



ECL Model Suite

Version 1.0, July 2020

Based on: “Expected Credit Loss Modeling from a Top-Down Stress Testing Perspective”, by Gross, M., Laliotis, D., Leika, M., and P. Lukyantsau (2020), IMF Working Paper No. 20/111.

OVERVIEW

Module	Name
1	ECL CALCULATOR WITH "BETA-LINKING"
2	ECL CALCULATOR WITH "Z-TM-ANCHORING-IN-PDs"
3	ECL CALCULATOR WITH Z-SCORE
4	Z-SCORE CALCULATION
5	LGD MODELS
6	EXEMPLARY IFRS 9 DATA TEMPLATES

MODULE 1: ECL CALCULATOR WITH "BETA-LINKING"

DESCRIPTION

The module's purpose is to illustrate how the provision stock and flow calculations based on Incurred Loss (IL) à la IAS 39 and Expected Credit Loss (ECL) à la IFRS 9 and CECL can be conducted.

Transition matrices as of Year 0 (incl. PDs) and LGDs are assumed to be given. The "Beta-Linking" methodology is involved for projecting the transition matrices based on a PD scenario path.

Available in two versions: with annual and quarterly frequency.

RELEVANT SECTIONS IN THE PAPER

Sections III. and IV.

Section III.C. for an explanation of the "Beta-Linking" approach.

Section III.E. and Box 4 for LT ECL calculations as presented on the tabs called "LT ECL...".

Section III.F. and Box 5 for provision stock and flow calculations as located on the tab called "Provisioning".

Section III.G and Box 6 for link to risk weights; see tab called "Risk Weights".

MODULE 1: ECL CALCULATOR WITH "BETA-LINKING"

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IMPUTS

TD Transition Matrix (Coeff. quarterly Flow Balance Sheet Dynamics and Other Parameters)

Scenario	Baseline	Adverse	ER (annualized)
Y0	0.91	0.91	0.91
Y1	0.92	0.92	0.92
Y2	0.93	0.93	0.93
Y3	0.94	0.94	0.94
Y4	0.95	0.95	0.95
Y5	0.96	0.96	0.96

TD Stacks

Scenario	Baseline	Adverse
Y0	0.96	0.96
Y1	0.97	0.97
Y2	0.98	0.98
Y3	0.99	0.99
Y4	1.00	1.00
Y5	1.01	1.01

PIT PDs, LGDs, and Gross Loan Growth for the Portfolio

Scenario	PD (yr)	LGD (%)	Gross Loan Growth (%)
Y0	0.00	0.00	0.00
Y1	0.01	0.01	0.01
Y2	0.02	0.02	0.02
Y3	0.03	0.03	0.03
Y4	0.04	0.04	0.04
Y5	0.05	0.05	0.05

Provision Flows (annual, or % of end-of-previous-year gross loan stock)

Scenario	IL (IAS 39)	S-ECL (IFRS 9)	S-LT-ECL (CECL)
Y0	0.00	0.00	0.00
Y1	0.01	0.01	0.01
Y2	0.02	0.02	0.02
Y3	0.03	0.03	0.03
Y4	0.04	0.04	0.04
Y5	0.05	0.05	0.05

Provision Stocks (end-year)

Scenario	IL (IAS 39)	S-ECL (IFRS 9)	S-LT-ECL (CECL)
Y0	0.00	0.00	0.00
Y1	0.01	0.01	0.01
Y2	0.02	0.02	0.02
Y3	0.03	0.03	0.03
Y4	0.04	0.04	0.04
Y5	0.05	0.05	0.05

Loan Loss Rates (% of end-of-previous-year gross loan stock)

NPL Ratio

NOTES

- All blue cells are user inputs.
- The PD, PIT reference paths (J22-K45) can be from an aggregate banking-system model for instance, or for the specific bank portfolio at hand. In the latter case, cell J25 would equal cell F22. In either case, the PD path for the bank is going to be anchored in the weighted average S1/S2 starting point PD displayed in cell F12.
- The PD, PIT reference paths (J22-K45) are default rates with quarterly frequency and a quarterly default flow window. Likewise, the TD transition matrix (D8-F10) is to contain transition rates that capture quarterly flows.
- When choosing a static balance sheet (cell I8), the write-off rates may wish to be set to zero (cells N13 and N14 for the baseline and adverse scenarios); although they do not have to if they were kept at a positive percentage combined with a static balance sheet, it will mean that write-offs occur, while new business would be more stable (inflow to S1) than otherwise, which would be set by the tool such that gross loan stocks are constant (static).
- When choosing a static balance sheet mode (cell I8), the gross loan growth paths in range N26-O45 are ignored.
- The parameter "mean reversion adverse to baseline in years" (cell K8) refers to the period starting after a 20 quarter (5 years) period, after which the adverse scenario's PD, PIT and LGD parameters decay linearly back to the baseline over the period defined in cell K8.
- The EIR (cell M8) is an annual effective interest rate that is used to discount the expected credit losses along the relevant horizon.
- Selected additional user inputs concerning the risk weight pass-through are to be found and set by the user, if needed, on the tab called "Risk Weights".
- The write-off rate parameters (cells N13 and N14) are used to reflect asset sales (AS), where relevant, as well.
- The model-implied TD provision stocks under the baseline scenario (cells T19, V19, X19) can be used to judge the adequacy of the banks' portfolio's accounting provision coverage at the outset.
- The model-implied TD provision stocks under the adverse scenario (cells U19, W19, Y19) are hypothetical TD loan loss reserve stocks that might be used to inform an analysis of the adequacy of required regulatory provision coverage ratios. The model-implied adverse scenario-conditional provision stocks in TO are of course specific to a particular adverse scenario.

