CLIMATE RISK IN THE BANKING INDUSTRY | THE CHALLENGES TO 2050

Understand the limits of climate risks modeling

For Risk Manager…

PREAMBLE

This publication is a synthesis of several months of reflection and sharing with experts in the sector and on the climate issue. I would particularly like to thank them for their help, their comments, and their insights.

Thanks are also due to all the open access (or not) studies that supported the formulation and structuring of the ideas expressed in this document.

These ideas are intended to contribute to an informed and constructive debate among risk practitioners, regulatory experts, and researchers. They are intended solely to serve the common good through initiatives focused on the financial sector.

The opinions expressed in this publication are those of the author and do not necessarily reflect the official position of CH&CO.

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Synthesis for Risk Practitioners

This short paper proposes the idea that **the characteristics of climate risk cannot be properly modelled by the usual approaches, especially statistical ones.**

This idea is based on the principle that, unlike other risks, climate risk does not have a standard distribution profile, since it evolves. This leads to the question, in the long term, of the future coverage of this risk by banking institutions (equity, provisions or both?)

6 major ideas summarize the subject:

1. The climate risk must be able to be expressed as the probability **that the variation in CO_2 of Anthropocene origin between two periods of time is strictly positive.**
2. **The climate risk appetite of the financial sector is therefore understood as the additional level of CO_2 of Anthropocene origin that remains to be financed or invested.** This level can in no way exceed the threshold set by the Paris agreements, without any time limit.
3. **Climate risk lacks generalizable statistical attributes.** Conventional banking models, especially statistical approaches, cannot account for changes in climate risk, nor can they assign a standard distribution profile to it.
4. **The probability of occurrence and the severity of a climate risk are strictly increasing over time.** In this respect, the split between EL and UL would be rather favourable to EL over the long term (what is considered UL today could in fact be defined as EL in 2050 - central role of the articulation between provision and capital in future years, not "Capital only").
5. **The systematic nature of climate risk must lead to the outsourcing of part of the capital mobilized by banks to cover this risk in ad hoc structure.** (Function of solidarity and countercyclicality of this structure in order to cover the occurrence of a risk which we do not know when or where it may strike but which we know will happen.)
6. **ALM risk is the one whose impact is the most underestimated among banking risks** (distortion of the maturities of balance sheet items, changes in customer behaviour and balance sheet options, changes in the interest rate structure).

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1. The expression of climate risk

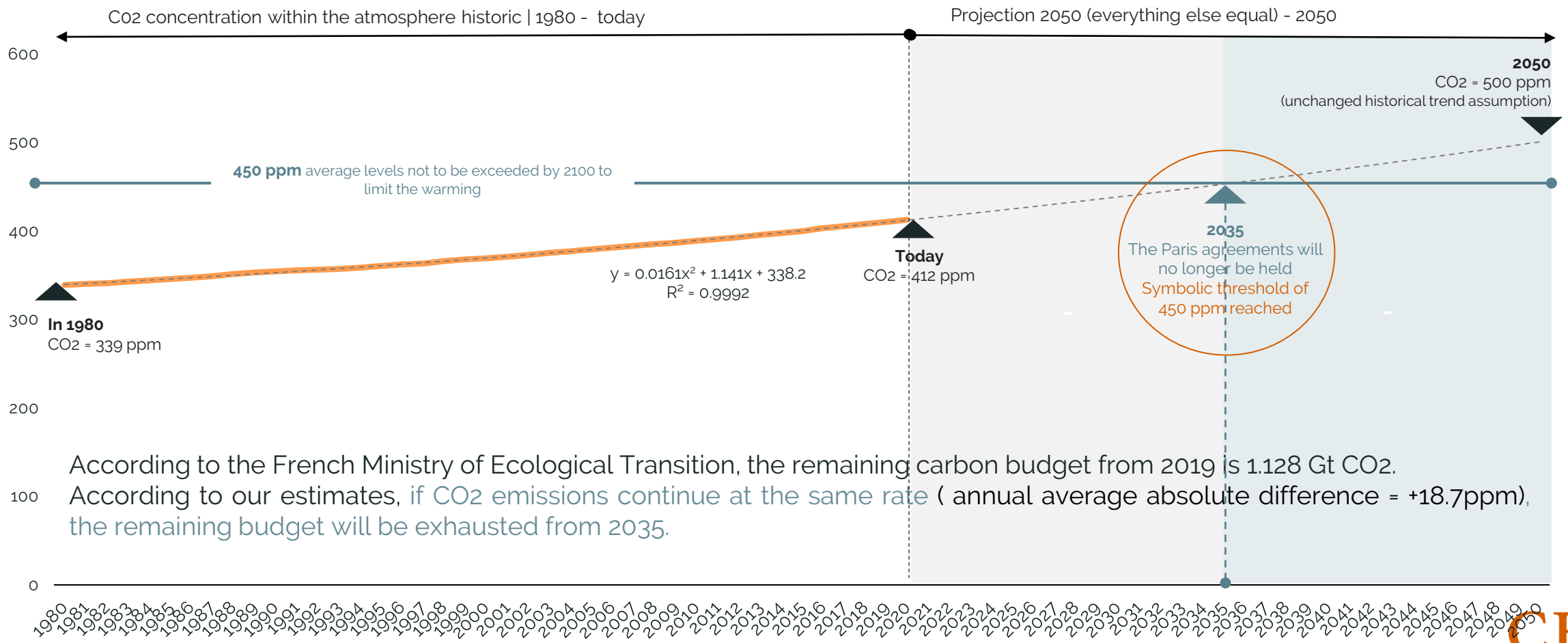
“The climate risk can be expressed as the probability that the variation of CO2 of anthropogenic origin between two successive time periods is strictly positive. ”

