



**Economic and Financial Issues
Related to the Impact
of Climate Change**

**Mark Carney, Maureen Cropper,
Ashley Schulten, and Nicholas Stern**

Pilita Clark, Moderator

Washington, D.C.

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Per Jacobsson Foundation

THE PER JACOBSSON LECTURE



Economic and Financial Issues Related to the Impact of Climate Change

Panel Discussion

*Mark Carney, Maureen Cropper,
Ashley Schulten, and Nicholas Stern*

Pilita Clark, Moderator

Per Jacobsson Foundation
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Foreword

The 2017 Per Jacobsson Lecture was a panel discussion, “Economic and Financial Issues Related to the Impact of Climate Change,” held Saturday, October 14, in the atrium of the IMF’s Headquarters 1 Building in Washington, DC, in the context of the Annual Meetings of the International Monetary Fund and the World Bank Group. The panelists were Mark Carney, Chair of the Financial Stability Board and Governor of the Bank of England; Maureen Cropper, Distinguished University Professor and Chair of the Department of Economics at the University of Maryland; Ashley Schulten, Head of Responsible Investing for Global Fixed Income at BlackRock; and Nicholas Stern, I. G. Patel Professor of Economics and Government at the London School of Economics and Chairman of the Grantham Research Institute on Climate Change and the Environment. The discussion was introduced by Guillermo Ortiz, Chairman of the Board of Directors of the Foundation, and moderated by Pilita Clark, Associate Editor of the *Financial Times*.

The Per Jacobsson Foundation was established in 1964 to commemorate the work of Per Jacobsson (1894–1963) as a statesman in international monetary affairs. Per Jacobsson was the third Managing Director of the International Monetary Fund (1956–63) and had earlier served as the Economic Adviser of the Bank for International Settlements (1931–56). Per Jacobsson Foundation Lectures and contributions to symposia are expressions of personal views and intended to be substantial contributions to the field in which Per Jacobsson worked. They are distributed free of charge by the Foundation. Further information about the Foundation may be obtained from the Secretary of the Foundation or may be found on the Foundation’s website (www.perjacobsson.org).

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Opening Remarks

GUILLERMO ORTIZ

Good afternoon. Welcome. My name is Guillermo Ortiz; I'm the Chairman of the Per Jacobsson Foundation. We have here David Lipton, who is President of the Per Jacobsson Foundation and First Deputy Managing Director of the IMF; Kate Langdon, Vice President of the Per Jacobsson Foundation and Deputy Director of the Communications Department. And we have a truly innovative panel today here at the headquarters of the IMF. We're going to have a panel on the financial and economic consequences of climate change. This is the first one for the Per Jacobsson Foundation. We usually sponsor lectures on monetary and financial issues. This obviously qualifies as a subject that Per Jacobsson in his time would have encouraged for discussion, since the importance of the subject is pretty clear to all of us. It obviously involves important spillovers in economic and financial markets, and it also requires international cooperation.

I will not even attempt to do any introduction on the substance of today's discussion because we have the good fortune of having Pilita Clark here, the Associate Editor of the *Financial Times*, who is going to moderate the panel, and she will introduce the subject. I will introduce the other panelists. We have what we can call an all-star panel. Lord Nicholas Stern is the I. G. Patel Professor of Economics and Government at the London School of Economics and Chairman of its Grantham Research Institute on Climate Change and the Environment. He is the author of the seminal *Stern Review* and recently published a book, *Why Are We Waiting? The Logic, Urgency, and Promise of Tackling Climate Change*. We have Ashley Schulten, who is the Head of Responsible Investing for Global

Fixed Income at BlackRock. She's a portfolio manager on global green and socially responsible mandates and leads coordination of BlackRock's firm-wide green-month effort. Maureen Cropper is Distinguished University Professor and Chair of the Department of Economics at the University of Maryland. She's also a Senior Fellow at Resources for the Future, a researcher associated with the National Bureau of Economic Research, and a member of the National Academy of Sciences. We have Mark Carney, who is the Chairman of the Financial Stability Board and Governor of the Bank of England. Mark has spearheaded work on the impact of climate change on financial markets both at the Financial Stability Board and at the bank.

So let me thank you all for participating in what I'm sure will be a fascinating discussion. Thank you very much.

Economic and Financial Issues Related to the Impact of Climate Change

MARK CARNEY, MAUREEN CROPPER,
ASHLEY SCHULTEN, AND NICHOLAS STERN

PILITA CLARK: Thank you very much, Guillermo. It is indeed a great pleasure to be here today with such a distinguished panel. I'm sure that I'm not the only one in this room who has been to the occasional panel discussion on the economic and financial implications of climate change, but it really is quite rare to have so many living godparents of the ideas under discussion as we do today.

So we have around 40–45 minutes to discuss what is an immensely broad and complicated area of climate finance. We're hoping—well, we will definitely have at least 10 minutes at the end for audience questions and answers. And the discussion itself—oh, I should say, if you are planning to tweet about it, that #ClimateFinance is the hashtag to use. Climate finance is obviously a very broad and very fast-growing area. When I first became the *Financial Times*' environment correspondent in 2011 it was actually quite rare to hear people talking about terms like “unburnable carbon” and “stranded assets” in relation to climate change, except if they were green activists or academics. Back then, only six years ago, the idea of a major corporate green bond was still pretty much unheard of. Certainly there were not so many central bank governors wandering around using terms like “climate change” and “financial instability” in the same sentence.

A lot has obviously changed since then; however, a lot more needs to change. Climate finance needs to become much more mainstream than it is if there's to be any hope of meeting the goals of the Paris Agreement.

So what we're going to do today is start off looking briefly at how we got to where we are and then spend most of the discussion looking at what needs to come next. And I'm going to ask Governor Carney first of all. Two years ago you made a speech in London, a speech that a lot of people will not be forgetting, where you actually talked about the risks of climate change, the financial-instability risks of climate change. It was quite a contentious speech. It certainly made a lot of people sit up and notice. And I just wonder when you first discussed the fact that you were going to focus on that, what was the reaction inside the bank?

MARK CARNEY: Well, thank you, Pilita, for the invitation, the IMF, the Per Jacobsson Foundation, for the invitation to be here.

Look, there were two catalysts behind that speech and one for each of the hats I wore at the time. First, in terms of Governor of the Bank of England, the bank does many things. One, it's the supervisor, it's the regulator of the insurance industry, the property and casualty industry, and one of the largest reinsurance markets in the world, Lloyd's of London. And if you know anything about the liability structure of those businesses, which you do, you know that climate change has direct relevance today for them. You know, some of the most sophisticated catastrophe modeling and underwriting is done at Lloyd's. And consistently the pricing and coverage of that insurance has adjusted for the reality of the physical risks, the physical manifestations of climate change. So we have to look at that, we have to manage it day to day as a regulator, as a supervisor. So that was one of the catalysts.

The second was that the G20 [Group of Twenty] had asked the FSB [Financial Stability Board], in regard to the other role I play, to look at the financial-stability implications of climate change. And so we needed, as an organization, the FSB—and the organization really is the regulators of the central banks and the finance ministries—to respond to the financial-stability risks. And the point I was making, and the FSB was developing, was that there are these physical risks and there are some legal liability risks which are present issues, but the biggest risk from a financial-stability perspective relates to the transition risks in terms of greater physical risks in the future, but also transitions to new policy frameworks, climate policy frameworks, prices of

carbon, regulation, other aspects. And those could be potentially discontinuous. And what was lacking at the time was the proper information, consistent information in the market in order to address the transition and in order to overcome what we called the “tragedy of the horizon.”

