Webinar: Where is the Climate Risk Premium?
29 June 2023

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Moderator: **Frédéric Ducoulombier**, Director of EDHEC-Risk Climate Impact Institute

General Considerations and a Big Thank You.

First of all, I would like to thank the delegates who have sent me really interesting questions. I have done my best to provide answers in this document.

Second, I would like to clarify a crucial point: the primary objective of the talk was not to propose a specific policy recommendation; rather, it was tailored with investors in mind. So, when I say that the climate risk premium could be of the order of half a percentage point, I do not mean that future GDP will decrease because of climate damages by the same amount. The impact of climate change on economic growth and on asset risk premia are two totally different question. I elaborate on this in the body of this Q/A paper.

Last, the quantification of the climate risk premium (between a quarter and a half percentage point) has been only provided to give an idea of the *order of magnitude* of the effect. There are cases (e.g., different abatement schedules) when the number can be significantly higher or lower. Overall, please take the numbers I have provided as skewed towards the lower bound of what it could be: I do not like dramatizing messages, and I always prefer to be safe than sorry. When the proper paper that we are producing on this topic becomes available, the best estimates of all the values in the different possible conditions will be spelled out precisely.

Thank you again!

Questions and Answers

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Systemic risk is generated by non-linear outcomes in relation with "trigger events" (e.g., high increase of temperature), did you attempt to model that?" 8

I trust the boundaries of open/closed economic and physical systems are important. Until we know what additional costs are applied to climate damaging enterprises (or are expected to be by the markets), the impact on risk premia may not be realised, do you agree? 8

Hedge by brown or green assets? Why not use carbon allowances?

The choice of hedging instrument is dictated by a host of considerations, such as liquidity, need to post collateral, balance sheet utilization, etc. This is an interesting but altogether different question from that addressed here. The first thing we need to determine is 'which way is up': will something behaving like a 'green' security act as a climate hedge or will it add to risk? This is the question I was trying to answer. If green-like securities tend to do well when the economy is strong, then they do not act as hedges. 'Risk' in this context is aggregate risk: the risk on your total portfolio. Investors do not care about 'named' risks (climate, liquidity, credit). In the end, they are only affected by shocks in consumption (roughly speaking, shocks to their global equity portfolio).

The discussion about hedges is fine but we do not know whether the economy will do poorly or strongly when climate risk will peak…

None of these things can be known with certainty, and this applies to any macro financial relationship – what we *can* work out are regularities based on a causal mechanism. This is what I have tried to do.

Can you explain again why hedging climate risk is not always desirable?

From the point of view of an investor, not every risk should necessarily be hedged away: after all, if we did, we could only hope for the riskless return. Take the case of duration risk. The fact that duration risk exists and is priced doesn't necessarily mean that I should automatically hedge it away. What an investor should do is to take the risk on board when the compensation for doing so (the risk premium) is high and avoid it when it is low. More generally, one should never look at a risk factor in isolation, but in the context of a global portfolio. Bonds in the Greenspan years were very risky on a stand-alone basis, but actually *reduced* risk from a portfolio perspective.

Does that mean that once we as a humanity transition to more conscious green energies (in a hundred years let's say) there won't be a reason to hedge against climate risks?

You are correct, but the actions between now and one hundred years' time will determine what kind of equilibrium we will find ourselves in: a 2.5 C equilibrium or a 4 C equilibrium? This affects mainly the expectation part of the price component.

Does the use of 2-degree warming on slide 6 reflect the implausibility of reaching 1.5 degrees?

