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Geopolitical Risk and Financial Stability

FRM Part II

1 Measuring geopolitical risk

- Geopolitical risk: wars, terrorism, tensions between states
- Hard to observe directly, so count the news
- Index: share of newspaper articles on adverse events
- Scaled so the long-run average is 100
- Spikes: start of wars, major attacks, sharp escalation

IN THE LESSON

- Geopolitical risk is the risk of adverse events that disrupt normal relations between states: wars, terrorism, and tensions between states, such as threats, sanctions or a military build up.
- It cannot be observed directly, so economists count the news.
- The usual measure is a news based index.
- It counts the share of newspaper articles in a month that discuss adverse geopolitical events.
- It is usually scaled so that its long run average equals one hundred, so a reading of two hundred means twice the usual amount of coverage.
- The index spikes at the start of wars, after major attacks, and in sharp escalations.

2 Case: a news index for Veloria

Veloria news index. Long-run average share of geopolitical articles: 2%

Articles in the month	sample of newspapers	**2,000**
On adverse geopolitical events	wars, terror, tensions	**60**
Share this month	60 ÷ 2,000	**3%**
Index (average = 100)	3 ÷ 2 × 100	**150**

IN THE LESSON

- Veloria's analysts track a sample of major newspapers.
- Over the long run, two per cent of the articles discuss adverse geopolitical events.
- This month the sample holds two thousand articles.
- Of these, sixty discuss wars, terror or tensions between states.
- The share this month is sixty divided by two thousand, which is three per cent.
- Scale it against the long run average: three divided by two, times one hundred, gives an index of one hundred and fifty.
- Coverage of geopolitical threats is half as large again as usual.

3 Four routes from risk to prices

- Uncertainty: higher risk premium, lower expected cash flows
- Commodities and supply chains: inflation and margins
- Flight to safety: into safe assets, out of emerging markets
- Institutions pull back: less credit, fund outflows
- The last route amplifies the first three

IN THE LESSON

- There are four main routes from geopolitical risk to asset prices.
- First, uncertainty.
- When the outlook darkens, investors become more risk averse and demand a higher risk premium, the extra return over a safe asset that they require for holding a risky one.
- At the same time, firms' expected cash flows fall.
- Second, commodities and supply chains.
- Disruptions to energy, food or shipping push up inflation and squeeze the profit margins of firms that rely on those inputs.
- Third, flight to safety.
- Money moves into safe assets, such as top rated government bonds and gold, and out of emerging markets.
- Fourth, financial institutions pull back credit, and investment funds face outflows.
- This last route amplifies the first three.

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4 Case: the first route in Veloria's stocks

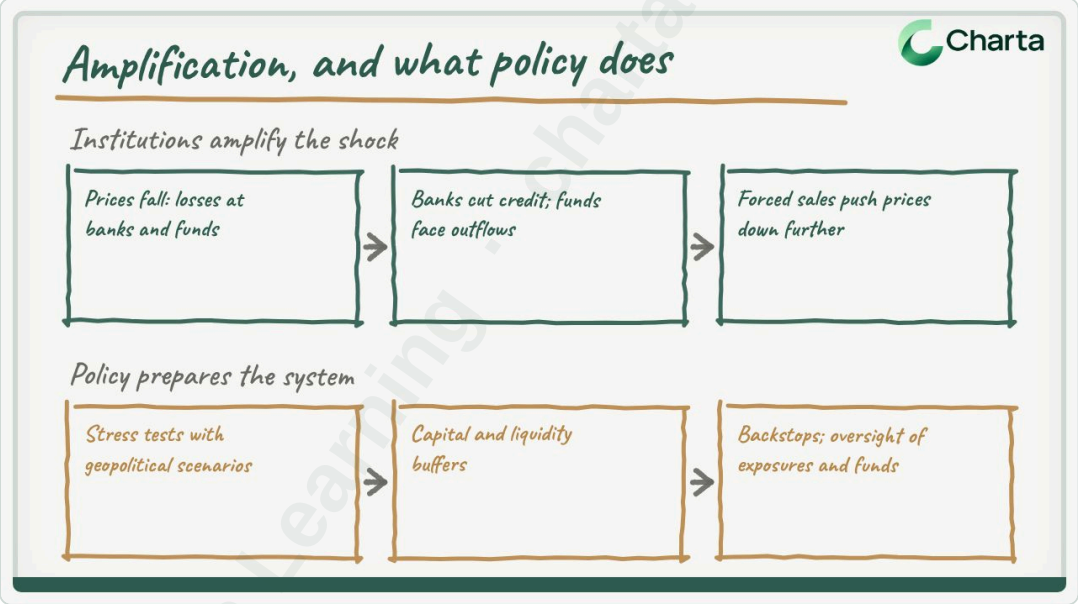
Veloria stocks: next dividend 5, required return 8%, growth 3%. Shock: premium +1 point

