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Tackling Non-performing loans in the Euro area

What are the costs of getting banks fit for a European Deposit Insurance Scheme?
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JEL-Classification:

G21 – Banks

G28 – Government Policy and Regulation

Summary

The study of non-performing loans (NPLs) is highly relevant when looking for a solution to the ongoing structural weaknesses in the Euro area banking sectors, especially in light of the planned completion of the banking union and the introduction of a European Deposit Insurance System (EDIS). While the aggregate data on non-performing loans shows some improvements, it cannot be ruled out that problems within large and systemically important banks may persist. For the quantification of these risks, the analysis of NPLs must be based on individual bank data. In order to gain a greater insight, I therefore built a dataset of 76 large and systemically relevant banks in the Euro area, which cover 74.6 percent of the non-performing loans in the Euro area. Although data points had to be imputed with the help of other data sources, the dataset provides a helpful impression of the ongoing problems with NPLs.

The analysis reveals that banks with an NPL ratio of 25 percent or higher represent 10.5 percent of the systemically important banks studied here. Moreover, close to 20 percent of the outstanding amounts of the NPLs concentrates on banks with an NPL ratio of 25 percent or higher. When it comes to the dynamics of the NPLs, the decline in the aggregate NPL ratio of the Euro area was mainly driven by banks with moderate NPL ratios that reduced their NPLs further, while banks with higher NPL ratios contributed negatively to the aggregate NPL ratio.

In order to demonstrate the extent to which NPLs can be reduced, I ran several simulations with the dataset. A reduction of NPLs in the amount of the loan-loss provisions of the banks is simulated first. It can be seen that the share of banks with an NPL ratio of only up to three percent could increase from 31.6 percent to 53.9 percent. However, the divide in the banking sector also shows up when it comes to write-offs: banks with a low NPL ratio can easily reduce it even further, while banks with a high NPL ratio have a hard time in reducing it significantly. The problem becomes even more severe at the long end of the NPL distribution. Although the number of banks with an NPL ratio of more than 25 percent can be reduced from 10.5 percent to 3.9 percent, there still remains two large with an NPL ratio of more than 25 percent.

I also simulated an additional write-off together with recapitalisation measures with the aim of finding banks with NPL ratios of 3 percent or lower and equity capital ratios of at least 7 percent. The recapitalisation costs of the banks in Cyprus would then amount to 2.4 percent of the GDP for each year from 2019 to 2022, while the yearly recapitalisation of the Greek banks would amount to 2.0 percent of the Greek GDP. In Italy, yearly recapitalisation measures would amount to 0.8 percent of the Italian GDP. Less exposed would be Spain with yearly recapitalisation costs of 0.4 percent of the GDP.

I conclude from these results, that there are still significant risks in the national banking sectors of the Eurozone, which implies the danger of rendering a common Euro area Deposit Insurance System into a transfer mechanism. If neither the governments nor the private sectors were willing to bear the costs of reducing NPLs and recapitalising their banks, it would be better to abandon the idea of a common deposit insurance or to postpone it far into the future in the hope that banks will grow out of their NPL problems.

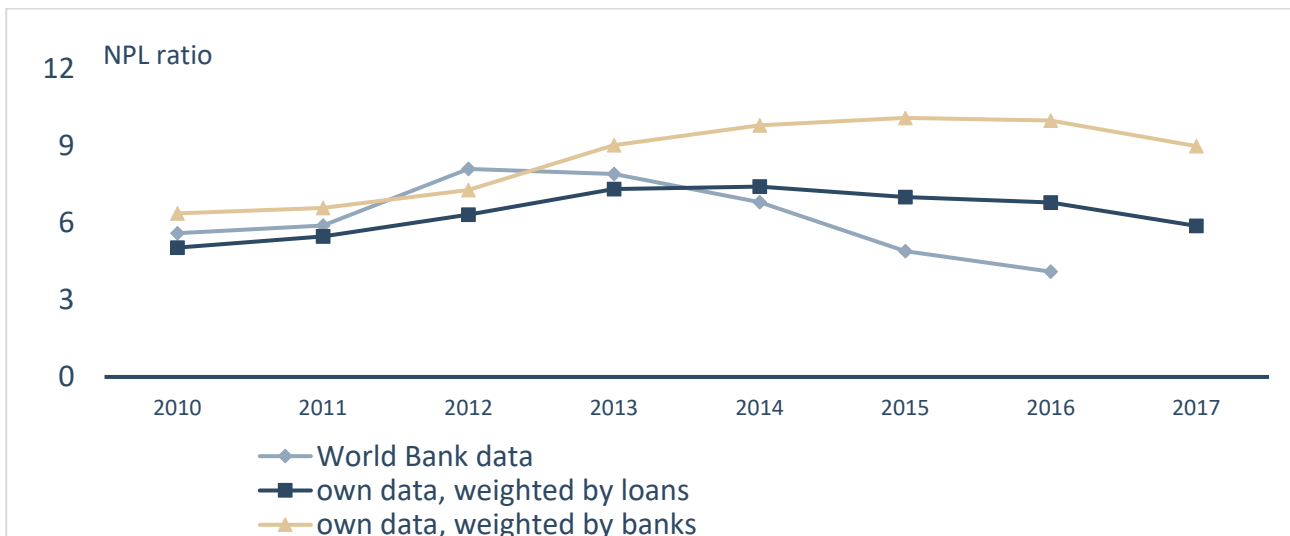
1 Non-performing loans in the Euro area

The study of non-performing loans (NPLs) in the Euro area is important for finding a solution for the ongoing structural weaknesses in national banking sectors. The results are also relevant for the discussion of the completion of the European Banking Union, especially for the establishment of a European Deposit Insurance System (EDIS), since banks enter this insurance mechanism with different risk profiles and legacy assets.

While the aggregate data on non-performing loans shows some improvements, it is possible that problems within large and systemically important banks could persist. These problems cannot be derived from aggregate data, because these problems can average out over banks. Because of their size, systemically important banks with a high amount of NPLs pose risks to the stability of the Euro area. Therefore, the empirical analysis of the NPL problem must be based on individual bank data, from which distributional statistics can be derived.

Figure 1-1: Non-performing loans in the Euro area

Outstanding amounts of NPLs in percent of outstanding amounts of bank loans, World Bank data also covers smaller banks; World Bank data is weighted by loans, own data is weighted either by loans or by banks, while weights based on banks are sensitive to outliers and therefore highlight problems in individual banks



Sources: World Bank, Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

In order to gain a greater insight into the NPL problem, I constructed a dataset, which consists of balance sheet data of large and systemically relevant banks in the Euro area. For 76 banks under the direct supervision of the Single Supervisory Mechanism (SSM), the dataset consists of outstanding amounts of non-performing loans and total loans of banks, their equity capital and their total assets. Data sources are Bloomberg, Moody's and Standard & Poor's as well as the financial statements of the banks. The data ranges from the end of 2010 to the end of 2017, where missing data was imputed with the help of other data sources in order to achieve a balanced panel. Imputation was especially necessary for the NPL data of the year 2017 in order to

stabilise the distribution of NPLs across banks. I therefore based the imputation on country-level NPL data from the ECB (ECB, 2018). From this data, I calculated the percentage change of the national NPL levels from 2016 to 2017 and used this value as the expected value to forecast the missing NPL data for 2017. Otherwise, missing data for larger banks would have skewed the mean value of the distribution, thereby understating the recent decline in NPLs. Table A-1 in the appendix shows the distribution of NPLs with and without imputation. From the comparison of the distributions of NPLs with and without imputation can be seen that imputation does not distort the results, but merely stabilises them. Imputation with the help of country-level data is unproblematic, because the aggregation over the 76 banks after imputation is consistent with the country-level data of the ECB. Moreover, I added country level data of banks' loan loss provisions provided by the European Banking Authority (EBA, 2017) to the individual bank data. Using country level data as an expected value for the individual loan-loss provisions seems unproblematic here since the loan loss provisions in percent of NPLs have a low cross-country variance. This low variance might be due to the fact that recommendations for national supervisors for loan loss provisions do not differ much from bank to bank, since the recommendations for loan loss provisions are stated in percent of NPLs. Although data points had to be imputed with the help of other data sources, the dataset provides a helpful impression of the ongoing problems with NPLs.

Figure 1-1 contains a comparison between my constructed dataset of the 76 largest banks of the Eurozone and the World Bank data on NPLs in the Eurozone. The difference between the two datasets is that my data focusses on large and systemically important banks, while the World Bank data covers also smaller banks. The World Bank calculates the NPL ratios as the sum of the outstanding amounts of all NPLs divided by the sum of all outstanding loans, while I differentiate between this approach (which is equivalent to weighting banks' NPL ratios by their loans) and the geometric average of the NPL ratios (which is an equal weighting of the NPL ratios of all banks). The difference between the two weighting schemes is that in the first weighting scheme the banks with large loan books have a large influence on the average NPL rate, while in the second weighting scheme outliers have a large influence on the average NPL rate. The comparison shows that until 2013 the NPL ratios of the World Bank data were higher than my NPL ratios based on weighting by loans. After 2013, we see a larger decline in the World Bank data compared to the average value of my dataset. This might be an indication that the larger banks from my dataset experienced more difficulties in reducing their NPLs compared to the smaller banks, which are also included in the World Bank data. Moreover, we can see a divergence between the average NPL ratio based on a weighting scheme by loans and the NPL ratio based on the equal weighting scheme. This might be an indication that large outliers have driven the results. Since these outliers are large and systemically relevant banks, hidden risks in the banking sector could be masked behind the aggregate data.

