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A vulnerability analysis of Irish SME credit exposures

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Abstract

I use loan-level data from three major banks to analyse the stock of performing Irish SME credit exposures as at June 2018. I calculate a vulnerability score for each exposure by linking borrower characteristics and macroeconomic conditions to historical default outcomes. I find evidence of improvement in the condition of the aggregate SME portfolio, but a subset of exposures – accounting for 7.3 per cent of performing balances – continue to have high vulnerability scores. These exposures are spread across all regions. Accommodation & Food and Wholesale & Retail borrowers account for a large share of high vulnerability balances, while borrowers in the Agriculture, Forestry & Fishing and Manufacturing sectors are under-represented relative to their share of outstanding credit.

1 Introduction

In this note, I conduct a vulnerability analysis of the Irish SME exposures of three major banks as at June 2018. The objectives of this study are to describe the contents of the aggregate SME lending portfolio of these banks, to assess the condition of this portfolio, and to highlight potential vulnerabilities. This work contributes to the ongoing monitoring of risks and resilience in the Irish financial system.

I use loan-level data to calculate a vulnerability score for each SME exposure by relating borrower characteristics and macroeconomic conditions to historical default outcomes. I find evidence of improvement in the condition of the aggregate SME portfolio, but I also show that there is wide dispersion in vulnerability scores across exposures. In particular, there is a subset of exposures with high vulnerability scores which account for 7.3 per cent of total performing balances. I document how vulnerability scores vary across and within borrower regions, sectors, product types, origination periods, and maturity periods.

Accommodation & Food and Wholesale & Retail exposures account for over half of high vulnerability balances, while Manufacturing and Agriculture, Forestry & Fishing are under-represented relative to their share of outstanding lending. I show that high vulnerability

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exposures are present across all regions. Term loans and overdraft facilities make up over 90 per cent of high vulnerability balances, while hire purchase and leasing agreements have relatively low scores and make up only a small portion of high vulnerability balances. Term loans originated in 2017 and 2018 are under-represented among high vulnerability balances and term loans originated before 2007 are over-represented, while loans maturing before 2021 make up a large share of high vulnerability balances.

It is important to recognise the context in which I conduct this work. Irish SMEs have deleveraged significantly over the past decade. Aggregate data show that bank credit outstanding to Irish resident SMEs in the non-financial and non-property sectors fell from over €30bn in 2010 to €15bn in 2018Q4.[1] McCann and McQuinn (2017) look at firm-level evidence on indebtedness from the Department of Finance Credit Demand Survey. They find that the proportion of SMEs reporting that they have no debt rose from 25 per cent in 2013 to 50 per cent in 2017. Of those SMEs with some debt, the average debt-to-turnover ratio fell from 48 per cent to 31 per cent over the same period.

While deleveraging has been the norm for Irish SMEs in recent years, McCann and McQuinn (2017) show that this is not universal across sectors. For example, they report that the debt-to-turnover levels of Hotels & Restaurants remain relatively high. In addition, there is variation in the indebtedness of firms within sectors. These two facts highlight the need to monitor vulnerabilities across and within borrower groups. This note does exactly this by analysing granular loan-level data from the main bank lenders to Irish SMEs.

2 Data and Methodology

I conduct this study using a panel of loan-level data collected by the Central Bank of Ireland from AIB, Bank of Ireland, and Ulster Bank. The dataset contains a snapshot of outstanding SME exposures held by these banks every six months between 2006 and 2018. The dataset includes details on each exposure's balance size, performance status, origination date, maturity date, product type, quality rating, borrower region, borrower sector, and a categorical proxy for borrower size class.

I estimate a model of loan default using loan-level data from 2006 to 2017. The key variables in the model are regional unemployment, exposure balance size, borrower size class, and a harmonised categorical rating of loan quality. I source unemployment data from the Central Statistics Office. Note that none of the model covariates are bank-specific and so the model can be applied to the exposures of banks outside of the estimation sample. The output of the model is a "vulnerability score" equivalent to a six-month probability of default.