Before the shock	5 ÷ (8% − 3%)	**100**
Premium up 1 point: r = 9%	5 ÷ (9% − 3%)	**83.3**
Dividend also cut to 4.8	4.8 ÷ (9% − 3%)	**80**
Total fall	(100 − 80) ÷ 100	**20%**

IN THE LESSON

- Here is the first route in numbers, using the Gordon growth model, which values a stock as next year's dividend divided by the required return minus the growth rate.
- Veloria's stock index will pay a dividend of five next year, investors require eight per cent, and dividends grow at three per cent.
- Before the shock, the value is five divided by eight per cent minus three per cent, which is one hundred.
- Then the risk premium rises by one percentage point, so the required return is nine per cent.
- With the same dividend, the value is five divided by nine per cent minus three per cent, eighty three point three.
- Firms also expect lower profits, so the dividend is cut to four point eight.
- The value is four point eight divided by nine per cent minus three per cent, eighty.
- The total fall is one hundred minus eighty, over one hundred, twenty per cent.

5 Amplification, and what policy does



IN THE LESSON

- Now the fourth route as a chain that can repeat, and what policy does about it.
- Look at the first row, where institutions amplify the shock.
- Prices fall, so banks and funds take losses on what they hold.
- Next, banks cut credit, and investors pull money out of funds.
- Then forced sales of assets push prices down further, and the loop can start again.
- The second row is the policy response, which is mostly preparatory.
- First, supervisors run stress tests with geopolitical scenarios, to see who would be hurt.
- Next, banks hold adequate capital and liquidity buffers to absorb the losses.
- Last, central banks stand ready as liquidity backstops, supervisors watch concentrated exposures, and the liquidity of funds is overseen.
- The point to remember: policy prepares the system.
- It does not remove the shock.

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6 Same event, different marks

- One event, very different effects across markets
- Dividing line: net commodity importers vs exporters
- Terms of trade: export prices relative to import prices
- Energy up: importers lose, exporters gain
- Importers' equities fall more; exporters' less, or rise

IN THE LESSON

- The same geopolitical event does not hit every market equally.
- The main dividing line is between net commodity importers, countries that buy more of a commodity abroad than they sell, and net commodity exporters, which sell more than they buy.
- The key idea is the terms of trade: the price of what a country exports relative to the price of what it imports.
- When an event pushes up energy or food prices, an importer pays more for the same imports, so it suffers a terms of trade loss, while an exporter earns more for the same exports.
- So the importer's equities tend to fall more, while the exporter's fall less, or even rise.
- We can put a rough number on this first round effect.

7 The first-round income effect

Effect = price change × net trade share of GDP
Net trade share: + for an exporter, − for an importer

Effect	Income gain or loss, % of GDP
Price change	% change in the commodity price
Net trade share	(Exports − imports) ÷ GDP

IN THE LESSON

- The first round income effect on a country is roughly the change in the commodity price times the country's net trade in that commodity as a share of its G D P, the value of everything it produces in a year.
- The net trade share is positive for an exporter and negative for an importer, so the sign of the effect depends on which side the country is on.
- Now the terms.
- The effect is the gain or loss of national income, as a share of G D P, before anything else adjusts, such as spending, exchange rates or policy.
- The price change is in per cent, positive when the price rises.
- And the net trade share is exports of the commodity minus imports, divided by G D P.

8 Case: Veloria and Tarsen when oil moves

Veloria: net energy imports 5% of GDP. Tarsen: net energy exports 8% of GDP

Veloria, oil up 40%	40% × (−5%)	**−2.0% of GDP**
Tarsen, oil up 40%	40% × (+8%)	**+3.2% of GDP**
Veloria, oil down 30%	−30% × (−5%)	**+1.5% of GDP**
Tarsen, oil down 30%	−30% × (+8%)	**−2.4% of GDP**

Exporters do not always win: the sign follows the price change

IN THE LESSON

- Veloria's net energy imports are five per cent of its G D P.
- Another country, Tarsen, has net energy exports of eight per cent.
- First, an event pushes oil up forty per cent.
- For Veloria, forty per cent times minus five per cent is minus two per cent of G D P, a real loss of income.
- For Tarsen, forty per cent times plus eight per cent is plus three point two per cent of G D P.
- Now the classic mistake: assuming exporters always win.
- Suppose instead an event lowers oil prices by thirty per cent, for example because it is expected to cut global demand.
- For Veloria, minus thirty times minus five per cent is plus one point five per cent of G D P.
- For Tarsen, minus thirty times plus eight per cent is minus two point four per cent.
- The pattern reverses.