PILITA CLARK: And then so out of that discussion, or as a result of those sorts of thoughts, we saw the establishment of this task force—

MARK CARNEY: Yes.

PILITA CLARK: —looking at climate. Can you talk a little bit about that and why it was decided that that was the best means of approaching this information?

MARK CARNEY: Well, the issue at the time was there were a large number—almost 100—of different ways of providing some information about climate risk, ranging from integrated reporting to London Stock Exchange listing requirements, but they were quite disparate. If you looked at the top couple of hundred companies, for example, in the United States, only about 30 percent of them disclosed consistent information or comparable information. So the providers of capital, whether they were lenders or investors, asset managers or pension funds, didn’t have useful information in order to make judgments. Different investors placed different weights on these risks. Different investors have different time horizons. The best investors anticipate potential changes, positive or negative. I mean this is a market, so people are neutral in terms of their outlooks, but positive or negative. But they didn’t have the information. And so the judgment was that we needed to get the private sector together, the issuers, people who needed capital, providers of capital, the people who prepare the statements, so the Big Four accounting firms, the rating agencies which judge them—get them all in a room and for them to decide what the appropriate disclosure was, led by Mike Bloomberg. They came back over the course of the year and the final recommendations, as many people know, went to the leaders at the Hamburg Summit and now are starting to be implemented.

PILITA CLARK: Ashley Schulten, BlackRock was among the companies that were involved in developing those guidelines. And I just wonder, from where you sit, I know it's quite an early stage now, but from your perspective, what has been the impact of those recommendations so far?

ASHLEY SCHULTEN: So thank you to the IMF and the Per Jacobsson Foundation for hosting us. I'm incredibly humbled and honored to be included in this conversation. I'll tell you that climate risk is a very important topic for us at BlackRock. It's important to our clients, and it's important to our thinking about risk. And we are working on the tools to try to integrate this into our day-to-day business, in our portfolios.

And so one of the challenges that Governor Carney mentioned was getting the data. So we have a lot of theory about the macro risk of climate change, but for a portfolio manager on a day-to-day basis, really what are you supposed to do about that? How do you start to price these things, what are the metrics, how do you measure it? And I would say that there were two things that were really impactful about the task force release. The first is really the form which it took. And so you think about something that is being governed by the FSB and is being driven by such a credible organization and has a collective group of experts among a lot of different sectors, so a lot of broad based buy in. So, first of all, the credibility of the report and the acceptance of what that report was going to suggest. Also the fact that it was a year-long process that included lots of different opinions in the market, and really I think there's probably over 100 different separate disclosure schemes that we're already looking at, to go through all those different disclosure schemes and try to pull them into one paper that we could all point to and we could all reference. So the form and the credibility I think was incredibly important to elevate the conversation.

Secondly, in terms of what we got out of the report, I would say two things. The highlighting of the governance and the focus around governance really elevates the conversation about climate risk within firms. And so it's to the board level and to the senior management level firstly. But, secondly, as a portfolio manager, the part that I loved was the part in the back with the metrics in the annex. And going through sector by sector and coming up

with what are the top five or seven metrics that a sector should be reporting as it relates to climate change. And that's what we really can use as portfolio managers on a day-to-day basis. And so we can use that now on engagement with companies, in terms of going to them and saying, "Here's a credible piece of work that we've all gotten together on to decide these are the seven things we'd like to get from you; could you provide that to us?" And then for those portfolio managers who are sort of new to the concept of introducing climate risk, it points out things within a sector that they may not have been thinking about up to now in terms of climate risk. So, incredibly helpful and just the start of a longer process.

PILITA CLARK: We've seen some groups of investors in the United Kingdom suggest that they will potentially start voting against companies unless they follow these guidelines, because these guidelines are obviously not mandatory, they're voluntary. Do you think that that sort of action is likely to become more widespread? Could we see more asset managers deciding to take action like that?

ASHLEY SCHULTEN: Yes. I think that we need more disclosure from companies in terms of specific metrics about their business to evaluate climate risk in our own portfolios. So this conversation has been something that has been going on for several years now, and the fact that we now have a format to ask and suggest where there's a good degree of agreement around the metrics to use—we'll continue to see that. We're going to continue to see pressure on companies to give us more reporting around climate and sustainability metrics in general.

PILITA CLARK: Lord Stern, I just want to look more broadly now at some of the research issues that have underpinned these ideas. Now, obviously, policymakers and regulators look to economists to guide their actions, and always have when it comes to climate action. You've actually recently been quite critical of some of the integrated assessment models that economists use to estimate the losses stemming from climate change. And I just wonder if you could talk about how big a problem this is and what its implications are.

NICHOLAS STERN: Thank you. And again, let me echo the thanks to the Per Jacobsson Board and the IMF for inviting us here and particularly for taking this serious subject seriously.

If you want to think about the adequacy of an economic model to capture the issues that you're worrying about, then you have to go back to ask, What are those issues? What does the science, in particular in this case, tell us about those issues? And let me do it by relating it to what we did in the *Stern Review*, which was 11 years ago now. And we said that the costs of inaction were far greater than the costs of action. Looking back I think I badly underdid it. I think the costs of inaction are much bigger than we thought then and the costs of action are much less; in fact they're probably negative. If you ask what we've learned about the science: the emissions have grown pretty rapidly, and a lot of the effects have been coming through more quickly than we anticipated then and with greater severity. Hurricane season is one example, but there are many more around the ice and the glaciers and what's been happening to rainfall in different parts of the world, and so on. So the science has moved and has told us that it's actually still more risky than we thought then.

And if you look at the costs of action, we didn't anticipate that the price of a solar panel in that period would come down by a factor of 10 or more. We didn't anticipate that solar electricity in India on scale would be coming in, in the last few months, at three cents a kilowatt hour. We didn't anticipate that the heads of the main motor companies would be talking about the end of the era of the internal-combustion engine. We didn't anticipate how powerful the digital world would become in terms of managing various demands for energy and how much by good management you could become more efficient. I could go on—all sorts of advancements in materials. So the science looks worse in terms of what it's saying about the risks, and what's happened to technology looks better. And on top of that we've understood just how devastating air pollution is. We kill millions of people a year. In my own country, the United Kingdom, we kill 30–40,000 people a year from air pollution, we kill perhaps 1,500–2,000 in road accidents. We should worry about the road accidents; we should worry even more about the air pollution.

So if you look at the benefits of action, it's not simply reducing the risk of climate change, it is also giving you cities where you

can move and breathe, much more efficient economies, and so on. So I think we see now that action is about switching over to a much more attractive growth path.

So how do the economics tell the story I've just told? Because that's the story in my view. So do the economic models capture that story? And the answer is that they don't. If we go on with not much action on climate change, over 100 years or so temperatures could increase by three, four, five degrees centigrade or more. We don't know exactly; there's uncertainty. That's the name of the game, to try to understand the risks. But they could go up by three, four, five degrees or more over a century with no action. Now, we haven't been at three degrees for about three million years. We haven't been at four or five degrees for tens of millions, perhaps 30 million years.

