Introduction

The people of the world are gambling for colossal stakes. Two centuries of scientific enquiry, founded in basic physics and powerful evidence, indicate that the risks from a changing climate over the next hundred years and beyond are immense. There is a strong possibility that the relationship between humans and their environment would be so fundamentally changed that hundreds of millions of people, perhaps billions, would have to move. History tells us that this carries serious risks of severe and extended conflict. We are the first generation that through its neglect could destroy the relationship between humans and the planet, and perhaps the last generation that can prevent dangerous climate change.

On the other hand, the potential paths of development embodying strong reductions in greenhouse gas emissions (mitigation) and creative adaptation to now unavoidable climate change are becoming ever clearer, and they look ever more attractive in themselves, over and above the fundamental climate risk reductions that they bring. We are constantly discovering and demonstrating different ways of managing the production and consumption of energy, of organizing cities, and of using land productively, with the aid of new technologies and smarter processes. We can now see that growth, development, mitigation, and adaptation go hand in hand, and that the portrayal of climate action as being in inexorable conflict with growth, poverty reduction, and radical improvements in human well-being is false and diversionary. Indeed, an attempt at high-carbon growth will self-destruct through the hostile physical environment it will create. A committed and measured low-carbon transition would likely trigger an exciting new wave of global investment, innovation, and prosperity.

The economic policies that can guide this transition are sufficiently clear to embark on the journey, and we will learn much along the way. They build on basic ideas about overcoming market failures, on an understanding of technological transformations in economic history, and on theories and experience of economic growth. If such policies are adopted, they will stimulate investment, growth, efficiency, and innovation. There is much that each country can do now that is in its own interests, even without placing a value on emissions reductions and without the context of an international agreement on climate change: make markets function better, improve infrastructure, stimulate investment and innovation, reduce inefficiencies and waste in the use of energy and other natural resources, improve energy security, and reduce local forms of environmental pollution and damage.

Now is a critical time to make this transition. We stand at a crossroads where, consciously or otherwise, we must make fundamental choices that will shape our future economy and climate. Over the next two decades we will see a remarkable coincidence of two vital transformations in world history. First, it is in this period that we will largely determine whether or not we have a reasonable chance of avoiding dangerous climate change, usually defined as holding the increase in average global surface temperature to less than 2°C above nineteenth-century levels. The link between emissions of greenhouse gases and climate change should be well known. Our activities cause the emission of these gases (among which carbon dioxide is particularly important) which are not fully absorbed by the earth and which thus accumulate in the atmosphere, thereby raising concentrations of the gases. These concentrations prevent energy from escaping, resulting in global warming and climate change. We have a period-by-period "ratchet effect" of flows of emissions into concentrations in the atmosphere because carbon dioxide, in particular, is very long-lasting in the atmosphere.

The stock of greenhouse gases in the atmosphere is already at worryingly high levels; if we stay substantially above those levels for a long time, it will be difficult or impossible to have a reasonable chance of holding the global temperature increase to 2°C. And delay is dangerous because of the ratchet effect and because we will have locked in more long-lived, high-carbon capital and infrastructure. The window for action is closing.

The second reason why the next two decades are a critical period for climate action has to do with the extraordinary structural changes that will happen anyway over this period. It is a period that will determine the shape of many cities, energy systems, and land use patterns for decades or even centuries to come. Cities will grow rapidly, and older cities will require reform and renewal. Energy systems will be created as many countries pass through stages of development in which energy demand will grow strongly, while richer countries will be refurbishing their systems. And many of the battles to save and enhance forests and ecosystems will be resolved in the face of strong pressures from growth of population and demand for materials and food.