Inputs | TM Paths | ImPLY S1-2-3 stocks | LT ECL S1 - Baseline | LT ECL S1 - Adverse | LT ECL S2 - Baseline | LT ECL S2 - Adverse | Provisioning | Risk Weights | **Outputs**

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Exposures (end-year)

	Baseline				Adverse				
	S1	S2	S3	Gross	S1	S2	S3	Gross	
Y0	500.0	380.0	30.0	710.0	4.2%	500.0	380.0	30.0	710.0
Y1	467.3	265.1	34.8	717.1	4.3%	370.6	251.5	82.9	705.0
Y2	457.9	229.2	37.3	724.3	5.1%	323.6	257.5	124.6	705.7
Y3	457.3	226.7	38.6	721.6	5.3%	352.0	244.6	125.1	718.9
Y4	460.0	239.4	39.5	738.9	5.3%	408.9	236.7	73.3	718.9
Y5	464.0	242.3	40.1	746.4	5.4%	427.9	240.4	57.8	726.1

Provision stocks (end-year)

	IL (IAS 39)			S-ECL (IFRS 9)			ECL global (CECL)		
	Base	Adv	Diff	Base	Adv	Diff	Base	Adv	Diff
Y0	0.00	7.50	12.21	32.51	14.55	35.95			
Y1	6.36	20.73	14.87	48.77	16.42	51.24			
Y2	7.45	32.39	15.66	49.35	17.56	50.86			
Y3	7.73	26.28	16.09	37.72	17.59	39.47			
Y4	7.93	16.12	15.37	27.09	17.68	23.09			
Y5	8.02	11.96	16.59	22.72	18.11	24.85			

Provision flows (throughout the year)

	IL (IAS 39)			S-ECL (IFRS 9)			ECL global (CECL)		
	Base	Adv	Diff	Base	Adv	Diff	Base	Adv	Diff
Y1	2.88	17.74	3.58	36.96	3.41	38.32			
Y2	2.64	18.40	2.95	7.32	2.90	6.95			
Y3	2.54	1.47	2.70	-4.04	2.69	-3.80			
Y4	2.51	-5.13	2.62	-5.61	2.63	-5.36			
Y5	2.51	-1.23	2.60	-1.04	2.61	-0.92			

Risk weights (end-year)

	Base		Adv	
	Base	Adv	Base	Adv
Y0	53.3%			
Y1	53.6%	57.0%		
Y2	53.6%	59.6%		
Y3	53.7%	57.3%		
Y4	53.7%	55.2%		
Y5	53.7%	54.5%		

LT ECL S2 - Adverse | Provisioning | Risk Weights | **Outputs**

MODULE 2: ECL CALCULATOR WITH "Z-TM-ANCHORING-IN-PDs"

DESCRIPTION

The module's purpose is to illustrate how the provision stock and flow calculations based on Incurred Loss (IL) à la IAS 39 and Expected Credit Loss (ECL) à la IFRS 9 and CECL can be conducted.

Historical transition matrices are assumed to be available. The "Z-TM-anchoring-in-PDs" methodology is involved for projecting the transition matrices based on a PD scenario path.

Available in two versions: with annual and quarterly frequency. The module involves a VBA script.

RELEVANT SECTIONS IN THE PAPER

Sections III. and IV.

Section III.C. for an explanation of the "Z-TM-anchoring-in-PDs" approach.

Section III.E. and Box 4 for LT ECL calculations as presented on the tabs called "LT ECL...".

Section III.F. and Box 5 for provision stock and flow calculations as located on the tab called "Provisioning".

Section III.G and Box 6 for link to risk weights; see tab called "Risk Weights".

