capital requirement that provides a buffer against unexpected losses at a specific level of statistical confidence, set by regulators at 99.9%.

The model proposed by De Lisa et al. (2010) focuses on the tail risk not covered by the Basel II capital requirements by assuming that a bank defaults when its losses exceed the buffer provided by its capital.

In this way the model makes an explicit link between two main pillars of the financial safety net - banks' capital requirements and deposit insurance/guarantee - as the latter comes to play a role when the former is not sufficient (see Figure 1).

Figure 1. Basel II tail risk, and deposit insurance.



Moreover, the model has the feature of considering two channels of banking contagion as sources of systemic financial instability. The first channel depends on the correlation between banks' exposures that may exist as a consequence of banks' common exposure to the same borrower or, more generally, to a particular influence of the business cycle. The second channel depends on the linkages among financial institutions through the interbank credit market (interbank market contagion).

[1] De Lisa R, Zedda S., Vallascas F., Campolongo F., Marchesi M., "Modelling Deposit Insurance Scheme Losses in a Basel 2 Framework, *Journal of Financial Services Research*, 2010, Second invited revision.

The model has been applied to unconsolidated accounting data for a sample of 494 Italian banks for the year 2007. The data are drawn from the ABIBANK dataset managed by the Italian Banking Association (ABI).

In a first approach, the Deposit Insurance Scheme (DIS) loss distribution has been estimated under the assumption that a bank default any time its simulated loss is higher than the capital requirements. The estimates of the DIS loss distribution thus obtained are reported in the following Tables 1 and 2.

Table 1 presents the DIS loss distribution considering all simulations, including those where no banks fail (unconditional loss distribution). Table 2 presents instead the DIS loss distribution considering only those simulations where at least one bank defaults (conditional loss distribution).

Note that these figures differ from those reported in the paper by De Lisa et al. (2010) as in that case the bank is assumed to default only when its actual capital (and not the regulatory capital) is below the simulated loss.

Table 1. DIS loss distribution for different values of the loading of common factor β. Amounts are in m€.

	Loading of common factor β (macroeconomic systemic risk factor)		
	30%	50%	70%
Panel A: without interbank contagion			
N. Simulations	10,611,304	13,553,057	13,566,756
Mean	0.89	0.75	0.91
Percentile:			
99.90%	0	0	0
99.99%	1,321	966	1,374
100.00%	81,841	81,841	84,604
Panel B: with interbank contagion			
N. Simulations	10,611,304	13,553,057	13,566,756
Mean	4.1	3.7	4.3
Percentile:			
99.90%	0	0	0
99.99%	1,321	966	1,379
100.00%	381,893	381,893	381,893

Note: Panel A shows summary statistics of the DIS loss distribution, estimated via Monte Carlo simulation, under the assumption of no interbank contagion. Panel B presents the same statistics when the simulations consider the impact of interbank contagion. A sample of 494 Italian banks is employed; accounting data refer to 2007.

Table 2. DIS loss distribution constructed on the basis of 10,000 scenarios with at least one bank default for different values of the loading of the common factor β. Amounts are in m€.

	Loadings of common factor β (macroeconomic systemic risk factor)		
	30%	50%	70%
Panel A: without interbank contagion			
Mean	944	1,019	1,233
St. dev.	4,495	4,780	5,339
Percentile:			
25%	51	57	69
50%	123	131	164
75%	316	375	505
90%	1,512	1,765	2,284
95%	3,757	4,120	4,752
99%	22,451	22,451	26,644
99.9%	79,479	79,479	79,656
100%	81,841	81,841	84,604
Panel B: with interbank contagion			
Mean	4,339	4,970	5,796
St. dev.	37,431	40,358	43,405
Percentile:			
25%	51	57	69
50%	123	131	164
75%	316	375	505
90%	1,513	1,765	2,284
95%	3,757	4,120	4,789
99%	33,341	381,854	381,893
99.9%	381,893	381,893	381,893
100%	381,893	381,893	381,893

Note: Panel A shows summary statistics of the DIS loss distribution, estimated via Monte Carlo simulation, under the assumption of no interbank contagion. Only the 10,000 scenarios with at least one bank default are considered. Panel B presents the same statistics when the simulations consider the impact of interbank contagion. A sample of 494 Italian banks is employed; accounting data refer to 2007.

