
To: Credit Risk Standing Group Date: January 25, 2012
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Subject: **RESULTS OF 2011 HYPOTHETICAL PORTFOLIO EXERCISE FOR SOVEREIGNS, BANKS AND LARGE CORPORATES**

1. Introduction

1. This report gives the results of the FSA's 2011 sovereign, bank and large corporate hypothetical portfolio exercise (HPE), which follows on from similar exercises done in 2007 and 2009.¹ In the 2011 exercise the FSA collected both PD and LGD estimates from eight firms. Six of the firms had AIRB waivers and their PD and LGD estimates have been used in this report; two firms had FIRB waivers and only their PD estimates have been used in this report.
2. By design some participants will find that their PD and LGD values are above the mean or median. However it would not be appropriate for these firms to respond by reducing their PDs and LGDs to this mean or median as under the IRB approach the FSA expects firms to generate PDs and LGDs using processes and models that have their own internal logic.
3. Sovereign, bank and large corporate portfolios are particularly suitable for the HPE as there is a good likelihood that firms will estimate PDs and LGDs for the same obligors, enabling the FSA to do a direct comparison between the different firms. For other asset classes firms do not consistently lend to the same obligor, which would make a HPE more complex and the results less conclusive.

2. Portfolio Analysis

4. The FSA requested firms' PD and LGD estimates for 50 sovereign, 100 bank and 200 large corporate obligors as at the end of Q2 2011. Further details of the PDs and LGDs collected in the HPE can be found in sections 3 and 4 of this report.

¹ Reports on the 2007 and 2009 HPE are available on the FSA's external website at http://www.fsa.gov.uk/pubs/international/crsg_hyp_portfolio_exercise.pdf.
http://www.fsa.gov.uk/pubs/international/sbc_hpe.pdf

5. Firms were only asked to provide PDs and LGDs for obligors that they already rated. The number of obligors of each type that all participating firms rated was smaller than ideal but generally larger than in the 2007 and 2009 exercises.
6. To give an external benchmark, the FSA collected S&P ratings as at the end of Q2 2011 and used the “S&P corporations and financial institutions” average annual default rate over the years 1981-2010 for all three classes of exposure². In doing this, the FSA recognises that the S&P default rates may not be fully comparable to the firms’ PDs; for example S&P may have a different definition of default and it is only one of several credit rating agencies. Also, the FSA is not suggesting that the 1981-2010 S&P default rates represent the standard for calibrating IRB PD models. Nevertheless, the external comparison gives a helpful perspective on the firms’ PDs.

Results – ‘jointly-rated’ samples

7. Table 1 gives the PD results for the ‘jointly-rated’ sample. The results are based on the mean value of each firms’ estimates. Column 1 shows the number of obligors in the ‘jointly-rated’ sample and columns 2 to 5 give a sense of the variation in PDs for these obligors across the firms. This appears large, and dependent on the asset class the highest mean PDs are approximately 5 to 9 times as large as the lowest mean PDs. The FSA caveats this result by noting that firms’ rating systems differ in the degree to which they are point-in-time (PiT) or through-the-cycle (TtC), and this will contribute to variation in PDs for given obligors across the firms. Only one participant in our sample uses a variable scalar approach for their bank and large corporate portfolios.
8. Table 2 gives the ‘jointly-rated’ sample for LGDs. The number of jointly-rated obligors is different from the number in Table 1, as Table 2 only uses estimates from firms with an AIRB waiver. Again the variation appears large; the highest mean LGD is 2 to 3 times as large as the lowest mean LGD. However it should be noted that LGD data is scarce and the assumptions that firms have to make to estimate LGD contribute to the variation.
9. Table 3 gives the ‘jointly-rated’ sample for the RWA estimates (‘proxy RWA’) for firms with an AIRB waiver. The ‘proxy RWA’ were calculated using the firms’ PDs and LGDs and the FSA’s assumption of an exposure at default (EaD) of £1 and maturity (M) of 2.5 years for the remaining parameters. The table gives the results as an ‘index’ calculated for each portfolio with the firm with the lowest ‘proxy RWA’ getting a value of 100 and the remaining firms scaled to this base value. There is a large variation, with the highest ‘proxy RWA’ being approximately 3 to 4 times higher than the lowest ‘proxy RWA’.

² S&P (2011): *2010 Annual Global Corporate Default Study and Rating Transitions*.