What's the relevant evidence? Well, we have to try to understand what the world might have looked like at that time. And you know, there's paleoclimatology. We can be pretty clear that there were very severe storms, that sea levels were tens of meters higher than they are now, the deserts were in different places. With that kind of storm surges and sea level rises, Bangladesh and other countries, Florida, would be submerged. That is a huge rewrite of where we can live and how we could live. Hundreds of millions, possibly billions, would probably have to move. And with conflict which you couldn't simply turn off. How does that get modeled? These models at four or five degrees say that there is a loss of GDP of 5 or 10 percent. No damage to capital, no knocking down of the growth rate, you just lose 5 or 10 percent of GDP. The scientists don't understand what they're talking about.

PILITA CLARK: So in other words, in the absence of evidence, the inclination is to just not count?

NICHOLAS STERN: They write it right down, there's no—I described a story which is perfectly possible—talking about risk here—perfectly possible and we'd see major loss of life. We don't know how many billions the earth could support at those kinds of temperatures. It could be a lot less than the 10 billion that we now see.

In those models the risk of massive loss of life, the risk of big movement of people is simply not there. And they just take off 5,

10 percent of GDP for a circumstance that's a complete rewrite. Eighteen degrees centigrade—eighteen degrees centigrade. Some of the models have a 50 percent loss of—we'd be dead. I mean we really would have wiped ourselves out way before eighteen degrees centigrade. So they're simply not capturing the magnitude of the risks that are involved.

On the cost side they usually have rising marginal cost of action. In other words, no economy at scale and no serious technical progress in learning. We have seen massive technical progress, we've seen massive economies at scale. So the big issues are actually the big risks of loss of life, rewriting of where we can live. They're not in the models, but they are big risks. And the costs of action and how those costs of action change and what drives them, they're not in the models either. So it's not surprising I'm a bit skeptical about what they tell us.

PILITA CLARK: One other criticism that's often made of these models is the way that they can underestimate quite a critical metric in the United States, and that's the social cost of carbon.

And Professor Cropper, I want to bring you in because you recently cochaired quite an extensive National Academy of Sciences study on ways to improve calculation of the social costs of carbon. And the United States previously used a figure of around \$40, but the current administration now appears to be looking at a figure of \$1–\$6. And we're talking obviously about the cost of emitting an extra ton of carbon dioxide equivalent.

Can you explain to us how that difference has arisen? Is it just because the administration is looking only at costs inside the United States and ignoring external costs, or is there something else as well?

MAUREEN CROPPER: So under the Obama Administration the social cost of carbon, which is subject to the limitations that Nick mentioned, but has a history in the United States where we do try to calculate the benefits of reducing greenhouse gas emissions, was calculated—the mean value at a 3 percent discount rate was \$45 for 2020. On Monday, in order to justify repealing the Clean Power Plan, this was recalculated to be “between \$1 and \$6.” If you look at damages only to the United States as opposed to the world, at a 3 percent discount rate you go from \$45 to \$6. If you

use a 7 percent discount rate, then the damages go to \$1. So it's both a combination of looking at domestic-only damages and also using a 7 percent discount rate.

PILITA CLARK: And what were the findings of your study in relation to theirs?

MAUREEN CROPPER: First of all, we said that it's important, even if the United States is not altruistic, to use a global value. There are damages to other countries that result in civil conflict, in migration, in damages that affect us through trade that these models certainly don't capture. You can't separate out a domestic value. The other thing is that from a strategic viewpoint the United States wants other countries to use a global value. We are going to be affected adversely by their carbon emissions, and we want them to use a global value. And so from a strategic viewpoint we really do want, ourselves, to use a global value.

PILITA CLARK: Yes, because other countries don't place quite as much weight on concepts like the social cost of carbon. They tend to look at temperature targets and carbon budgets. Do you think that's ever likely to become a factor in the United States, or is the social cost of carbon still going to be a really key metric here?

MAUREEN CROPPER: Well, I would say under the current administration the ray of hope is that last spring, three prominent Republicans actually suggested that the United States adopt a carbon tax of \$40 per ton of carbon dioxide, which would start at \$40 and be ramped up. It would yield something between \$200 and \$300 billion a year in revenue. Their suggestion was to return the revenue lump sum to households. They also wanted to repeal the Clean Power Plan, unfortunately, as the price of this. But the idea that this would be talked about—Senator Lindsey Graham has talked about also using a carbon tax. And the benefits of the carbon tax of course are that it raises revenues. Those revenues can be recycled. And so I think that that's appealing. I wouldn't want to bet money on the chances of a carbon tax being passed in the current administration, but I don't think it's out of the question.

PILITA CLARK: Anybody else care to weigh in and say whether they think it's out of the question or likely to happen, possibly not?

NICHOLAS STERN: I think it's an outrageous change, but I'm not forecasting what happens in U.S. politics.

PILITA CLARK: I want to move on to the way in which climate finance or green finance might become more mainstream. Governor Carney, you have spoken about the importance of the green-bond market in driving low-carbon investment. And of course, we've seen this market grow exponentially over the last few years. But green bonds of course still make up only a small fraction of the overall global debt market. And we've got different rules applying in different parts of the world. How important do you think it is to standardize the rules? How close are we to improving standardization, and what are the best means of doing that, do you think?

MARK CARNEY: First, overall context, because I think it's important. The scale of investment that's required is measured in trillions and even though the green-bond market has been doubling consistently, it's approaching \$100 billion per annum. So when you need to ramp up to probably on the order of magnitude of \$2 trillion–\$3 trillion per annum of investment, and perhaps more, we have to keep it in perspective. However, it is an incredibly useful instrument because it has potential to grow quite substantially, it has significant potential, particularly—in my judgment—international issuance in local currency, if along standardized terms. So the Chinese government has issued through London in renminbi, Indian entities have issued in masala bonds, so called masala bonds, same thing. And this has potential to provide a substantial proportion of future financing, ultimately—let me make this point and I'll come back to standardization—ultimately to finance the transition to a low-carbon future. It's going to be mainstream debt, equity, bank loans, and it is just straight on balance sheet. And that requires the overall policy framework to adjust, and that's where people will adjust it. When I say the “policy framework,” I mean the climate policy framework.

Back to standardization on green bonds, your question. There's been a lot of progress recently. And we at the Bank of England, working with the People's Bank of China under the Chinese presidency, working with industry, we're moving toward standardization. And I might just pass to Ashley on this because it's now more in the hands of industry to take that final step—again, there's a common theme here—the market is going to decide what works for the market and to get that level of green certification.

PILITA CLARK: Ashley, I know you've been involved with the green-bond principles and other measures that are trying to bring in standardization from an industry point of view. Do you think that's going to be enough to escalate the market as dramatically as is needed?

ASHLEY SCHULTEN: I see two points on that. Governor Carney makes this important point that we really have to think about mobilizing mainstream capital. And so often in these meetings I think this question goes around of, Why can't we get more investors to buy renewable infrastructure in EM? And that is not how a lot of institutional investors invest. You know, they can't move from a 2 percent allocation to infrastructure into 11 percent. It's illiquid, it has a 12-year lockup, there's no CUSIP. We have to think about packaging this in a way that's digestible to those big pockets of money.

