ASEAN Climate Vulnerability: Putting the Whole Module Together

Module 4 Companion 6 of 6 lessons

For complete beginners. This capstone uses every tool from Lessons 1 to 5 on the region the module is built for. After it you will be able to score a country's climate risk, roll a shock up to a whole portfolio, and read what it does to a bank's capital.

Deltas, coasts and thin cushions

Southeast Asia is where the abstract risk becomes concrete. Its economies lie on crowded river deltas and long coastlines, depend on farming and tourism, and their banks hold thin cushions compared with European ones. The same storm does more damage here, and the bank that financed the farm has less room to absorb it. The tools of Lessons 1 to 5 apply to that reality end to end.

Start Here: what you need to know first

This capstone reaches back across the module, so its groundwork is a quick refresher of the load-bearing ideas plus two regional ones.

the credit-risk triad and expected loss. When a bank lends money it asks three questions about each loan. **PD**, the **probability of default**, is the chance the borrower fails to repay (for example a 5 percent chance, written 0.05). **LGD**, the **loss given default**, is the share of the money the bank would lose if that happens, after selling any collateral (for example 0.60, meaning it recovers 40 percent). **EAD**, the **exposure at default**, is how much is owed at that moment (for example 300 million). Multiplying the three gives the **expected loss**, the average amount the bank expects to lose on the loan: $EL = PD \times LGD \times EAD$. Climate risk raises PD (borrowers hit by disasters default more often) and LGD (flooded collateral is worth less), so it raises the expected loss.

a portfolio of loans. A **portfolio** is the whole collection of loans or investments an institution holds, looked at together. A bank's **loan portfolio** (or **loan book**) is every loan it has made. The amount tied up in any single borrower or sector is called the **exposure** to that borrower or sector. We care about the portfolio because a shock that hits many loans at once (a flood across a whole farming region) is far more dangerous than one borrower failing on their own.

capital adequacy and risk-weighted assets. Regulators do not count every loan as equally risky. They scale each by how risky it is to get **risk-weighted assets** (RWA). The bank's safety is then judged by its **capital adequacy ratio** (CAR): its capital divided by its RWA. International rules set a floor of 10.5 percent (an 8 percent minimum plus a 2.5 percent buffer). Drop below it and the bank faces hard consequences: it must stop paying dividends and raise fresh capital. A climate stress test asks whether the CAR stays above that line after a climate shock.

percentage points versus percent. Two small units cause big confusion. If a default rate rises from 5 percent to 8 percent, that is a rise of 3 **percentage points** (the gap), not "3 percent." Saying it rose 3 percent would mean it barely moved, to about 5.15. For finer steps bankers use **basis points**: one basis point is one hundredth of a percentage point, so 25 basis points is a quarter of a percentage point. Keeping these straight keeps the numbers honest.

non-performing loans and the NPL-to-GDP ratio. A few country-level words recur in Lesson 6. A **non-performing loan** (NPL) is one the borrower has stopped repaying; the **NPL ratio** is the share of a bank's loans in that state, a key health gauge. **GDP at risk** is the slice of a country's yearly output a hazard could wipe out. **Insurance penetration** is how much of the economy is insured, usually low across developing ASEAN, which is why disasters there hurt so much.

blended finance. Adaptation projects in poorer countries are often too risky for ordinary investors alone. **Blended finance** mixes public or charitable money with private money to make a deal work. The trick is layering into **tranches**: a **first-loss** tranche of **concessional** (cheap, patient) public money takes the first hit if things go wrong, which makes the senior tranche safe enough for commercial investors to join. The public bodies that supply this catalytic money are development finance institutions (DFIs) and multilateral development banks (MDBs).

what econometrics is for. Lesson 6 uses some research tools, but you need only their plain idea. **Panel data** means watching many units (say, banks) over many years at once. **Fixed effects** is a clean-up trick that cancels out the fixed quirks of each bank and each year, so what is left is the real effect you are chasing. And **difference-in-differences** compares the change in a group hit by something (a flood) against the change in a similar group that was not, so the gap between the two changes is the flood's effect. The deck shows the formulas; here the ideas are enough.

reading a regression. Often we want to know how one thing moves with another: does a hotter year raise loan defaults? A **regression** draws the best straight line through the data and hands back a **coefficient**, a number saying how much the result changes when the cause rises by one unit. Two companions to it: the **t-statistic** says whether the relationship is strong enough to trust (a rule of thumb is bigger than about 2), and the **R-squared** says how much of the variation the line explains. You will not run a regression here; you only need to read what a coefficient and a t-statistic are telling you.