Table 1: PD statistics for Sovereign, Bank and Large Corporate portfolios (jointly-rated sample by all firms)					
	1	2	3	4	5
	PD (%)				
	# of jointly-rated obligors	Average portfolio mean	Lowest portfolio mean	Highest portfolio mean	Range
Sovereigns	39	1.693	0.515	3.662	3.147
Banks	51	0.456	0.078	0.697	0.619
Corporates	21	0.115	0.044	0.215	0.171

Table 2: LGD statistics for Sovereign, Bank and Large Corporate portfolios (jointly-rated sample by AIRB firms)					
	1	2	3	4	5
	LGD (%)				
	# of jointly-rated obligors	Average portfolio mean	Lowest portfolio mean	Highest portfolio mean	Range
Sovereigns	44	41.10	27.05	76.29	49.24
Banks	69	44.75	26.52	77.50	50.98
Corporates	42	50.95	32.74	73.41	40.67

Table 3: Estimated proxy RWA statistics for Sovereign, Bank and Large Corporate portfolios (jointly-rated sample by AIRB firms)					
	1	2	3	4	5
	RWA (index value)				
	# of jointly-rated obligors	Average portfolio RWA	Lowest portfolio RWA	Highest portfolio RWA	Range
Sovereigns	43	166	100	336	236
Banks	67	231	100	428	328
Corporates	42	236	100	334	234

Results – PDs for Sovereigns

10. Table 4 summarises the PD estimates firms submitted for sovereigns using the S&P ratings. Column 2 shows the number of sovereign obligors from the HPE in each S&P grade at the end of Q2 2011. Column 3 shows the total number of observations across the participating firms for each S&P grade (e.g. for the two 'BB-' sovereigns, seven firms provided PDs for both sovereigns and one firm provided a PD for one sovereign giving 15 PD estimates for this grade). Column 4 shows the long-run average S&P default rate. Column 5 to 9 show the minimum, 1st quartile, median, 3rd quartile and maximum PD for all sovereigns with a particular S&P rating (e.g. for grade 'BB-' the calculation is based on 15 PD estimates).
11. Comparing columns 4 and 7 it can be seen that in terms of the absolute difference, the median of firms' PDs is relatively close to the S&P long-run average default rate for all S&P grades except BB-, B+ where the firms' estimates are higher and CCC where the firms' estimates are significantly lower. It should also be noted that for some grades the relative difference between the S&P default rates and the firms' PDs is large (e.g. grades A, A-).
12. Column 5 shows the minimum PD supplied for sovereigns at each S&P rating. The FSA expects differences in firms' rating approaches to give some outliers, but some of the PDs in this column are surprisingly low.
13. Column 9 shows the maximum PD for sovereigns at each S&P rating. Comparing column 5 (minimum PD) and column 9 (maximum PD) shows that there is a considerable variation in the PDs firms attach to sovereigns at a given rating.
14. The largest differences were for the PDs for Greece. The PDs for Argentina, Iran, Bangladesh, Ethiopia, Libya and Venezuela also showed significant variation.
15. Table 4a gives a comparison of the firms' average PD value in each S&P grade. For each of the eight participants the average PD of all the sovereign obligors they rated in each S&P grade has been calculated. The table shows the median, minimum and maximum average PD values for each credit grade (e.g. for 'BBB' there were three obligors in the HPE and one firm's average PD for the three obligors that they rated was 0.053% - the minimum - noting that this "average" could be based on one obligor if that is all the firm rated in the 'BBB' grade).
16. The results in Table 4a show that with the exception of grades 'A+', 'A', 'BB' and 'CCC/C', the median values of the firms average PDs tend to be above the S&P long run default rate. Also, with the exception of grades 'A' and 'BB' (which have a low number of obligors), the firms' average PD values increase for the lower S&P grades.