And so I think the way to get that is on one side to think about really starting to get the market to price climate risk effectively. And we get that through disclosure, and we get that through more work and partnership with research and academic institutions, to really figure out what are the material financial risks in some of these companies because of their climate exposure.

Then we also are creating vehicles for people to express climate-friendly investments in a way that fits into their normal asset allocation. And so this conversation always comes up of why—we have only \$260 billion now, and it's really only a drop in the bucket, but we need to remember that this is a market that is about four years old, really. And four years ago when we started this, I never would have dreamed that we would have sovereign issuers—Standard & Poor's and Moody's—rating this,

making it valid as an asset class, thinking about global labels. It's incredibly powerful, the potential here. And if we can work to a place where we do have enough global standardization—and I have to say, honestly, standardization is last year's conversation, because we are really at that point where I would say 95 out of 100 of the green bonds that I look at conform to the green-bond principles and are green enough. And so if we can get a little bit of a pricing tension for good green bonds out there that changes the way that companies think about allocating capital internally, I think there's huge potential for this market.

NICHOLAS STERN: I think ramping up the world's infrastructure investment and at the same time making it sustainable is absolutely at the heart of this story. So what kinds of policies, what kinds of financial structures can make that happen is at the core of what we have to do. Infrastructure will probably more than double in the next 20 years or so. The world economy will probably roughly double, and the infrastructure will more than double because you've got so many countries going through periods when they're going to have to invest a lot.

If we get that wrong we lock in the high-carbon economy, we lock in the dirty infrastructure, we lock in cities where we can't move and breathe and be productive. That next 20 years is of fundamental importance. And probably in that time world infrastructure investment will rise from a bit over \$3 trillion a year to maybe \$7 trillion a year. So it's urgent that we get that right. And it's very encouraging actually that the financial markets are moving so quickly. But there's a great deal that the multilateral development banks can do. And essentially they can help with the policies that actually bring down the risk in the investment, and that's in the institutions. That's very important.

But on the financing side they can help get through those difficult early states of infrastructure. They can do guarantees, they can take equity, they can do long-term loans, and they actually can put it in a bundle. And if you get through those early stages, then there is a big wall of institutional money that can get behind infrastructure that's gotten through the early stages and is giving you a decent revenue stream. And multilateral development banks, if they do it well when they sell it on, because they've managed the risk, they make some money and they recycle that back.

So there's a tremendous contribution that the multilateral development banks could make to all this, but they're going to need the capital to do that. That's another story.

PILITA CLARK: Right—probably requiring another seminar. Governor Carney, I can see that you would like to comment.

MARK CARNEY: Well, just I guess two points. Because you're rightly talking about mainstreaming. And start with the policy frameworks in Paris, the nationally determined contributions that countries have committed, and as they operationalize those. This goes to Nick's point about this flow of infrastructure; currently \$3 trillion a year is the relevant infrastructure spending. It needs to ramp up to \$6 trillion. The question is, How much of that is going to be consistent with a two-degree world and the ultimate policies that are in place? You know, there will be chop and change in policy, but the ultimate policy is in place. The people who think long term—the buy side, the providers of capital who think long term, it starts with the sovereign wealth funds, the pension funds, the major life insurance companies—they are all onto these issues. You look at the people who are implementing the TCFD [Task Force on Climate-Related Financial Disclosures], a third of them are exactly that pool of capital. The asset managers, depending on the fund, are thinking about it, and the bigger ones are thinking about it—as Ashley demonstrates, they're out in front on this because they know that they don't want to put money in infrastructure that becomes obsolete because it's inconsistent. And then what they require is clarity from governments and clarity in terms of the decision-useful information so that they can make those calls. And that's how it links up.

I will reinforce, though, what Ashley said, which is that the standardization in the green-bond market is getting there, and the private sector's delivering it, and we will see a ramp up with that, but in the end it's mainstream debt/equity bank loans that's going to make the difference.

PILITA CLARK: A couple of weeks ago another central bank, the Dutch central bank, issued quite an interesting report where they talked about the big jumps in green investment that we've seen, particularly over the last couple of years. And they

actually warned that there could be a green bubble if there was a continuation of these sort of flows, akin to the tech bubble that we saw nearly 20 years ago.

I just wonder, Governor Carney, is that something that you think is realistically around the corner anytime soon, or is it something that could indeed ever happen?

MARK CARNEY: Well, never say never. You know, that's a very dangerous question. I haven't read what our colleagues at the Dutch central bank said. You will always get, in any market, overshoots, undershoots, euphoria, despair. I think what we're seeing in climate markets—and this is not investment advice—but we're seeing a learning process, very early stages of a learning process. And again, what you want in a market is people who are techno-optimists and -pessimists, people who are true believers or doubters, evangelists, or not, and that is what makes a market. They need the information in order to make the market they're getting at.

Look, as Ashley intimated, if you look at the pricing in, say, green bonds, you're still getting green for free. Now basically—is that fair? So because of standardization, you're basically getting a capital market instrument that actually gives you this additional benefit, which, if you have a view that the climate policy framework is going to tighten over time, actually gives you some protection in terms of the underlying credit—but you're getting that for free right now. So I'm not sure I would look at that market and say that there's some extreme there.

PILITA CLARK: Before we move away from these instruments, as you both know, a lot of advocates in this sector are saying that if we're really going to push the market, the green-bond market in particular, to grow much more quickly, we need to be looking at some forms of incentives, subsidies, maybe tax breaks on issuance costs, or even lower capital requirements for financial institutions that are backing green projects or businesses. Governor Carney, what's your view of that sort of support?

MARK CARNEY: Well, it's not for me to say on the other instruments. I think the core point that we've been making on prudential regulations is that you don't use them as back-door

climate policy. And so you're making a judgment if you're lending into a CCGT [combined-cycle gas turbine] plant in China versus a coal plant, or solar here versus coal, for example. You as the credit provider have to make your own judgment about the future policy environment, not have the bank regulator make a judgment for you. And that's again the reason why we want to get the proper information. So I wouldn't advocate using prudential regulation. I'll tell you: prudential safety and soundness regulation has a big impact on insurers and reinsurers because they take direct risk to these issues today. And you can just think about the last couple of months as examples, but I wouldn't go through that.

Those other issues, it's outside the purview of a central bank to comment.

PILITA CLARK: Ashley, what's the industry view of this?

ASHLEY SCHULTEN: So of course we don't want to introduce anything that would increase risk to the financial system. But I will say that as all of you here hear, there is enormous conversation around the public-private partnership and how can public capital pull in the trillions of private capital that we need to fund the low-carbon transition. And here's the green-bond market that is basically a private sector initiative that is succeeding. And to the extent that we can get standards, we would ask for some sort of public support. I don't know what that public support takes: is it a tax incentive, is it encouragement of public money to invest in these? But I surely see that there is an opportunity where we could have some partnership that would help further the market.