FROM PHYSICAL LAWS TO FINANCIAL MARKETS

The Lack of Manoeuvre Margin

CO2 concentration within the atmosphere | Trend for 2050

Exprimé en partie pour million (ppm).



According to the French Ministry of Ecological Transition, the remaining carbon budget from 2019 is 1.128 Gt CO2.
According to our estimates, if CO2 emissions continue at the same rate (annual average absolute difference = +18.7ppm), the remaining budget will be exhausted from 2035.

CMDGS under the auspices of WMO, 2018

CLIMATE RISK EXPRESSION

A Universal Expression of Climate Risk

According to us, the climate risk can be expressed as the probability **that the variation of CO2 of anthropogenic origin between two periods of time is strictly positive.**

This probability can be expressed according to the expression opposite.

Even if this risk can take different forms such as physical or transitional risks (expression of consequences), its definition and characteristics, notably its intensity and frequency, can only have a systemic origin where the isolated action of a single actor is considered as null.

$$Climate\ Risk$$

$$= P\left(CO^2_{t+1} > CO^2_t\right)$$

$$= P\left(CO^2_{t+1} - CO^2_t > 0\right)$$

$$= P\left(\Delta^{CO2}_{t+1\,-t} > 0\right)$$

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CLIMATE RISK EXPRESSION

An Expression Aligned with the Paris Agreement (+2° C)

If we apply the above-mentioned principle to international issues (Cop21 in particular), the climate risk is expressed **more as a conditional probability.**

Indeed, the climate risk is then the probability that the level of CO2 in the atmosphere goes beyond the threshold defined by the Paris Agreement.

In other words, the climate risk is the probability that the **sum of future positive CO2 variations** (the increase in cumulative CO2 in the atmosphere and of anthropogenic origin) **does not exceed the threshold of 450 ppm.**

This can be translated into the following simplified expression:

$$Climate\ Risk$$

$$= P\left(CO_{t+1}^2 - CO_t^2 > 0 \mid Max\ CO_{2100}^2 < S\right)$$

$$= P\left(\Delta_{t+1\ -t}^{CO2} > 0 \mid Max\ CO_{2100}^2 < 450\ ppm\right)$$

$$Simplified\ expression$$

$$= P\left(\sum_{i=Today}^{2100} \Delta_i^{CO2} < 450\ ppm\right)$$

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CLIMATE RISK APPETITE FRAMEWORK

An Appetite for Climate Risk Dependent on Two Factors

The challenge for the financial sector is to measure its direct and indirect contribution to the rise in climate risk. **This could well be expressed as the level of CO2 financed or invested observed on the balance sheet of all known banks at a given date (idea of carbon intensity). This also indicates the degree of climate risk appetite of the sector.**

The total of this amount (current and future for that matter) cannot lead to exceeding the banking sector's tolerance **threshold that delimits the theoretical reserve of CO2 available before reaching 450 ppm.** This threshold should never be exceeded in theory.

The probability that this threshold will be reached depends factually on 2 factors:

- **The volume of anthropogenic CO2** generated by the activities financed by the banking sector as a whole. This one must reach 0 before reaching the tolerance threshold.
- **The speed of reduction of this volume** by the banking sector as a whole. This must be consistent with international targets.

Given X: ***The additional volume of CO2*** *generated by the funded activities and the investments made*

$$= P\left(X_{t+1}^{CO2} > X_t^{CO2}\right)$$

$$= P\left(\Delta_{t+1\,-t}^{CO2} > 0 \mid Max\ CO_{2100}^{2} < 450\ ppm\right)$$

Given Y : ***the average annual speed Increase in the additional volume Of CO2 generated by the financial sector***

$$= P\left(Y_{t+1}^{CO2} < Y_t^{CO2}\right)$$

$$avec\ \left(Y_{t+1}^{CO2} - Y_t^{CO2}\right)\ coverging\ towards\ 0\ before\ 2050$$

The additional volume of CO2 financed by the banking industry each year (X) is a function of the speed (Y), itself dependent on the level of global activity.

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SCENARIO OF RESPECT OF THE + 2° C BY 2050

A scenario insensitive to the isolated action of a bank or a group of banks

The climate risk appetite of the financial sector is expressed as the level of additional anthropogenic CO2 remaining to be financed or invested. This level may not exceed the threshold set by the Paris agreements, and there is no time limit.