Table 4: Comparison of firm PDs for Sovereigns with S&P default rates								
1	2	3	4	5	6	7	8	9
S&P rating	# of obligors	Observations across all firms	S&P default rate	Min PD (%)	1 st quartile PD (%)	Median PD (%)	3 rd quartile PD (%)	Max PD (%)
AAA	13	103	0.00	0.005	0.008	0.015	0.020	0.040
AA+	2	16	0.00	0.005	0.016	0.020	0.026	0.070
AA	3	23	0.02	0.010	0.021	0.031	0.040	0.220
AA-	3	24	0.04	0.010	0.030	0.040	0.068	0.130
A+	3	24	0.07	0.010	0.034	0.045	0.074	0.270
A	2	16	0.09	0.014	0.040	0.055	0.070	0.130
A-	1	8	0.08	0.020	0.045	0.103	0.163	0.270
BBB+	2	16	0.16	0.020	0.130	0.194	0.330	1.200
BBB	3	23	0.23	0.040	0.193	0.227	0.375	1.329
BBB-	6	46	0.38	0.040	0.220	0.382	0.680	2.250
BB+	1	8	0.55	0.160	0.608	0.878	1.016	1.329
BB	1	8	0.80	0.160	0.583	0.735	1.158	1.329
BB-	2	15	1.30	1.072	2.215	3.125	7.807	29.34
B+	4	28	2.60	1.541	2.592	4.410	6.376	100.0
CCC/C	1	8	27.39	6.490	7.758	9.422	40.20	100.0
NR	3	16	---	---	---	---	---	---
Total	50	---	---	---	---	---	---	---

Table 4a: Comparison of firms' average PD for Sovereigns per S&P grade					
1	2	3	4	5	6
S&P rating	# of obligors	S&P default rate	Median PD (%)	Min PD (%)	Max PD (%)
AAA	13	0.00	0.015	0.005	0.030
AA+	2	0.00	0.019	0.008	0.055
AA	3	0.02	0.033	0.010	0.140
AA-	3	0.04	0.043	0.010	0.090
A+	3	0.07	0.058	0.010	0.117
A	2	0.09	0.054	0.014	0.100
A-	1	0.08	0.103	0.020	0.270
BBB+	2	0.16	0.295	0.020	0.665
BBB	3	0.23	0.300	0.053	0.623
BBB-	6	0.38	0.475	0.113	1.153
BB+	1	0.55	0.878	0.160	1.329
BB	1	0.80	0.735	0.160	1.329
BB-	2	1.30	3.633	1.920	17.915
B+	4	2.60	5.175	2.715	35.813
CCC/C	1	27.39	9.422	6.490	100.00
NR	3	---	---	---	---
Total	50	---	---	---	---

Results – LGDs for Sovereigns

17. Table 5 summarises the LGD estimates for sovereigns. The statistics are based on 292 observations from the six firms with an AIRB waiver. Column 1 shows the mean LGD values, columns 2 to 6 the minimum, 1st quartile, median, 3rd quartile and maximum LGD values.
18. Comparing column 2 (minimum LGD) and column 6 (maximum LGD) shows that there is considerable variation in firms' sovereign LGD estimates. It was found that some firms estimated low LGDs for highly rated sovereigns and high LGDs for low rated sovereigns, whereas two firms have assigned a single LGD value to all sovereigns.

Table 5: Comparison of AIRB firms' LGDs for Sovereigns; all obligors					
1	2	3	4	5	6
Mean LGD (%)	Min LGD (%)	1 st Quartile LGD (%)	Median LGD (%)	3 rd Quartile LGD (%)	Max LGD (%)
42.55	5.00	25.00	45.00	51.60	88.00

Results – PDs for Banks

19. Table 6 summarises the PD estimates for banks using the S&P ratings. The overall conclusions are similar to those for sovereign PDs. In particular, in absolute terms the median PD for obligors at each rating grade (column 7) is similar to the S&P long-run default rate (column 4). An exception is the lowest grade ('CCC'), where the firms' estimates are significantly below S&P's. The three obligors in this grade are all Greek banks.
20. Column 5 gives the minimum PD and shows that several of the firms estimate a PD at the 3-basis-point floor for a wide range of banks, even by one firm to an 'A-' rated bank.
21. Some of the differences in the PD estimates may be explained by the different approaches firms' have taken to incorporating explicit or anticipated government guarantees in their PD estimates for banks.
22. It is also worth noting that the largest differences in firms' PDs estimates were for banks domiciled in Greece, Spain and the Republic of Ireland.
23. Table 6a gives a comparison of the firms' average PD value in each S&P grade. The results show that for the twelve grades available, in exactly half the grades the median of the average PD values is lower than the S&P long run default rate. Also, for the investment grades, the average PD values increase for the lower S&P grades, but this is not the case for the sub-investment grades.

