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Thank you very much, Mr Chairman. It is an honour to be here and to introduce this session. The idea of my talk is to discuss what science has to say about global risks and how we should listen. This is coming from an insurance company. It is always interesting to know what is ahead of us and to make sure that we actually try to act upon it. I am going to start with an example where this did not happen successfully. You heard about the Aquila earthquake in Italy in 2009, which cost the lives of 300 people, but maybe you have not heard that much about the other Aquila event, a kind of replica of this earthquake, which saw six prominent Italian seismologists sentenced to jail sentences for manslaughter, because they had let the public get the wrong impression about what was going to happen with this earthquake. The Aquila trial is the most significant sign in recent months, of a botched science policy dialogue. At the AXA Research Fund, we have tried to look into that. How can we characterise, in very simple terms, what would be the correct characteristics of such a dialogue?

The AXA Research Fund designed a very simple heuristic to help leverage the science-policy dialogue to tackle major risks. There are three core responsibilities of decision makers: first, they shall make sure, at any point in time, that there exists a central scenario known to civil society and based on the best and latest scientific data available. Yet decision makers cannot afford to be blinded by any single scenario and ignore alternatives which may have extreme consequences. So their second responsibility is to make sure those alternatives are explored scientifically and publicly debated. Policy makers' third responsibility is to act upon this knowledge and prevent, prepare and mitigate accordingly.

Why is AXA interested in this science policy dialogue? Obviously, as an insurer, we end up being on the frontline of that and, sometimes, late. We are trying to help with the emergence of such a dialogue. This is what we aim for with AXA-funded researchers. We actually support 350 scientists who tackle major risks all over the world. We try to help them on a financial and philanthropic basis, so that they can do their work in the best possible conditions and under no influence whatsoever, so as to avoid bias in their research, but also to help them impact this science policy dialogue. That leads us to a very broad approach of risk which is only fitting for an insurance company. If you look at the scientific literature over the last 10 years, the word 'risk' appears in about 15% of it, which makes it a significant data problem in itself, to try to characterise the main risks.

Here is a mesmerising map of the risks we deal with and it is composed of 11,000 words that we find in the scientific literature dealing with risk over the last 10 years. You will probably find one of your pet risks or pet diseases in this map. It goes from biology in the lower parts to environment in the northwest quadrant, to financial risks in the northeast. I am not going to focus on all of those. However, I want to focus on the two major risks where I think we have governance issues. This is longevity and climate change.

Starting with longevity, I want to begin with good views; often we say today that 60 is the new 50. This is an interesting thought. That is a result from Carol Jagger, who is a researcher at Newcastle University, and supported by the AXA Research Fund. She asked those aged 85+ about their health. It is good news: 80% of the 85+ find that they are in excellent or very good health. Now, what do you think? She also asked their physicians and 80% of those over 85 have at least three diseases, which means that being in good health does not mean not having a disease, at this time. We know that, because we can live with our diseases. We can outlive many of them and we can live with many of them. Obviously, this sometimes does not end well, but it is comforting news.

This has been the case for a long time. If we look at male life expectancy over the last 40 years, we can see a linear continuous improvement scenario. It is interesting that the average official age of retirement in OECD countries, for instance, is pretty much linear, but in the other direction, which is probably going to be one of the issues Raphael Wittenberg is going to talk about. I am not going to touch much more on it. We have seen this continuous improvement scenario; that is the central scenario that we are dealing with. Life expectancy is progressing in a linear way. This has been the case for a long time. If we look at the decline in death rates from tuberculosis in England since the mid-19th



century for example, this linearity has been through the progress of governance and sanitary policies, much more than by the simple fact that we discovered the cause of tuberculosis or the antibiotic. The sewage system in London and the World War have had stronger effects than the discovery of the cause itself.

What is interesting is that this central scenario is challenged today by an alternative scenario. This is a less probable scenario, but we are not in the realm of impossibility and there are geneticists and biologists working on what we could call breaking the death barrier. In the same way that there is an escape velocity from the gravity barrier or you can break the sound barrier. Breaking the death barrier is about understanding the maintenance system at cell and organ levels. A lot of research is being done in Germany, France, Japan, and other countries on this today. We know, better and better, the maintenance system of the cell, providing increased resistance to not one disease, but to anything that can occur, which we usually call aging. What is interesting is that in more recent years, we are seeing an increase in the speed at which life expectancy grows. It might comfort you again to know that tonight you slept for free. Our life expectancy is increasing at the rate of six hours a day, at this point, which kind of makes our night free, or not part of our life when we started sleeping.