NICHOLAS STERN: Good policy goes to the root of the problem. And good policy means you tax things that are bad and that you make the dirty and the damaging more expensive. And in so doing and in moving in that direction you make it more risky. We know that there are severe difficulties in capital markets in allocating long-term monies. Development banks organized in the right way to bring the right kind of instruments can help overcome those market imperfections. Research and development (R&D) is very important here, and we know the government policy towards R&D there. R&D gives very positive externalities, so supporting R&D. So go to the root of the problem, whether

it's the damage from the greenhouse gases, the damage from the air pollution, the failures in the capital markets, the R&D, the building of networks, such as broadband and grids, which require some kind of government policy to support them, otherwise they don't function well. Go to the root of the problem rather than in some kind of substitute way subsidize because you're not doing the things you should be doing.

PILITA CLARK: Professor Cropper, your work has already spanned a huge range of these sorts of issues, but if you're looking specifically at ways in which to mainstream climate finance, what sorts of areas of research do you think would be most useful, most beneficial? If you could just nominate one or two, what would they be?

MAUREEN CROPPER: I think economists can be useful in two ways. They can actually improve their estimates of climate damages. I think that if you're going to get the kind of political support that you need—and I think implicit in all of these discussions of green finance, as Nick said, is that you have to have the will to have put a price on carbon, and so you need the political will to do this—it's important to be able to document the damages of extreme temperatures at a fine geographic scale. There is work that is going on at the Climate Impact Lab at the University of Chicago looking at the impacts of extreme temperature on eight sectors—health, agriculture, migration, energy, consumption, and others—and it's doing it at a very fine scale. It's important to know with temperature extremes, under a business-as-usual scenario, how many people are going to die in Bihar and how many are going to die in Kerala. And I think that that kind of information is very important for spurring action, and also, for sectors like coastal damages, it can also be a guide to adaptation. So I think that that's very important.

The other thing that's important is really for economists to study what works and what doesn't in terms of policies to actually induce the adoption of green technologies. So in the United States there have been federal subsidies for solar PV [photovoltaic] panels for years. There's huge variation across states in the rate of adoption. This is partly due to the fact that there are actually easier methods of financing this. In California you can actually put the cost of

the panel onto your property tax bill. There are also differences in subsidies across states. And the question is, you know, what really is the impact on reducing carbon dioxide of the uptake of these programs, and that really requires study. So I think that's important.

MARK CARNEY: Just, if I may, one other contribution—there's many other contributions here for economists to make—but one of the things in the TCFD recommendations for particular sectors is to do scenario analysis. So in other words, if we're in a two-degree world—in other words, a world with a policy framework that will deliver two degrees in your jurisdictions of operation—what impact does that have on your ash flows, on your metrics? And that's something that we're working through, or the private sector is working through, to deliver. And some of the most sophisticated scenario analyses come out of the energy sector, the chemical sector. I think it's no accident that the first company to issue under TCFD is BHP Billiton, because these are companies that have to think longer term and have to think about how it's going to impact. That an early-stage process. It's going to be a process of learning. It will get better. There will be good versions and less-good versions, but that's a way of providing a feedback mechanism to markets. And that's where economists, financial analysts, investors, and obviously the companies themselves are going to play, I think, a big role going forward.

ASHLEY SCHULTEN: That's another interesting point that the task force recommended. It really introduced the concept of the handful of scenarios that the market was sort of going to coalesce behind. And so now you have a lot of companies who know what the IEA [International Energy Agency] 450 is. And they wouldn't have really had that conversation a year ago. So even though these scenarios aren't perfect, the fact that we can have a conversation about what forward-looking commitments look like.

And then in addition to the IEA 450 scenario, we're looking also at the physical-risk scenario. And to your point about the Climate Impact Lab, that's something that we've been toying with at BlackRock in terms of getting very specific projections, like, for example, for the U.S. muni market. And what does the business-as-usual case look like for the U.S. muni market which is issuing

very long-term debt? And so I think this is happening at Mach 10, really—the amount of focus on this in terms of company disclosure, but also external tools that we can use, and the computational power that we have now that we can get down to these local grids and really look at what temperature changes or sea level rises would be.

PILITA CLARK: President Macron from France, as you know, is holding a climate summit in December in Paris, and he was saying in fact this week that he hopes that more countries would try to adopt or encourage these task force guidelines. I just wonder if you think that there is a case for them to become mandatory. Governor, do you think so?

MARK CARNEY: Well, I think the spirit of the whole project has been that it's voluntary. And it's a solution of the market for the market. And I think we have to recognize as well that there are over 100 companies that have already signed up, \$3.5 trillion of market cap, \$25 trillion of balance sheet, U.S. dollars. This is big—and a lot more is coming. And what's going to happen in the early stages, the next several years, is there's going to be some trial and error. We'll see what's better practice, what works less well, and that's just on static disclosure through to governance, strategy, scenario analysis, those aspects. And governments will decide what they want to do, but the spirit of the effort has been to get this towards the mainstream and learn as we do it. And I like the speed limit that Ashley put on it. If some things are moving at Mach speed, you don't necessarily have to reinforce it. But others, you know, different countries, will make judgments.

Questions and Answers

Following the panel discussion, a question-and-answer session was held, moderated by *Financial Times* Associate Editor Pilita Clark.

PILITA CLARK: I have many more questions but considering we've got a little bit more than 10 minutes, let me throw it open to the audience. If you have a question, please raise your hand. I believe we have microphones around the room.

Yes, the lady in the middle here. I might take a couple at a time. Did I see another hand? Yes, the gentleman in the grey jacket as well and the lady down here in black.

QUESTIONER: One thing that you haven't discussed is the pricing of carbon sinks, which seems to me to be a needed addition to the market to allow carbon sinks to be an income-producing stream and also make this more of a market. And I was hoping that you could comment on that.

QUESTIONER: Do you think that climate risk is properly quantified in insurance markets? And given also that the IPCC's [Intergovernmental Panel on Climate Change's] results don't include the two biggest sources of carbon, permafrost and the methane hydrates, can we really afford to use those as projections for our timeline? And that's the stick, but on the flip side of carbon, the carrot is—with \$9 trillion in parked capital, what's it really going to take to get something that's going to work, to mobilize the markets to get it out of that parked capital and into these very well demonstrated profitable scenarios?

QUESTIONER: My question is about the development banks. We saw this week the World Bank agreed to report on its portfolio

emissions for the first time. So the development banks are obviously starting to make progress on this. And I wondered what can the development banks be doing in this case to actually price in the risk of climate change and to help countries adapt to those risks as well?

PILITA CLARK: On the pricing of carbon sinks, I'm thinking that's probably Professor Cropper or—

ASHLEY SCHULTEN: I can mention what we're doing. I can just tell you where carbon sinks have impacted us. So when people talk about carbon footprinting portfolios, traditionally what that has referred to is taking corporate emissions, scope 1 and scope 2 emissions, and scaling them over some sort of denominator, like total capital. And so when you think about fixed-income portfolios, how do you treat sovereigns? And so can we think of ways—I mean maybe you can't merge them together—but can we think of ways to incorporate a sovereign carbon footprint? And when we think about using—whether it's CAIT data or whatever source working in consumption and production or consumption and production plus carbon sink—what country should we be including in that, and scaling that by GDP? So that's one way that it's come up.

And then also, in California, you know, people buy in offsets from forests, and I think that you see this movement toward companies to carbon neutral. And how are they going to get carbon neutral? They do some of it through energy efficiency upgrades, but they'll do some of it in terms of buying offsets from California forests.

PILITA CLARK: Good answer. Anybody else?