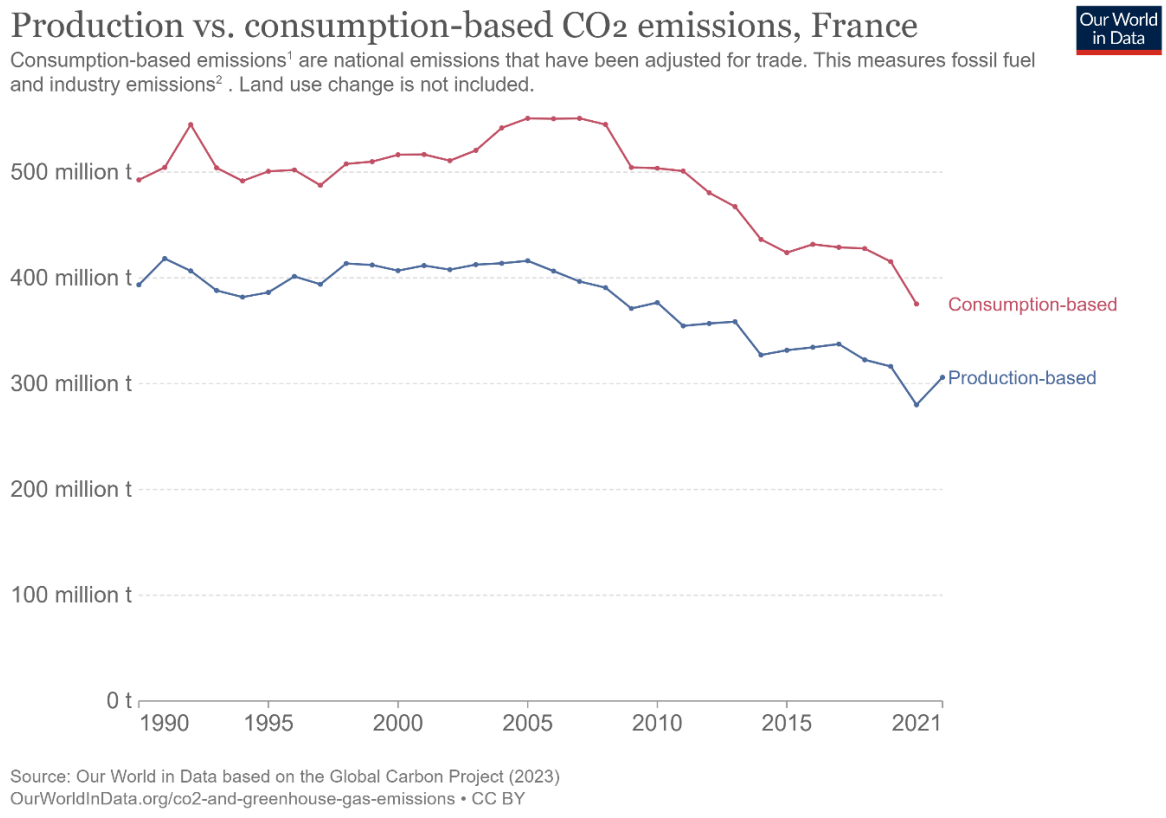
Not exceeding 1.5 C (or 2 C) by the end of the century is not *technologically* impossible: the scientific consensus is that we are not past some physics irreversible point (yet). However, it would require extremely drastic actions, and some important additions to the policy toolkit (e.g., negative emission technologies) that I do not see happening. The policy risk is hugely skewed towards missing the target, and the corridor is getting narrower and narrower.

You have highlighted the gargantuan and unprecedented changes required to meet emission limits consistent with 2 degrees. Do the shifts illustrated implicitly include the other transitions, such as preserving biodiversity, or does managing these other necessary transitions come in addition to the challenge already outlined?

Unfortunately, what I show are 'only' the expected cuts in emissions needed to stay within a given temperature target. If we want to hit other targets, the task is more difficult, and some goals could be on a collision route. For instance, if we want to maximize carbon capture, some tree species are more effective than others, but this does not address biodiversity.

Are France's per capita CO2 emissions on a production or consumption basis? If the former, should not one also look at outsourcing?

Excellent questions – I think that you are referring here to "exported emissions". Most European countries are net emission exporters, and therefore looking at production emissions flatters their 'greenness'. Having said that, in the case of France the *trend* of consumption and production emissions has been very similar (please see the figure attached, from *Our World in Data*), and that is why I did not distinguish between the two.



But now that we have been closing nuclear programs which third way do you see?