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9 Industries and assets differ too

How groups usually react when an event pushes energy prices up

Group	Typical move	Why
Energy producers	Fare better	Sell at higher prices
Defence firms	Fare better	Defence spending expected up
Airlines	Fare worse	Fuel up, travel down
Consumer discretionary	Fare worse	Households put off spending
Gold, a safe haven	Tends to rise	Investors seek safety

IN THE LESSON

- Industries differ too.
- Here is how groups usually react when an event pushes energy prices up.
- Energy producers tend to fare better, because they sell at higher prices.
- Defence firms also tend to fare better, because investors expect a rise in defence spending.
- Airlines fare worse: fuel costs go up, and travel goes down when tensions rise.
- Consumer discretionary firms, which sell things households can put off, such as cars and holidays, fare worse, as households put off spending.
- Assets differ as well.
- Gold, a classic safe haven, tends to rise, because investors seek safety.

10 Measuring a market's reaction

- Event study: compare returns with what was expected
- Estimation window: calm days earlier, to fit a model
- Event window: the days around the event
- Abnormal return: actual return minus expected return

IN THE LESSON

- How do we measure how much a stock market reacted to an event?
- Prices move every day for many reasons, so we compare what happened with what we would have expected without the event.
- This is an event study.
- First, an estimation window: a stretch of calm days well before the event, used to fit a simple model of how the market normally behaves.
- Second, the event window: the days around the event, for example from the day before to the day after.
- Third, the abnormal return: the actual return in the event window minus the return the model expected.
- The abnormal return is our measure of the event's effect.

11 Abnormal returns and the market model

Abnormal = actual return − expected return
Expected = α + β × market return

Abnormal return	Unexplained part: the event
Actual return	What the asset really earned
α (alpha)	Intercept, fitted on calm days
β (beta)	Sensitivity to the market
Market return	Broad benchmark, same window

IN THE LESSON

- In symbols, the abnormal return equals the actual return minus the expected return.
- The usual model is the market model, where the expected return equals alpha plus beta times the market return.
- Now the terms, from left to right.
- The abnormal return is the part the model cannot explain, which we credit to the event.
- The actual return is what the asset really earned in the window.
- Alpha is the intercept, the asset's average return when the market is flat, fitted on the calm days.
- Beta is the sensitivity, how much the asset usually moves for each one per cent move in the market.
- And the market return is that of a broad benchmark, here a world equity index, over the same window.

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12 Case: Veloria on the day of a global event

Global event. Veloria's market model on calm days: α = 0.1%, β = 1.2

World market return	event day	**−3.0%**
Expected for Veloria	0.1% + 1.2 × (−3.0%)	**−3.5%**
Actual Veloria return	event day	**−6.0%**
Abnormal return	−6.0% − (−3.5%)	**−2.5%**

IN THE LESSON

- A global geopolitical event strikes.
- On the calm days, Veloria's market model has an alpha of zero point one per cent and a beta of one point two against a world equity index.
- First, the world market return on the event day is minus three per cent.
- Second, the expected return for Veloria is zero point one per cent plus one point two times minus three per cent, which is minus three point five per cent.
- Third, Veloria's actual return on the event day is minus six per cent.
- So the abnormal return is minus six per cent less the expected minus three point five, which is minus two point five per cent.

13 Domestic and global events

- Domestic events: hit the local market hardest
- Global events: many markets fall, most with strong links
- Russia's invasion of Ukraine, February 2022
- US-China trade tensions: rounds of tariffs and retaliation
- Spillovers: trade, supply, commodities, finance, mood

IN THE LESSON

- Both domestic and global events matter.
- A domestic event, such as a political crisis or an attack inside one country, hits that country's own market hardest.
- A global event lowers equity prices in many countries at once, and most where trade, energy and financial links to the parties involved are strong.
- Two examples are Russia's invasion of Ukraine in February twenty twenty two, and the escalation of U S China trade tensions, with rounds of tariffs and retaliation.
- Spillovers across borders travel through five channels: trade, supply chains, commodity prices, financial linkages such as cross border lending and investment, and investor sentiment, as fear spreads from one market to the next.

14 Case: one global event, three countries

World market −3%. Expected return from each country's own market model

Country	Exposure	Model	Expected	Actual	Abnormal
Veloria	Far, strong links	α 0.1, β 1.2	−3.5%	−6.0%	−2.5%
Brenna	Next door, few links	α 0.0, β 0.8	−2.4%	−3.0%	−0.6%
Tarsen	Far, energy exporter	α 0.1, β 0.9	−2.6%	−1.8%	+0.8%

IN THE LESSON

- Here is one global event across three countries.
- The world market fell three per cent, and each country's own market model gives its expected return.
- Veloria, with alpha zero point one and beta one point two, is far from the conflict but has strong trade, energy and financial links.
- It was expected to fall three point five per cent, actually fell six, and so has an abnormal return of minus two point five per cent.
- Brenna, with alpha zero and beta zero point eight, is next door, but has few links.
- It was expected to fall two point four, actually fell three, an abnormal return of minus zero point six.
- Tarsen, with alpha zero point one and beta zero point nine, is far away and an energy exporter.
- It was expected to fall two point six, but fell only one point eight, an abnormal return of plus zero point eight.
- Spillover size follows exposure, not distance alone.