I use this model to calculate vulnerability scores for the SME exposures of AIB, Bank of Ireland, and Ulster Bank as at June 2018. These three banks together provide the vast majority of bank finance to Irish SMEs.

[1] These data are drawn from the SME and Large Enterprise Credit and Deposits statistics of the Central Bank of Ireland.

Table 1: Summary of performing balances at June 2018

(a) Region

Region	€m	%	Region	€m	%	Region	€m	%
Border	854	7.1	Midlands	663	5.5	South-West	1,955	16.3
Dublin	2,519	20.9	Mid-West	1,149	9.6	West	888	7.4
Mid-East	1,196	10.0	South-East	1,181	9.8	Not specified	1,622	13.5

(b) Sector

Sector	€m	%	Sector	€m	%
A – Agri., Forestry & Fishing	2,585	21.5	I – Accom. & Food	1,516	12.6
B – Mining & Quarrying	135	1.1	J – Information & Comm.	73	0.6
C – Manufacturing	940	7.8	L – Real Estate	231	1.9
D – Elect., Gas, Steam	103	0.9	M – Prof., Tech., & Scientific	326	2.7
E – Water, Sewerage & Waste	7	0.1	N – Admin. & Support	464	3.9
F – Construction	230	1.9	Q – Human Health	952	7.9
G – Wholesale & Retail	1,879	15.6	Not specified	2,100	17.5
H – Trans. & Storage	486	4.0			

(c) Product type

Product Type	€m	%	Product Type	€m	%
Term Loan	8,369	69.6	Revolving Credit	148	1.2
Hire Purchase	923	7.7	Invoice Finance	85	0.7
Overdraft	589	4.9	Other	50	0.4
Leasing	507	4.2	Not specified	1,183	9.8
Unit Stocking	174	1.4			

(d) Term loan origination period

Origination	€m	%
Pre-2005	194	2.3
2005–06	320	3.8
2007–08	561	6.7
2009–10	410	4.9
2011–12	347	4.2
2013–14	889	10.6
2015–16	2,155	25.7
2017–18	3,095	37.0
Not specified	397	4.7

(e) Term loan maturity period

Maturity	€m	%
2018–19	1,086	13.0
2020–21	1,256	15.0
2022–23	1,615	19.3
2024–25	1,316	15.7
2026–27	835	10.0
2028–29	741	8.9
2030–31	470	5.6
Post-2031	389	4.6
Not specified	660	7.9

I keep the focus of the analysis on enterprise lending by excluding exposures in NACE sectors K, O, P, R, S, T, and U. Borrowers in these sectors include financial services companies, public administration bodies, and voluntary bodies such as sports clubs.[2] In addition, I exclude any exposure labelled commercial real estate investment or development. The total stock of performing SME exposures in the sample is €12,027m.

Table 1 presents a summary of performing exposures at June 2018. Panel 1. (a) reports outstanding balances by borrower region. For example, €2,519m worth of balances have a declared borrower residence of Dublin. €1,622m of balances – 13.5 per cent – have no declared region.

Panel 1. (b) shows that three largest lending sectors are Agriculture, Forestry & Fishing, Wholesale & Retail, and Accommodation & Food. These three sectors make up approximately 50 per cent of all balances, while Manufacturing and Human Health contribute a further 15.7 per cent. 17.5 per cent of balances have no declared NACE sector code. The remaining sectors make up a relatively small share of the total and certain sectors are very small. For instance, just €7m worth of balances are associated with sector E – Water, Sewerage & Waste.

Panel 1. (c) reports the product type breakdown of balances. Term loans make up approximately 70 per cent of balances. Hire purchase agreements, overdrafts, and leasing make up another 16.8 per cent. Most of the remaining balances have no declared product type.