This is not a central scenario. This is an alternative scenario. It is in the realm of improbability, but it is not in the realm of impossibility. This is so challenging in ethical, economical, and sociological terms, that it would make sense to have a B team to start thinking about it. Of course, the continuous improvement scenario is already good, but a change in this would be kind of, dramatic and, of course, a good thing in itself, but it could lead to unexpected consequences.

Let me turn now to the second global challenge that I want to discuss today. This is about climate change. Here, I want to start again with an interesting figure. This is Cannes and la Baie des Anges. You know, if you have read the World Bank report published last month, that one of the instabilities in the rise of the sea level is West Antarctica and Greenland icecaps melting. We have probabilities. We know that if the Earth's temperature rises more than one and a half degrees, Greenland is bound to melt. It is going to take some time, but it is going to. What would happen here if Greenland was to melt? Would we be able to have this conference here? Obviously, we would not. We would have to move to the second floor.

Just for the sake of argument, there is instability in the Western Antarctic ice shelf as well, so let us go for the whole thing and suppose that the whole Antarctica would be melting. Would we be able to have this conference here? Yes, we would. We would have to be on a big ship and that is an interesting setting for such a conference, but that would absolutely be possible, because we would have 60 metres of water beneath us.

It is interesting to think about climate as a dynamic system. You know what a dynamic system is. It is like heads and tails. Science can tell you a lot about dynamic systems. What it cannot tell you is what is going to happen for sure. If you play heads and tails, science can tell you that it is going to be 50% heads and 50% tails, but it cannot tell you what is going to happen. We are entering these types of questions with climate change, because a plus two degrees world is quite linear in the way it is similar to our world. However, a world that is four degrees warmer is more complicated to apprehend and assess as a central scenario. This does not mean that we do not know anything, as with heads and tails. The coin remaining vertical, on the edge, is a very rare outcome (*points to an image of a coin on the slice*). We can prepare for some outcomes. However, it is difficult to formulate that central scenario anymore. I think it is fitting in a governance conference to quote Machiavelli, who said, 'I hold it to be true that fortune is the arbiter of one half of our actions, or perhaps a little less.' However, that still leaves us to direct the other half. This is, again, where governance issues take place.

An interesting example, which some of you probably remember, is the ozone hole. If you are looking at the press in the 80s, we were all bound to die from skin cancer or become nocturnal animals because of the ozone hole. It was becoming a threat, because the UV sunrays could pass through the atmosphere. The Montréal Protocol was put into place in 1984, if I am not mistaken, and stopped the expansion of the ozone hole. At the time, it was hoped and believed by scientists that by 2042, the ozone layer would be restored to the original 1980 level. This did not happen. Scientists got it wrong and the ozone layer will not be restored to its original state before 2065. Still, we have stopped the problem from becoming a global threat. It worked and that was a big effort to ban CFCs from our fridges that made it so.



I want to conclude with noting that science policy interface protocols are very complex. It is difficult to formulate the central scenario. It is difficult not to be blinded by this central scenario. For instance, in climate, at this point, the central scenario has been, up to now, a two degrees world, where preparation means trying to curb our CO2 emissions. However, if we are to really prepare for a world that is four degrees warmer, then preparation involves many other things, such as dealing with climate refugees, desalinating massive amounts of water, dealing with the spread North of infectious diseases, and so on. Again, you can refer to the World Bank report on that. However, if we are serious about the fact that this is going to be our unpleasant albeit most probable, hence central scenario, it we should start discussing it.

To begin with, science-policy interface protocols are very complicated (*points to powerpoint*). It is in itself the topic of scientific analysis at this point. Which is why we developed our simple heuristic. It is a kind of checklist for governing bodies. Do you have a central scenario at this point on climate change? I think we lack an explicit and consensual central scenario. Are we blinded by this central scenario so that we do not see alternative scenarios? That might be the case with longevity and aging, at this point. We have been in this linear adaptation for so long that it is difficult to see potential breakthroughs and their consequences. Are we including both the central scenarios and extreme consequences in our mitigation, which definitely did not happen in Aquila?

I will end by quoting Joseph Beuys, the German artist, who said, 'We have to become a friend of freedom and uncertainty.' This is a comforting thought, again, for us and for governing bodies, that this uncertainty has the same origin as our freedom. We must manage both of them. In this regard, not taking a risk or not assuming our risks, not facing the risks we find thanks to science, may actually be the bigger risk we can run. Thank you.