Table 6: Comparison of floored firm PDs for Banks with S&P default rates								
1	2	3	4	5	6	7	8	9
S&P rating	# of obligors	Observations across all firms	S&P default rate	Min PD (%)	1 st quartile PD (%)	Median PD (%)	3 rd quartile PD (%)	Max PD (%)
AA	8	63	0.02	0.030	0.030	0.030	0.036	0.130
AA-	10	75	0.04	0.030	0.030	0.030	0.040	0.220
A+	17	124	0.07	0.030	0.030	0.040	0.056	0.370
A	27	196	0.09	0.030	0.040	0.056	0.085	2.250
A-	13	84	0.08	0.030	0.056	0.093	0.161	0.630
BBB+	2	8	0.16	0.040	0.080	0.190	0.238	0.630
BBB	2	16	0.23	0.048	0.092	0.200	0.270	0.870
BBB-	3	20	0.38	0.075	0.205	0.384	0.683	1.329
BB+	3	19	0.55	0.130	0.322	0.486	1.329	2.250
BB	1	7	0.80	0.168	0.520	0.750	1.100	1.930
B	1	6	5.88	0.511	4.057	8.101	9.571	10.663
CCC/C	3	24	27.39	0.450	1.000	7.079	9.272	10.663
NR	10	54	---	---	---	---	---	---
Total	100		---	---	---	---	---	---

Table 6a: Comparison of firms' average PD for Banks per S&P grade					
1	2	3	4	5	6
S&P rating	# of obligors	S&P default rate	Median PD (%)	Min PD (%)	Max PD (%)
AA	8	0.02	0.032	0.030	0.050
AA-	10	0.04	0.039	0.030	0.068
A+	17	0.07	0.044	0.031	0.095
A	27	0.09	0.064	0.035	0.234
A-	13	0.08	0.097	0.037	0.314
BBB+	2	0.16	0.174	0.043	0.630
BBB	2	0.23	0.183	0.056	0.750
BBB-	3	0.38	0.516	0.096	0.976
BB+	3	0.55	0.679	0.265	1.930
BB	1	0.80	0.750	0.168	1.930
B	1	2.60	8.101	0.511	10.663
CCC/C	3	27.39	6.785	0.511	10.663
NR	10	---	---	---	---
Total	100	---	---	---	---

Results – LGDs for Banks

24. Table 7 summarises the LGD estimates for the banks portfolio. The statistics are based on 549 observations from the six firms with an AIRB waiver.
25. Comparing column 2 (minimum LGD) and column 6 (maximum LGD) shows that there is considerable variation in firms' LGD estimates; although the variation is lower than observed for the sovereign portfolio. The LGD estimates were not found to be correlated with the S&P grades.

Table 7: Comparison of AIRB firms' LGDs for Banks; all obligors					
1	2	3	4	5	6
Mean LGD (%)	Min LGD (%)	1 st Quartile LGD (%)	Median LGD (%)	3 rd Quartile LGD (%)	Max LGD (%)
45.91	25.00	30.00	45.00	56.30	84.97

Results – PDs for Large Corporates

26. Table 8 summarises the PD estimates for large corporates using the S&P ratings. As with the sovereign and bank portfolios, the median PD is fairly close to the S&P long-run default rate.
27. The table shows that several of the firms estimate a PD at the 3-basis-point floor for a wide range of large corporates, even by one firm to a 'BBB-' rated large corporate.
28. Table 8a gives a comparison of the firms' average PD value in each S&P grade.
29. The results show that for six of the fourteen grades available the median of the average PD values is lower than the S&P long run default rate. Also the average PD values increase for the lower S&P grades (across all the grades) and that the minimum average is only just above the 3-basis-point floor for all grades to 'BBB+'.

Table 8: Comparison of floored firm PDs for Large Corporates with S&P default rates								
1	2	3	4	5	6	7	8	9
S&P rating	# of obligors	Observations across all firms	S&P default rate	Min PD (%)	1 st quartile PD (%)	Median PD (%)	3 rd quartile PD (%)	Max PD (%)
AAA	4	21	0.00	0.030	0.030	0.030	0.030	0.091
AA+	1	8	0.00	0.030	0.030	0.031	0.049	0.090
AA	10	58	0.02	0.030	0.030	0.031	0.040	0.145
AA-	14	53	0.04	0.030	0.030	0.036	0.040	0.370
A+	22	123	0.07	0.030	0.030	0.040	0.070	2.602
A	17	108	0.09	0.030	0.040	0.070	0.085	0.370
A-	32	186	0.08	0.030	0.040	0.076	0.130	1.650
BBB+	26	135	0.16	0.030	0.070	0.161	0.220	0.630
BBB	15	83	0.23	0.030	0.099	0.220	0.270	0.630
BBB-	9	46	0.38	0.030	0.164	0.270	0.384	2.602
BB+	2	6	0.55	0.080	0.166	0.372	0.600	0.799
BB	1	6	0.80	0.160	0.330	0.985	1.812	2.602
BB-	3	17	1.30	0.320	1.130	1.303	1.449	2.602
B+	1	5	2.60	0.630	1.329	1.746	3.310	3.620
NR	43	171	---	---	---	---	---	---
Total	200	---	---	---	---	---	---	---