The NPL problem has been already recognised by politics and by authorities, which are responsible for the stability of the financial system. The European Commission published two progress reports on the reduction of NPLs in Europe (COM, 2018a, 2018b). The European Central Bank issues recommendations for banks on how they should handle their NPLs (ECB, 2017a). In addition, the International Monetary Fund has issued proposals for policy tools (Aiyar et al., 2015; Bergthaler et al., 2015; Jassaud et al., 2015; Liu et al., 2013). Most of the proposals focus on

establishing bad banks for the NPLs (Barkbu et al., 2013; Ingves et al., 2004; Woo, 2000), and also the European Commission seems to favour this approach (COM, 2018a, 2018b). In Demary/Diermeier (2017) we argue that bad banks with public guarantees are suitable tools for crisis management, but not for solving structural problems in the aftermath of a crisis. Moreover, bad banks can tackle NPLs in the long-term, while the time horizon for the proposed common deposit insurance system is only some years. An analysis of the distribution of NPLs across banks and how policy measures can alter this distribution is missing thus far.

In this paper, I highlight the necessity of analysing the distribution of NPLs as well as the change in the distribution of NPLs through policy measures. The aim of this paper is not to recommend one policy measure, but to highlight the NPL problem in more detail and to give an indication about the possibility and costs of improving the NPL distribution in the Euro area. The simulated write-offs of NPLs might be the most costly restructuring measures compared to the sale of NPLs. Therefore, the calculated costs in this paper should be interpreted as an estimate of the upper limit of possible NPL restructuring costs.

2 The distribution of non-performing loans

This section contains the analyses of the distribution of NPLs across countries and across banks. It also tackles the dynamics of the NPL distributions over time.

2.1 The distribution of non-performing loans across countries

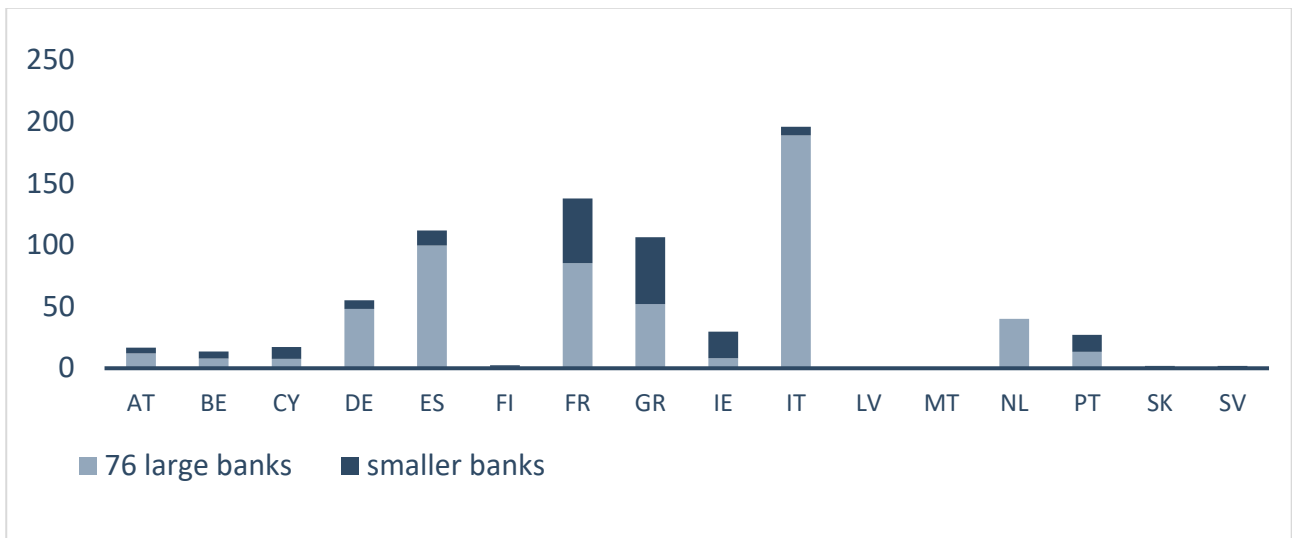
The outstanding amounts of NPLs in the Euro area in the third quarter of 2017 amount to 759 billion Euro according to data from the European Central Bank (ECB, 2018). In my dataset of the 76 largest banks, the NPLs of these banks amount to 566 billion Euro, indicating a concentration risk in the Euro area banking sector, because the 566 billion Euro of NPLs represent three quarters of the NPL volume in the Eurozone, while the 76 systemically important banks in my sample represent only 1.6 percent of all Euro area banks. Because of their systemic importance, even the failure of one or two of these banks would pose a high risk to the financial stability of the banking sectors in which these banks are headquartered.

The evidence of concentration risks arises for the first time when we look at the geographical distribution of the NPLs of the large and systemically relevant banks. The largest outstanding amounts of NPLs in the 76 large banks can be found in the Italian banking system (188.9 billion Euro), in Spain (99.5 billion Euro), France (85.3 billion Euro), in Greece (52.0 billion Euro) and in Germany (48.1 billion Euro), where most of the NPLs were located in HSH Nordbank in the past. But it should be noted that at the end of 2017 HSH could decrease its NPLs from 14.6 billion Euro to 7.5 billion Euro. Moreover it could sell 6.3 billion Euro of NPLs to investors. Although HSH Nordbank was sold to investors, it is still a part of the German banking system (Reuters, 2018). Its NPL rate will be lower than 2 percent after the transaction. The country aggregate for Germany has therefore be treated with caution, because it contains HSH in 2017, i.e. before a large part of NPLs were sold to investors. In addition to that, is the value for Germany based on 16 large banks, but with an average NPL ratio of only 3.5 percent.

Although these numbers appear quite high, there was some progress in the NPL reduction (ECB, 2017). In addition, the Italian banks in my dataset reduced their NPLs from 2016 to 2017 from 246 billion Euro to 189 billion Euro. Smaller improvements can be found in Spain, where the NPLs on the balance sheet of the large banks declined from 111 billion Euro to 100 billion Euro, or Germany, where NPLs declined from 57.2 billion Euro to 48.1 billion Euro.

Figure 2-1: Non-performing loans in the Euro area

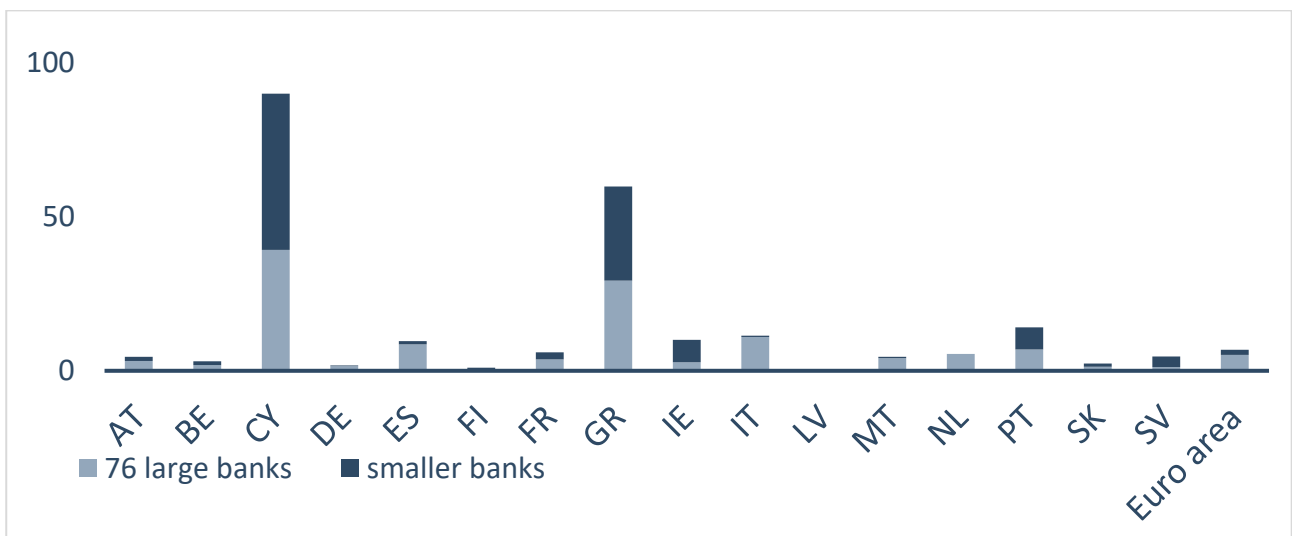
Outstanding amounts at the end of 2017, in billion Euro