Regions, countries, provinces, cities, businesses, and households will have many decisions to make across these critical domains of cities, energy systems, and land use. These decisions can be made well or badly, explicitly or implicitly, haphazardly or thoughtfully. They can be made with sound judgment, with an eye to the future and with an understanding of the consequences of our actions for the environment and society—we can be thinking, for example, about the kind of cities we wish to live in and the pollution, congestion, and sense of community they might embody, the future of our ecosystems and natural resource usage, and the harnessing of opportunities that come from new technologies. Or they can be made with an eye to the past and narrowly—we can assume that traditional ways of doing things should be replicated, and that we can ignore consequences to others and the opportunities and challenges that surround us. If the decisions around this second transformation are made wisely, a great deal of what we need to do to avoid dangerous climate change will have been achieved just by doing what was sensible and desirable during this critical process of structural change, even without factoring in the longer-term climate benefits of reduced emissions. This structural change will require strong investments. One way or another, investments in and during this transformation will take place in some shape or form. The challenge is to create policies and frameworks that will encourage those investments to be sound in the sense just described. If we do, the challenge of managing climate change will be far less difficult than if we manage this structural change badly.

International cooperation can play an important role in accelerating the transition to the low-carbon economy and making it more equitable.

Yet understanding the dynamics of structural change within countries, cities, firms, and households casts the role of international cooperation on climate change in a rather different light from the past. We need to think rigorously about the *kind* of cooperative interactions and institutions that can help steer these two transitions, the structural and the climatic, wisely—remembering that the case for each country to make the domestic transition toward a low-carbon, climate-resilient economy is already strong, but that constructive and equitable international cooperation would greatly strengthen that case and make the two transitions still more attractive, rapid, and efficient.

Part of the collaboration should include global goals on greenhouse gases that could avoid dangerous climate change, expressed in ways that provide clear signals that can induce confidence about the future direction of the global economy. International institutions, moreover, can help give countries a picture of global progress, through careful measurement of emissions across the globe and by diffusing more specific examples, lessons, and good practice from around the world. And they can also help coordinate the international transfer of more tangible things, like finance and clean technologies. Much of the cooperation should involve policies that help markets work well, including, for example, the pricing of greenhouse gases, supporting innovation, building networks (for example for electricity and transport), overcoming market obstacles and failures in long-term finance, sharing technologies, fostering measures to protect and enhance forests and ecosystems, and supporting poorer countries. Policies, in other words, that will promote sustainable poverty reduction and growth. The equity part of the story is basic, not only because ethical principles tell us that equity matters, but also because it is crucial for the sustainability of international understandings—arrangements that are seen to be inequitable or unjust may not last.

If we are to tackle climate change successfully, it will be necessary that those who make and influence climate policy—from treasury officials to business leaders, from international negotiators to ordinary citizens—have a strong understanding of why action is necessary, why now, what form it could take, and what it would deliver. The purpose of this book is to contribute to an analysis that could support such understanding. Specifically, I examine the powerful case for climate action in relation to the *problem* (including its nature, scale, and urgency), the *responses* to it

(their attractiveness, effectiveness, and feasibility), and the *institutions, policies, and measures* that can be put in place to shape those responses (at the subnational, national, and international levels). The analysis and argument draw on a range of disciplines and perspectives—especially science, economics, and philosophy; politics, history, geography, and others must play a strong role too. The analytical insights from these disciplines assembled here provide, I trust, clear and robust guidance to decision-makers. Along the way they also dispose, I trust convincingly, of the muddled and weak arguments for inaction, be they well-motivated or advanced by those with a vested interest.

The book is structured as follows.

Part I frames the basic choices the world faces: put starkly, between peril and prosperity. Chapter 1 sets out the basic science and the risks it implies. It provides the scientific foundation that forms the basis for the discussion and analysis in the following chapters of what can and should be done in order to make good economic policy for the transition to a low-carbon, sustainable, and more attractive economy and society. I argue that the extraordinary nature and scale of those risks requires that we think carefully about, and work to improve how we communicate, the climatic and economic impacts of possible future paths of greenhouse gas emissions.