The core idea 1: risk is three things multiplied

Disaster experts capture climate risk in one tidy sentence, and it is the backbone of this lesson: risk is hazard times exposure times vulnerability.

$$\boxed{\text{Risk} = \text{Hazard} \times \text{Exposure} \times \text{Vulnerability}.}$$

Hazard is how often and how hard nature strikes (the typhoons, the floods, the heat). **Exposure** is how much value is in harm's way (the people, farms, and loans in the flood plain). **Vulnerability** is how much the thing breaks when struck (a flimsy warehouse versus a hardened one). Because the three are multiplied, two lessons follow at once. If any one of them is zero, the risk is zero. And

you usually cannot change the hazard, so the way to cut risk is to cut exposure or vulnerability. That single insight is what adaptation spending buys.

The core idea 2: rolling one shock up to the whole portfolio

A bank does not lend to one country; it lends across the region. To see its total climate shock, it takes the default jump from each country (the kind of ΔPD you built in Lesson 3) and weights each by how much of the portfolio is there:

$$\boxed{\Delta \text{PD}_{\text{portfolio}} = \sum_i w_i \times \Delta \text{PD}_i.}$$

This is the same weighted-average move you used for carbon intensity in Lesson 4, now pointed at default rates.

Worked example, every step shown

A regional bank splits its loan book across three countries. Vietnam holds half the book (weight 0.50), and a delayed-transition scenario lifts its default rate by 28 percentage points. Thailand holds 0.30 with a 20 point rise. The Philippines holds 0.20 with a 13 point rise.
Weight and add: $0.50 \times 28 + 0.30 \times 20 + 0.20 \times 13 = 14 + 6 + 2.6 = 22.6$.
The whole portfolio's default rate rises by about 22.6 percentage points under this future. One number now stands for the entire region's credit shock, ready to hit the capital line.

The core idea 3: what it does to capital, and why ASEAN has less room

The portfolio shock turns into losses, the losses eat capital, and the capital ratio falls, exactly the subtraction from Lesson 5.

Worked example, every step shown

The group holds $84 of capital against $500 of risk-weighted assets, a ratio of $84/500 = 16.8$ percent. The 22.6 point default shock works through to $15.5 of losses.
Shrink and recompute: $84 - 15.5 = 68.5$, and $68.5/500 = 13.7$ percent.
The ratio falls from 16.8 percent to 13.7 percent, a drop of 3.1 percentage points. It is still above the 10.5 percent floor, but the cushion is much thinner, and in ASEAN it usually started thinner to begin with.

Why thinner? The region's banks tend to run lower buffers and a higher NPL-to-GDP ratio, and the public money for protection is scarce. The most recent credible estimate puts Southeast Asia's annual adaptation finance gap at about US$17.5 billion a year, the shortfall between what is needed to cut vulnerability and what is spent. Closing it is where blended finance comes in, using a slice of public or donor money to make adaptation projects safe enough that private banks will lend the rest.

Beyond this companion: see the lecture deck

The figures above are taught from the ground up with econometrics. Default rates are tracked across countries and years with a panel regression, $\text{NPL}_{it} = \alpha_i + \beta\,\text{climate}_{it} + \varepsilon_{it}$; reverse causality is handled with instruments via two-stage least squares (2SLS); spillovers between neighbours use a spatial autoregressive term (ρW); sharp policy cutoffs are read with regression discontinuity (the McCrary test); and the chance of several countries being

hit together is modelled with a copula. The lecture deck develops these; here, the weighted sums above are enough.

Now you are ready

You have now run the module's whole chain on one region: hazard to exposure to a default shock to the capital line. **Handout Chapter 6** adds the country detail and the policy response, and **Lesson 6 (Deck L6)** brings the panel and spatial tools from the advanced box. That completes Module 4.

Check yourself

1. Write the risk identity in words. *(Risk equals hazard times exposure times vulnerability.)*
2. If you cannot change the hazard, what two levers cut the risk? *(Exposure and vulnerability.)*
3. A book is 0.40 Vietnam (ΔPD $= 30$) and 0.60 Thailand (ΔPD $= 10$). What is the portfolio shock? ($0.40 \times 30 + 0.60 \times 10 = 18$ *percentage points.)*
4. A bank's CAR falls from 15 percent to 11 percent. Is it still above the 10.5 percent floor, and by how much? *(Yes, by 0.5 percentage points.)*

Mini-glossary. *Hazard, exposure, vulnerability:* the three multiplied factors of climate risk. *Portfolio shock:* the weighted-average default jump across a loan book. *Adaptation finance gap:* the yearly shortfall in money spent to cut vulnerability. *Blended finance:* public money used to pull in private lending.

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