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

Figure 2-2: Non-performing loans in the Euro area

Outstanding amounts in percent of the national gross domestic product, 2017



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

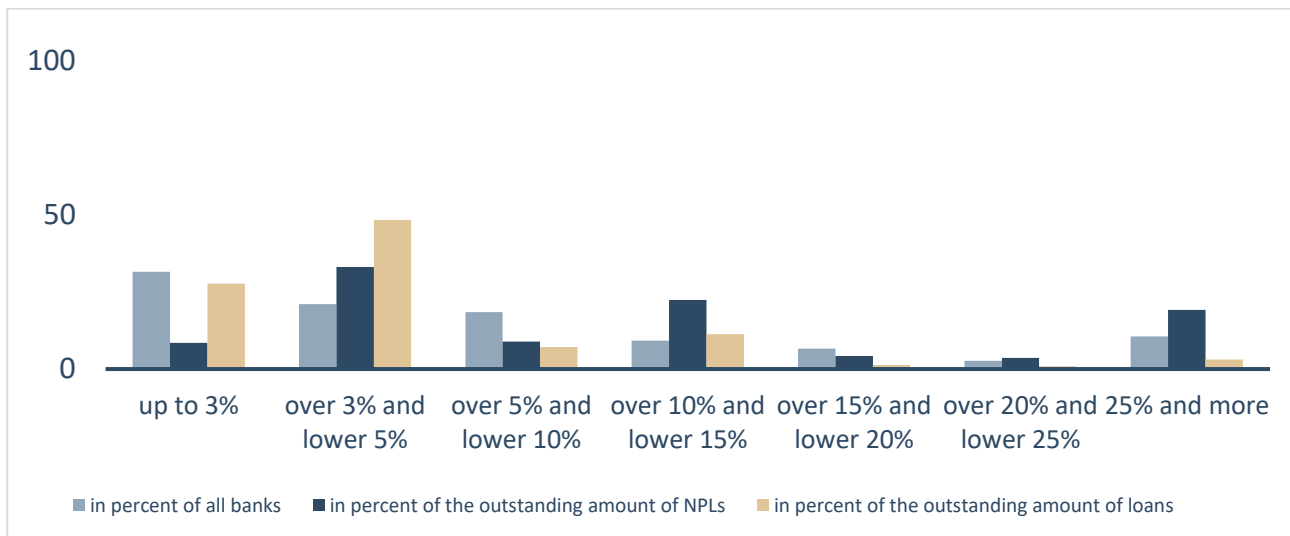
The huge outstanding amounts of NPLs in these countries are in part due to the large banking sectors of these countries. Therefore, scaling the outstanding amounts of NPLs by the country gross domestic product (GDP) gives a clearer picture of the vulnerability of the national banking sectors to NPLs (figure 2-2). Most affected by NPLs is the banking system is Cyprus, where the outstanding amounts of NPLs amount to 90 percent of the national GDP. The Greek banking system, in which the outstanding amounts of NPLs amount to 60 percent of the national GDP is also heavily impaired by NPLs. In the Spanish as well as in the Irish banking system NPLs amount to 10 percent of GDP, while they amount to 11 percent of the GDP in Italy. The German and the Finnish banking systems have the lowest outstanding amounts of NPLs, amounting to 2 and 1 percent of GDP.

2.2 The distribution of non-performing loans across banks

The evidence of concentration risks hardens we we take a deeper look at the distribution of NPLs across banks. The distribution of NPLs across banks is uneven when calculated in percent of all banks as well as when calculated in percent of the outstanding amounts of NPLs and total loans (figure 2-3). It can be seen that the distributions are very different from each other. This has to do with the fact that banks with a low NPL ratio can have large amounts of NPLs on their balance sheet, when they have large loan books. Whether banks with high NPL ratios have large amounts of NPLs on their balance sheet is also dependent of the size of their loan books.

Figure 2-3: The distribution of non-performing loans across banks

In percent, 2017



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

Banks with an NPL ratio of up to 5 percent make up a little more than half of the banks. These banks supply the majority of the loan volume, which is a little more than three quarters of the loan volume. Because of their higher loan volumes, a little more than 40 percent of the NPL

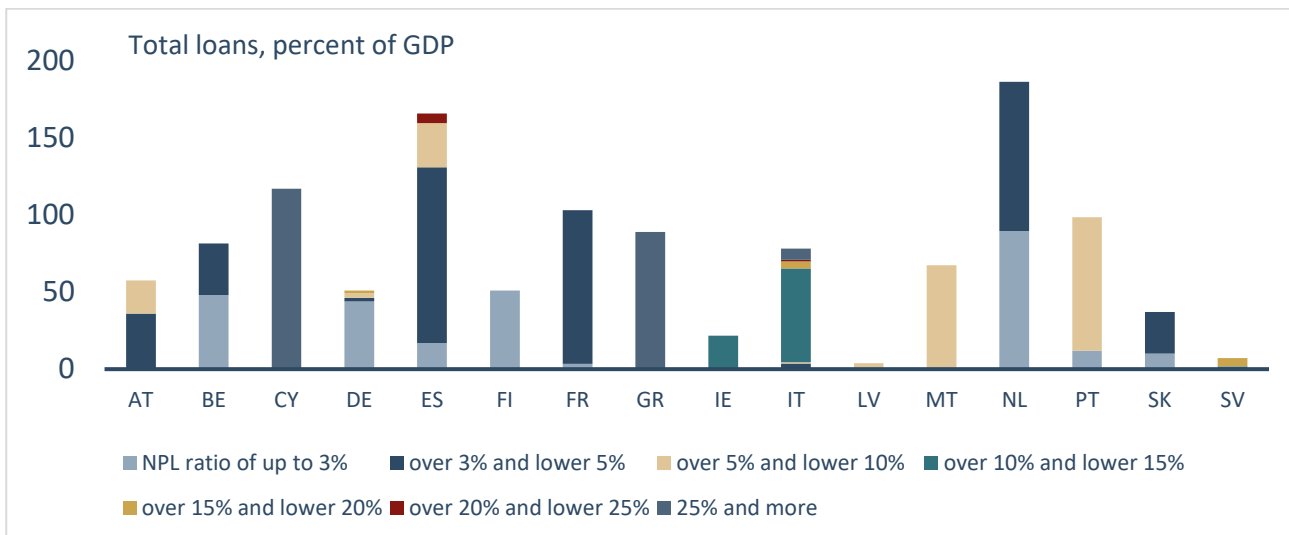
volume concentrates on banks with an NPL ratio of up to 5 percent. Thus, the good news is that a large part of the aggregate NPL volume seems to be on the balance sheets of healthy banks, which should be able to tackle their NPLs without the help of the Single Supervisory Mechanism.

More critical is the higher end of the distribution. Banks with NPL ratios of more than 25 percent make up one tenth of the 76 banks under investigation, but they hold one fifth of the outstanding amounts of NPLs on their balance sheet. This one fifth of the NPL volume is located in banks that only supplied 3 percent of the loan volume. Thus, the bad news is that a significant part of the NPL volume concentrates on banks with an NPL ratio of 25 percent and more. These banks seem to struggle a lot under NPLs and they seem not to participate significantly in financing the economy anymore. For these banks, a possible future intervention of the Single Supervisory Mechanism seems likely.

A potential problem may also be the banks in the middle of the distribution. Banks with an NPL ratio between 5 and 20 percent make up one third of all banks under analysis here, they supply one fifth of the loan volume, but have more than one third of the NPL volume on their balance sheet. Thus, a critical part of the NPL volume is on the balance sheet of banks which can either solve their problems on their own, or which have to rely on interventions by the Single Supervisory Mechanism.

Figure 2-4: The distribution of loans across banks and countries

Total loans across banks, percent of GDP, banks are subdivided by their NPL ratios, 2017



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

It is not only problematic that a large volume of NPLs is located in banks that are most likely unable to solve their problems without a possible future intervention by the Single Supervisory Mechanism, but in addition, it is problematic that these banks concentrate on national banking systems. The banks with NPL ratios of more than 25 percent are mostly located in Cyprus,

Greece and Italy posing elevated risks to the banking systems in these countries. Mostly unaffected by an NPL crisis would be Germany, since its banks are mostly located in the group of banks with an NPL ratio of below 3 percent. An NPL crisis is most likely for Italy, where no bank has an NPL ratio of below 5 percent and which has a significantly high number of banks with an NPL ratio of 10 percent or higher (figure 2-4).

This uneven distribution of NPLs across countries is in part caused by unfavourable economic conditions, a less efficient bank restructuring policy of national competent authorities for banking supervision and through less efficient insolvency laws in some countries. The analysis of the drivers of the uneven NPL distributions is left out of the paper, since the paper will concentrate on the outcome of NPL restructurings on the NPL distribution and on the capital buffers of banks. The interested reader could consult the 2016/17 annual report of the German Council of Economic Experts or to Aiyar et al. (2015) for an empirical analysis of the drivers of national NPL levels in the Euro area (GCEE, 2016). Aiyar et al. (2015) found that countries with an insolvency framework with long foreclosure periods are also burdened with high NPL levels. In the Euro area, for example, the insolvency frameworks in Finland and Germany are much faster, more cost efficient and produce higher recovery rates than the one in Italy according to World Bank data. At the same time, have Finland and Germany low NPL ratios, while Italy has a higher NPL ratio.

2.3 The dynamics of the distribution of non-performing loans

For a risk assessment of the NPL problem, it is necessary to analyse the dynamics of the distribution of NPLs across the systemic important banks in more detail.

Table 2-1 contains an analysis of the time dynamics of the distribution of banks, NPLs and the loan volume across banks with different NPL ratios. It yields the following results:

- **The fraction of banks with high NPL ratios has increased:** the share of banks with an NPL ratio of up to 5 percent dropped from 51.3 percent in 2010 to 38.2 percent in 2013, but returned to 52.6 percent in 2017. During the same period, the share of banks with NPL ratios between 5 and 20 percent dropped from 46.1 percent to 34.2 percent. This decline corresponds to a steady increase of the share of banks with NPL ratios of 20 percent and higher from 2.6 percent to 13.2 percent.
- **More of the NPL volume currently concentrates on banks with high NPL ratios:** the share of the NPL volume on the balance sheets of banks with an NPL ratio of up to 5 percent increased slightly from 38.0 percent in 2010 to 41.6 percent in 2017. While the share of the NPL volume of the balance sheet of banks with an NPL ratio between 5 and 20 percent has declined from 58.7 percent in 2010 to 35.6 percent in 2017, has the share of the NPL volume on the balance sheet of banks with NPL ratios of 20 percent and higher increased from 3.3 percent to 22.8 percent.