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15 Classic mistake: too narrow a window

Tensions build for ten days before an anticipated event. Veloria's abnormal returns

Ten days before the event	sum of abnormal returns	**−3.0%**
Event day only	the narrow window	**−1.0%**
Wide window: whole reaction	−3.0% + (−1.0%)	**−4.0%**
Narrow window catches	1.0 ÷ 4.0	**25%**

The narrow window misses 3.0 points of the fall

IN THE LESSON

- Now a classic mistake.
- Suppose the event was anticipated: tensions built for ten days before it, and investors repriced along the way.
- First, over those ten days, Veloria's abnormal returns add up to minus three per cent.
- Second, on the event day itself, the abnormal return is minus one per cent.
- An analyst who looks only at the event day reports minus one per cent.
- Third, the wide window, which captures the whole reaction, starts ten days before: minus three plus minus one, which is minus four per cent.
- So the narrow window catches only one divided by four, twenty five per cent of the reaction.
- It misses three percentage points of the fall, because part of the repricing happened earlier.

16 Sovereign spreads

- Sovereign spread: government yield minus a risk-free yield
- Pays for the expected loss from default
- Plus a risk premium for bearing that risk
- Shocks widen spreads: mostly premium, some default risk

IN THE LESSON

- Now government bonds.
- A sovereign spread is the yield on a government's bond minus the yield on a risk free benchmark of the same maturity, such as a top rated government bond in the same currency.
- It compensates investors for two things.
- The first is the expected loss from default: the chance that the government fails to pay, times how much would be lost.
- The second is a risk premium, extra pay for bearing that default risk, because a default tends to come in bad times, when losses hurt most.
- Geopolitical shocks widen sovereign spreads, mainly through a higher risk premium, and partly through a rise in perceived default risk.

17 The credit triangle

Spread ≈ default probability × (1 − recovery rate)
Risk premium = spread − expected loss

Spread	Yield − risk-free yield
Default probability	Chance of default in a year
Recovery rate	Share recovered after default
Risk premium	Spread above expected loss

IN THE LESSON

- The credit triangle says the spread is approximately the default probability times one minus the recovery rate.
- With the probability the market prices, the product is the whole spread.
- With a real world estimate of the probability, the product is only the expected loss, and the rest of the spread is the risk premium.
- Now the terms.
- The spread is the bond's yield minus the risk free yield.
- The default probability is the chance of default in a year.
- The recovery rate is the share of the money investors get back after a default, so one minus it is the share lost.
- And the risk premium is the part of the spread above the expected loss.

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18 Case: splitting Veloria's spread

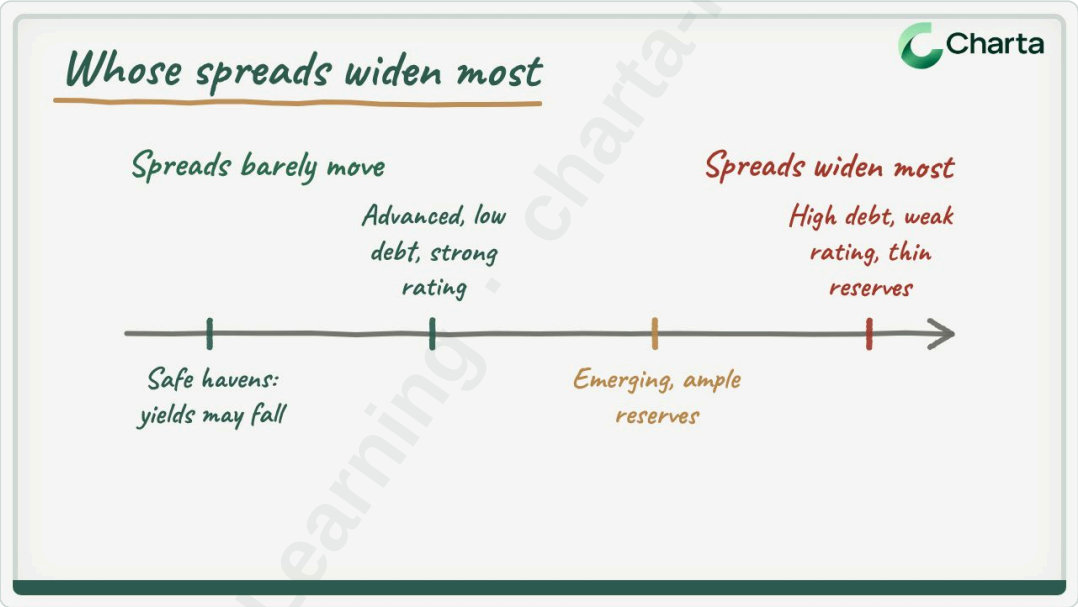
Veloria yield 6%, benchmark 4%, PD 1%, recovery 40%. After: yield 7%, PD 1.5%