NICHOLAS STERN: On the IPCC modeling, one of the problems when you do modeling is, if it's quite difficult to capture it, you tend to leave it out. And that's essentially saying that naught is your best guess. And it's obviously daft. Naught can't possibly be the best guess for the emissions from the permafrost. So that's one example. I mean I didn't rehearse it in what I said at the beginning, but that's one example of the way the model systematically underestimates the risks.

I think the carbon sink story is going to be very big. We have to be net zero about 50 years from now to be well below two

degrees, the Paris target. If you want to stop temperature rising, you have to stabilize concentrations. If, God forbid, you stabilize concentrations at a level that gave you four degrees centigrade, you still would have to have net zero, otherwise the concentrations will be rising and the temperature would be going up. So the tougher or the more ambitious the temperature target, the earlier you have to do net zero. There are going to be lots of things that are still positive even when you're running 50 years from now. So you're going to have to have some negatives, and carbon sinks are extremely important in that.

So in some way or other policy ought to be encouraging. If it's done by pricing, so you get the benefit and you're paid directly, that's one way, but there are other ways too.

Finally, on development banks, I think we should ask, indeed insist, that all development banks use internal carbon pricing. Many big firms, many responsible firms do exactly that. All the development banks should do that. The World Bank has begun, the IFC [International Finance Corporation] is experimenting. They should all do it. And I hope that that's one outcome in the Macron summit. It's a very simple ask, and we could all do that. And of course, they should encourage good policies, which not only is having internal carbon prices themselves, but encouraging the governments they work with to push policy in the right direction.

MAUREEN CROPPER: The World Bank is indeed using a shadow price of carbon, and they're actually moving now to the prices suggested in the high-level commission's report on pricing carbon. So this is something that's going forth.

And I think also in terms of actually trying to figure in costs of adaptation and deal with that in terms of projects, that's also an active area of interest to the banks. So I think that these are issues that are being internalized.

MARK CARNEY: Two quick points. First, it's the stock, not the flow, that matters ultimately. And Nick's point: you have to be at net zero. And the reason I say that—and I suspect everyone in this room knows that, and many who watch—but not all the market knows that. It's a very basic point but what two degrees, or two and a half, or three means ultimately is net

zero. It's a stock point. And there are people who are out in front, investing out in front on that, and there are others who will be laggards and figure it out.

And then there was a specific question. I think the first part of the question was about the insurance sector and whether it was pricing well. From what we oversee in the United Kingdom, and that would include, as I said, Lloyd's and the reinsurance through their property and casualty through there, a lot of exposure to the areas hit by recent hurricanes, and they have the capital to absorb and to honor. The market does as a whole. The point I would make, though, is that up until two years ago there had been a tripling of extreme weather events over the last 30 years, a quintupling of the losses. Pricing and coverages adjusting, prices and coverages dynamic. They will adjust again if it's judged that the tail moves in towards being the median on these physical events. And you really do see in the insurance market—remember it reprices every year, and so it's able to update quite quickly. But you do see how what was extreme, 30 years ago, 20 years ago, 10 years ago, is becoming more normal.

PILITA CLARK: I think we've got time for one more round of questions. The gentleman there in the fourth row, and the gentleman here in the second row, and the gentleman over there in the white jacket.

QUESTIONER: Governor Carney, in the discussion the last couple of weeks about the capital ratio requirements you may recollect the European Banking Federation is pushing hard for capital ratio relief for green bonds. The Dutch central bank came back and said no, unless you could improve valuation for green assets. You may know the European Covered Bond Council and the European Mortgage Federation have a project in Europe specifically to do this, to try and match the study in the United States about the differential valuation of green mortgages, that is, mortgages to homes that are energy efficient, versus other ones. In that circumstance, can you see the Bank of England and other regulators following the Dutch central bank's openness to capital ratio requirements relief for green bonds, in that circumstance of qualitative evidence?

QUESTIONER: How does the United States getting out of the Paris Agreement affect the scenario that you have proposed, and what are the things that will change eventually, and how do you perceive it? What will the future be like, and how will this disengagement of the U.S. reflect? Thank you.

QUESTIONER: I want to ask a question about the fact that green finance needs cooperation of both regional organizations and international organizations. So I've heard that the NDB, New Development Bank, in Asia plans to change its model to more green finance. So what do you think of the view of the plans that the IMF can have with the New Development Bank? What is the future of the cooperation of the IMF and regional organizations like the New Development Bank?

PILITA CLARK: Governor Carney, the first questioner has asked you a very specific question and an interesting one.

MARK CARNEY: It was.

PILITA CLARK: What's the answer?

MARK CARNEY: The answer is twofold. First, I would note that actually we are doing some work, not just the Bank of England but more broadly within the G20, on exactly this issue of covered bonds, of securitization—covered bonds obviously being the most straightforward aspect of securitization, but broader securitization options—for green finance. So it's a live issue and it's another sort of, if I can use the term, “wedge” of the financing that I think has some viability.

In terms of actual differential capital standards, as you can appreciate, the question is—directionally you're right, of course, as a central banker, if the Dutch central bank said that of course I agree because we always agree with each other, but I'm sure what they also said is, it's a question of the performance history. And so from a capital relief perspective you need to have enough of a life cycle history around these bonds, and it is relatively early stage. So a prudential regulator—and I see Gabriel Bernardino is here as well and he's nodding, thumbs up—so whether you're a bank regulator or an insurance regulator there's just not enough of a performance

history yet to give capital relief. But it doesn't follow then that if I'm providing that capital, buying those bonds, that I might see the outperformance that's there and pick it up, including in anticipation potentially of a regulatory benefit down the road.

PILITA CLARK: And now just quickly on Paris, it's a very important point that Paris is sort of supposed to accelerate the move of regulators and policymakers around the world and therefore potentially enhance climate risk. And now we've got the world's largest economy saying they're withdrawing from Paris. So doesn't that therefore affect the thesis? Actually, Governor Carney, it's kind of you again, but if anyone else would like to—

MARK CARNEY: I think Maureen wants to.

MAUREEN CROPPER: Well, I wanted to say in defense of the United States that in terms of what states are doing, not just the state of California, but the regional greenhouse gas initiative, in many ways Trump's idea of taking us out, which of course can't happen until 2020, is something that really has redoubled the efforts at the state level. And I think that that message is something that will come across—I hope. I'm not in the position to say how capital markets will react to it, but I think that one should give credit where credit is due.

NICHOLAS STERN: The question was also about what other countries would do. I've learned that commenting on the United States in an English accent is at best ineffectual and can be much worse than that. But I will comment on how other countries react to the United States. And essentially, just as Maureen Cropper described, what the states and the cities and firms in the United States have been doing—they've said we carry on. And even more strongly that's true outside the United States. I was in COP22 in Marrakech [the 2016 UN Climate Change Conference] in the days after the election results in the United States came through. Country after country stood up and said, "We get on with it." And that's exactly what they've been doing. Why—(a) because it's the right thing to do and (b) because that alternative growth path is a much more attractive way and a more sustainable and stable way to grow into the future.

So the rest of the world says very clearly: we get on with it. At the G20 in Hamburg, all the countries except the United States said Paris is irreversible. Even the preamble in the G20 communiqué said that the objective of their actions in the G20 is strong balance, sustainable and inclusive growth. The United States actually signed up to that.