Table 2-1: The distributions of banks, loan volume and NPL volume

Share of banks with an NPL ratio ranging from ... percent to ... percent.

Distribution of banks	2010	2011	2012	2013	2014	2015	2016	2017
Up to 3%	26.3	26.3	25.0	25.0	27.6	28.9	28.9	31.6
Over 3% to 5%	25.0	22.4	19.7	13.2	10.5	11.8	15.8	21.1
Over 5% to 10%	32.9	32.9	28.9	26.3	23.7	23.7	19.7	18.4
Over 10% to 15%	13.2	15.8	17.1	15.8	17.1	10.5	9.2	9.2
Over 15% to 20%	0.0	0.0	5.3	7.9	7.9	7.9	9.2	6.6
Over 20% to 25%	0.0	0.0	1.3	5.3	2.6	5.3	5.3	2.6
Over 25%	2.6	2.6	2.6	6.6	10.5	11.8	11.8	10.5
Distribution of NPLs	2010	2011	2012	2013	2014	2015	2016	2017
Up to 3%	9.7	9.3	9.1	8.4	5.8	8.3	6.6	8.5
Over 3% to 5%	28.3	25.6	20.1	13.2	15.4	20.5	23.1	33.1
Over 5% to 10%	33.6	24.9	21.3	24.3	24.3	18.3	16.9	8.9
Over 10% to 15%	25.1	37.5	31.1	17.3	10.9	5.7	7.1	22.5
Over 15% to 20%	0.0	0.0	9.3	14.0	22.6	23.1	19.3	4.2
Over 20% to 25%	0.0	0.0	3.0	11.8	2.4	4.1	7.0	3.6
Over 25%	3.3	2.7	6.2	10.5	18.7	19.9	19.9	19.2
Distribution of loans	2010	2011	2012	2013	2014	2015	2016	2017
Up to 3%	23.8	26.0	25.6	22.7	20.7	26.7	23.9	27.7
Over 3% to 5%	41.9	38.6	33.5	26.4	28.4	33.5	37.8	48.4
Over 5% to 10%	24.1	20.7	22.5	29.6	29.4	20.6	19.1	7.2
Over 10% to 15%	9.6	14.2	15.2	11.6	7.3	3.5	4.3	11.3
Over 15% to 20%	0.0	0.0	1.6	5.6	10.4	11.1	9.7	1.3
Over 20% to 25%	0.0	0.0	0.5	2.3	0.8	1.3	2.0	0.9
Over 25%	0.5	0.6	1.1	1.8	3.1	3.3	3.3	3.1

Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

- The loans supply of healthy banks has increased:** the share of the loan volume supplied by banks with an NPL ratio of up to 5 percent has increased from 65.7 percent to 76.2 percent. During the same time period has the share of the loan volume of banks with an NPL ratio between 5 and 20 percent fallen from 33.7 to 19.8 percent, while the share of

the loan volume supplied by banks with an NPL ratio of 20 percent and more has increased from 0.5 percent to 4.0 percent.

In order to better understand the dynamics of the individual banks' NPL ratios one has to analyse how the change in the group sizes from 2012 to 2017 derives from banks which maintained their NPL ratio and banks which increased or decreased their NPL ratios (table 2-2):

Table 2-2: Transition matrix

Distribution of NPL ratios across banks in 2017 given the NPL ratios in 2012.

	2017	2017	2017	2017	2017	2017	2017	2012
Columns: 2017	up to 3%	over 3% to 5%	over 5% to 10%	over 10% to 15%	over 15% to 20%	over 20% to 25%	over 25%	All banks in 2012
Rows: 2012	Number of banks							
up to 3%	17	1			1			19
over 3% to 5%	5	9			1			15
over 5% to 10%	2	5	12	1	1	1		22
over 10% to 15%		1	2	6	1	1	2	13
over 15% to 20%					1		3	4
over 20% to 25%						0	1	1
over 25%							2	2
Banks in 2017	24	16	14	7	5	2	8	76
	Transition rates, in percent							
up to 3%	89.5	5.3			5.3			100.0
over 3% to 5%	33.3	60.0			6.7			100.0
over 5% to 10%	9.1	22.7	54.5	4.5	4.5	4.5		100.0
over 10% to 15%		7.7	15.4	46.2	7.7	7.7	15.4	100.0
over 15% to 20%					25.0		75.0	100.0
over 20% to 25%						0.0	100.0	100.0
over 25%							100.0	100.0

Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

- The survival rate of banks with an NPL ratio of up to 3 percent in 2012 to maintain their NPL ratio in 2017 was 89.5 percent. Thus, banks with a low NPL ratio were more likely to keep their low ratio. The other banks have increased their NPL ratios. One bank with a low NPL ratio in 2012 is now located on the group with NPL ratios between 15 and 20 percent.
- For banks with an NPL ratio between 3 and 5 percent, only 60.0 percent could maintain their NPL ratio. While 6.7 percent have more NPLs in 2017 than in 2012, 33.3 percent of the banks could improve their NPL ratio. This is an indication that banks with a higher, but not too high NPL ratio were successful in reducing NPLs.
- Banks with an NPL ratio between 5 and 10 percent as well as banks with an NPL ratio between 10 and 15 percent had a hard time in reducing their NPLs. The survival rate was 54.5 and 46.2 percent for both groups. Bank left both groups either through improving or through worsening NPL ratios.
- Banks with an NPL ratio between 15 and 20 percent were unsuccessful in reducing their NPLs. Their survival rate was only 25 percent. Problematic is that 75 percent of the banks with an NPL ratio between 15 and 20 percent moved to the group with an NPL ratio of 25 percent and more.
- For banks with NPL ratios of 25 percent and higher, the survival rate was 100 percent. These banks were unable to reduce their NPLs significantly.

This exercise reveals the divide in the banking sector: banks with a lower NPL ratio and banks with a high NPL ratio are more likely to maintain it. The high persistence in the NPLs of the banks with already high NPL ratios clearly highlights that the reduction in NPLs is far from being successful. Thus, deciding on the progress in risk reduction based on aggregate data appears highly problematic.

2.4 Non-performing loans and bank equity capital

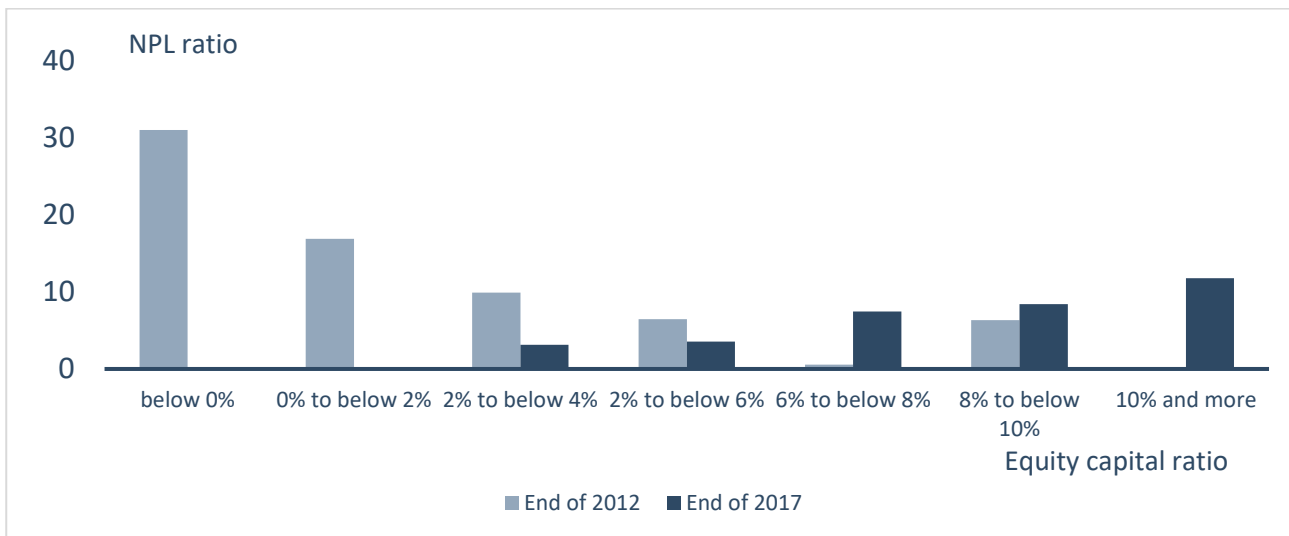
NPLs are less problematic when banks are equipped with sufficiently high loan-loss provisions as buffers against expected losses and with high equity capital ratios as a buffer against unexpected losses. Therefore, an analysis of the NPL problem must also include an analysis of the banks' loan-loss provisions and their equity capital buffers. In this paper, banks equity capital ratios were calculated from balance sheet data by dividing equity capital by total assets.

Figure 2-5 shows banks' NPL ratios as a function of their equity capital ratio for the year 2012 and the year 2017. It can be seen that banks' equity capital ratios have improved. Moreover, it can be inferred that banks with a lower equity capital ratio had a higher NPL ratio in 2012, while banks with lower equity capital ratios have lower NPL ratios in 2017. The inverse relationship between equity capital ratios and NPL ratios in 2012 might be a crisis-related effect because banks had to realise losses at the same time when their asset quality has worsened. The relationship has changed because of loan loss provisioning. Better capitalised banks might have higher NPL ratios now due to lower loan loss provisions, while banks with lower equity capital

ratios might have lower NPL ratios because of higher loan loss provisions. It should also be remembered that loan loss provisions do not count as equity capital. The higher loan loss provisions might have enabled these banks to write-off the NPLs, which would result in lower NPL ratios. It might be that these banks have lower loan-loss provisions and higher equity capital ratios because they want to signal to the market that they are well-capitalised in order to mask their NPL problems.