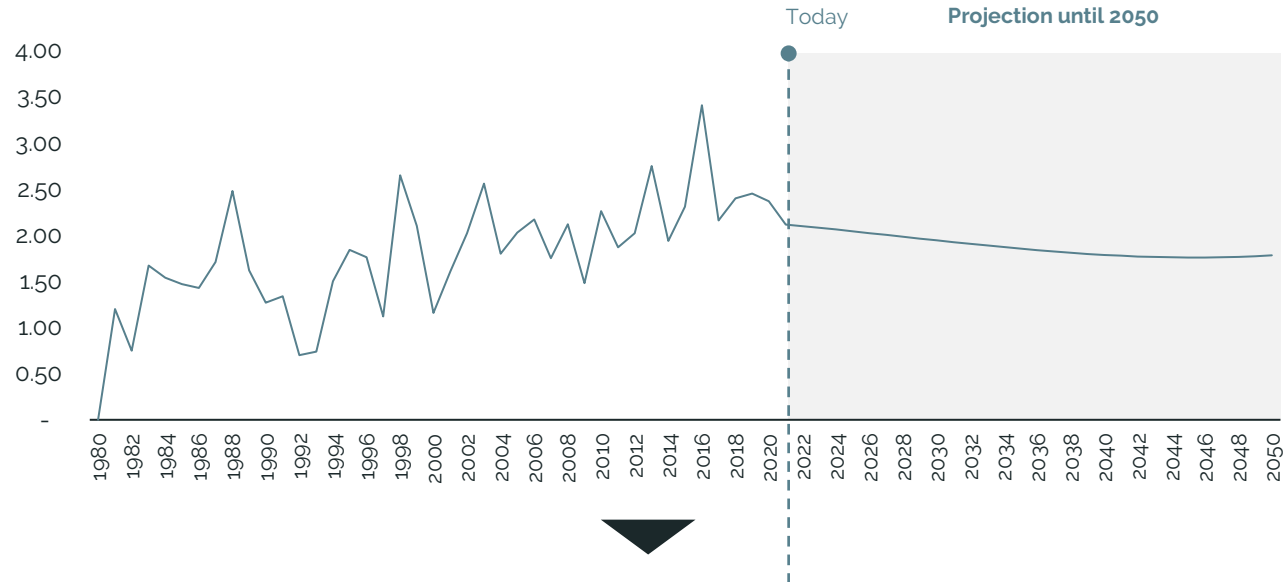
To avoid exceeding this threshold, the rate of additional CO2 emissions financed by banking institutions must decrease to 0 before the +2° C threshold is theoretically reached. This is to ensure that the cumulative total of CO2 in the air does not exceed the tolerance threshold of 450 ppm.

The probability that this trajectory will be respected is now close to 0

In this situation, isolated action has no effect. A bank with a **satisfactory carbon balance does not mean that its climate risk is reduced.** This risk, which is systemic in nature, is only reduced by the sum of the individual and combined actions of all banks as a whole and at the same time. **The actions of international supervisors and public authorities are therefore fundamental.**

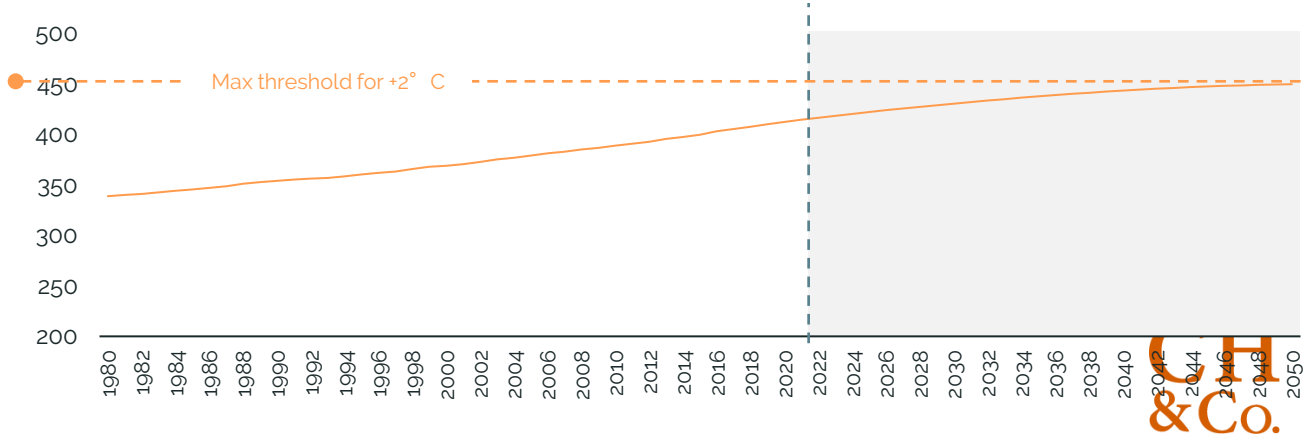
Annual Variation of CO2 in the Atmosphere

Favourable scenario for reducing CO2 emissions the 450 ppm threshold *(Paris Agreement)*



Cumulative CO2 levels in the atmosphere(in ppm)

Favorable scenario for reducing CO2 emission to the 450 ppm threshold



2. Climate risk properties

“The properties of climate risk lead us to consider that this risk is still unknown, in constant evolution and underlining the weakness of traditional statistical methods.”