Panel 1. (d) provides a breakdown of term loan balances by origination period. I restrict this summary to term loans so as to avoid ambiguity in the data regarding the origination date of outstanding credit and the date at which products such as overdrafts and revolving credit facilities were first granted. 73.4 per cent of term loan balances were originated between 2013 and 2018. Panel 1. (e) provides a similar breakdown of term loan balances by maturity date. 81.8 per cent of balances are scheduled to mature by 2029.

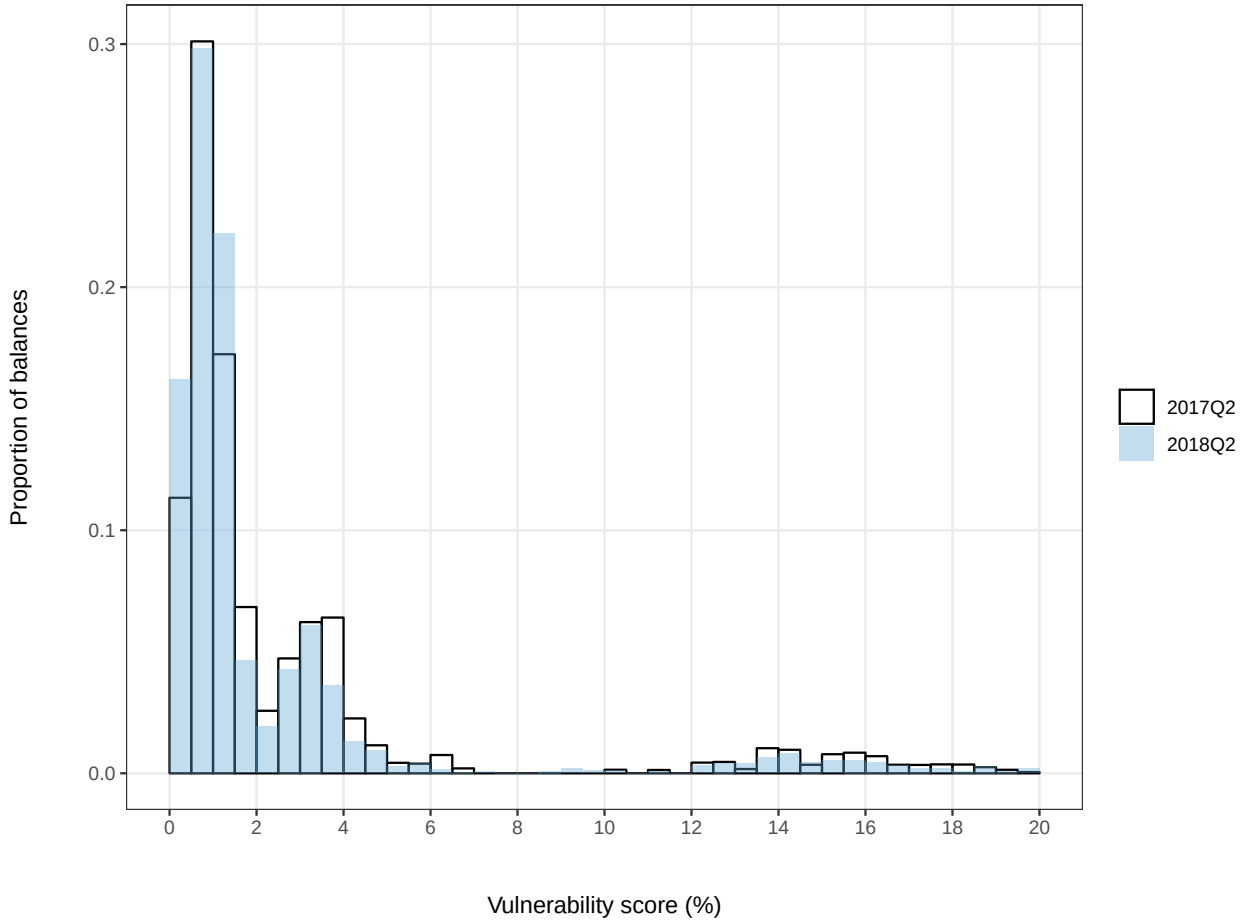
3 Assessing vulnerability

In this section, I look first at the distribution of vulnerability scores across the whole SME portfolio and then I look at vulnerability scores within each region, sector, product type, origination period, and maturity period.