I personally believe that nuclear energy should play an important role in tackling climate change. In the West (apart from France) we are still very reluctant to 'go nuclear', but countries such as China are embracing the nuclear option more readily (China produced 110 TW of nuclear energy in 2004, but over 400 TW in 2022). My main concerns with the widespread adoption of nuclear are of geopolitical nature: I am referring here to the risk of nuclear weapon proliferation.

You have estimated the climate risk premium. What assumptions and unknown quantities do your answers depend on?

Excellent question. There are two main components to the problem: the financial modelling part, and the policy uncertainty part. Regarding the first, there are, of course, considerable model and parameter uncertainties, but I try to limit these by making sure that my models recover basic facts in asset pricing, such as the equity premium and the level of rates. As for policy uncertainty (which determines the speed of abatement and hence the size of the risk premium), it is well-nigh impossible to say anything precise, but in my research group we are still trying to give some order-of-magnitude probability estimates. These are based on things we do know (such as the maximum speed of abatement possible), and reasonable assumptions (such as that abatement becomes more likely if we experience a higher temperature, or if abatement costs go down). We are working on a comprehensive probability-aware scenario programme.

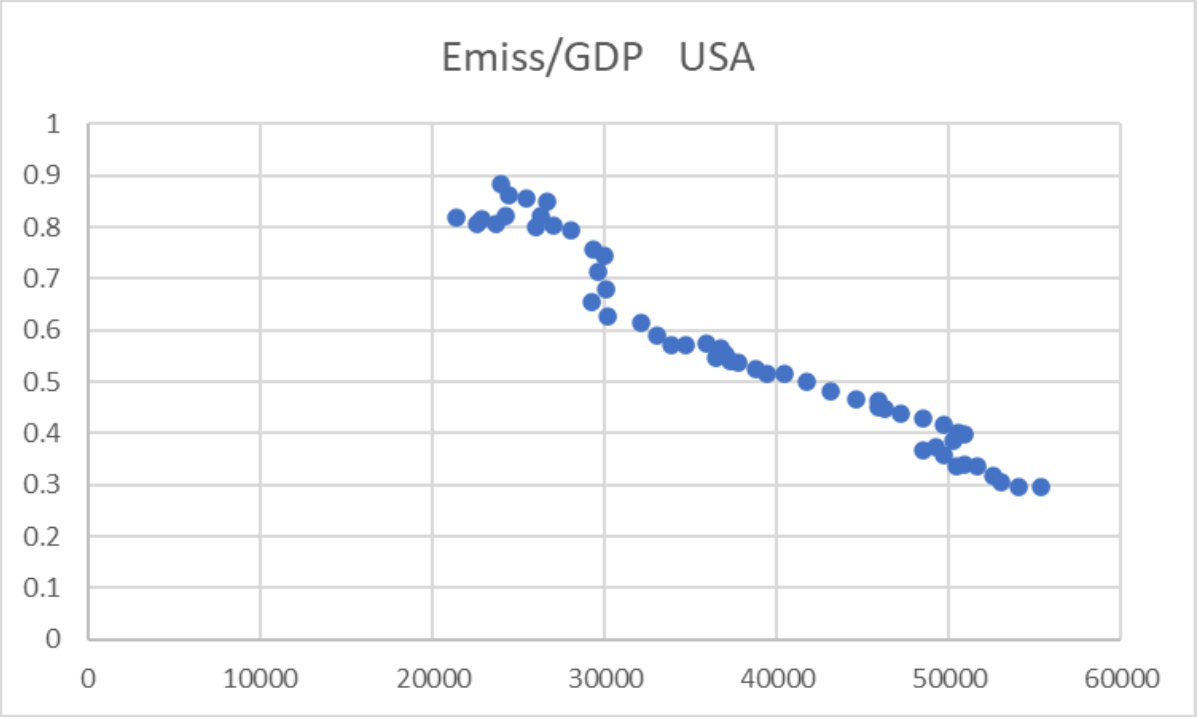
You said that the risk premium depends on the speed of abatement. But how do we know this?