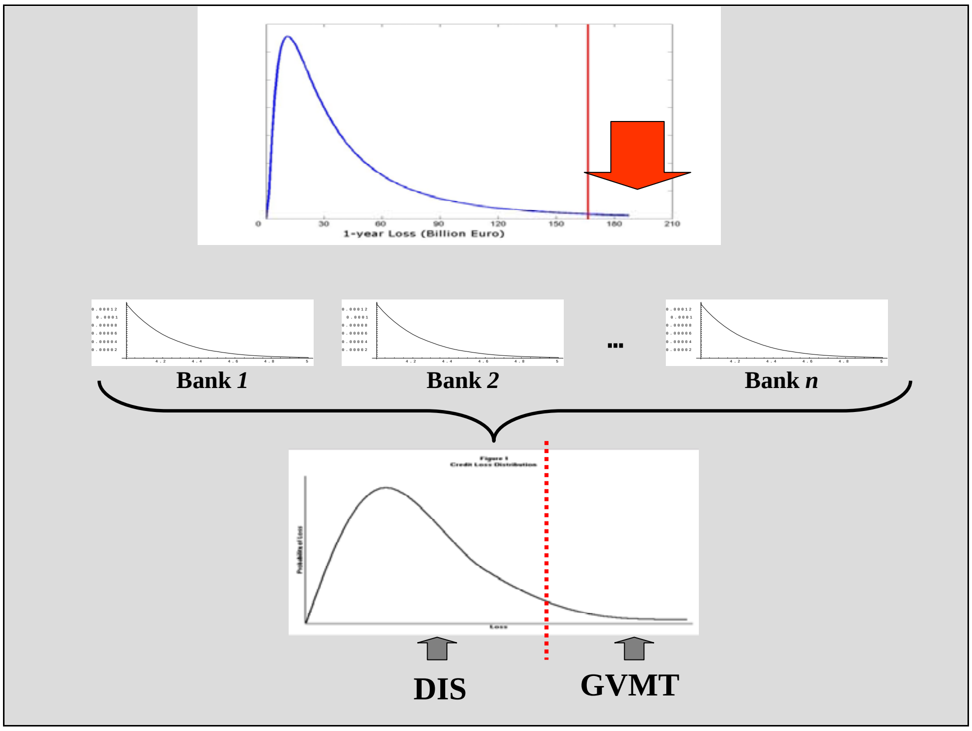
2. Model policy applications

The model has several possible applications that are relevant for policy making purposes relating to banking prudential regulation.

2.1. The choice of the deposit insurance scheme size

The model allows the determination of the distribution of banks' losses that are not covered by banks' capital requirements (excess losses[2]) and are therefore passed on to other components of the financial safety net such as a Deposit Insurance Scheme, or the Government (Fig. 2). And this allows a risk based policy choice relating to the size of the Deposit Insurance Scheme.

Figure 2 – Deposit Insurance Scheme funding endowments and part of its loss distribution left to the possible intervention of Government (GVMT).



Funding needs/financial endowments of an insurance scheme are in fact influenced, most of all, by the level of security that one wants to provide to consumers: the higher security one wants to provide with a guarantee scheme, the higher the insurance scheme financial endowments/funding needs which will be obviously needed. A key policy decision is therefore the choice of the level of security that a DIS is expected to provide to consumers.

[2] In Section 4, more details are provided on the calculation of excess losses. The results of an alternative method for calculating excess losses are also presented.

In practical terms, the level of security provided to consumers / depositors is determined in relation to the part (statistically, the *percentile*) of the DIS loss distribution that the DIS financial endowments are enough to cover.

The percentile (level of security) chosen should not only provide a high level of security for consumers but also be financially realistic: that is, it should have the potential to be appropriate in terms of achieving the objective of a sufficiently high protection of the policyholders, but also do it without requiring excessively expensive resources.

Several risk based criteria can be envisaged to choose the (target) size of a DIS. For instance the criterion may be to be able to have funds sufficient to cover the average loss that would hit the DIS in all situations where at least one bank default occurs. Following this criterion, the loss distribution computed by means of the presented model allows an estimations of the target size of the DIS size, as the target size of the fund would correspond in the estimations of the model to the average of the conditional loss distribution. For instance, in the case of Italy and of a 50% loading of systematic risk factor, the target fund would be **4,970 m€** or **1,019 m€** under the assumption of interbank contagion or no interbank contagion respectively (see Table 2)**.** It is worth noticing that the actual size of the Italian DIS in 2007 was of **1,602 m€.**

Many other criteria can be chosen as an alternative. Once any criterion has been chosen and a target size has been determined, however, the presented model allows with its DIS loss distribution to evaluate the level of security (the percentile) associated with the chosen size, providing a valuable risk related information: the percentage of loss "scenarios" for which the chosen target fund would not be enough (meaning that other types of intervention, for instance by the Government, might be needed).