Figure 1 shows the vulnerability score distribution of SME exposures in 2017Q2 and 2018Q2 weighted by exposure balance size. The bordered white distribution relates to 2017Q2 and the borderless blue distribution relates to 2018Q2. The median score in 2018Q2 is 1.1 per cent – half of all balances belong to exposures with scores of 1.1 per cent or less. This is lower than a median of 1.3 per cent in 2017Q2. The vast majority of balances in both periods are associated with exposures with scores of less than 4 per cent. However, the two distributions both have very long right tails. A subset of balances have vulnera-

[2] The CSO provide information on NACE sector codes: https://www.cso.ie/px/u/NACECoder/NACEItems/searchnace.asp

Figure 1 | Vulnerability score distribution



bility scores of over 10 per cent in both cases. I look further at this subset of exposures in Section 4.

3.1 Borrower region

I next look at vulnerability score distributions separately for each region. Table 2 reports percentile values for each of these distributions. The colouring of the table depends on the relative ranking of the region's score where darker shading represents a higher score at a given percentile.

The median – 50th percentile – values range from 0.91 per cent in the South-West to 1.65 per cent in the Midlands, with most regions having median scores of closer to 1.1 per cent. Exposures in the Midlands have relatively high vulnerability scores at lower percentiles, while exposures in the Mid-West, South-East, and South-West typically have lower scores relative to the other regions at a given percentile.

Table 2: Vulnerability score distribution by region

	Percentile								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
Border	0.34	0.39	0.50	0.67	1.22	3.26	4.91	16.61	21.85
Dublin	0.29	0.34	0.45	0.62	1.21	2.56	5.19	14.49	22.59
Mid-East	0.31	0.36	0.42	0.63	1.14	3.06	4.39	15.55	21.78
Midlands	0.40	0.46	0.62	0.80	1.65	3.96	7.11	14.17	20.09
Mid-West	0.30	0.34	0.36	0.59	1.09	2.93	3.47	13.02	16.25
South-East	0.32	0.36	0.39	0.63	1.15	3.08	3.88	13.74	18.68
South-West	0.29	0.33	0.34	0.56	0.91	2.04	4.29	14.14	18.63
West	0.33	0.38	0.46	0.66	1.24	3.24	13.35	16.37	25.39

A common feature across these distributions is the existence of long right tails. For example, 10 per cent of balances in the West region have scores of 13.35 per cent or higher and 1 per cent of balances have a score 25.39 per cent or higher. We see a similar dynamic in the Border, Dublin, and Mid-East regions, particularly at the 95th percentile and higher. While differences in the level of scores across regions are explained in part by variation in regional unemployment rates, the elevated scores in the right tails of these distributions are determined principally by exposure characteristics. Table 2 clearly shows that these relatively weak credit exposures exist in each of the eight regional portfolios.

3.2 Borrower sector

Table 3 shows vulnerability distributions for each borrower sector. Most sectors have high vulnerability scores in the right tail of their distributions. For example, the majority of sectors have scores of over 10 per cent at the 95th percentile of their distribution and almost all sectors have values of over 15 per cent at the 99th percentile. Accommodation & Food and Wholesale & Retail stand out in this regard as having a relatively large amount of highly vulnerable exposures. For example, 10 per cent of Accommodation & Food balances have a score of 15.4 per cent or higher. Agriculture, Forestry & Fishing and Manufacturing have relatively low scores at the 90th percentile of their respective distributions.

The Electricity, Gas & Steam and Water, Sewerage & Waste sectors have relatively low vulnerability scores across their distributions, but recall from Table 1 that both sectors represent only small portions of overall lending portfolio. Real Estate exposures have relatively high vulnerability scores at lower percentiles.

