Author: Kaiwen Shen
Student Number: 1009970239

Risk Management Assignment 1: Regulatory and Climate Risk

A

Q1: Asset, Liability, Equity, E/A

| Millions of Swiss francs (CHF) | Total Asset | Total Liability | Total Equity | E/A *(Rounding 3 digits)* |
|---|---|---|---|---|
| Before AT1 | 540291+16000=556291 | 486038+16000 =502038 | 54253 | 0.098 |
| After AT1 to zero | 540291 | 486038 | 54253 | 0.100 |
| After AT1 to Equity | 540291+16000=556291 | 486038 | 54253+16000 =70253 | 0.126 |

Q2: In comparing case 2 and 3, explain in which scenario it is better to have been a AT1 holder and in which scenario it is better to have been an equity holder?

To compare, the seniority claim in the event of bankruptcy is an important aspect

In scenario 2, it is better to be an equity holder. If you are a AT1 holder you just lose all the money and doesn't have any claim in the event of bankruptcy, but as the equity holder, although they are the last in the seniority claim, it is better than nothing. In addition, a large portion of the debtholder just got wiped out, hence there is suddenly more asset to claim in case of bankruptcy.

In scenario 3, it is better to be an AT1 holder.

When the trigger event happen and AT1 holder convert to equity, although the value on AT1 decrease, AT1 holder still have the same claim as Equity, however, the original equity holder's share got diluted, suddenly there are new AT1 converted Equity holders having the same seniority. This also coincide with the research of Pazarbasioglu et al. (2011) where they claim that because of the AT1 convert to Equity mechanism, it helps align incentives of principal agent problem as shareholders are more risk-averse to avoid getting diluted.

Q3. Given the prospect of being written down to zero or being converted to equity, why would an investor ever purchase an AT1 bond? How do you think investors are being compensated for that risk? (A very short paragraph.)

AT1 bond holder in general receives a higher coupon than a regular T1 bond holder, and in the post-2018 crisis, banks have much more regulations than it used to be, with Basel III, new risk regulations, many thinks the risk is minimal and they are getting compensated by putting on the risk, i.e. they are expecting that a "black swan" event will not happen to them. It is extremely right skewed return distribution where payoff is good most of the time but in the rare event you take extreme loses. It is "pickup pennies in front of steamroller", similar to selling deep out-of-money call, which is what partially the reason that bankrupted LTCM.

B

Q4: show that when climateAdd-on = 0, climatePD=PD and climateLGD=LGD

$$climatePD = \frac{1}{1 + \exp\left(-\left(ln\left(\frac{PD}{1-PD}\right) + climateAddon\right)\right)}$$

$$climateLGD = \frac{\Phi[\Phi^{-1}(climatePD) - \Phi^{-1}(PD) + \Phi^{-1}(PD \times LGD)]}{PD}$$

When $climateAddon = 0$,

$$climatePD = \frac{1}{1 + \exp\left(-\left(ln\left(\frac{PD}{1-PD}\right)\right)\right)}$$

$$= \frac{1}{1 + \frac{1-PD}{PD}}$$

$$= \frac{1}{\frac{1}{PD}} = PD$$

Since $climatePD = PD$, climateLGD can be written as

$$climateLGD = \frac{\Phi[\Phi^{-1}(PD) - \Phi^{-1}(PD) + \Phi^{-1}(PD \times LGD)]}{PD}$$

$$= \frac{PD - PD + PD \times LGD}{PD}$$

$$= \frac{PD \times LGD}{PD} = LGD$$

QED

Q5. Calculate baseRWA and plot the ratio of climateRWA / baseRWA

Maturity adjustment:

$$b = (0.11852 - 0.05478 \times \ln(PD))^2$$

Capital Requirement:

$$K = \left[LGD \times \Phi\left(\frac{\Phi^{-1}(PD) + \sqrt{R} \times \Phi^{-1}(0.999)}{\sqrt{1-R}}\right) - (LGD \times PD)\right] \times \left(\frac{1 + (M - 2.5) \times b}{1 - 1.5 \times b}\right)$$