Table 8a: Comparison of firms' average PD for Large Corporates per S&P grade					
1	2	3	4	5	6
S&P rating	# of obligors	S&P default rate	Median PD (%)	Min PD (%)	Max PD (%)
AAA	13	0.00	0.030	0.030	0.047
AA+	2	0.00	0.0305	0.030	0.090
AA	3	0.02	0.034	0.030	0.063
AA-	3	0.04	0.043	0.033	0.081
A+	3	0.07	0.0635	0.030	0.278
A	2	0.09	0.086	0.033	0.103
A-	1	0.08	0.105	0.031	0.171
BBB+	2	0.16	0.159	0.035	0.226
BBB	3	0.23	0.208	0.054	0.3055
BBB-	6	0.38	0.409	0.085	0.7165
BB+	1	0.55	0.420	0.0965	0.799
BB	1	0.80	0.985	0.160	2.602
BB-	2	1.30	1.301	0.6125	1.650
B+	4	2.60	1.746	0.630	3.620
NR	3	---	---	---	---
Total	50	---	---	---	---

Results – LGDs for Large Corporates

30. Table 9 summarises the LGD estimates for large corporates. The statistics are based on 812 observations from the six firms with an AIRB waiver.
31. The results show that there is a significant difference between the estimates among the firms. Comparing column 2 (minimum LGD) and column 6 (maximum LGD) shows that there is considerable variation in firms' LGD estimates. The LGD estimates were not found to be correlated with the S&P grades.

Table 9: Comparison of AIRB firms' LGDs for Large Corporates; all obligors					
1	2	3	4	5	6
Mean LGD (%)	Min LGD (%)	1 st Quartile LGD (%)	Median LGD (%)	3rd Quartile LGD (%)	Max LGD (%)
49.63	9.58	37.34	49.00	55.70	100.00

3. Choice of PDs

32. As the FSA requested, some firms' returns included several different PD estimates. The analysis in this paper uses:
- Post-override PDs (in preference to pre-override PDs).
 - Foreign-currency PDs (in preference to local-currency ratings).
 - Through-the-cycle PDs (in preference to Point-in-Time PDs) for firms that were able to supply both.
 - Corporate and bank PDs floored at 3 basis points.

4. Choice of LGDs

33. The FSA asked firms to provide downturn (regulatory) unsecured LGD estimates for the following type of exposures:

Sovereigns: Long-term (e.g. 10-yr) Government bond.

Banks: Plain vanilla interest rate swap exposure (net of any collateral or netting agreements), that is considered senior unsecured for LGD purposes.

Corporates: Senior unsecured bi-lateral loan.

5. Conclusions

34. As our conclusion to the reports on the 2007 and 2009 exercises noted, the FSA does not expect the IRB regime to give identical PDs for the same obligors across firms. Were this to occur it might cause systemic risk. Nonetheless, the

FSA would expect some overall comparability of PDs between firms and with the credit rating agencies long-run default rates.

35. The data above shows that in absolute terms the median of the firms' PDs at each S&P rating grade is broadly similar to the S&P long-run default rate. Overall it suggests that firms' sovereign, banks and large corporate PDs are broadly consistent with the external data. However, there are examples of estimates that are significantly lower or higher than the median PD for a given rating.
36. The 2011 HPE is the first to collect LGD estimates that can be compared between firms and this has shown a large variation in firms LGD estimates. The FSA is currently discussing approaches to wholesale LGD and EAD modelling with the industry – with the aim of improving the consistency of the estimates used by different firms.
37. The collection of PD and LGD values allowed the FSA to approximate RWA estimates for the three portfolios. The results suggest that there might be a significant difference in the RWAs being held by firms against the same obligors.
38. Using the PD values from the 2007, 2009 and 2011 exercises the FSA assessed the change in PDs over this period. This showed that overall, from 2007 to 2011 there was an increase in the banks PDs, a slight increase in sovereign PDs and large corporate PDs remained broadly constant.