2.2. Estimating banks' risk contributions

Once the target size of the DIS has been established, the total amount of money to be collected need to be distributed among banks belonging to the DIS in accordance to their risk profiles.

Several criteria can be used to compute risk-based contributions. Examples of possible criteria have been proposed in the report “Possible models for risk-based contributions to EU Deposit Guarantee Schemes”[3] which takes into account current practices in the EU.

Here we propose an alternative. The idea is to use the model described above to estimate the contribution to the total loss of the system (in percentage) that is attributable to each bank. These contributions have been estimated under different assumptions, depending on how inter-bank contagion has been taken into account.

More precisely three different scenarios have been considered:

(1) Inter-bank contagion is not taken into account. A default can occur only as a consequence of credit

losses in the bank portfolio.

(2) Passive inter-bank contagion is considered. A default may occur also as a consequences of losses induced on the analyzed bank from the failures of other banks.

(3) Passive and active inter-bank contagion is considered. We not only take into account the losses that a given bank can receive from the default of another bank , but we also take into account the possible contagion effects that the losses of the analyzed bank can passing on via the inter-bank market to the other banks.

In the first scenario the contribution is obtained by running the model via a Monte Carlo simulation, without inter-bank contagion, and considering for each bank the sum of all losses transferred to the DIS as a consequence of the bank's default. The obtained figures can then be used to derive the relative contributions to the total DIS loss attributable to each bank.

In the second scenario, we use the same approach but we run the model including the possibility of inter-bank contagion.

Finally, the contributions in the third scenario are obtained using the “leave-one-out” approach. The model is run to compute first the overall DIS loss and then the loss that would be obtained leaving out the analysed bank. The difference between the two losses represents the marginal contribution of the given bank to the overall risk.

The contributions to the total loss (in percentage) attributable to each bank in the three scenarios are reported in Table 3.

Table 3. Risk contributions – Italy – 2007 – First 30 banks sorted by first column.

BANCA	Scenario 1	Scenario 2	Scenario 3
INTESA SANPAOLO	22.106%	18.076%	15.782%
UNICREDIT	7.910%	9.245%	5.178%
MONTE PASCHI DI SIENA	7.155%	6.060%	15.104%
BANCA NAZIONALE DEL LAVORO	5.599%	5.106%	13.890%
BANCA ANTONVENETA	2.957%	2.697%	12.837%
B.POP. DI MILANO	2.534%	2.941%	1.647%
BANCO DI NAPOLI	2.421%	2.904%	2.445%
CR DI PARMA E PIACENZA	2.304%	2.439%	1.366%
CREDITO EMILIANO	1.731%	1.782%	0.997%
BANCO DI BRESCIA	1.658%	1.619%	0.946%
BIPIELLE	1.553%	1.632%	1.750%

[3] http://ec.europa.eu/internal_market/bank/docs/guarantee/2009_06_risk-based-report_en.pdf

BANCA TOSCANA	1.517%	1.481%	0.829%
CR DI PADOVA ROVIGO	1.474%	1.283%	0.718%
BANCA CARIGE	1.335%	1.444%	0.808%
CREDITO BERGAMASCO	1.232%	1.277%	0.715%
B.POP. DI NOVARA	1.175%	1.460%	0.832%
CR DI FIRENZE	1.169%	1.402%	0.785%
B.P.C.I.	1.030%	0.992%	0.555%
BANCA DELLE MARCHE	0.978%	0.973%	0.544%
B.POP. DELL'EMILIA ROMAGNA	0.912%	1.264%	1.136%
BANCA SELLA	0.874%	0.876%	0.491%
UNICREDIT PRIVATE BANKING	0.850%	0.830%	0.887%
BANCA MEDIOLANUM	0.847%	0.827%	0.894%
BRE	0.832%	0.857%	0.479%
UNIPOL BANCA	0.830%	1.113%	0.623%
CR LUCCA PISA LIVORNO	0.764%	0.747%	0.417%
CREDITO ARTIGIANO	0.686%	0.674%	0.377%
B.POP. DI VICENZA	0.685%	0.976%	1.403%
CR IN BOLOGNA	0.618%	0.654%	0.790%
VENETO BANCA	0.575%	0.714%	0.399%

The risk-based contributions can then be derived by applying these percentages to the target size of the fund.