Base RWA calculation

$$baseRWA = 12.5 \times EAD \times K$$

For parameter $LGD = 0.4, PD = 0.01, EAD = 1{,}000{,}000,\ M = 1, R = 0.15$

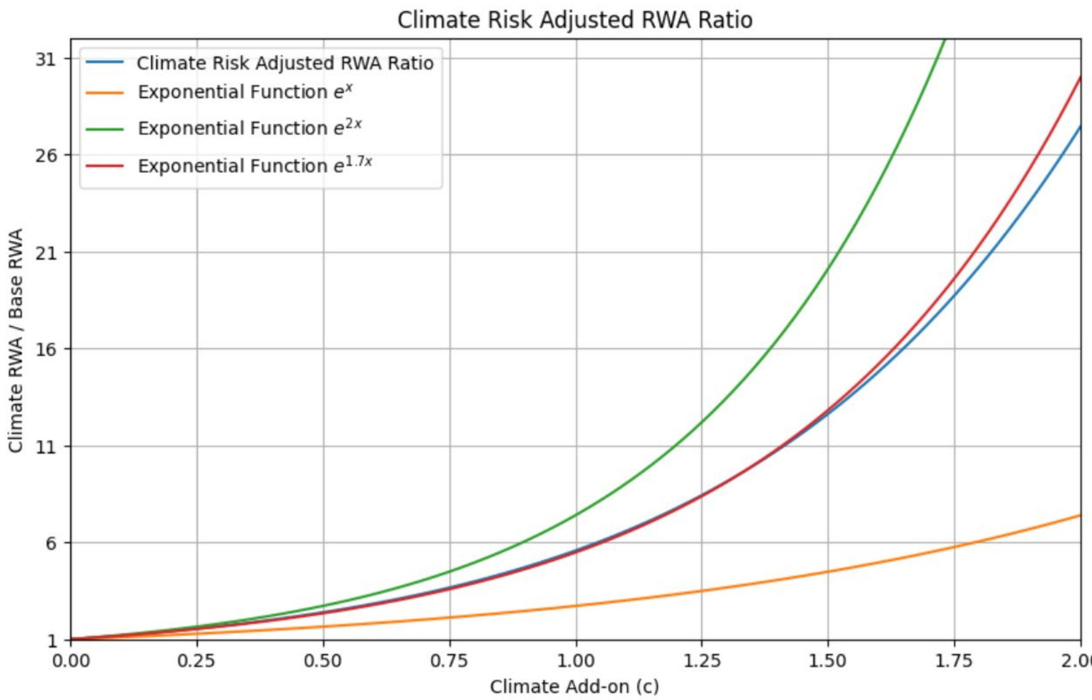
$$b = (0.11852 - 0.05478 \times \ln(0.01))^2 = 0.1374$$

$$K = \left[0.4 \times \Phi\left(\frac{\Phi^{-1}(0.01) + \sqrt{0.15} \times \Phi^{-1}(0.999)}{\sqrt{1-0.15}}\right) - (0.4 \times 0.01)\right]$$

$$\times \left(\frac{1 + (1 - 2.5) \times 0.1374}{1 - 1.5 \times 0.1374}\right) = 0.0401$$

$$baseRWA = 12.5 \times 1{,}000{,}000 \times 0.0401 = 501323.7828$$

By adjusting PD and LGD to climatePD and climateLGD, we calculate the ratio of climate risk to base climate risk, plot the climate add-on (c) from 0 to 2 gives us the following plot:




In the plot, the blue line is the climateRWA/baseRWA, it has a convex shape, so I plotted exponential function $e^c, e^{2c}$, then did a "visual Maximum Likelihood Estimation" and plotted $e^{1.7}$. these extra lines help us to better explore the properties of climateRWA/baseRWA: the rate of change of climateRWA/baseRWA with respect to the climate Add-on first stays relatively flat and then accelerate exponentially, roughly equivalent to $e^{1.7x}$. By changing the climate add-on, OSFI can effectively weight in the consideration of climate risk's impact on "brown asset" that may face risk when government's environmental law shifted. This also effectively nudged banks and insurance companies to invest or issue loans to companies with lower climate risk, since different assets will have different climate Add-ons, they will have less of a burden on banks and insurance companies' balance sheet.

Code available at GitHub.

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Reference

Pazarbasioglu, C., Zhou, J., Le Leslé, V., Moore, M., 2011. Contingent capital. Staff Discussion Notes 11, 1.