So I think the reaction around the world has been impressive and strong and people will just get on with it. I've been very involved with the NDB; I'm quite happy to say something about that.

PILITA CLARK: I was going to say we've got a flashing red light, but if you could actually answer. Very interesting question.

NICHOLAS STERN: Yes, an important question. For transparency: I was very much involved in the founding of the NDB and I'm on the International Advisory Panel of the Asia Infrastructure Investment Bank. Both those banks have put right at the top of their strategy sustainable infrastructure. The first five loans in the NDB were all for renewable energy, one in each of B-R-I-C and S [Brazil, Russia, India, China, and South Africa]. They are getting on with doing good things. I think they should absolutely be welcomed into the development banking community.

PILITA CLARK: Well, unfortunately that is it, time wise. I would like to say a very, very heartfelt thank you to all of our panelists. In climate change generally it often seems as if not very much happens very fast, however, it's quite uplifting in many ways to hear people suggesting that we are, and in fact to see that we are, seeing some real acceleration in some aspects of the debate and actually on the ground, concrete change.

So, thank you very much, Lord Stern, Ashley Schulten, Professor Cropper, and Governor Mark Carney. It's been a pleasure. Thank you. Please join me in thanking them.

Biographies



Mark Carney

Mark Carney is Governor of the Bank of England, a position that he has held since July 2013. In addition to his duties as Governor, he serves as Chairman of the Financial Stability Board, as First Vice-Chair of the European Systemic Risk Board, and as a member of the Group of Thirty and the Foundation Board of the World Economic Forum.

After a thirteen-year career with Goldman Sachs, Mr. Carney was appointed Deputy Governor of the Bank of Canada in August 2003. In November 2004, he left the Bank of Canada to become Canada's Senior Associate Deputy Minister of Finance. He held this position until his appointment as Governor of the Bank of Canada and Chairman of its Board of Directors in February 2008, a position which he held until he assumed his current position with the Bank of England.

A native of Canada, Mr. Carney received a bachelor's degree in economics from Harvard University in 1988 and a master's degree and doctorate in economics, both from Oxford University, in 1993 and 1995, respectively.



Maureen Cropper

Maureen Cropper is a Distinguished University Professor and Chair of the Department of Economics at the University of Maryland. She is also a Senior Fellow at Resources for the Future, a Research Associate of the National Bureau of Economic Research, and a member of the National Academy of Sciences.

Professor Cropper served as a Lead Economist in the World Bank's Research Department from 1993 to 2006 and was a member of the Science Advisory Board of the U.S. Environmental Protection Agency from 1994 to 2006, where she chaired the Advisory Council on Clean Air Compliance Analysis and the Environmental Economics Advisory Committee. She recently cochaired the National Academy of Sciences Committee on Assessing Approaches to Updating the Social Cost of Carbon.

Professor Cropper's research has focused on valuing environmental amenities, on evaluating the trade-offs implicit in environmental regulations, and on the choice of discount rates for evaluating public policies. She has published more than 80 books and journal articles. Her current research centers on valuing climate amenities in the United States and evaluating energy and environmental policies in India.



Ashley Schulten

Ashley Schulten is Head of Climate Solutions, Fixed Income, at BlackRock. She is a portfolio manager on global green and socially responsible mandates and leads the coordination of BlackRock's firmwide Green Bond effort. She partners with BlackRock's Global Fixed Income team to bring ESG and climate risk integration tools and strategies to the investment process. Prior to this role, she spent several years in the Global Rates Trading team. Previous to BlackRock, Ms. Schulten's work included 20 years as a sell-side interest rate and options trader.

Ms. Schulten earned a BA in political science from Vanderbilt University in 1992. She serves on the Executive Committee of Green Bond Principles and Cicero's Climate Finance Board. She has contributed to publications on green finance including "Investor Expectations of the Green Bond Market" through Ceres and "Categorizing Climate Risk for Investors" through the Cicero Center for International Climate Research. In her personal capacity, she sits on the Board of the Mianus River Gorge, the first Nature Conservancy land project.



Nicholas Stern

Nicholas Stern is I. G. Patel Professor of Economics and Government at the London School of Economics and Chairman of its Grantham Research Institute on Climate Change and the Environment. He is a member of the Group of Twenty Eminent Persons Group. He served as President of the British Academy from July 2013 to July 2017 and was elected a Fellow of the Royal Society in 2014.

Lord Stern was Chief Economist at both the World Bank (from 2000 to 2003) and the European Bank for Reconstruction and Development (from 1994 to 1999). He was Head of the UK Government Economic Service from 2003 to 2007 and produced the landmark *Stern Review* (2006) on the economics of climate change. He was knighted in 2004, made a cross-bench life peer in 2007, and appointed Companion of Honour in 2017 for his services to economics, international relations, and tackling climate change.

Lord Stern's most recent book is *Why Are We Waiting?* (MIT Press, 2015).



Pilita Clark (Moderator)

Pilita Clark is an associate editor and business columnist at the *Financial Times*. She writes a weekly column on modern corporate life, as well as features and other articles.

She joined the *Financial Times* in 2003 as a commissioning editor on the newspaper's weekend magazine and went on to cover aviation and the environment. She was previously a Washington correspondent for Australian newspapers and a Nieman Fellow at Harvard University.

The Per Jacobsson Lectures

- 2017 *Economic and Financial Issues Related to the Impact of Climate Change*. Panel discussion with Mark Carney, Maureen Cropper, Ashley Schulten, and Nicholas Stern, moderated by Pilita Clark.
- 2016 *Are We Safer? The Case for Strengthening the Bagebot Arsenal*. Lecture by Timothy F. Geithner.
Reflections on Central Banking: What Is It All About? Lecture by Jacob Frenkel (Basel).
- 2015 *Latin America: Outlook and Challenges Ahead*. Panel discussion with Carmen M. Reinhart, Rodrigo Valdés, and Julio Velarde (Lima).
- 2014 *The Federal Reserve and the Global Economy*. Lecture by Stanley Fischer.
Managing Financial Crisis in an Interconnected World: Anticipating the Mega-Tidal Waves. Lecture by Zeti Akhtar Aziz (Basel).
- 2013 *Central Banking in the Crisis: Conceptual Convergence and Open Questions on Unconventional Monetary Policy*. Lecture by Jean-Claude Trichet.
- 2012 *China's Monetary Policy Since the Turn of the Century*. Lecture by Zhou Xiaochuan (Tokyo).
Society, Economic Policies, and the Financial Sector. Lecture by Y. V. Reddy (Basel).
- 2011 *The IMF and the International Monetary System: Lessons from the Crisis*. Lecture by Axel A. Weber.
What Financial System for the Twenty-First Century? Lecture by Andrew Crockett (Basel).
- 2010 *Navigating the New Normal in Industrial Countries*. Lecture by Mohamed A. El-Erian.
Markets and Government Before, During, and After the 2007–20XX Crisis. Lecture by Tommaso Padoa-Schioppa (Basel).
- 2009 *Growth After the Storm? A Longer-Run Perspective*. Lecture by Kemal Derviş (Istanbul).
- 2008 *The Role and Governance of the IMF: Further Reflections on Reform*. Symposium panelists: Stanley Fischer, Trevor Manuel, Jean Pisani-Ferry, and Raghuram Rajan.
The Approach to Macroeconomic Management: How It Has Evolved. Lecture by Lord George (Basel).
- 2007 *Balance of Payments Imbalances*. Lecture by Alan Greenspan.
- 2006 *Asian Monetary Integration: Will It Ever Happen?* Lecture by Tharman Shanmugaratnam (Singapore).
Competition Policy and Monetary Policy: A Comparative Perspective. Lecture by Mario Monti (Bern).
- 2005 *International Financial Institutions: Dealing with New Global Challenges*. Lecture by Michel Camdessus.
- 2004 *The U.S. Current Account Deficit and the Global Economy*. Lecture by Lawrence H. Summers.
Some New Directions for Financial Stability? Lecture by C.A.E. Goodhart, CBE (Zurich).
- 2003 *The Arab World: Performance and Prospects*. Lecture by Abdlatif Yousef Al-Hamad (Dubai).
- 2002 *The Boom-Bust Capital Spending Cycle in the United States: Lessons Learned*. Lecture by E. Gerald Corrigan.
Recent Emerging Market Crises: What Have We Learned? Lecture by Guillermo Ortiz (Basel).