3. Application of the model to other countries

The model developed by De Lisa et al. (2010) has been applied here to other 3 EU countries: UK, Germany, and Spain. It should be noticed, however, that for these countries it has been necessary to use consolidated rather than individual bank data, data for 2008 and only a more limited sample of banks compared to Italy. The first sample is of 23 banks from UK, representing a total of 12.4 trillion euro of total assets, the second is of 17 banks from Germany, representing a total of 5 trillion euro of total assets, and the third of 54 banks for Spain, representing a total of 3,35 trillion euro.

The model has been run as in the case of Italy for several million times in order to achieve 10,000 scenarios containing at least one bank default. The loading of the common macroeconomic systemic risk factor has been set to 50%.

Tables 4 and 5 report the results of the loss distributions built by considering only the 10,000 scenarios containing at least one bank default. These distributions can then be interpreted as the loss distributions of the DIS in negative market scenarios.

Table 4 assumes that the only channel of interbank contagion is represented by the correlation among banks' exposure (no inter-bank contagion), while Table 5 also assume the existence of a direct linkage among banks which is due to the inter-bank credit market.

Table 4. DIS conditional loss distribution for UK, Germany, and Spain. No direct interbank contagion is assumed. The loading of the common factor β is set to 50%. Amounts are in m€.

	UK	**DE**	**ES**
Mean	186,602	79,525	25,940
St. dev.	264,971	116,225	61,416
Percentile:			
0.25	1,892	7,312	4,175
0.5	22,334	15,936	8,559
0.75	262,201	121,493	17,288
0.9	453,129	170,203	41,919
0.95	639,512	395,553	136,284
0.99	1,115,327	395,553	378,750
0.999	1,117,081	404,956	382,132
0.9999	1,377,539	517,051	420,688
1	1,485,207	565,756	617,757

Table 5. DIS conditional loss distribution for UK, Germany, and Spain. The existence of direct interbank contagion is assumed. The loading of common factor β is set to 50%. Amounts are in m€.

	UK IB	**DE IB**	**ES IB**
Mean	453,814	290,382	57,703
St. dev.	1,078,527	464,383	229,909
Percentile:			
0.25	1,892	7,312	4,175
0.5	22,334	15,936	8,559
0.75	262,201	140,119	17,288
0.9	1,115,327	1,119,432	42,927
0.95	4,180,117	1,119,432	136,284
0.99	4,180,117	1,119,432	1,350,573
0.999	4,180,117	1,119,432	1,350,573
0.9999	4,181,871	1,119,432	1,357,391
1	4,181,871	1,119,432	1,357,391

Table 6 reports the total number of simulations that had to be executed for each country in order obtain 10,000 scenarios with at least one default.

Table 6. Total number of simulations.

UK IB	**DE IB**	**ES IB**
211,723,252	314,511,715	95,586,108

Table 7 and 8 report the percentiles of the unconditional distributions, respectively in the absence and presence of direct interbank contagion. Lower percentiles are not reported as they are all equal to zero, as in most simulation scenarios there are no defaults and therefore no loss hitting the fund.

Table 7. DIS unconditional loss distribution for UK, Germany, and Spain. No direct interbank contagion is assumed. The loading of common factor β is set to 50%. Amounts are in m€.

	UK		**DE**		**ES**
Mean	**8.81**		**2.53**		**2.71**
Percentile:		**Percentile:**		**Percentile:**	
0.999964576	1,892	0.999976154	7,312	0.999921537	4,175
0.999976384	22,334	0.999984102	15,936	0.999947691	8,559
0.999988192	262,201	0.999992051	121,493	0.999973846	17,288
0.999995277	453,129	0.99999682	170,203	0.999989538	41,919
0.999999528	1,115,327	0.999999682	395,553	0.999998954	378,750
0.999999953	1,117,081	0.999999968	404,956	0.999999895	382,132
1	1,485,207	1	565,756	1	617,757

Table 8. DIS unconditional loss distribution for UK, Germany, and Spain. Presence of interbank contagion is assumed. The loading of common factor β is set to 50%. Amounts are in m€.