Figure 2-5: Relationship between equity capital and non-performing loans

Outstanding volume of NPLs in percent of the outstanding volume of loans, equity capital in percent of total assets

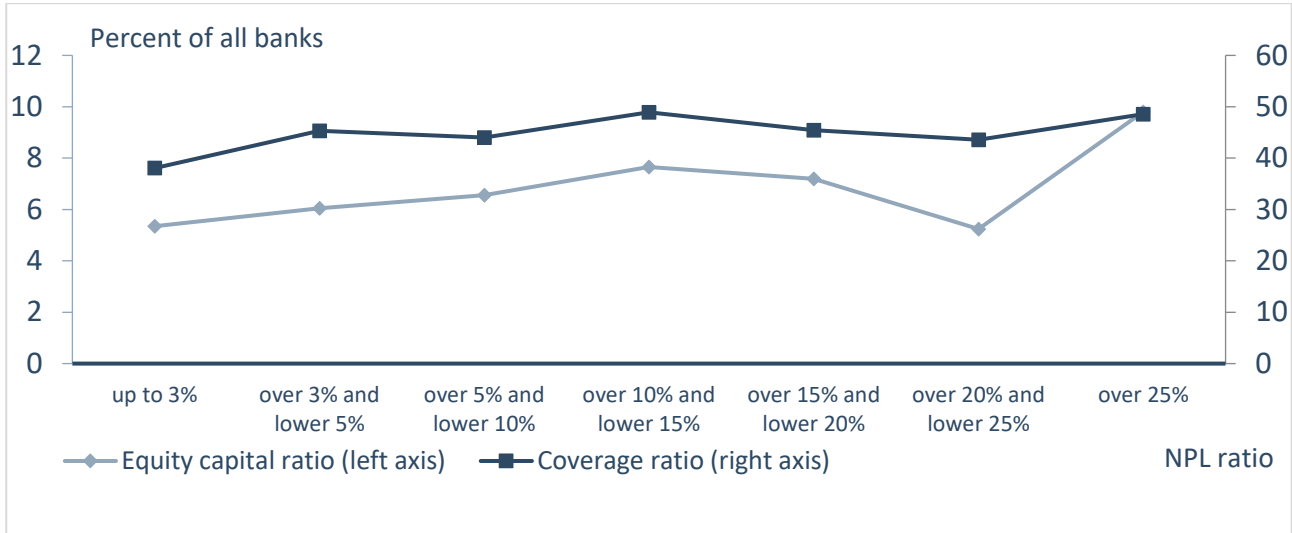


Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

In order to gain a greater insight into banks' loans loss provisioning, figure 2-6 plots banks' loan loss provisions in percent of their NPLs and banks' equity capital ratios as functions of banks' NPL ratios. Data for risk provisions are available on a country basis from the European Banking Authority (EBA). I use the country average as an expected value for the banks' individual loan loss provisions. This assumption is less problematic, since the cross-country variation in loan loss provisions divided by NPL volume is low. The data shows that banks with an NPL rate of up to 3 percent have on average loan loss provisions for 38.1 percent of their NPL, while banks with an NPL ratio of 25 percent and more have a coverage ratio of 48.5 percent. Thus, banks with higher NPL ratios tend to have covered a larger share of their NPLs with loan loss provisions. When it comes to buffers against unexpected losses, banks with an NPL ratio of up to 3 percent have an equity capital ratio of 5.3 percent. The equity capital ratio increased to 7.6 percent for banks with an NPL ratio between 10 and 15 percent, then drops to 5.2 percent for banks with an NPL ratio between 20 and 25 percent and then increases to 9.8 percent for banks with an NPL ratio of 25 percent and more. These results contradict our first assessment that banks with high NPL ratios have a lower loan loss provisioning and higher equity capital ratios in order to signal the market a higher solvency. On the contrary, banks with an NPL ratio between 20 and 25 percent kept their loan loss provisioning at a comparable level than banks with lower NPL ratios, at the expense of a lower equity capital ratio.

Figure 2-6: Equity capital ratio and coverage ratio

Equity capital ratio: equity capital in percent of total assets, coverage ratio: loan loss provisions in percent of NPL



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

3 The write-down of non-performing loans

In this section, I analyse how the write-off of NPLs would change the distribution of NPLs and the distribution of banks' equity capital ratios. I use these two indicators, since NPLs only measure asset quality, but not the banks' ability to buffer unexpected losses. For the first simulations, I simulate a write-off of NPLs in the amount of the banks' loan loss provisions, for those banks with an NPL ratio above 3 percent. Thus, banks cover the losses from the NPL write-off in this simulation by means of their loan loss provisions, i.e. bank's equity capital is unaffected by the write-off. Risk provisions are not part of the equity capital, because they are buffers against expected losses, and thereby liabilities. After the write-off has taken place, I calculate the distribution of NPLs after the write-off and compare it to the distribution of NPL in the baseline scenario, i.e. before the write-off.

In the second simulation, I simulated an additional write-off in the amount of 20 percent of the remaining non-performing loans for banks with an NPL ratio above 3 percent. The difference to the first simulation is that the loan loss provisions are exhausted, so banks have to use equity capital for the second write-off. I then calculate the distribution of NPLs and equity capital ratios and compare them to the distributions in the baseline scenario and to the distributions under scenario 1.

In the third simulation, I simulate an additional and final write-off for the banks with an NPL ratio of above 3 percent. Within this write-off, NPLs were written off so that the bank's NPL ratio after the write-off is 3 percent. Since this write-off will wipe out the equity capital of some banks,

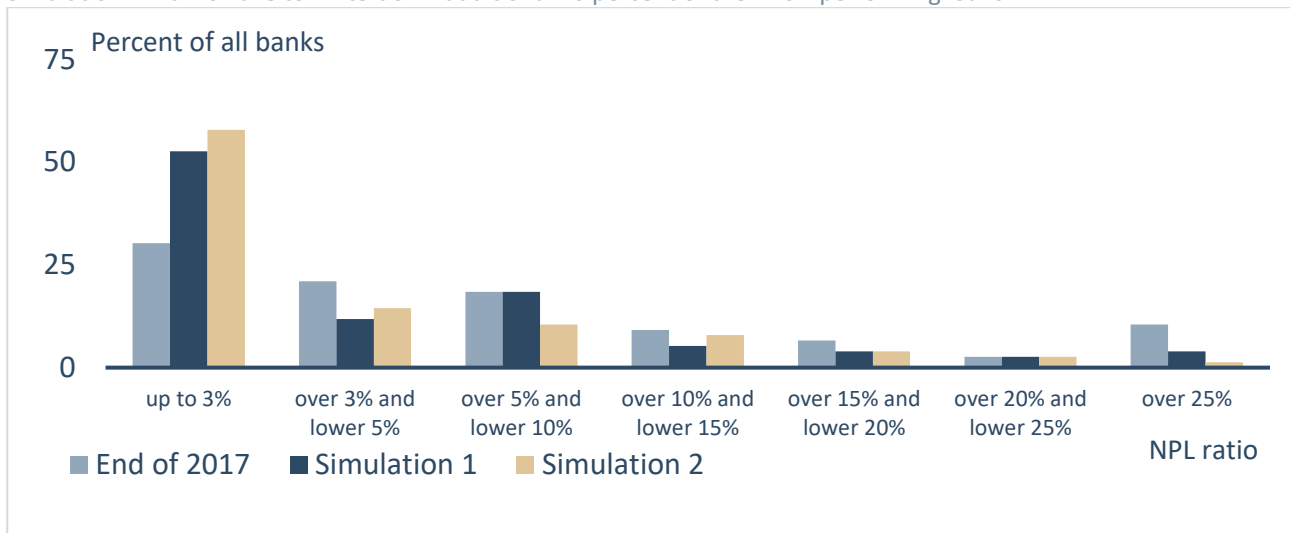
a recapitalisation is simulated for the banks such that the equity capital ratio for all banks is equal or higher than 7 percent in the end. The value 7 percent is derived from the data, where the average capital ratio of the 76 banks was 6.1 percent, under the additional assumption that banks are still in a process of increasing their capital base. The aim of this exercise is to calculate the cost of making banks fit for a common European Deposit Insurance System. One part of this exercise is the write-off of NPLs, while the other part is the recapitalisation of banks. Also included in the recapitalisation exercise are banks with low NPL ratios and low equity capital ratios. The aim of this paper is not to favour the write-off of NPLs over other policy measures to reduce them. It is just that the write-off is the most expensive way of getting rid of NPLs. Therefore, the results should be interpreted as an estimate of the upper limit of bank restructuring costs.

Figure 3-1: Distribution of non-performing loans

In percent of all banks

Simulation 1: Banks have to write down non-performing loans in the amount of their risk provisions

Simulation 2: Banks have to write-down additional 20 percent of their non-performing loans



Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations

Although the result have to be treated with some caution, because the loan-loss provisions are only available as country averages and not on the company-level and NPL values had to be imputed from other data sources, the simulations give an indication of the remaining risks in the banking system.