CLIMATE RISK PROPERTY| #1

A risk with an unknown and non-stationary profile

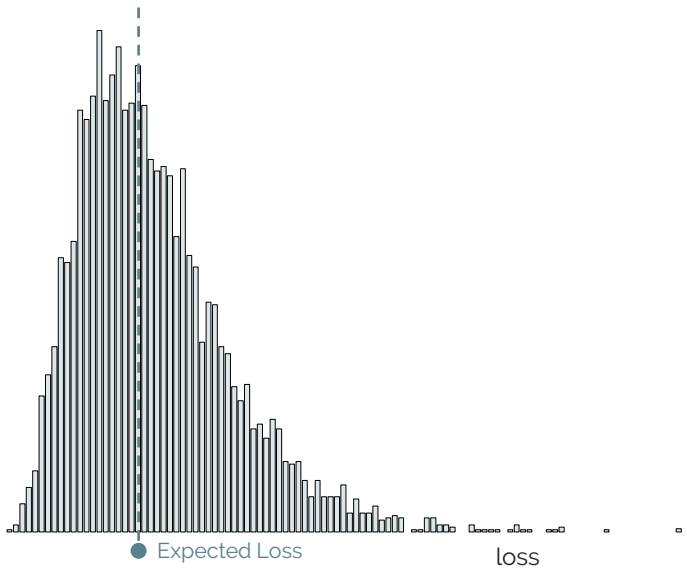
The loss distribution profile for each of the "classic" banking risks is known. It is on these standard profiles that the assumptions of risk modelling in financial institutions are based (Normal Law, EVT ...)

Climate risk does not have this advantage:

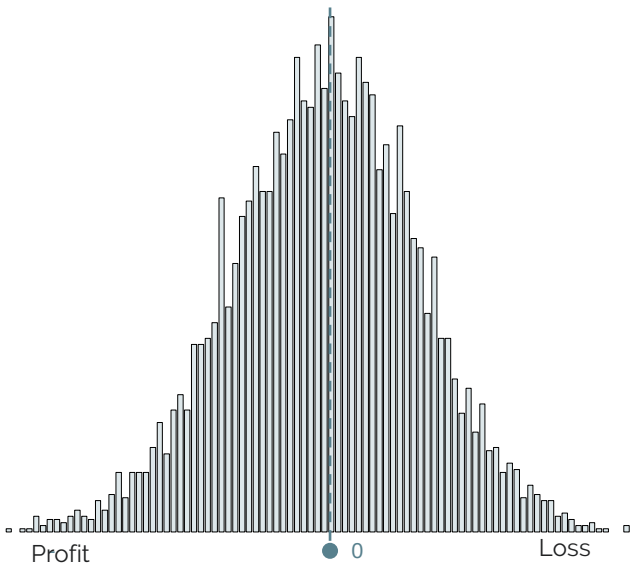
1. Firstly, because it is **impossible today to deduce a recognizable and therefore reproducible distribution profile of climate losses.**
2. Secondly, because **this risk is not stable over time.** Its characteristics change according to environmental developments. Moreover, it is confirmed that the higher the average global temperature rises, the greater the uncertainty of the models.

=> It could be useful for banks to think about using non-conventional models (World3 type: retroactive loop model) rather than statistical regressions