MODULE 2: ECL CALCULATOR WITH "Z-TM-ANCHORING-IN-PDs"

Module 2 - ECL with Z-TM-Anchoring-in-PDs - Quarterly Frequency - Excel

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General

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Historical Transition Flow and Exposure Stocks

Balance Sheet Dynamic and Other Parameters

Provision Flow (Excess, or % of end-of-previous-year gross loan stock)

Provision Stocks (end-year)

Notes

1) All blue cells are user inputs.

2) The PD PIT reference paths (Z1:AA44) can be from an aggregate banking-system model for instance, or for the specific bank portfolio at hand.

3) The PD PIT reference paths (Z1:AA44) are default rates with quarterly frequency and a quarterly default flow window. Likewise, the historical transition flow matrix (C9-R44) captures quarterly flows.

4) When choosing a static balance sheet mode (cell Y8), the gross loan growth paths in range AD21:A64 are ignored.

5) The parameter "mean reversion adverse to baseline in years" (cell A48) refers to the period starting at t+20 quarters (5 years) period, after which the adverse scenario's PD PIT and LOD PIT parameters decay linearly back to the baseline over the period defined in cell A48.

6) The ER (cell AC8) is an annual effective interest rate that is used to discount the expected credit losses along the relevant horizon.

7) Selected additional user inputs concerning the risk weight pass-through are to be found and set by the user, if needed, on the tab called "Risk Weights".

8) The write-off rate parameters (cells AC12 and AC13) are used to reflect asset sales (AS), where relevant, as well.

9) The model-implied T0 provision stocks under the baseline scenario (cells AM15, AD19, AD20) can be used to judge the adequacy of the banks' portfolio's accounting provision coverage at the outset.

10) The model-implied T0 provision stocks under the adverse scenario (cells AN19, AP19, AR19) are hypothetical T0 loan loss reserve stocks that might be used to inform an analysis of the adequacy of required regulatory provision coverage ratios. The model-implied adverse scenario-conditional provision stocks in T0 are of course specific to a particular adverse scenario.

Inputs TM Paths ImPLY S1-2-3 stocks LT ECL S1 - Baseline LT ECL S1 - Adverse LT ECL S2 - Baseline LT ECL S2 - Adverse Provisioning Risk Weights Outputs

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Exposures (end-year)

	Baseline				Adverse			
	S1	S2	S3	Gross NPL ratio	S1	S2	S3	Gross NPL ratio
Y0	57.7	86.5	30.6	4.2%	57.7	86.5	30.6	4.2%
Y1	461.9	228.7	43.5	7.0%	295.6	296.5	195.5	7.7%
Y2	457.7	225.5	54.4	7.3%	258.8	279.5	190.1	7.8%
Y3	461.0	238.1	56.0	7.4%	357.7	246.9	190.1	7.7%
Y4	465.5	240.3	56.9	7.5%	433.3	261.7	174.0	10.3%
Y5	470.1	242.7	57.5	7.5%	447.9	274.4	174.0	8.4%

Provision stocks (end-year)

	IL (IAS 39)			S-ECL (IFRS 9)			-ECL global (CEC)		
	Base	Adv	Base	Adv	Base	Adv	Base	Adv	
Y0	6.11	7.64	21.21	46.39	23.83	56.38			
Y1	3.91	33.93	26.83	91.10	29.19	84.85			
Y2	10.88	45.42	28.15	81.35	30.46	83.30			
Y3	11.20	32.52	26.64	55.38	30.97	58.09			
Y4	11.37	36.74	28.98	38.24	31.33	41.53			
Y5	11.50	12.54	29.28	34.60	31.85	38.01			

Provision flows (throughout the year)

	IL (IAS 39)			S-ECL (IFRS 9)			-ECL global (CEC)		
	Base	Adv	Base	Adv	Base	Adv	Base	Adv	
Y0	6.11	7.64	21.21	46.39	23.83	56.38			
Y1	6.11	7.64	21.21	46.39	23.83	56.38			
Y2	4.09	26.44	4.42	10.56	4.40	9.36			
Y3	3.63	-5.88	3.80	-14.54	3.82	-14.98			
Y4	3.55	-10.02	3.72	-11.38	3.74	-10.80			
Y5	3.55	-8.69	3.73	-11.3	3.75	-10.01			

Risk weights (end-year)

	Base		Adv	
	Base	Adv	Base	Adv
Y0	53.7%	53.7%		
Y1	54.5%	53.5%		
Y2	54.6%	62.8%		
Y3	54.7%	58.6%		
Y4	54.7%	55.5%		
Y5	54.7%	55.0%		

LT ECL S2 - Adverse Provisioning Risk Weights Outputs

MODULE 3: ECL CALCULATOR WITH Z-SCORE

DESCRIPTION

The module's purpose is to illustrate how the provision stock and flow calculations based on Incurred Loss (IL) à la IAS 39 and Expected Credit Loss (ECL) à la IFRS 9 and CECL can be conducted.