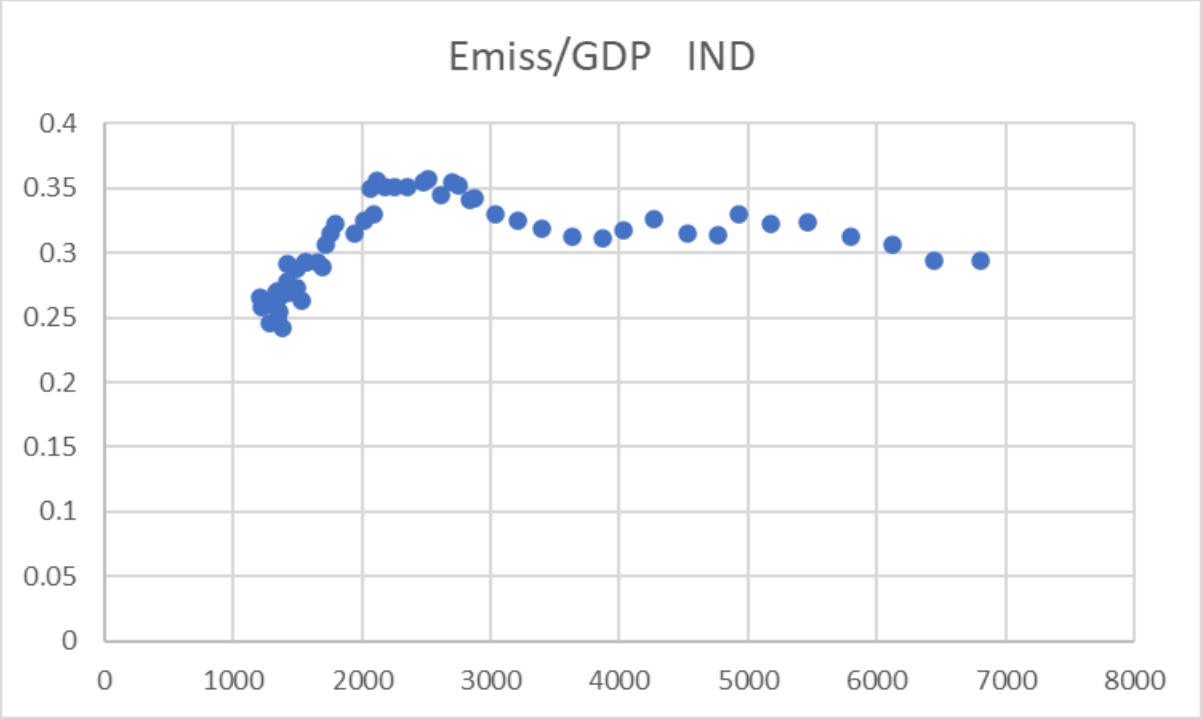
The magnitude of the climate risk premium depends i) on whether the climate losses occur when we feel rich or poor and ii) on how large these losses are. If we abate aggressively, emissions will be curbed quickly, damages will be small, and the compensation for bearing this risk is correspondingly small. In the limit when we have no climate damages clearly there is no climate risk premium. And vice versa. As for the probability of different abatement schedules, please see the answer to the question above.

Hasn't economic production been largely decoupled with carbon emissions? After all, several countries have achieved economic growth over the last decade even after accounting for exported emissions...

You raise a good point. However, the decoupling has mainly occurred in Europe, Canada and the US. There is still a strong link between emissions and GDP growth for countries such as India and China. For African countries the link is even stronger. See in the two figures below Emission / GDP for USA and India: a very different pattern…

So, the really important question is: where are the next big emission going to come from? If from yet-to-develop countries, will the development be fossil-fuel intensive, or based on renewables?





My understanding is many IAMs assume GDP as an input, i.e., no damage function?,

This is a bit technical, but the IAMs you are referring to are probably Process-Based (PB) IAMs, which do not carry out a utility optimization (the often optimize other things, such as costs given a target). And yes, you are right, most of PB IAMs do not have damage functions – but these are not the IAMs that we use: our models are essentially Dynamic Stochastic General Equilibrium models, *that need a damage function to work properly.*

Is there a plausible set of parameters in the integrated assessment models that would make the climate risk premium positive?