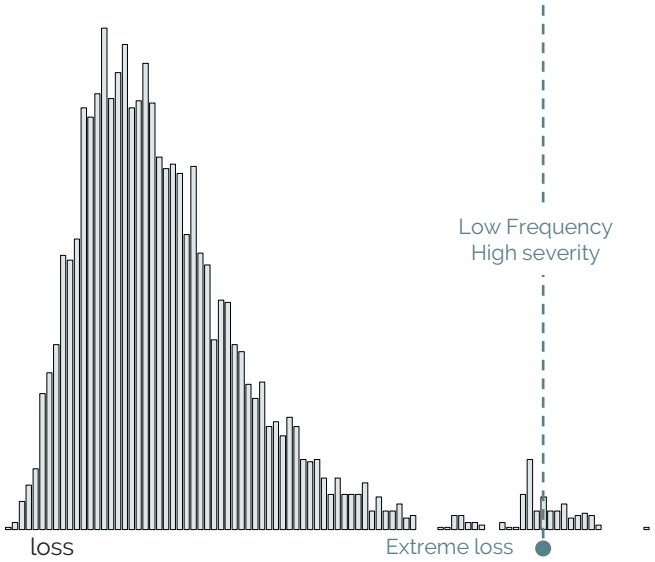
Credit risk profile



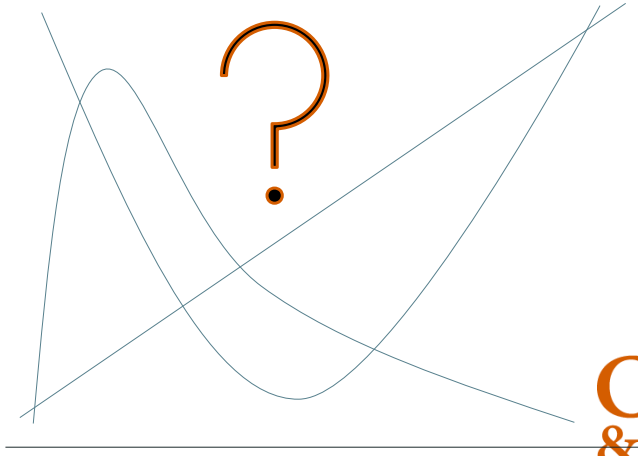
Market risk profile



Operational risk profile



Absence of climate risk profile



CLIMATE RISK PROPERTY| #2

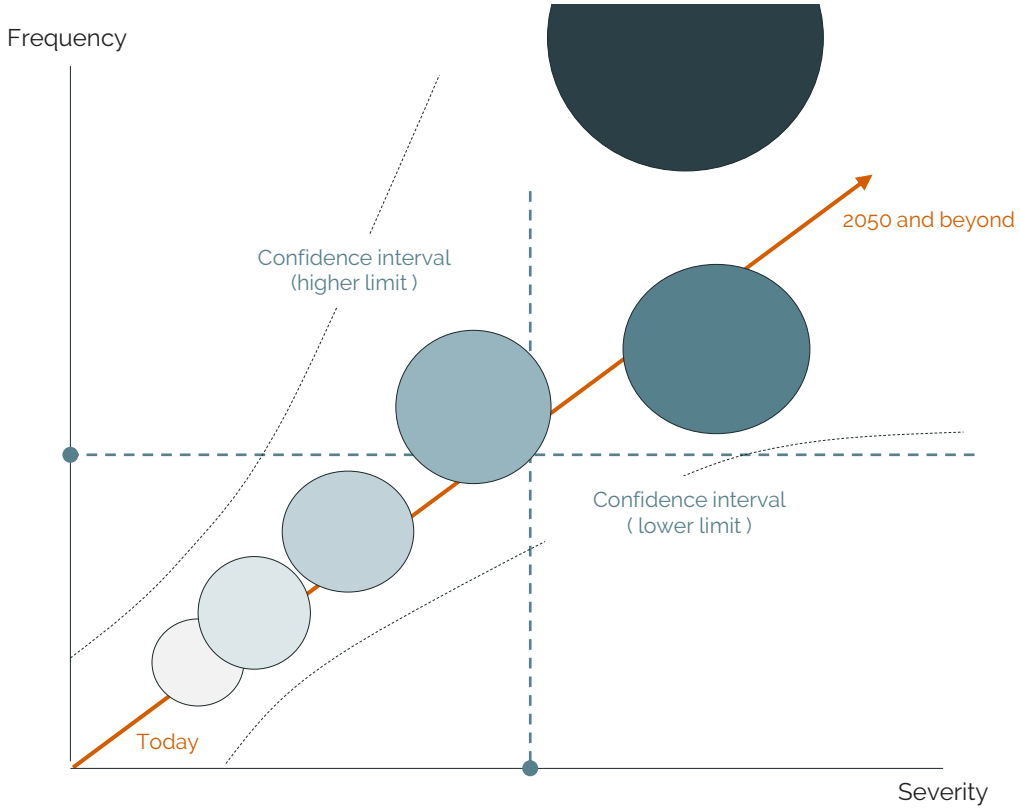
A Growing Risk Strictly Monotonous

Paradoxically, climate risk presents a certain trajectory. Like other risks whose trajectories are partially linked to economic cycles or to the evolution of markets, climate risk follows a strictly monotonic increasing trajectory.

The frequency of climatic events and their severity increase systematically, but with a degree of precision that is inversely proportional to the passage of time: It is thus certain that climate risk is increasing, but it is not known precisely by how much and with what consequences.

=> It could be useful for banks to consider climate risk as a risk whose materiality is increasing indefinitely and whose degree of accuracy in predicting future environmental losses is deteriorating (increasingly wide confidence interval)

A Growing Strictly Monotonous Risk
With a degree of accuracy inversely proportional to the time passed