	UK IB		**DE IB**		**ES IB**
Mean	**21.43**		**9.23**		**6.04**
Percentile:		**Percentile:**		**Percentile:**	
0.999964576	1,892	0.999976154	7312	0.999921537	4175
0.999976384	22,334	0.999984102	15936	0.999947691	8559
0.999988192	262,201	0.999992051	140119	0.999973846	17288
0.999995277	1,115,327	0.99999682	1119432	0.999989538	42927
0.999999528	4,180,117	0.999999682	1119432	0.999998954	1350573
0.999999953	4,180,117	0.999999968	1119432	0.999999895	1350573
1	4,180,117	1	1119432	1	1357391

4. Alternative methodology for the calculation of excess losses

The application of the De Lisa et al. (2010) model that has been shown above, envisages that when a bank fails, the amount of the excess loss transferred to the DIS is equal to its worst case value, i.e. the value of the banks' insured deposits.

This hypothesis is coherent with a worst case scenario where the liquidity needed by the bank is that caused by a bank run of all depositors, and therefore equal to the amount of the bank's insured deposits.

It has, however, also been analysed a no worst case scenario, considering the exact value of banks' excess losses obtained in the performed simulations.

The results of the simulations in this case are shown in Tables 9 and 10. Results are reported, for an easy comparison, also for the worst case scenario.

Table 9. DIS loss distribution – Loading of common factor β =50% - Amounts are in m€.

	Worst case	Exact excess loss
Panel A: without interbank contagion		
N. Simulations	13,553,057	
Mean	0.75	0.03
Percentile:		
99.90%	0	0
99.99%	966	20
100.00%	81,841	14,388
Panel B: with interbank contagion		
N. Simulations	13,553,057	
Mean	3.7	4.5
Percentile:		
99.90%	0	0
99.99%	966	25
100.00%	381,893	381,893

Table 10. DIS loss distribution constructed on the basis of 10,000 scenarios with at least one bank default – Loading of common factor β =50% - Amounts are in m€.

	Worst case	**Exact excess loss**
Panel A: without interbank contagion		
Mean	1,019	24.4
St. dev.	4,780	208.6
Percentile:		
25%	57	0.4
50%	131	1.7
75%	375	6.5
90%	1,765	23.9
95%	4,120	60.7
99%	22,451	335
99.9%	79,479	2,801
100%	81,841	10,072
Panel B: with interbank contagion		
Mean	4,970	4,115
St. dev.	40,358	38,541
Percentile:		
25%	57	0.4
50%	131	1.7
75%	375	6.7
90%	1,765	25
95%	4,120	70
99%	381,893	363,529
99.9%	381,893	368,660
100%	381,893	369,245

5. Conclusions

In this paper we have considered the deposit insurance model recently developed by De Lisa et al. (2010), pointing out its relevance in terms of deposit insurance policies.

We argue that the model proposed by De Lisa et al. (2010) has two major points of strengths. First of all, the model is fully in line with Basel II requirements as it defines the event of “default” as a situation where the Basel II bank capital requirements are not sufficient to cope with the bank’s losses.

On the contrary, the existing literature that aims at estimating the DIS loss distribution is mainly based on structural models for credit risk and there is no sign of any consideration of the link that exists between banks' capital requirements and the shape and size of the DIS loss distribution.

Second, the model is extremely flexible and it can provide answers to a number of relevant policy questions, among which the following ones.

First, by estimating the potential loss hitting a DIS under several economic scenarios, we have highlighted how the model can be employed to establish the target size of the DIS, which is the amount of money that the fund should have available where needed.

Moreover the model can be used to set the risk-based premia that banks should pay to the DIS according to their degree of riskiness.

In general, we argue that the flexibility of this model makes it very relevant to policy makers, as by changing data and assumptions it allows answering various questions relevant to deposit insurance regulation.

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Abstract

This paper discusses a deposit insurance model recently developed by De Lisa et al. (2010), highlighting its policy implications.
Compared to existing ones, the model proposed by De Lisa et al. (2010) presents the important advantage of taking into account Basel II banking regulation, thus linking two pillars of financial safety net: banks' capital requirements and deposit insurance.
The model, which estimates the potential loss hitting a Deposit Insurance Scheme (DIS) under several economic scenarios, can be used to establish the target size of the fund, which is the amount of money that the DIS should have available in case of need.
Moreover the model can be used to estimate the contribution (to this loss) that each bank should pay to the fund according to its degree of riskiness.

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