The module requires scenario-conditional Z-score paths as input.

Available in two versions: with annual and quarterly frequency.

RELEVANT SECTIONS IN THE PAPER

Sections III. and IV.

Sections III.A. and B for an explanation of the Z-score methodology.

Section III.E. and Box 4 for LT ECL calculations as presented on the tabs called "LT ECL...".

Section III.F. and Box 5 for provision stock and flow calculations as located on the tab called "Provisioning".

Section III.G and Box 6 for link to risk weights; see tab called "Risk Weights".

MODULE 4: Z-SCORE CALCULATION

DESCRIPTION

The purpose of this module is to illustrate how the Z-score can be computed from historical transition matrix data.

RELEVANT SECTIONS IN THE PAPER

Sections III. and IV.

Sections III.A. and B for an explanation of the Z-score methodology.

MODULE 4: Z-SCORE CALCULATION

Module 4 - Z-Score - Excel

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Share Comments

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1																																		
2		P/T Transition Matrix	S1	S2	S3			Z	rho	1	Var(Z) target	0.950	Corresp. opt. rho	0.080																				
3		S1	95.15%	4.16%	0.68%																													
4		S2	27.67%	63.74%	2.59%																													
5		S3	3.44%	18.98%	77.98%																													
6																																		
7		Av. (equilibrium) TM	S1	S2	S3																													
8		S1	90.03%	7.94%	2.03%																													
9		S2	19.01%	74.99%	6.00%																													
10		S3	1.96%	13.03%	85.02%																													
11																																		
12		Bin boundaries (upper)	S1	S2	S3																													
13		S1	1000000	-1.26	-2.05																													
14		S2	1000000	0.88	-1.55																													
15		S3	1000000	2.06	1.04																													
16																																		
17		Bin boundaries (lower)	S1	S2	S3																													
18		S1	-1.28	-2.06	-10000																													
19		S2	0.88	-1.55	-10000																													
20		S3	2.06	1.04	-10000																													
21																																		
22		TM cond.	S1	S2	S3																													
23		S1	95.41%	3.96%	0.63%																													
24		S2	28%	69.87%	2.43%																													
25		S3	3%	19%	78%																													
26																																		
27		Dev^2	S1	S2	S3																													
28		S1	0.000	0.000	0.000																													
29		S2	0.000	0.000	0.000																													
30		S3	0.000	0.000	0.000																													
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Compute Z-Score

Z-Score

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MODULE 5: LGD MODELS

DESCRIPTION

The purpose of this module is to illustrate the functioning of two LGD models for real estate-collateralized portfolios.

RELEVANT SECTIONS IN THE PAPER

Sections III. and IV.

Section III.D. and Box 3 for an explanation of the LGD models.

MODULE 5: LGD MODELS

Module 5 - LGD Models - Excel

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Inputs			Model 1		Model 2	
	T0	Scenario	Scenario outputs		Model/Solver	
LGD	33.0%	-	LGD	56.5%	Sales haircut (SH)	-61%
LTV	55.0%	-			Sales ratio (SR=1+SH)	39.1%
Cure rate	15%	10%			Q	0.21
V	20%	25%			Effective sales ratio (eSR)	36.9%
Cost	5%	10%			LGL	32.9%
HP change	-	-35.0%			LGD	33.0%
					dev^2	0.00055
					Q*	0.0
					eSR*	39.1%
					LTV	84.6%
					LGL	53.8%
					LGD	58.4%

Run Model 2

Scenario outputs

LGD

Scenario	LGD
T0	33.0%
Model 1	56.5%
Model 2	58.4%

NOTES LGD_Model

Calculate

MODULE 6: EXEMPLARY IFRS 9 DATA TEMPLATES

DESCRIPTION

Exemplary IFRS 9 data templates. Including indicative IAS 39 vs. IFRS 9 accounting classification mapping.

RELEVANT SECTIONS IN THE PAPER

Section V.

NOTES

- All current numerical inputs to the tools are artificial data inputs.
- The (LT-)ECL calculations in Modules 1, 2, and 3 are conducted in a consistent manner in parallel based on IL (IAS 39), IFRS 9, and CECL principles; that is, the Stage 3 (NPL stock)-related provision stocks and flows are identical under all three approaches, and the LT-ECL provision stocks and flows related to Stage 2 stocks are consistent across the IFRS 9 and CECL approach.
- The parameter inputs in the quarterly and annual frequency versions of Modules 1, 2, and 3 are not currently numerically consistent, that is, they result in different loan loss provision flows over a common horizon in their quarterly and annual versions.
- Module 2 (ECL Calculator with "Z-TM-Anchoring-In-PDs"), Module 4 (Z-Score Calculation), and Module 5 (LGD Models) contain VBA macros that can be run by hitting the relevant buttons.