Figure 3-1 contains the results of the first two simulations. The baseline scenario is defined as the distribution of non-performing loans across banks based on the data for the end of 2017. Simulation 1 yields the result that the share of banks with an NPL ratio of up to three percent can be increased from 31.6 percent to 53.9 percent by using banks loan loss provisions. Hence, banks' loan loss provisions are sufficient for achieving an outcome in which more than half of the banks are located in the interval with the lowest NPL ratios. In the second group, which

contains banks with an NPL ratio between 3 and 5 percent, the number of banks decreases from 21.1 percent to 11.8 percent after the write-off, since more banks switch to group 1 (NPL ratio up to 3 percent) than banks switch from group 3 (NPL ratio between 5 and 10 percent) to group 2. For banks with NPL ratios between 10 and 25 percent only slight changes can be observed. This observation is due to the large reductions in the share of banks with NPL ratios of 25 percent and higher, which switch into these groups.

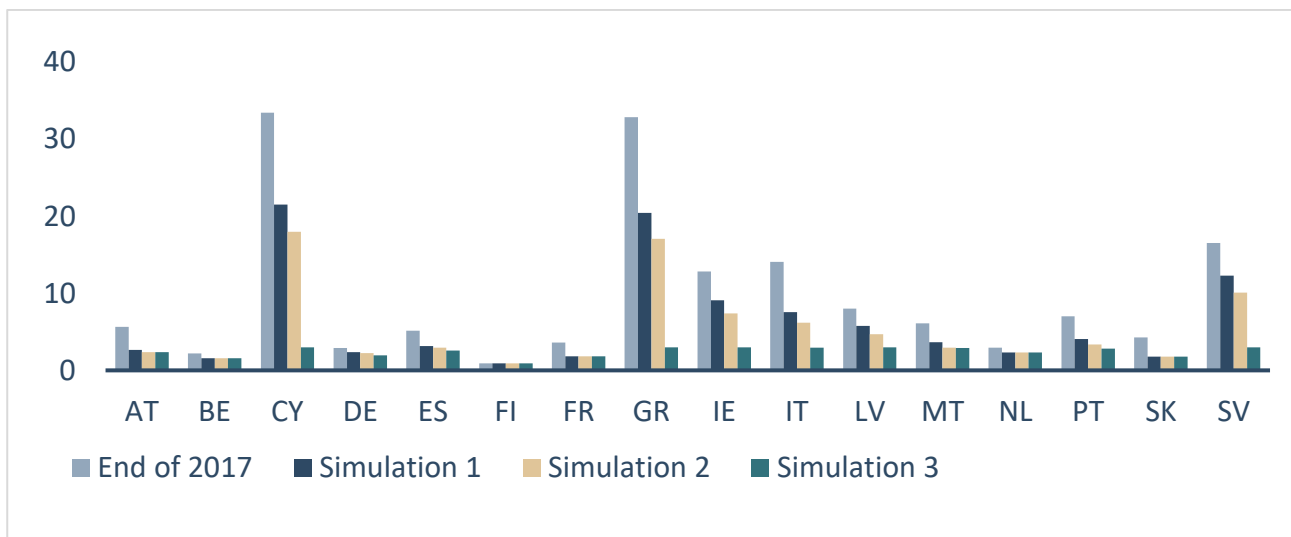
Figure 3-2: Regional distribution of non-performing loans

Non-performing loans in percent of outstanding loans, based on a sample of 76 large and systemic relevant banks of the Euro area

Simulation 1: Banks have to write down non-performing loans in the amount of their risk provisions.

Simulation 2: Additional write-down of 20 percent of the individual banks' NPLs.

Simulation 3: Final write-down for those banks with an NPL ratio of more than 3 percent such that all banks have an NPL ratio below or equal to 3 percent. Recapitalisation such that all banks have an equity capital ratio of at least 7 percent.



Sources: Bloomberg, European Central Bank, European Banking Authority, Fitch, Moody's, companies' financial statements, own calculations

Simulation 2 is the result of an additional write-off of 20 percent of the banks' remaining NPLs. It can be seen that one has a hard time in skewing the distribution even further towards low NPL ratios. The share of banks with an NPL ratio of up to 3 percent only increases from 53.9 to 59.2 percent from simulation 1 to simulation 2. The share of banks with NPL ratios between 3 and 5 percent increases from 11.8 to 14.5 percent, while the share of banks with NPL ratios between 5 and 10 percent drops from 18.4 to 10.5 percent. At the upper end of the distribution, the shares change only slightly.

Figure 3-2 contains the NPL ratios across countries for the baseline scenario as well as for three simulations. Simulation 1 and simulation 2 are equal to the write-off of NPLs for banks with an NPL ratio above 3 percent by using the banks' loan-loss provisions and the additional write-off of 20 percent of the banks' NPLs. Simulation 3 describes a final write-off for banks with an NPL ratio above three percent and a subsequent recapitalisation of the banks with an

equity capital ratio below 7 percent, so that the equity capital ratio after recapitalisation is at least 7 percent. Figure 3-2 highlights that analysing the aggregate data with NPL averages for the euro area is hugely misleading. This can be seen from the write-off of NPLs using banks' loan-loss provisions (simulation 1), which would result in a considerable decline of the aggregate average NPL ratio for the euro area from 6.3 percent to 3.7 percent, and the additional write-offs would reduce the average NPL ratio to 3.3 percent and 2.3 percent. However, when individual countries were analysed, one can find that after simulation 1 some national banking systems are still heavily burdened with high NPL ratios. For example, in Cyprus the NPL ratio would decline from 33.4 percent to 21.5 percent, which is still quite high. A similar result can be found for Greece, where the write-off using banks' loan-loss provisions would decrease the NPL ratio from 32.9 percent to 20.5 percent, which is still not sufficient. The exercise would also leave banks in Italy and Ireland or in Slovenia with NPL ratios of 7.6 percent, 9.1 percent and 12.5 percent on average. The additional write-off in the amount of 20 percent of the banks' remaining NPL would also leave the banking systems in Cyprus, Greece and Slovenia with NPL ratios of 18.0 percent, 17.1 percent and 10.1 percent. Although the results have to be treated with some caution, because missing data had to be imputed with the help of country averages, the results give an indication that NPL write-downs of this type would not be sufficient in some countries.

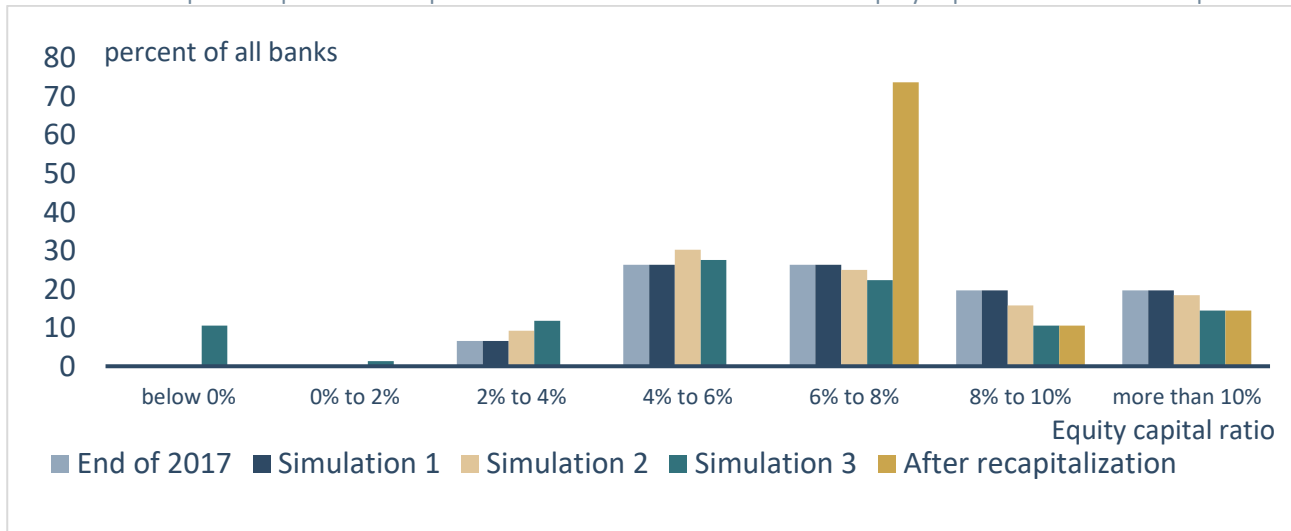
Figure 3-3: Distribution of equity capital ratios

Equity capital in percent of total assets, in percent of all banks, based on a sample of 76 large and systemic relevant banks of the Euro area

Simulation 1: Banks have to write down non-performing loans in the amount of their risk provisions.

Simulation 2: Additional write-off of 20 percent of the individual banks' NPLs.

Simulation 3: Final write-off for those banks with an NPL ratio of more than 3 percent such that all banks have an NPL ratio below or equal to 3 percent. Recapitalisation such that all banks have an equity capital ratio of at least 7 percent.



Sources: Bloomberg, European Central Bank, European Banking Authority, Fitch, Moody's, companies' financial statements, own calculations

Figure 3-3 contains the analysis of the distribution of banks' equity capital ratios after the three simulations. Again, equity capital ratios were calculated from balance sheet data by dividing

equity capital by total assets. The write-off using banks loan-loss provisions (simulation 1) does not change the distribution of banks' equity capital ratios, since no equity capital was used for the write-off. After the additional write-off in the amount of 20 percent of the banks' remaining NPLs no bank has an equity capital ratio below 2 percent. However, the share of banks with equity capital ratios between 2 and 4 percent increases from 6.6 percent in the baseline scenario to 9.2 percent. Similar increases the share of banks with an equity capital ratio between 4 and 6 percent from 26.3 percent to 30.3 percent. This increase was caused by a decline in the number of the better capitalised banks. The share of banks with an equity capital ratio between 8 and 10 percent decreases from 21.1 percent to 17.1 percent, while the share of banks with an equity capital ratio of 10 percent in more only decreased slightly from 19.7 percent to 18.4 percent.