CLIMATE RISK PROPERTY| #3

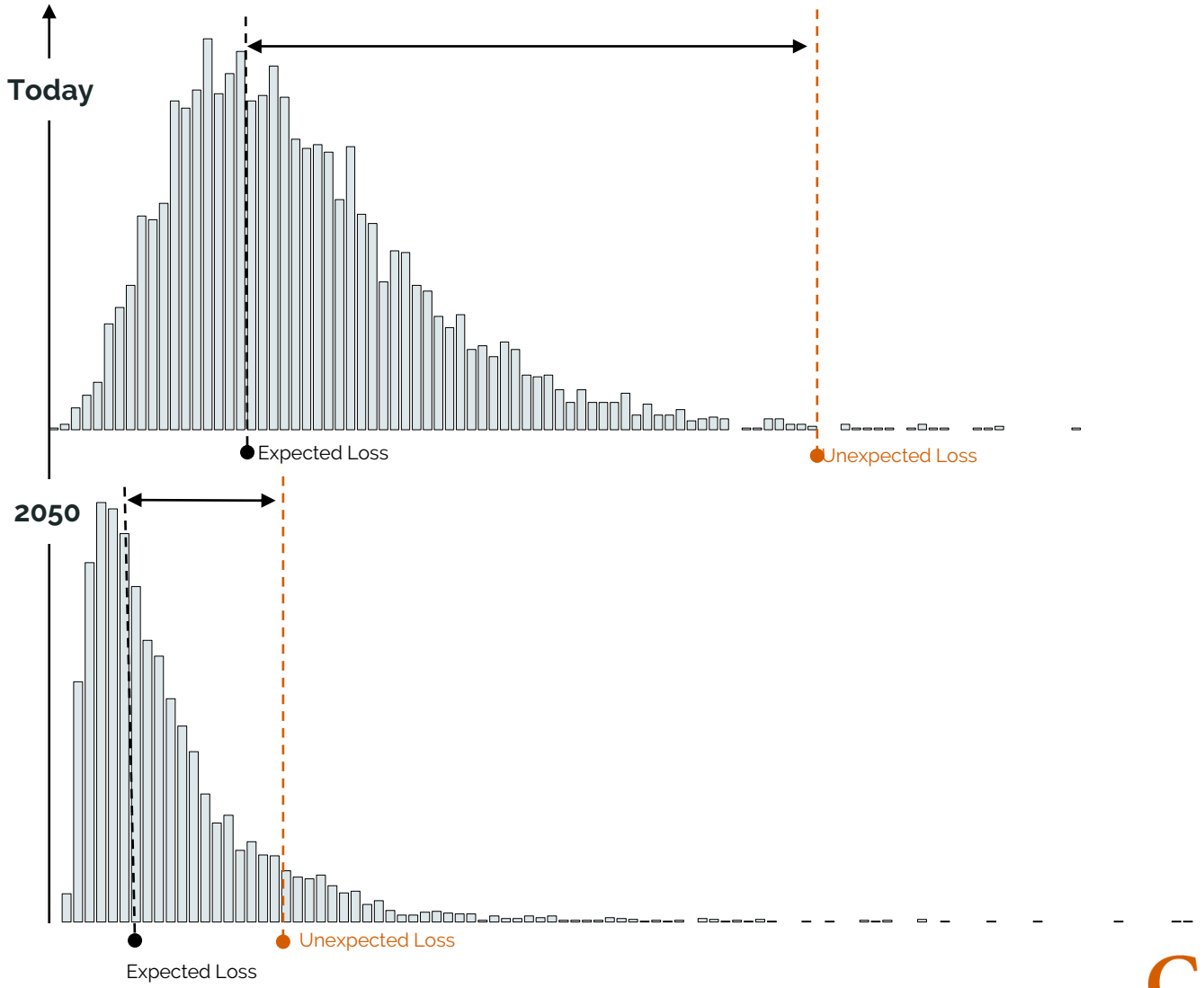
On the Long Term, a Risk that generates EL rather than UL.

The current debate is to know how to propose the coverage of the climate risk by the prudential equity (Pillar 1 or Pillar 2 for that matter)

However, if the climate risk is really monotonic and increases with time, it is appropriate to anticipate that the expectation of climate losses will also increase.

In other words, on a long-term horizon (2050?), climate losses could rather be managed in the manner of "**Expected Climate Loss**."

=> It could be useful for banks but also for international regulatory authorities to anticipate the coverage of climate risks by equity capital but also progressively by the appearance of a new form of provisioning (dedicated IFRS?)