Spread before	6% − 4%	**2.0%**
Expected loss before	1% × 60%	**0.6%**
Premium before	2.0 − 0.6	**1.4%**
Spread after	7% − 4%	**3.0%**
Expected loss after	1.5% × 60%	**0.9%**
Premium after	3.0 − 0.9	**2.1%**
Widening: premium + loss	(2.1 − 1.4) + (0.9 − 0.6)	**0.7 + 0.3 = 1.0**

IN THE LESSON

- Veloria's ten year bond yields six per cent and the benchmark four per cent.
- Analysts estimate a real world default probability of one per cent a year, with a forty per cent recovery.
- After the shock, the yield is seven per cent and the default probability one point five.
- First, the spread before is six minus four, two per cent.
- Second, before the shock, the expected loss is one per cent times sixty per cent, zero point six, so the premium is two minus zero point six, one point four.
- Third, the spread after is seven minus four, three per cent.
- Fourth, after the shock, the expected loss is one point five times sixty per cent, zero point nine, so the premium is three minus zero point nine, two point one.
- Last, the widening: the premium rose by zero point seven and the loss by zero point three, one point in all.

19 Whose spreads widen most



IN THE LESSON

- The effect is not equal across countries.
- Picture a line from sovereigns whose spreads barely move, on the left, to those whose spreads widen most, on the right.
- At the far left are safe haven sovereigns.
- Investors flee into their bonds, so their yields may even fall.
- Next come advanced economies with low debt and strong ratings, which are only mildly affected.
- Further right are emerging markets with ample foreign currency reserves, which can cushion the outflows.
- At the far right are countries with high debt, weak credit ratings and thin reserves.
- Investors doubt they can absorb a shock, so their risk premium jumps the most.
- In general, emerging markets are hit harder than advanced economies.

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20 Case: a spread that widens on its own

Veloria's own yield stays at 7%. Investors flee into the benchmark bond

Spread before the flight	7.0% − 4.0%	**3.0%**
Benchmark yield falls	4.0% → 3.5%	**−0.5 point**
Spread after	7.0% − 3.5%	**3.5%**
Change in Veloria's own yield	7.0% → 7.0%	**none**

IN THE LESSON

- There is a twist in how spreads are measured.
- Veloria's own yield stays at seven per cent, but investors flee into the benchmark bond, a safe haven.
- First, the spread before the flight is seven minus four, three per cent.
- Second, the benchmark yield falls from four per cent to three point five, down by half a point.
- Third, the spread after is seven minus three point five, three point five per cent.
- Last, the change in Veloria's own yield: seven per cent before and after, so none.
- The spread widened because the safe haven rallied, not because Veloria became riskier.

21 Classic mistake: reading a CDS as a forecast

Veloria 5-year CDS spread 3.0%, recovery 40%. Is the implied PD a real-world one?

PD implied by the CDS	3.0% ÷ (1 − 40%)	**5.0% a year**
Real-world estimate	after-shock PD, earlier case	**1.5% a year**
Gap: premium, in PD terms	5.0% − 1.5%	**3.5 points**
Overstatement	5.0 ÷ 1.5	**3.3 times**

IN THE LESSON

- A credit default swap, or C D S, is insurance against a government's default, and its spread is the yearly premium.
- Veloria's five year C D S spread is three per cent, with a forty per cent recovery.
- The classic mistake is to solve the credit triangle and call the answer the real world default probability.
- First, the probability implied by the C D S is three per cent divided by one minus forty per cent, five per cent a year.
- Second, the real world estimate, the after shock figure from the earlier case, is one point five per cent a year.
- Third, the gap is five minus one point five, three point five points.
- That is the risk premium, in default probability terms.
- So the implied figure is five divided by one point five, three point three times the real world one.
- It is a risk neutral probability, and it overstates physical default risk.

22 Option markets: level and shape

- Implied volatility: the volatility priced into options
- After a shock, implied volatility rises
- Out-of-the-money puts: pay only after a big fall
- Skew steepens: these puts get dearer than calls
- Rising skew signals demand for protection

IN THE LESSON

- Equity and option markets show geopolitical risk through both levels and shapes.
- An option's price depends on how much the market expects the underlying to move, and the volatility implied by that price is called implied volatility.
- After a shock, implied volatility rises: the level goes up.
- The shape changes too.
- An out of the money put is an option to sell well below today's price, so it pays only after a big fall.
- It is insurance against a crash.
- After a shock, investors rush to buy it, so these puts become dearer relative to at the money options, whose strike is near today's price, and to calls.
- The volatility skew steepens.
- Rising skew signals demand for protection, not only higher average volatility.