Under simulation 3, the final write-off for banks with an NPL ratio of more than three percent to a target level of not more than three percent wipes out the equity capital buffers of a significant number of banks. After the write-off 10.5 percent of all banks have an equity capital ratio of below zero percent, while 1.3 percent of the banks have an equity capital ratio of 0 to 2 percent. More than half of the banks would have an equity capital ratio of between 2 and 6 percent.

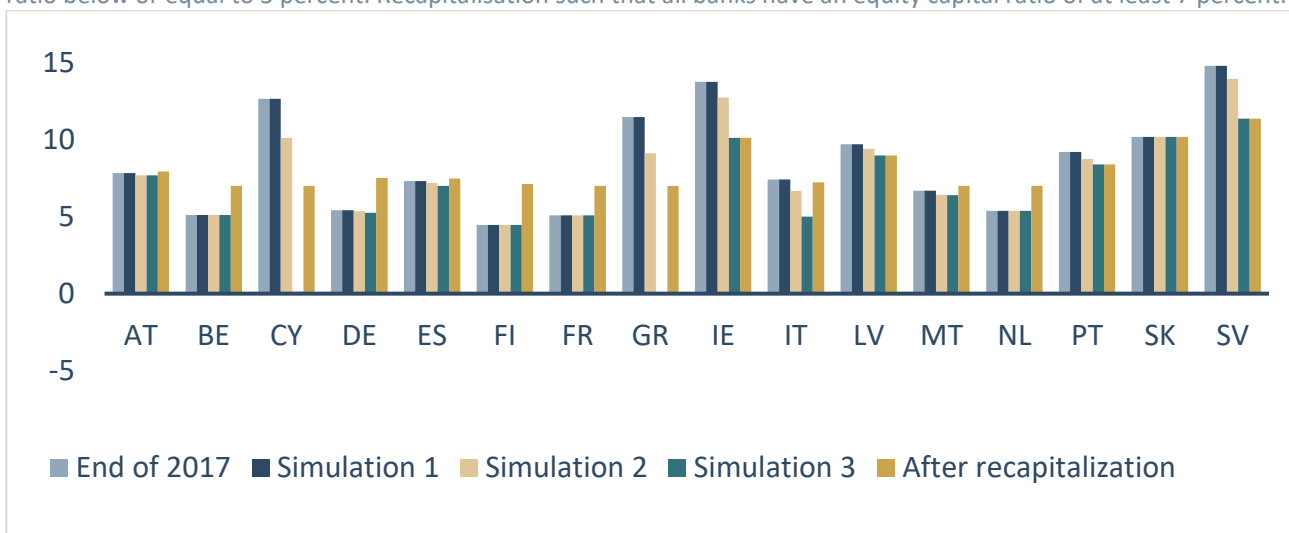
Figure 3-4: Regional distribution of equity capital ratios

Equity capital in percent of total assets, based on a sample of 76 large and systemic relevant banks of the Euro area

Simulation 1: Banks have to write down non-performing loans in the amount of their risk provisions.

Simulation 2: Additional write-down of 20 percent of the individual banks' NPLs.

Simulation 3: Final write-down for those banks with an NPL ratio of more than 3 percent such that all banks have an NPL ratio below or equal to 3 percent. Recapitalisation such that all banks have an equity capital ratio of at least 7 percent.



Sources: Bloomberg, European Central Bank, European Banking Authority, Fitch, Moody's, companies' financial statements, own calculations

Before we come to the costs of recapitalising these banks after the NPL write-offs, we must first analyse the change in the regional distribution of the banks' average equity capital ratios after the simulated write-downs. When we focus on Austria, Belgium, Germany, Spain, Finland,

France, Latvia, Malta, the Netherlands and Slovakia, we see that these countries only experience some small reductions in banks' average equity capital ratios, because the NPLs were sufficiently covered by loan-loss provisions. In these countries, the banks only have to increase their equity capital ratios, because they started from below Euro area average levels in the baseline simulations. It should be remembered that the target level for the equity capital ratio in this analysis is seven percent because the aim of the exercise is to calculate the recapitalisation costs of making banks fit for a common European Deposit Insurance System. Very large drops in the equity capital ratios can be found in Cyprus and Greece, where the average bank equity capital ratios turn negative. Also large drops can be found in Ireland, Italy and Slovenia. However, the banks in Ireland and Slovenia are equipped with sufficiently large equity capital ratios so that there is no need for a recapitalisation, while the banks in Italy need capital injections after the final write-down, because their loan-loss provisions and their equity capital are not sufficiently high to cover all losses.

4 The costs of bank recapitalisation measures

In order to make banks fit for a common European Deposit Insurance System, I propose a target of 3 percent and lower for the NPL ratio and a target of at least 7 percent for the equity capital ratio. The value 7 percent is derived from the data, where the average capital ratio of the 76 banks was 6.1 percent, under the additional assumption that banks are still in a process of increasing their capital base. Under these conditions, banks are considered to be stable enough so that large capital transfers within the common European Deposit Insurance System in the early years will be relatively unlikely. The thresholds were derived from the values of better performing banks in the dataset. Not considered are the long-term effects of a divergent profitability of banks on the common deposit insurance here. Making banks fit for the common deposit insurance in the proposed way would require a recapitalisation of the banks through private sector participation as well as a public sector participation. How losses are shared between the private sector and the public sector is not covered within this paper because I intend to focus on the recapitalisation costs. Recapitalisation costs can arise from three factors: high notional amounts of NPLs, low loan loss provisions or low capital buffers as well as by combinations of the three factors. Although the numbers have to be treated with some caution because some values were imputed by means of country averages from other data source, these recapitalisation costs give some indication about the costs of the needed structural reforms of the banking sectors. Since the write-off of NPLs is more costly than the purchase of NPLs to other investors, the calculated recapitalisation costs should be interpreted as an estimate of the upper limit of the costs of bank restructuring.

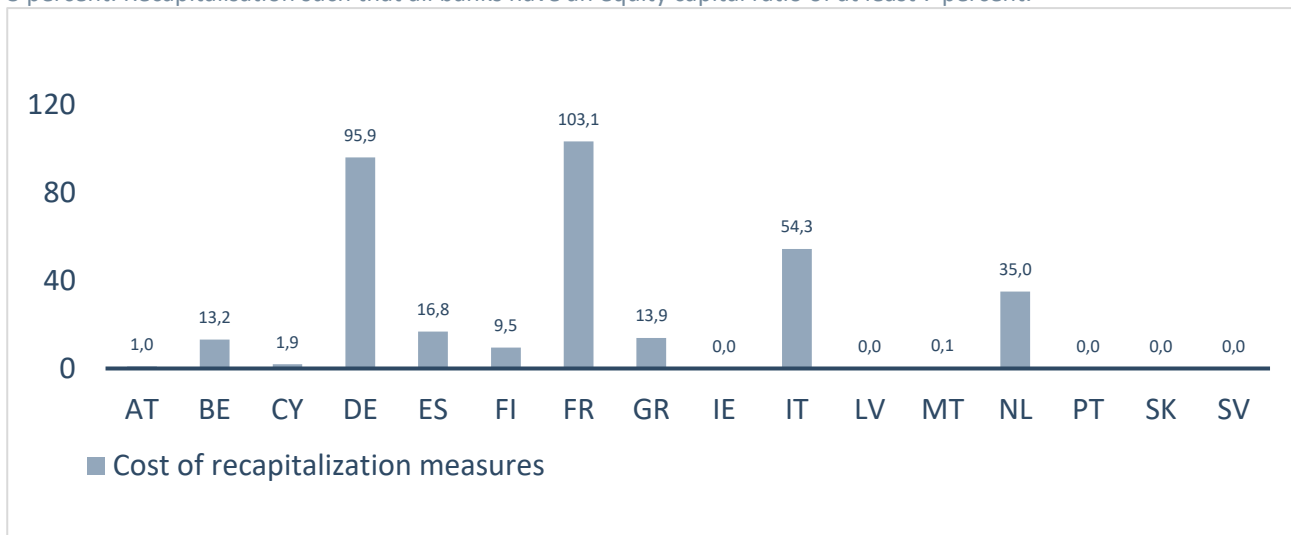
The largest banking sectors are in Germany, France and Italy. Here, the total recapitalisation costs amount to 95.9 billion Euro in Germany, 103.1 billion Euro in France and 54.3 billion Euro in Italy. Since the larger economies have larger banking sectors and therefore also larger volumes of NPLs in their banking sectors, a more informative picture can be drawn by scaling the recapitalisation costs with the GDP per year and, in addition, to stretch the recapitalisation period over the years 2019 to 2022 until the proposed beginning of the common European Deposit Insurance System. Moreover, GDP-related figures can better be compared to the public budgets

of the countries. Thus, it is a better indicator about how high the risk is that bank recapitalisation would worsen the government finances and lead to a sovereign debt crisis. The recapitalisation of the banks in Cyprus would then amount to 2.4 percent of the GDP for each year from 2019 to 2022, while the yearly recapitalisation of the Greek banks would amount to 2.0 percent of the Greek GDP. In Italy, yearly recapitalisation measures would amount to 0.8 percent of the Italian GDP. In addition, a high burden would be placed on France and the Netherlands, where recapitalisation would amount to 1.1 percent and 1.2 percent of the GDP, respectively. Less exposed would be Spain, which would have to invest yearly recapitalisation measures in the amount of 0.4 percent of its GDP. That would be even lower than in Germany, where yearly recapitalisation costs would amount to 0.7 percent of the GDP for each year from 2019 to 2022.

