

Logistic Regression and Transition Matrix to Calculate PD

NC STATE UNIVERSITY

Xiangnan Lin, Shiran Jia, Alex Tunnell, Zezhou Wang
NC State, Financial Mathematics

Introduction

CECL is the new accounting standard by FASB (Financial Accounting Standards Board)

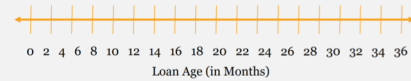
FASB is replacing the current "incurred loss" accounting model with an "expected loss" model – CECL.

• Banking regulators have referred to CECL as "the biggest change ever to bank accounting."

ECL Model:

Expected Credit Loss = Probability of Default (PD) * Loss Given Default (LGD) * Exposure at Default (EAD)

$$ECL = \sum_{t=1}^T \frac{PD(t) LGD(t) EAD(t)}{(1+r)^t}$$



Reasearch Data

	Count (# NaN)	Percent NaN Values
Original Combined LTV		0.0003
Number of Borrowers		0.0014
Original Debt to Income Ratio	7046	2.4527
Credit Score (Borrower)	526	0.1831
Primary Mortgage Insurance Percent	244280	85.0335
Credit Score (Co - Borrower)	159679	55.5840
Mortgage Insurance Type	244280	85.0335
Servicer	284784	99.1329
Current Actual UPB	10	0.0035

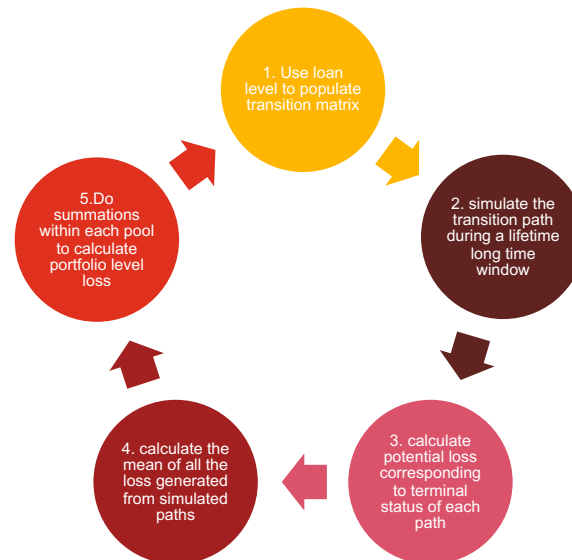
Logistic Regression and Transition Matrix

- -1: prepaid state
- 0: current state
- 1: 30 day delinquency state
- 2: 60 day delinquency state
- 3: 90 day delinquency state
- 4: Default

The probabilities of these transitions occurring can be represented by a state transition probability matrix.

We run logistic regression to describe the quantitative relationship between transitions of status and FICO score, HPI, unemployment rate and so on.

DTMC and Monte Carlo Method



Pro and Con analysis

Pros

- Calculation precision
- Free-up unnecessary capital occupation
- Path-tracking realizable

Cons

- Calculating-expensive
- Require detailed data
- storage intensive

Demo for transition matrix

	0	1	2	3	4	-1
0	0.62	0.29	0	0	0	0.09
1	0.44	0.13	0.43	0	0	0
2	0.07	0.09	0.06	0.78	0	0
3	0.16	0	0	0.08	0.76	0

Demo for PD*LGD

Loan#	UPB	PD	Collatera l	LGD	Expected Credit Loss
1	5000	5.00%	0	-5000	-250
2	25000	2.00%	18000	-8800	-176
3	150000	100.00%	250000	0	0
4	75000	5.00%	0	-7500	-375
5	25000	3.00%	150000	-19000	-570
Total	212500			-40300	-1371

contact information for poster :
Xiangnan Lin: xlin22@ncsu.edu
Zezhou Wang: zwang78@ncsu.edu
Alex Tunnell: aktunnel@ncsu.edu
Shiran Jia: sjia3@ncsu.edu

Reference and Acknowledgements:
CECL Workshop