Table 3: Vulnerability score distribution by sector

	Percentile								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
A – Agri., Forestry & Fishing	0.29	0.33	0.36	0.56	1.00	2.83	3.61	12.95	17.17
B – Mining & Quarrying	0.34	0.40	0.58	0.78	1.36	4.91	9.23	9.81	16.53
C – Manufacturing	0.31	0.34	0.37	0.57	0.77	1.57	3.87	12.53	19.17
D – Elect., Gas, Steam	0.33	0.38	0.40	0.60	1.05	1.48	2.30	2.53	3.95
E – Water, Sewerage, Waste	0.29	0.35	0.36	0.64	0.67	0.70	0.77	1.09	1.30
F – Construction	0.29	0.32	0.33	0.50	0.64	2.79	12.47	13.94	16.66
G – Wholesale & Retail	0.33	0.36	0.44	0.62	1.22	3.19	13.35	16.32	25.82
H – Trans. & Storage	0.29	0.33	0.34	0.49	0.64	1.34	4.04	13.83	22.01
I – Accom. & Food	0.33	0.39	0.53	0.70	1.40	3.48	15.40	18.97	24.56
J – Information & Comm.	0.29	0.33	0.36	0.50	0.64	1.39	3.86	14.92	16.23
L – Real Estate	0.57	0.69	0.94	1.24	2.88	3.32	7.11	13.81	18.34
M – Prof., Tech., & Scientific	0.30	0.34	0.37	0.58	0.86	2.82	4.56	14.16	15.68
N – Admin. & Support	0.33	0.45	0.57	0.77	1.77	3.19	12.38	14.01	16.84
Q – Human Health	0.33	0.37	0.46	0.72	1.47	2.56	4.76	7.04	19.61

3.3 Product type

Table 4 reports vulnerability score distributions by product type. The products are ranked according to their share of outstanding lending as outlined in Table 1.

Table 4: Vulnerability score distribution by product type

	Percentile								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
Term Loan	0.31	0.36	0.47	0.63	1.29	3.11	8.89	15.47	22.61
Hire Purchase	0.29	0.33	0.34	0.54	1.04	1.13	1.22	1.44	3.96
Overdraft	0.33	0.39	0.50	0.58	1.15	2.81	12.37	14.05	15.82
Leasing	0.29	0.29	0.31	0.35	0.58	1.10	1.22	1.44	12.37
Unit Stocking	0.31	0.32	0.32	0.34	0.41	0.58	0.63	0.68	0.71
Revolving Credit	0.29	0.32	0.34	0.49	0.60	1.15	1.64	3.49	15.02
Invoice Finance	0.57	0.60	0.62	0.67	1.22	1.46	3.49	4.22	19.55

Term loans and overdrafts have relatively poor vulnerability scores. 10 per cent of term loan balances have scores of 8.89 per cent or higher and 10 per cent of overdraft balances have scores of 12.37 per cent or higher. Hire purchase exposures have remarkably low scores, even at the 99th percentile of its distribution. Leasing also has a reasonably low score of 1.44 per cent at its 95th percentile. There are relatively weak exposures in the extreme tails for some products. For instance, Leasing, Revolving Credit, and Invoice Financehave scores ranging from 15.02 per cent to 19.55 per cent at their 99th percentiles.

3.4 Origination period

Table 5 shows vulnerability score distributions by origination period for term loans only. There is no immediately obvious pattern. The median score for the pre-2005 cohort of 0.81 is lower than for other exposure groups. Exposures originated in 2017 or 2018 have relatively low scores at the 75th and 90th percentiles. All cohorts have elevated scores at the 95th percentile level. Exposures with origination years of 2005—2006 and 2013—2014 have a relatively large share of high vulnerability exposures.