Figure 4-1: Costs of recapitalisation measures

In billion Euro, total amount, based on a sample of 76 large and systemic relevant banks of the Euro area

Simulation: Banks have to write down non-performing loans in the amount of their risk provisions. Then final write-down for those banks with an NPL ratio of more than 3 percent such that all banks have an NPL ratio below or equal to 3 percent. Recapitalisation such that all banks have an equity capital ratio of at least 7 percent.

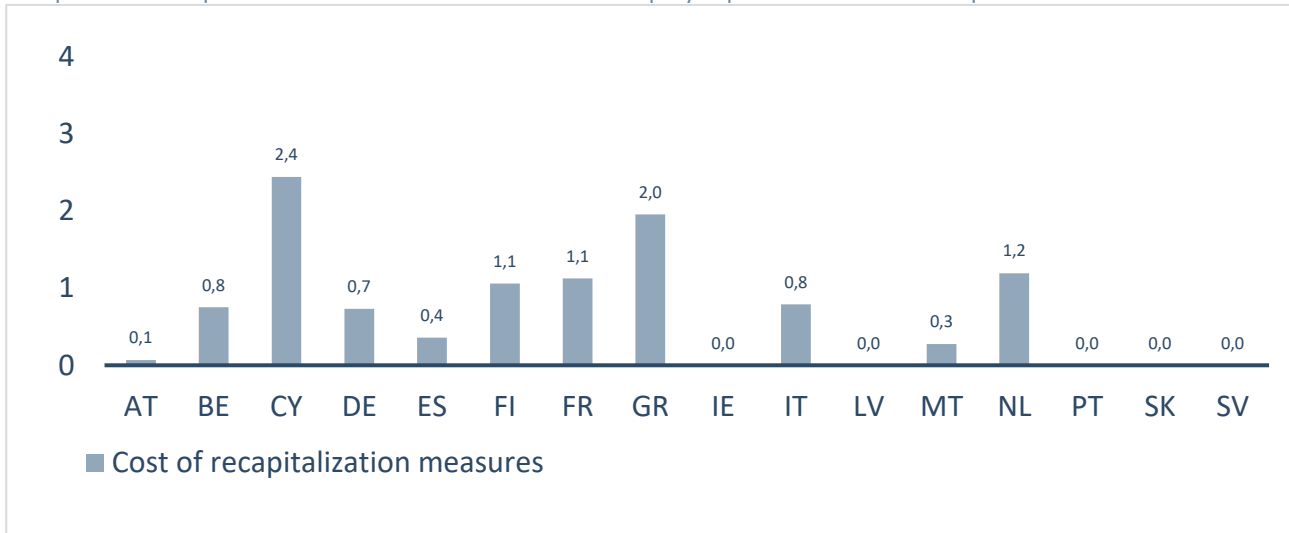


Sources: Bloomberg, European Central Bank, European Banking Authority, Fitch, Moody's, companies' financial statements, own calculations

Figure 4-2: Costs of recapitalisation measures

Yearly costs of recapitalisation measures from 2019 to 2022, in percent of GDP, based on a sample of 76 large and systemic relevant banks of the Euro area

Simulation: Banks have to write down non-performing loans in the amount of their risk provisions. Then final write-off in 2022 for those banks with an NPL ratio of more than 3 percent such that all banks have an NPL ratio below or equal to 3 percent. Recapitalisation such that all banks have an equity capital ratio of at least 7 percent.



Sources: Bloomberg, European Central Bank, European Banking Authority, Fitch, Moody’s, companies’ financial statements, own calculations

5 Conclusion

The study of NPLs is highly relevant when looking for a solution to the ongoing structural weaknesses in the Euro area banking sectors, especially in light of the planned completion of the banking union and the introduction of a European Deposit Insurance System. While the aggregate data on non-performing loans shows some improvements, it cannot be ruled out that problems within large and systemically important banks may persist. For the quantification of these risks, the analysis of NPLs must be based on individual bank data. In order to gain a greater insight, I therefore built a dataset of 76 large and systemically relevant banks in the Euro area, which cover 74.6 percent of the non-performing loans in the Euro area. Although data points had to be imputed with the help of other data sources, the dataset provides a helpful impression of the ongoing problems with NPLs.

The analysis reveals that banks with an NPL ratio of 25 percent or higher represent 10.5 percent of the systemically important banks studied here. Moreover, close to 20 percent of the outstanding amounts of the NPLs concentrates on banks with an NPL ratio of 25 percent or higher. When it comes to the dynamics of the NPLs, the decline in the aggregate NPL ratio of the Euro area was mainly driven by banks with moderate NPL ratios that reduced their NPLs further, while banks with higher NPL ratios contributed negatively to the aggregate NPL ratio.

In order to demonstrate the extent to which NPLs can be reduced, I ran several simulations with the dataset. A reduction of NPLs in the amount of the loan-loss provisions of the banks is simulated first. It can be seen that the share of banks with an NPL ratio of only up to three percent could increase from 31.6 percent to 53.9 percent. However, the divide in the banking sector also shows up when it comes to write-offs: banks with a low NPL ratio can easily reduce it even further, while banks with a high NPL ratio have a hard time in reducing it significantly. The problem becomes even more severe at the long end of the NPL distribution. Although the number of banks with an NPL ratio of more than 25 percent can be reduced from 10.5 percent to 3.9 percent, there still remains two large with an NPL ratio of more than 25 percent.

I also simulated an additional write-off together with recapitalisation measures with the aim of finding banks with NPL ratios of 3 percent or lower and equity capital ratios of at least 7 percent. The recapitalisation costs of the banks in Cyprus would then amount to 2.4 percent of the GDP for each year from 2019 to 2022, while the yearly recapitalisation of the Greek banks would amount to 2.0 percent of the Greek GDP. In Italy, yearly recapitalisation measures would amount to 0.8 percent of the Italian GDP. Less exposed would be Spain with yearly recapitalisation costs of 0.4 percent of the GDP.

The aim of this paper was not the promotion one policy measure, but rather an analysis of the extent to which the distribution of NPLs in the Euro can be improved. Moreover, I wanted to illustrate the costs of that improvement although the costs must be interpreted as an estimate of the upper limit of the costs of restructuring banks, since the write-off is much more expensive than the purchase of NPLs to investors.

I conclude from the results, that there are still significant risks in the banking sectors of the Euro area, which could easily render a common Euro area deposit insurance system into a transfer mechanism. If neither the governments nor the private sectors were willing to bear the costs of reducing NPLs and recapitalising their banks, it would be better to abandon the idea of a common deposit insurance or to postpone it far into the future in the hope that banks will grow of their NPL problems during the economic recovery. In addition to that, a restructuring of NPLs would not necessarily prevent NPLs to grow in the future. For this not to happen the Single Supervisory Mechanism should be well equipped with policy tools to handle NPL problems in large and systemically relevant banks.

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Appendix

Table A-1: The impact of imputation on the distribution of banks

Banks with an NPL ratio of ... to ... in percent of all banks.

	2010	2011	2012	2013	2014	2015	2016	2017
	Before imputation							
Up to 3%	21.3	19.1	18.8	19.2	18.9	17.6	19.6	0.0
3% to 5%	31.9	27.7	22.9	13.5	13.2	15.7	23.5	53.8
5% to 10 %	36.2	34.0	25.0	26.9	24.5	23.5	13.7	15.4
10% to 15%	10.6	17.0	18.8	13.5	15.1	7.8	7.8	23.1
15% to 20%	0.0	0.0	8.3	9.6	9.4	11.8	11.8	0.0
20% to 25%	0.0	0.0	2.1	7.7	3.8	5.9	5.9	0.0
25% and more	0.0	2.1	4.2	9.6	15.1	17.6	17.6	7.7
	Average NPL ratio							
Weighted by banks	5.4	6.6	8.3	10.5	11.5	12.2	11.9	9.6
Weighted by loans	4.0	4.7	5.5	6.5	6.8	6.3	6.5	6.7
	After imputation							
Up to 3%	26.3	26.3	25.0	25.0	27.6	28.9	28.9	31.6
3% to 5%	25.0	22.4	19.7	13.2	10.5	11.8	15.8	21.1
5% to 10 %	32.9	32.9	28.9	26.3	23.7	23.7	15.7	18.4
10% to 15%	13.2	15.8	17.1	15.8	17.1	10.5	9.2	9.2
15% to 20%	0.0	0.0	5.3	7.9	7.9	7.9	9.2	6.6
20% to 25%	0.0	0.0	1.3	5.3	2.6	5.3	5.3	2.6
25% and more	2.6	2.6	2.6	6.6	10.5	11.8	11.8	10.5
	Average NPL ratio							
Weighted by banks	6.4	6.6	7.3	9.0	9.8	10.1	10.0	8.9
Weighted by loans	5.0	5.5	6.3	7.3	7.4	7.0	6.8	5.8

Sources: Bloomberg, European Central Bank, Fitch, Moody's, companies' financial statements, own calculations