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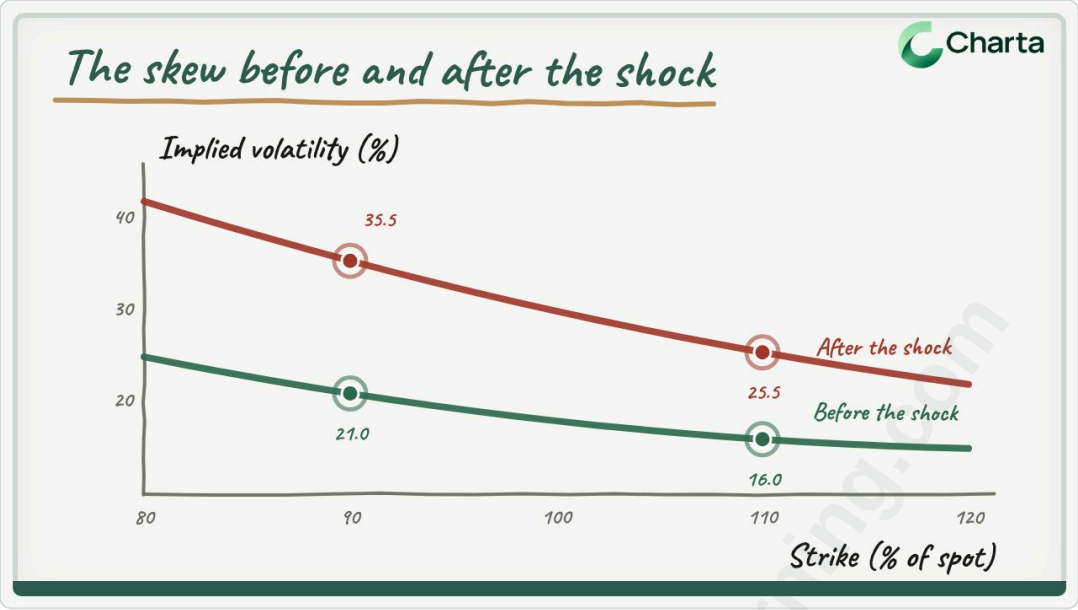
23 The skew before and after the shock



IN THE LESSON

- Here is the skew for Veloria's one month index options.
- Along the bottom is the strike, as a per cent of today's price, from eighty to one hundred and twenty.
- Up the side is implied volatility, in per cent.
- The green curve is before the shock.
- It rises gently to the left, where the puts sit.
- The red curve is after the shock.
- It is higher everywhere, and it rises more steeply to the left.
- Now read the dots, from left to right.
- Before the shock, the put at ninety has twenty one per cent, and the call at one hundred and ten has sixteen, so the gap, call minus put, is minus five points.
- After, the put has thirty five point five and the call twenty five point five, a gap of minus ten.
- That gap between a call and a put volatility is called the risk reversal, and we now put it in a formula.

24 Risk reversal and variance risk premium

Risk reversal = call implied vol − put implied vol
Variance risk premium = implied variance − expected realised variance

Risk reversal	110% vs 90% strikes; or by delta
Variance risk premium	Variance priced above expected
Implied variance	Implied volatility, squared
Expected realised variance	Expected realised vol, squared

IN THE LESSON

- Two measures summarise the shape.
- The risk reversal is the implied volatility of an out of the money call minus that of an out of the money put.
- The variance risk premium is implied variance minus expected realised variance.
- Now the terms.
- In this simplified risk reversal the strikes are symmetric, such as one hundred and ten and ninety per cent of today's price, though market quotes often match the options by delta instead.
- It becomes more negative after a shock, as puts get dearer.
- The variance risk premium is the variance priced above what is expected.
- Implied variance is implied volatility squared.
- And expected realised variance is taken here as the square of expected realised volatility, a simplification.
- So square first, then subtract.