Table 5: Vulnerability score distribution by origination period

	Percentile								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
Pre-2005	0.33	0.35	0.39	0.58	0.81	3.41	14.24	16.24	19.12
2005–2006	0.33	0.36	0.41	0.61	1.21	3.57	15.74	18.65	25.82
2007–2008	0.33	0.37	0.52	0.63	1.29	3.44	9.81	15.59	18.76
2009–2010	0.31	0.36	0.47	0.62	1.23	3.28	12.50	15.72	18.98
2011–2012	0.31	0.36	0.46	0.64	1.38	3.58	13.54	14.17	15.65
2013–2014	0.32	0.36	0.44	0.61	1.11	3.13	13.35	17.12	25.39
2015–2016	0.31	0.36	0.47	0.64	1.32	3.19	12.68	16.51	22.29
2017–2018	0.30	0.35	0.46	0.63	1.22	2.81	4.53	13.01	21.67

3.5 Maturity period

Table 6 shows vulnerability score distributions by maturity period for term loans only. Exposures with maturity dates between 2018 and 2021 stand out as having relatively weak scores at higher percentile levels. For example, 10 per cent of balances with a 2018–2019 maturity period have scores of 16.95 per cent or higher. The equivalent score for the 2020–2021 period is 15.78 per cent. All maturity cohorts have high vulnerability scores at the 95th and 99th percentiles.

Table 6: Vulnerability score distribution by maturity period

	Percentile								
	1st	5th	10th	25th	50th	75th	90th	95th	99th
2018–2019	0.30	0.38	0.49	0.66	1.52	4.30	16.95	22.01	26.01
2020–2021	0.30	0.35	0.49	0.66	1.35	3.26	15.78	19.00	22.61
2022–2023	0.30	0.36	0.52	0.66	1.29	2.94	4.98	14.05	19.12
2024–2025	0.33	0.36	0.50	0.66	1.32	2.81	4.44	9.48	16.62
2026–2027	0.32	0.35	0.39	0.59	0.84	2.05	3.64	9.23	16.21
2028–2029	0.33	0.36	0.42	0.60	0.92	2.98	5.70	14.15	16.02
2030–2031	0.33	0.37	0.43	0.59	0.84	2.96	3.91	12.57	16.84
Post-2031	0.31	0.34	0.36	0.58	0.79	1.75	3.81	14.45	22.29

4 High vulnerability exposures

In this section, I analyse the subset of exposures with particularly high vulnerability scores and assess the economic magnitudes of these exposures. I label any exposure with a score of over 10 per cent as a "high vulnerability" exposure. The sum of outstanding balances associated with these exposures is €875m – or 7.3 per cent of all performing balances.

Table 7 provides a breakdown of high vulnerability balances by region, sector, product type, origination period, and maturity period. Table 7. (a) shows that these exposures are not concentrated in any particular region. €204m – 23.3 per cent of all highly vulnerable balances – relate to Dublin borrowers and €155m of the total are associated with borrowers in the South-West. The Mid-East and West both account for €103m each.

If we compare Table 1. (a) with Table 7. (a), then it seems that the Mid-West and South-East may be mildly under-represented among high vulnerability balances. However, this kind of comparison is difficult to make given the share of balances in Table 1. (a) which have no specified borrower region.

Table 7. (b) reports high vulnerability balances by sector. Accommodation & Food and Wholesale & Retail account for just over half of high vulnerability balances. Both sectors appear to be over-represented relative to their share of outstanding lending as seen is Table 1. (b). Agriculture, Forestry & Fishing accounts for 16.6 per cent of these balances. This is lower than its share of overall outstanding credit as documented in Table 1. (b).

Table 7. (c) clearly shows that high vulnerability balances are concentrated among term loans and overdraft facilities. These two products account for 96.2 per cent of all high vulnerability balances. Hire purchase and leasing agreements account for only €13m – 1.5 per cent – of all high vulnerability balances. Miscellaneous products make up only a very small proportion of the total.