- 2001 No lecture took place due to the cancellation of the Annual Meetings of the IMF and the World Bank.
- 2000 *Ten Years On—Some Lessons from the Transition*. Lecture by Josef Tošovský (Prague).
Strengthening the Resilience of Financial Systems. Symposium panelists: Peter B. Kenen, Arminio Fraga, and Jacques de Larosière (Lucerne).
- 1999 *The Past and Future of European Integration—A Central Banker's View*. Lecture by Willem F. Duisenberg.
- 1998 *Managing the International Economy in the Age of Globalization*. Lecture by Peter D. Sutherland.
- 1997 *Asian Monetary Cooperation*. Lecture by Joseph C.K. Yam, CBE, JP (Hong Kong SAR).
- 1996 *Financing Development in a World of Private Capital Flows: The Challenge for International Financial Institutions in Working with the Private Sector*. Lecture by Jacques de Larosière.
- 1995 *Economic Transformation: The Tasks Still Ahead*. Symposium panelists: Jan Svejnar, Oleh Havrylyshyn, and Sergei K. Dubinin.
- 1994 *Central Banking in Transition*. Lecture by Baron Alexandre Lamfalussy (London).
Capital Flows to Emerging Countries: Are They Sustainable? Lecture by Guillermo de la Dehesa (Madrid).
- 1993 *Latin America: Economic and Social Transition to the Twenty-First Century*. Lecture by Enrique V. Iglesias.
- 1992 *A New Monetary Order for Europe*. Lecture by Karl Otto Pöhl.
- 1991 *The Road to European Monetary Union: Lessons from the Bretton Woods Regime*. Lecture by Alexander K. Swoboda (Basel).
Privatization: Financial Choices and Opportunities. Lecture by Amnuay Viravan (Bangkok).
- 1990 *The Triumph of Central Banking?* Lecture by Paul A. Volcker.
- 1989 *Promoting Successful Adjustment: The Experience of Ghana*. Lecture by J.L.S. Abbey.
Economic Restructuring in New Zealand Since 1984. Lecture by David Caygill.
- 1988 *The International Monetary System: The Next Twenty-Five Years*. Symposium panelists: Sir Kit McMahon, Tommaso Padoa-Schioppa, and C. Fred Bergsten (Basel).
- 1987 *Interdependence: Vulnerability and Opportunity*. Lecture by Sylvia Ostry.
- 1986 *The Emergence of Global Finance*. Lecture by Yusuke Kashiwagi.
- 1985 *Do We Know Where We're Going?* Lecture by Sir Jeremy Morse (Seoul).
- 1984 *Economic Nationalism and International Interdependence: The Global Costs of National Choices*. Lecture by Peter G. Peterson.
- 1983 *Developing a New International Monetary System: A Long-Term View*. Lecture by H. Johannes Witteveen.
- 1982 *Monetary Policy: Finding a Place to Stand*. Lecture by Gerald K. Bouey (Toronto).
- 1981 *Central Banking with the Benefit of Hindsight*. Lecture by Jelle Zijlstra; commentary by Albert Adomakoh.
- 1980 *Reflections on the International Monetary System*. Lecture by Guillaume Guindey; commentary by Charles A. Coombs (Basel).

- 1979 *The Anguish of Central Banking*. Lecture by Arthur F. Burns; commentaries by Milutin Ćirović and Jacques J. Polak (Belgrade).
- 1978 *The International Capital Market and the International Monetary System*. Lecture by Gabriel Hauge and Erik Hoffmeyer; commentary by Lord Roll of Ipsden.
- 1977 *The International Monetary System in Operation*. Lectures by Wilfried Guth and Sir Arthur Lewis.
- 1976 *Why Banks Are Unpopular*. Lecture by Guido Carli; commentary by Milton Gilbert (Basel).
- 1975 *Emerging Arrangements in International Payments: Public and Private*. Lecture by Alfred Hayes; commentaries by Khodadad Farmanfarmaian, Carlos Massad, and Claudio Segré.
- 1974 *Steps to International Monetary Order*. Lectures by Conrad J. Oort and Puey Ungphakorn; commentaries by Saburo Okita and William McChesney Martin (Tokyo).
- 1973 *Inflation and the International Monetary System*. Lecture by Otmar Emminger; commentaries by Adolfo Diz and János Fekete (Basel).
- 1972 *The Monetary Crisis of 1971: The Lessons to Be Learned*. Lecture by Henry C. Wallich; commentaries by C.J. Morse and I.G. Patel.
- 1971 *International Capital Movements: Past, Present, Future*. Lecture by Sir Eric Roll; commentaries by Henry H. Fowler and Wilfried Guth.
- 1970 *Toward a World Central Bank?* Lecture by William McChesney Martin; commentaries by Karl Blessing, Alfredo Machado Gómez, and Harry G. Johnson (Basel).
- 1969 *The Role of Monetary Gold over the Next Ten Years*. Lecture by Alexandre Lamfalussy; commentaries by Wilfrid Baumgartner, Guido Carli, and L.K. Jha.
- 1968 *Central Banking and Economic Integration*. Lecture by M.W. Holtrop; commentary by Lord Cromer (Stockholm).
- 1967 *Economic Development: The Banking Aspects*. Lecture by David Rockefeller; commentaries by Felipe Herrera and Shigeo Horie (Rio de Janeiro).
- 1966 *The Role of the Central Banker Today*. Lecture by Louis Rasminsky; commentaries by Donato Menichella, Stefano Siglienti, Marcus Wallenberg, and Franz Aschinger (Rome).
- 1965 *The Balance Between Monetary Policy and Other Instruments of Economic Policy in a Modern Society*. Lectures by C.D. Deshmukh and Robert V. Roosa.
- 1964 *Economic Growth and Monetary Stability*. Lectures by Maurice Frère and Rodrigo Gómez (Basel).

The Per Jacobsson Lectures are available on the Internet at www.perjacobsson.org, which also contains further information on the Foundation. Copies of the Per Jacobsson Lectures may be acquired without charge from the Secretary. Unless otherwise indicated, the lectures were delivered in Washington, D.C.

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