I think that you refer to green assets. I find it extremely difficult to flip the sign of the risk premium, even if I introduce tipping points, really severe damage fucntions, etc.

Big damages occur in states of high consumption. So why at the moment it is only Africa and Asia getting the floods? Droughts? They are low consumption states/regions.

I should have been clearer here: when I say "states of high consumption", I mean "states of the economy", not states as in countries. My conclusion is that big climate damages are more likely to occur when the economy is growing strongly, than in situation of low growth.

Could we have a link to the 'Asleep at the Wheel' paper?

The paper will appear in the next Novel Risks issue of the *Journal of Portfolio Management* and we will share it with you as soon as we are allowed to distribute the pre-prints.

Meanwhile, here is a working paper version: https://climateimpact.edhec.edu/publications/asleep-wheel-risk-sudden-price-adjustments

If you gave this presentation to a politician, they would see 30bps and take no action in their currently political term – do you agree?

Politicians are probably more interested in GDP losses due to climate change. I am *not* saying that climate will reduce GDP by 30 bp/annum. I am saying that the expected return of a climate-sensitive security should be adjusted by about half a percentage point because of the risk premium component (exactly as the yield of Treasuries had to be adjusted downwards *over and above rate expectations* by a similar amount after the 2008-2009 crisis). The target audience of my talk was investors, not policy makers, who are sensitive to different metrics. The link between risk premium and GDP growth is tenuous at best. Risk premium has to do with what investors are prepared to pay for receiving cashflows in some states of the world rather than in others. GDP is about how these cashflows grow over time.

Do you think Carbon Pricing can be an efficient way to address the climate risk premium?

In theory, carbon pricing is considered a useful tool in tackling climate change. It is an economic policy mechanism that places a financial cost on greenhouse gas emissions, either through a tax or a market-based system such as cap-and-trade. However, direct carbon taxes are proving politically very unpopular. Also, a carbon-tax fiscal policy could be severely regressive and should therefore be matched by other compensating (redistributive) measures – also very contentious.

Most professional investors think about their careers and mandate wins/losses, i.e., the next few years. Based on the conclusions of this research do you agree they are unlikely to take action any time soon?

A price is made up of two components: expectations (about future cashflows), and risk premia – and the latter is what I have been talking about. When it comes to climate risk, I think that it is likely that neither expectations nor risk premia are currently properly priced. As we all know, repricing towards fundamentals eventually must take place (eventually it happened even with subprime mortgages…). If I am right, I think that there is a significant repricing risk. How long this will last it is difficult to tell.

How would you adjust the model in light of the fact that some investors are committed to net zero and therefore are not purely concerned about the performance of their assets in good/bad equity market environments?

For these investors discovering the sign of the risk premium is less important because economic performance is less important.

Systemic risk is generated by non-linear outcomes in relation with "trigger events" (e.g., high increase of temperature), did you attempt to model that?"

Yes, I did in a very quick-and-dirty way. As I mentioned, the sign of the risk premium did not change – it is not easy to get a Barro-like view of climate damages even with tipping points.

I trust the boundaries of open/closed economic and physical systems are important... For instance, open-cast mining is profitable if the externality of ecological damage is ignored by the market, but where the mining company faces penalties for ecological damage then it is less profitable. Until we know what additional costs are applied to climate damaging enterprises (or are expected to be by the markets), the impact on risk premia may not be realised, do you agree?

Good point here. What you are referring to is ultimately transition risk: the possibility, for instance that regulations may be put in place to 'price the externality'. I have focussed mainly on physical risk in my talk.

Can we have course on climate risk modelling?

We cover basics of climate modeling, and climate-related financial risks in these MOOCs available through Coursera: https://online.edhec.edu/en/online-programmes/climate-change-and-sustainable-investing/.

The School offers a MSc in Climate Change & Sustainable Finance jointly with engineering school Mines Paris – PSL: https://www.edhec.edu/en/programmes/masters-degree/msc-finance/msc-in-climate-change-and-sustainable-finance.

We will consider offering a course on climate risk modelling for practitioners in the medium term.