3. Climate Risk management principles to 2050

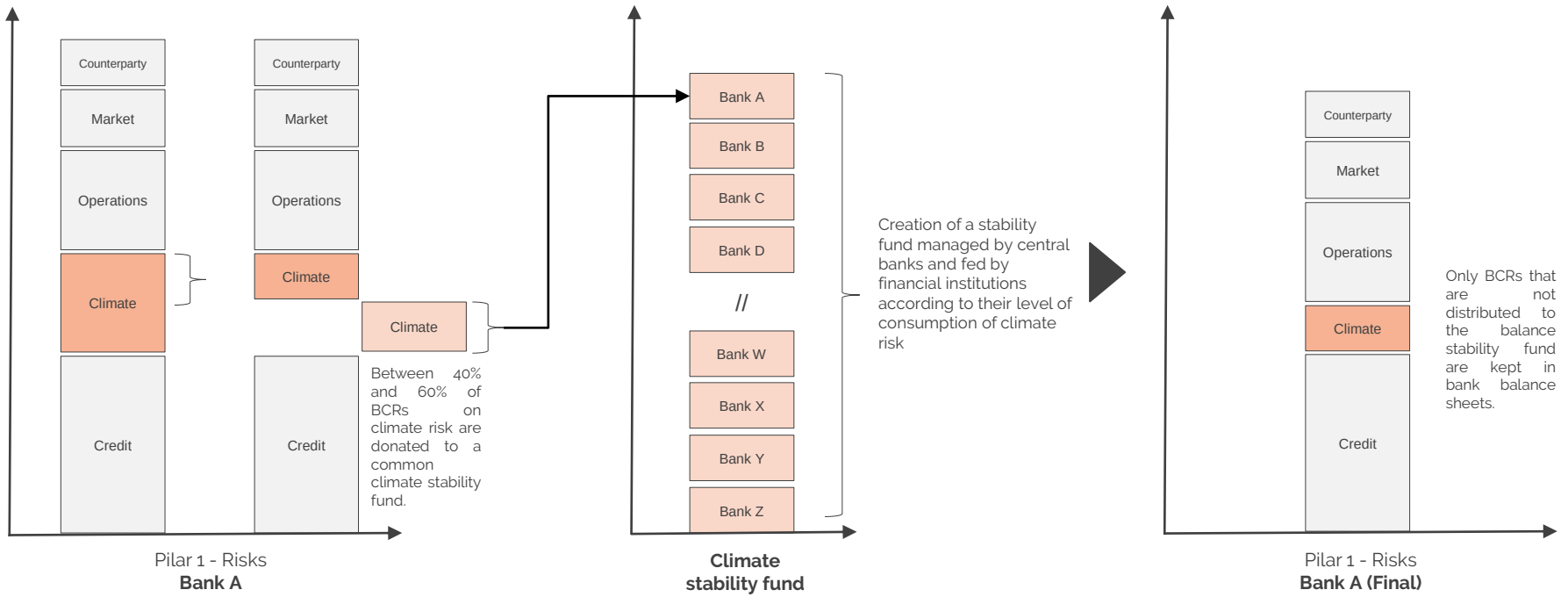
“Climate risk has the particularity of making isolated action useless. The good student will invariably see his climate risk increase if the whole market does not follow him. It is therefore irremediably subject to.”

PRINCIPLE #1

Systematic management of BCRs under climate risk : outsourcing

Because climate risk can occur randomly, without any predefined format, and independently of the quality of a banking institution's ESG system, its management must be a systemic and global response.
The idea would be to propose a collective insurance policy financed by the market and aimed at the market.

1 **Principle #1** | Creation of a climate stability fund financed by the capital requirements (BCR) of banks

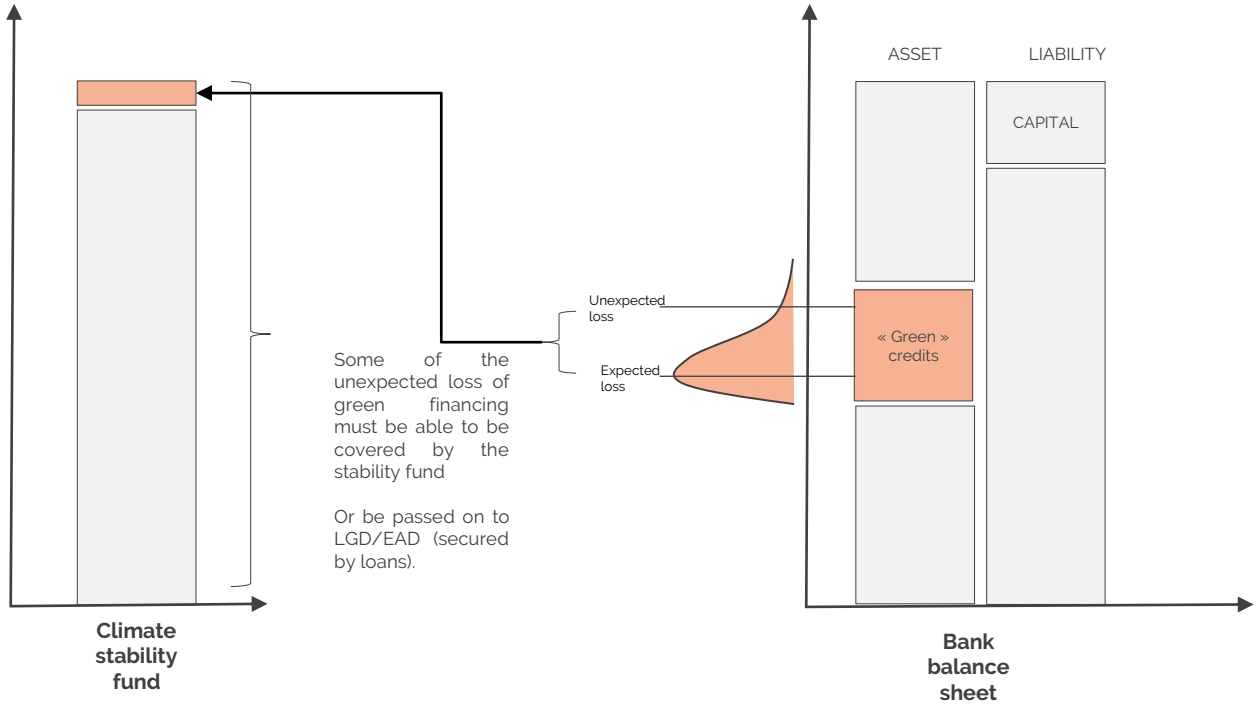


PRINCIPLE #2

A solidarity fund that guarantees stability and resistance to climate change.