Chapter 2 sets out alternative pathways we could take—the transition to a low-carbon world—and why they are both feasible and attractive, quite aside from the dramatic reduction in climate risk that they would bring. The scale of emissions reductions associated with avoiding grave risks of climate change implies nothing short of a new energy-industrial revolution—involving innovation, discovery, and learning on a massive scale. Experience of past technological revolutions suggests that they are associated with waves of investment, innovation, and growth of two to three decades or more. An energy-industrial revolution would bring radical improvements to the way we produce and consume energy, to the planning and livability of our cities, and in the sustainability of our use of land and other natural resources. Indeed that revolution should include how we manage and invest in our forests, land, and ecosystems. The chapter explores the technologies, services, and processes that we can now see will be a part of this brighter future (many others will be invented along the way). It considers the respective benefits and (in many cases,

rapidly falling) costs of these technologies, and the investments that could be required to bring about their widespread diffusion and deployment. And it sets out and discusses the work of the Global Commission on the Economy and Climate, which I co-chair with President Felipe Calderón.

Part II examines the analytical and policy tools and frameworks necessary to foster the rapid and radical change required to tackle climate change. Chapter 3 focuses on domestic policies for achieving dynamic structural change. The chapter sets out the lessons from public economics concerning market failure, as well as lessons from economic history and the Schumpeterian perspective on the economics of technology, innovation, and growth. Well-designed policy heeds these lessons and recognizes the close relationship between mitigation, adaptation, and development. It is also attuned to the mutually supportive roles of governments and businesses in the transition to a low-carbon economy.

In chapter 4, I examine, and criticize, the models of the economics of climate change that currently dominate much economic discussion. I argue that they grossly underestimate the economic damages and risks implied by the scientific climate models (which themselves omit important catastrophic risks that are difficult to model). We need not only a new generation of models, but also a broader and wiser set of perspectives on how to use the models that we have. We need a more strategic approach to understanding the great risks associated with climate change which allows us to assemble evidence from a broad range of sources and avoids being overly influenced by narrow modeling; such modeling excludes so much of what really matters and builds in strong and misleading assumptions—modest scale of risks, limited uncertainty, and exogenous drivers of growth. In other words, we need to put economics to work in a way that is much wiser in its understanding of the phenomena and risks at issue, in its choice of models, and in its understanding of the role of modeling in relation to the issues and to policy.

An important question that arises in what is fundamentally a short, medium, and long-run story is that of intertemporal values and valuations (in shorthand, discounting). Chapter 5 shows how many discussions and analyses of intergenerational issues have been marred by serious analytical errors, particularly in applying standard approaches to discounting that are associated with shorter-term decision-making. The errors arise, in part, from paying insufficient attention to the magnitude of potential

damages, in part from overlooking problems with using market information as the basis for public ethical decision-making about our long-term future, in part from an unwillingness or inability to grapple seriously with the basic ethical principles underlying the values and valuations, and in part from an ignorance or overlooking of much of the literature in public economics around cost-benefit analysis and discounting.

Chapter 6 goes beyond the standard ethical approaches used by economists in the context of discussions of intertemporal valuation and considers the broader ethical and moral issues that inform and enrich policy analysis of climate change. The chapter considers climate change through the lens of a number of different ethical theories and argues that they suggest very similar conclusions concerning the importance of strong and urgent action.

Together, the policy, economic, and ethical arguments assembled in part II provide, in my view, an analytically sound and powerful basis for strong action on climate change. Further, many of the necessary actions make sense for one country's policy regardless of what other countries do.

Part III of the book focuses on global aspects of climate change policy, and on the relationship between actions at a national and a global level. Chapter 7 traces some recent global developments in climate action. It discusses the evolution of the international climate change negotiations and traces the shift away from the centralized and legalistic "Kyoto approach," an approach that has proved in many ways impractical. The bulk of the chapter examines recent global trends in national climate change policymaking, along with examples of action from a range of developing and developed countries,[1] and from various types of nonstate actors. It shows that there is already a great deal of climate action going on, and that there are many positive examples from which to draw inspiration and lessons. But it also shows that the world is moving far too slowly and that an acceleration is urgently needed.