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25 Case: Veloria's risk reversal and variance premium

Veloria options, from the chart. After: ATM implied vol 30%, expected realised vol 20%

Risk reversal before	16.0% − 21.0%	**−5.0 points**
Risk reversal after	25.5% − 35.5%	**−10.0 points**
Implied variance after	0.30^2	**0.090**
Expected realised variance	0.20^2	**0.040**
Variance risk premium	0.090 − 0.040	**0.050**

Wrong: 0.30 − 0.20 = 0.10 subtracts volatilities

IN THE LESSON

- Now in numbers.
- After the shock, at the money implied volatility is thirty per cent, and investors expect realised volatility of twenty.
- First, the risk reversal before the shock: sixteen minus twenty one, minus five points.
- Second, the risk reversal after: twenty five point five minus thirty five point five, minus ten points.
- It doubled in size, because protection got dearer.
- Third, implied variance after the shock is zero point three squared, zero point zero nine.
- Fourth, expected realised variance is zero point two squared, zero point zero four.
- So the variance risk premium is zero point zero nine minus zero point zero four, zero point zero five.
- The classic mistake is to subtract volatilities: zero point three minus zero point two gives zero point one, which is not the premium.

26 Case: the left tail and the wedge

Veloria index, one month: mean 0.6%; volatility 4.0% before, 6.0% after

5% quantile before	0.6% − 1.645 × 4.0%	**−6.0%**
5% quantile after	0.6% − 1.645 × 6.0%	**−9.3%**
Risk-neutral P(fall > 10%)	from option prices	**6.0%**
Physical P(fall > 10%)	normal model, 6.0% volatility	**3.9%**
Tail wedge after	6.0% − 3.9%	**2.1 points**

Wedge before the shock: 1.5% − 0.4% = 1.1 points

IN THE LESSON

- The five per cent quantile is the return that is worse only one month in twenty.
- Assuming normal returns, it is the mean minus one point six four five standard deviations.
- Veloria's monthly mean is zero point six per cent.
- First, before the shock, zero point six minus one point six four five times four per cent is about minus six point zero per cent.
- Second, after the shock, zero point six minus one point six four five times six per cent is about minus nine point three.
- Third, option prices imply a risk neutral probability of six per cent that the index falls more than ten per cent in a month.
- Fourth, the physical probability, from the same normal model with six per cent volatility, is three point nine.
- So the wedge is six minus three point nine, two point one points.
- Before the shock it was one point five minus zero point four, which is one point one.
- The wedge indicates priced tail risk; it is not a price by itself.

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27 Banks and funds under geopolitical risk

- Share valuations: lower price-to-book, weaker returns
- Worse with low capital, weak profits, wholesale funding
- Credit supply: losses and risk weights squeeze capital
- Non-banks: open-end and EM funds face outflows
- Resilience: capital buffers and liquidity buffers

IN THE LESSON

- Last, the financial firms themselves.
- Firms exposed to geopolitical risk, through loans, investments or operations in affected regions, are weakened through three channels.
- First, share valuations.
- Exposed banks trade at lower price to book ratios, the share price divided by the accounting equity per share, and earn weaker returns.
- It is worse for banks with low capital, weak profits or heavy wholesale funding, money borrowed from markets rather than depositors, which can run quickly.
- Second, credit supply.
- Losses and higher risk weights squeeze capital, so lending tightens.
- Third, non banks.
- Investment funds, particularly open end funds, which let investors redeem on demand, and emerging market funds, face outflows.
- What decides resilience is capital buffers and liquidity buffers.

28 Case: two Velorian banks

Two Velorian banks, same book value per share. A geopolitical shock hits

Bank	Book/share	Price before → after	P/B before → after
Marlow: exposed, thin capital	$40	$36 → $26	0.90 → 0.65
Ostrel: low exposure, strong	$40	$44 → $42	1.10 → 1.05
Fall in P/B			0.25 vs 0.05

IN THE LESSON

- Here is the first channel at two Velorian banks with the same book value, forty dollars a share, held fixed for simplicity, when a geopolitical shock hits.
- Marlow Bank is heavily exposed, with thin capital and heavy wholesale funding.
- Its book value is forty dollars.
- Its shares fall from thirty six to twenty six dollars, so its price to book falls from zero point nine to zero point six five.
- Ostrel Bank has little exposure and strong capital.
- Its book value is also forty dollars.
- Its shares fall only from forty four to forty two, so its price to book goes from one point one to one point zero five.
- So the fall in price to book is zero point two five against zero point zero five.

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29 Why a loss shrinks lending

Capital ratio = capital ÷ risk-weighted assets (RWA)
RWA cut = loss ÷ target ratio

Capital ratio	Capital over RWA
RWA cut	Shrink in RWA: less lending
Loss	Hit to capital, e.g. write-downs
Target ratio	The ratio the bank holds

IN THE LESSON

- The second channel works through the capital ratio, capital divided by risk weighted assets.
- Risk weighted assets, or R W A, are the bank's assets, each weighted by its riskiness, so a risky loan counts for more than a government bond.
- A bank that keeps its target ratio after a loss, without raising new capital, must shrink its risk weighted assets.
- The required cut is the loss divided by the target ratio.
- Now the terms.
- The capital ratio is the bank's capital over its risk weighted assets.
- The cut is the reduction in risk weighted assets, mostly through less lending.
- The loss is whatever reduces capital, such as write downs on exposed loans.
- And the target ratio is the ratio the bank wants to hold.
- Because we divide by a small ratio, a small loss forces a large cut.