The creation of an externalized cushioning effect would allow the banking market to recapitalize in the future the banks directly affected by a major climate risk without impacting the solvency of other institutions (as long as the latter participate in this solidarity mechanism).

2 **Principle #2** | The climate stability fund used as a first-loss absorber for « green » or transitional financing



PRINCIPLE #3

A long-term mechanism, progressive and aligned with the speed of climate change

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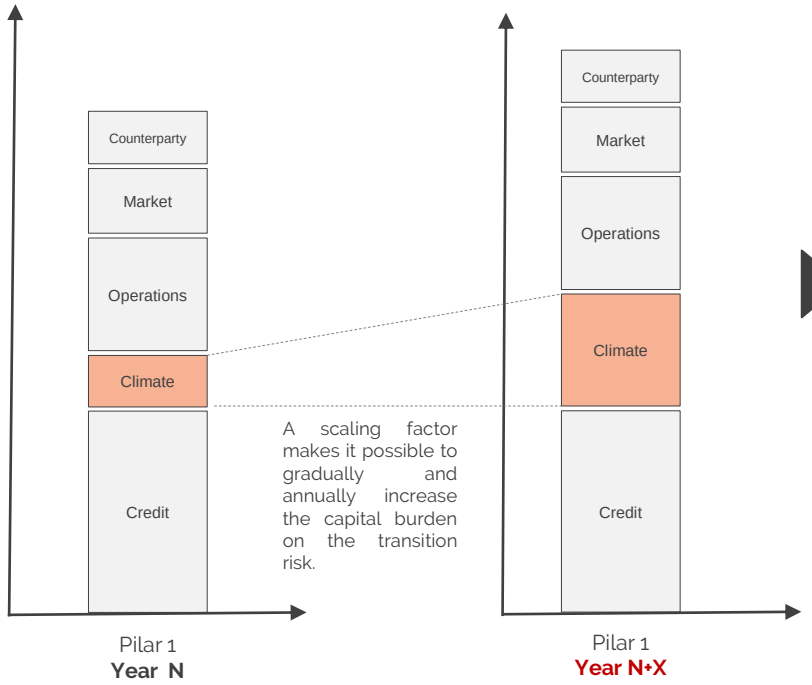
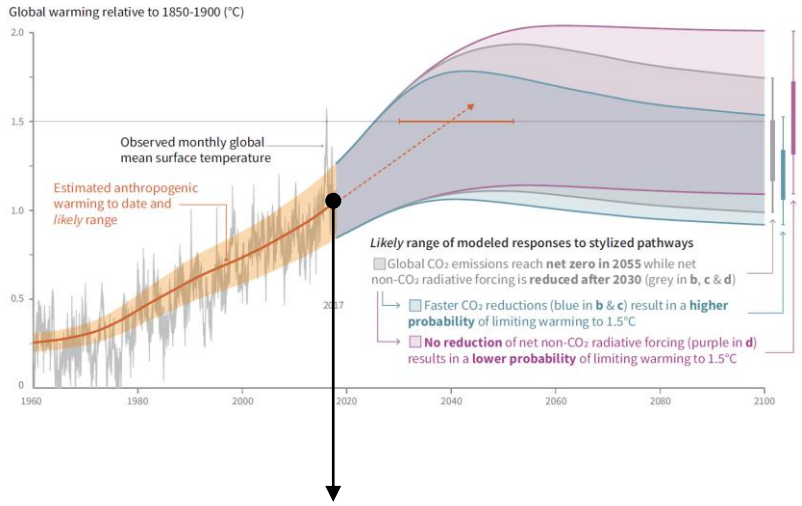
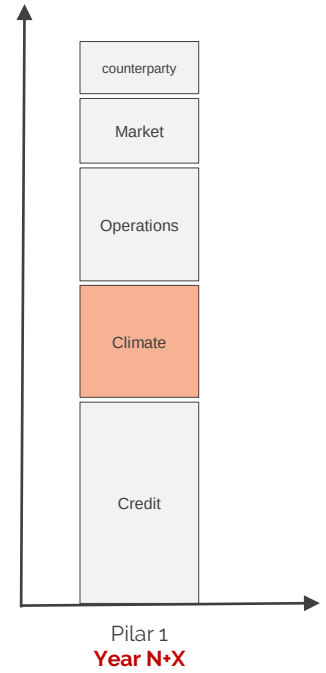
Principle #3 | Progressive integration of transition risk into prudential capital and alignment with international climate scenarios (IPCC)



Illustration

Source : IPCC, 2018. Summary for policymakers





We propose that **the annual progression of banks' capital levels be indexed to the climate scenarios** proposed by the IPCC

A **scaling factor should thus be applied**. In principle, the more the cumulative consumption of CO2 increases, the more the level of prudential capital must also increase.

PRINCIPLE #4

Coverage by equity(UL) and by provisions(**Expected Climate Loss**)

4 **Principle #4** | In the long term, the partial but gradual substitution of BCRs by provisions for climate risk