Chapter 8 draws on the lessons from chapter 7 to illustrate how the international climate change institutions and negotiations could evolve in the near future to promote more effectively the transition to a low-carbon economy at the scale, and with the speed, required. The chapter also comments on the importance and potential role of the 2015 UNFCCC Paris conference (COP 21) in generating the confidence needed by governments and investors to catalyze greater domestic action, and on the role of

domestic action in generating confidence necessary for an international agreement.

Chapter 9 sets out an approach to international equity that could underpin the framework for climate governance sketched in chapter 8. It explains how past approaches to international equity, framed around burden-sharing or distributing a set of static costs, fundamentally misrepresent the economics of action on climate change. This is a dynamic story in which innovation and discovery are at the core, and where much of the action by a country is economically beneficial to that country, apart from its longer-term contribution to the mitigation of climate risk and irrespective of what others do.

There will, however, be investments to be undertaken and costs to be borne in the transition to a low-carbon economy beyond those which a country might make from the perspective of narrow self-interest. Thus there are important questions about how to shape climate actions across countries in a way that is broadly equitable. I argue that countries should structure their responses according to the notion of "equitable access to sustainable development," to use the language of the Cancún (COP 16) UNFCCC agreement of December 2010. This can be understood in a number of ways, including that all countries undertake the transition to a low-carbon, climate-resilient economy, but that wealthier countries do so more quickly, bringing down the costs of key technologies in the process, providing strong practical examples, while also assisting poorer countries through finance, technology, and know-how.

The concluding chapter broadens out from parts I–III to consider some of the reasons why, despite such a strong analytical and ethical case, we do not see action on the scale and with the urgency required. It considers lessons from historical social advances, particularly those concerned with the management of risk, and from politics and psychology, and draws lessons as to how the barriers to climate action might be overcome.

As I explain in the preface, an extraordinary amount has changed between the time of writing (2014) and 2006 when *The Stern Review* was published. Much of that change has reduced the barriers to, and strengthened the case for, strong climate action. It has also broadened and deepened the analysis (for example in health and ethics), made it much more dynamic, and explored different approaches to international

collaboration and how ideas change. There are powerful implications for both domestic and international policy.

I hope that readers of this book will gain an appreciation not only of the risks implied in our present path, but of the extraordinary opportunities and prospects for a better future—not merely in the fundamentally important long-term sense, as a result of tackling climate change effectively, but also in the short to medium term, by integrating the climate-carbon transition with the fundamental structural changes that are in train in the economies, cities, and rural and forest areas of the world. I hope also that readers will find the basic ideas and arguments that arise from the economics, moral philosophy, and science to be fascinating and instructive as well as important. The perspective and logic assembled here have implications for any analysis of great risk which involves the long term, and for our basic ethical approaches to major policy questions.

But I hope also that it helps form an agenda for further research. This is an extraordinarily fascinating, as well as vitally important, area of research. So much of economics is involved in the dynamics of risk, learning, and change. Inevitably our questions take us beyond economics to ethics, history, geography, and so on. And social scientists must work hand in hand with scientists and engineers. Such collaborations can be extremely productive and rewarding.

I remain optimistic about what we can do if we are imaginative, rational, scientific, and collaborative. Yet overall progress is dangerously, indeed recklessly, slow. Part of the explanation for this delay is that some of the techniques for analyzing the case for action have been weak, wrong, or inappropriately applied; risks from climate change have been grossly underestimated in the economics literature and the distant future far too heavily discounted. That is why it is so important to both make the analysis robust and rigorous and to show how so much of the opposition to action is based on flawed analysis.

Sound argument should be a necessary condition for sensible and rational action. But it is not sufficient. This book will have achieved its aim if concerned citizens make these arguments cogently and strongly in the right places, in ways which can be understood and which resonate; and if those with influence participate, listen, and lead. As the following pages will show, the arguments are there to be won.

Why Are We Waiting?

The Logic, Urgency, and Promise of Tackling Climate Change

By: Nicholas Stern

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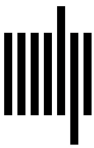

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