30 Case: Marlow Bank's credit squeeze

Marlow: capital $12bn, RWA $100bn, target 12%. Loss $1.2bn; risk weights add $3bn

Capital after the loss	12 − 1.2	**$10.8bn**
RWA that capital supports	10.8 ÷ 12%	**$90bn**
Cut from the loss	1.2 ÷ 12%	**$10bn**
Plus higher risk weights	10 + 3	**$13bn in all**
Wrong: cut equals the loss	ignores the division	**$1.2bn**

IN THE LESSON

- Marlow Bank has capital of twelve billion dollars and risk weighted assets of one hundred billion, a ratio of twelve per cent, which is its target.
- A geopolitical shock causes a loss of one point two billion, and higher risk weights on exposed loans add three billion of risk weighted assets.
- First, capital after the loss is twelve minus one point two, ten point eight billion.
- Second, the risk weighted assets that capital supports are ten point eight divided by twelve per cent, ninety billion.
- Third, the cut from the loss is one point two divided by twelve per cent, ten billion.
- Fourth, the higher risk weights must be offset too: ten plus three, thirteen billion in all.
- The classic mistake ignores the division and cuts by the loss itself, one point two billion.
- The true cut is more than ten times that.

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31 Case: outflows from Marlow's bond fund

Marlow EM Bond Fund: $2,000m of assets, $60m in cash. Investors redeem 10%

Redemptions	10% × $2,000m	**$200m**
Paid first from cash	the cash buffer	**$60m**
Forced asset sales	200 − 60	**$140m**
Wrong: sales = gross outflow	ignores the cash	**$200m**
With $200m of cash	200 − 200	**$0**

IN THE LESSON

- Now the third channel, at Marlow's emerging market bond fund, an open end fund with two thousand million dollars of assets, sixty million of it in cash.
- After the shock, investors redeem ten per cent.
- First, redemptions are ten per cent of two thousand million, two hundred million dollars.
- Second, the fund pays first from its cash buffer, sixty million.
- Third, the forced asset sales are two hundred minus sixty, one hundred and forty million, often into a falling market.
- Fourth, the classic mistake treats the whole two hundred million as forced sales, which ignores the cash.
- Last, with two hundred million of cash, forced sales would be two hundred minus two hundred, zero.
- Outflows net of cash are what force asset sales, and such fire sales push prices down further.

32 Mistakes to avoid

- Thinking policy removes the shock: it prepares the system
- Assuming commodity exporters always win
- Too narrow a window for an anticipated event
- Reading a CDS-implied PD as a real-world probability
- Subtracting vols for the VRP; cutting RWA by the loss

IN THE LESSON

- Before the quiz, here are the mistakes to avoid.
- Do not think policy can remove a geopolitical shock: it prepares the system to absorb it.
- Do not assume commodity exporters always win, because an event that lowers commodity prices reverses the pattern.
- Do not use too narrow an event window for an event that was anticipated, or you will understate the reaction.
- Do not read a default probability implied by a C D S spread as a real world probability: it is risk neutral and includes the premium.
- And do not subtract volatilities for the variance risk premium, or cut risk weighted assets by the loss alone.
- Square first, and divide the loss by the target ratio.

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33 Try three quick questions

1. Copper falls 20%. Net copper exports are 10% of GDP. First-round effect?
   Answer: −20% × 10% = −2.0% of GDP: the exporter loses.
2. CDS spread 2.5%, recovery 50%. Implied PD? Is it real-world?
   Answer: 2.5% ÷ (1 − 50%) = 5.0% a year; risk-neutral, so it overstates.
3. Target capital ratio 10%, loss $0.5bn. Cut in RWA?
   Answer: 0.5 ÷ 10% = $5bn of RWA.

IN THE LESSON

- Try three quick questions, then listen to the answers.
- Question one.
- Copper prices fall twenty per cent, and a country's net copper exports are ten per cent of its G D P.
- What is the first round effect?
- Minus twenty per cent times ten per cent, minus two per cent of G D P: here the exporter loses.
- Question two.
- A C D S spread is two point five per cent and recovery is fifty per cent.
- What default probability is implied, and is it real world?
- Two point five divided by one minus fifty per cent gives five per cent a year, but it is risk neutral, so it overstates real world risk.
- Question three.
- A bank targets a ten per cent capital ratio and loses half a billion dollars.
- How much must its risk weighted assets shrink?
- Zero point five divided by ten per cent, five billion dollars.

Summary notes for the Charta whiteboard lesson. Figures are from the lesson's made-up examples.

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