Table 7: Summary of high vulnerability exposures at June 2018

(a) Region

Region	€m	%	Region	€m	%	Region	€m	%
Border	74	8.4	Midlands	70	8.0	South-West	155	17.7
Dublin	204	23.3	Mid-West	73	8.3	West	103	11.8
Mid-East	103	11.7	South-East	76	8.7	Not specified	17	1.9

(b) Sector

Sector	€m	%	Sector	€m	%
A – Agri., Forestry & Fishing	145	16.6	I – Accom. & Food	231	26.4
B – Mining & Quarrying	3	0.3	J – Information & Comm.	5	0.6
C – Manufacturing	57	6.5	L – Real Estate	18	2.1
D – Elect., Gas, Steam	1	0.1	M – Prof., Tech., & Scientific	28	3.2
E – Water, Sewerage, Waste	0	0.0	N – Admin. & Support	46	5.2
F – Construction	27	3.1	Q – Human Health	39	4.4
G – Wholesale & Retail	214	24.5	Not specified	35	4.0
H – Trans. & Storage	27	3.1			

(c) Product type

Product Type	€m	%	Product Type	€m	%
Term Loan	782	89.4	Revolving Credit	4	0.5
Hire Purchase	8	0.9	Invoice Finance	4	0.4
Overdraft	60	6.8	Other	1	0.1
Leasing	5	0.6	Not specified	11	1.3
Unit Stocking	0	0.0			

(d) Term loan origination period

Origination	€m	%
Pre-2005	23	3.0
2005–06	46	5.8
2007–08	51	6.5
2009–10	42	5.3
2011–12	43	5.5
2013–14	106	13.5
2015–16	233	29.8
2017–18	198	25.3
Not specified	42	5.3

(e) Term loan maturity period

Maturity	€m	%
2018–19	209	26.7
2020–21	187	23.9
2022–23	120	15.3
2024–25	53	6.8
2026–27	39	4.9
2028–29	74	9.4
2030–31	24	3.0
Post-2031	25	3.3
Not specified	52	6.6

Table 7. (d) looks at high vulnerability exposures by origination period. Exposures originated in 2017–2018 account for 25.3 per cent of weak balances compared with 37 per cent of all performing balances as shown in in Table 1. (d). Exposures originated before 2007 appear to be slightly over-represented relative to their contribution to the sum of all balances. They make up 8.8 per cent of high vulnerability balances, but only 6.1 per cent of performing balances. Similarly, exposures originated between 2011 and 2016 appear to be slightly over-represented.

Table 7. (e) lists high vulnerability balances by maturity period. Exposures maturing between 2018 and 2021 are substantially over-represented in this subset of balances. €396m of high vulnerability balances are associated with these exposures or 50.6 per cent of the total, while these exposures account for only 28 per cent of all performing balances. The remaining maturity period buckets are almost all under-represented among high vulnerability balances.

5 Conclusion

In this note, I calculate vulnerability scores for performing Irish SME credit exposures at three major banks. I find evidence of improvement in the condition of the aggregate performing SME portfolio. I also show that the distribution of vulnerability scores has a very long right tail. I classify a subset of exposures – accounting for 7.3 per cent of balances – as having have high vulnerability scores. These high vulnerability exposures are spread across all regions. Borrowers in the Accommodation & Food and Wholesale & Retail sectors account for just over half of high vulnerability balances, while exposures in the Manufacturing and Agriculture, Forestry & Fishing sectors are under-represented among high vulnerability balances relative to their share of outstanding lending.

Term loans and overdraft facilities make up over 90 per cent of high vulnerability balances. Hire purchase and leasing agreements make up only 1.5 per cent of high vulnerability balances, while they represent at least 11.9 per cent of performing balances. Miscellaneous products make up a very small proportion of the total. Term loans originated in 2017 and 2018 are under-represented among high vulnerability balances and term loans originated before 2007 are over-represented. Loans maturing before 2021 make up a large share of high vulnerability balances.

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