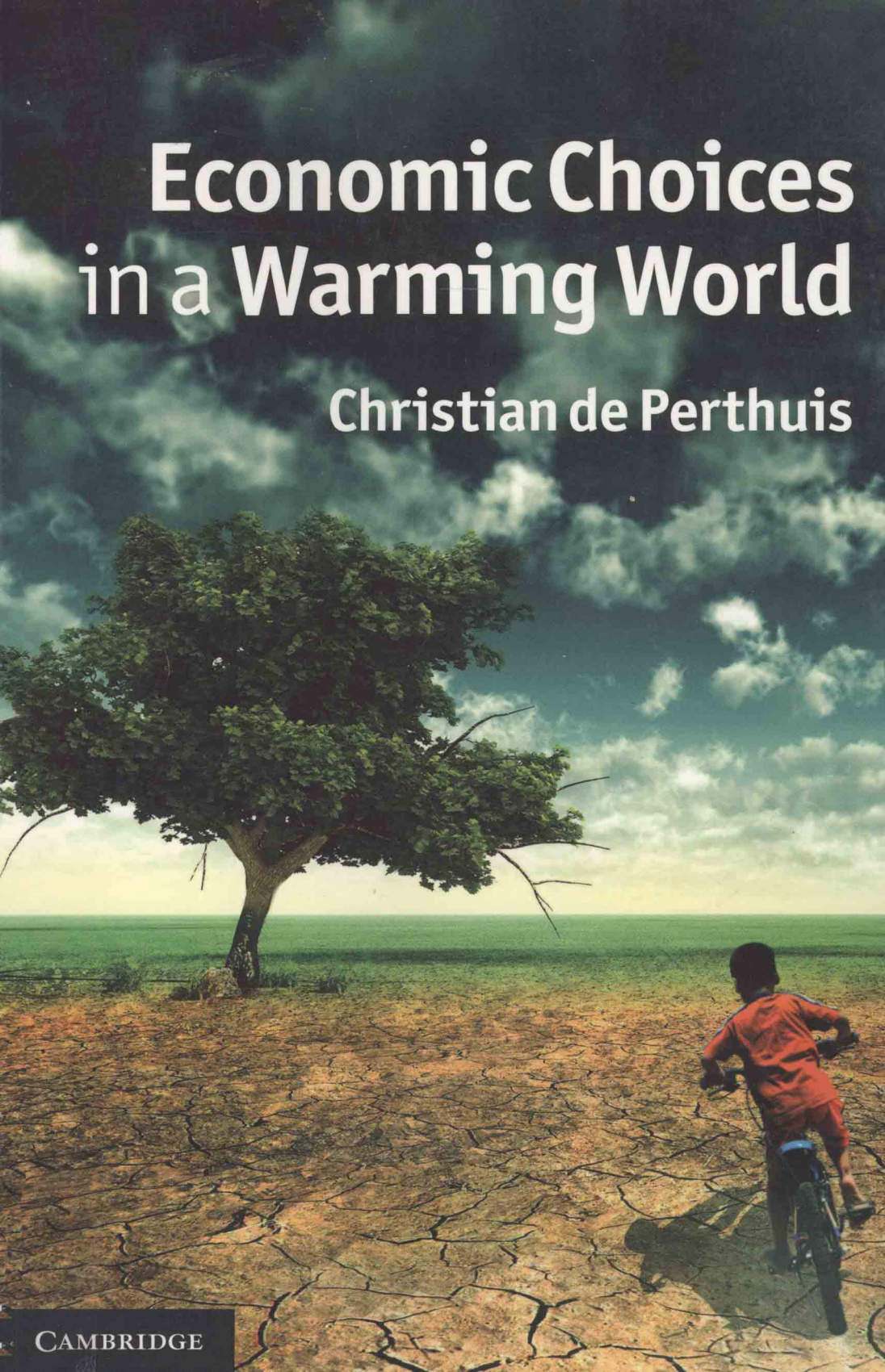
Economic Choices in a Warming World

Christian de Perthuis



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INTRODUCTION

Manaus opera house

The first glimmer of dawn lights up the dark water that extends as far as the eye can see. The air is heavy with humidity. The silhouette of a ship anchored in the river stands out clearly. It is an oil tanker from the Urucu oilfield, 650 kilometres upstream, here to supply the refinery in the free-trade zone, where the leading companies of the Brazilian electronics industry are booming. The river is already bustling with local traffic. Small boats are unloading cargoes of bananas and manioc destined for the central marketplace, the metal arches of which extend along the river bank. Street vendors are beginning to spread out their merchandise on the pavement. The opera house is perched half way up the hill, its dome towering above the city. In a few hours' time, visitors will be crowding inside, admiring the stage and the gilt décor, comparable to anything the Paris opera has to offer.

We are in Manaus. Two million people live here, in the heart of the Amazonian rainforest, 1,500 kilometres from the mouth of the Amazon. In 1669, the Portuguese settlers established a trading post to signal their presence to the overly close Dutch explorers in Surinam. The town grew by leaps and bounds in the late nineteenth century. From 1890 to 1910 Manaus was the richest city in Latin America and one of the most prosperous anywhere in the world.

Manaus's wealth was based on the rubber boom. The Amazonian hevea tree, naturally present in the forest, was for several decades the world's only source of latex. Its exploitation developed at a frenzied pace. The rubber barons sent their workforce, the *seringeros*, ever deeper into the forest to tap the hevea trunks and bring back the precious sap. The economic model was straightforward. On the supply side, it was a matter of taking the largest possible amount of latex from a seemingly inexhaustible reservoir: from Manaus, the Amazonian forest is a green ocean extending interminably in all directions. On the demand side, the need for rubber also seemed to be limitless, for competition was nonexistent. Prices, therefore, could only continue rising. The rubber barons' investments quickly took an extravagant – as testified by the town's central marketplace and opera house – and dangerously speculative turn.

With an economy of predation on the supply side and an economy of speculation on the demand side, it was a state of affairs that was bound to come to grief. The downfall of Manaus resulted from what some people view as one of the first acts of 'bio-piracy'. In 1876, the explorer Henry Wickham embarked for London with a collection of 70,000 hevea seeds in the hold, destined for the great greenhouses of Kew Botanical Gardens. Kew's biologists managed to keep alive fewer than 3,000 sprouts from the seeds, which were then sent to Colombo botanical garden in Sri Lanka. Colombo became the hub for hevea seeds destined for Asian commercial plantations, where production started around the turn of the century. The Manaus rubber barons never recovered. The most entrepreneurial of them tried to convert their mining-type production model into commercial plantations. But confronted by the green Amazonian ocean their efforts were in vain and none of them managed to curb the attacks of parasites, particularly microcyclus, that destroyed the young shoots. The decline of Manaus was unremitting and continued until around 1960. Travellers told of the dilapidation of the opera, its structure rotting away in the moist tropical heat. Eventually it had to be closed to the public.

The economic and financial crisis that struck the world economy in 2008–9 has certain similarities with the epoch of the rubber barons. We find the same two ingredients: a speculation economy and a predation economy.

Firstly, take a speculation economy. The bankruptcy of Lehman Brothers, one of the flagships of Wall Street, in September 2008, revealed the fragility of the sophisticated international financial products that were supposed to ensure better risk management by distributing it, through securitization, among a large number of actors. When speculation enters the picture, pushing asset prices ever higher on financial markets, the financial sphere becomes disconnected from economic reality. The prices posted in these markets no longer reflect the real risks to which savers and investors are exposed.

Secondly, take a predation economy. The recession was also triggered by the unprecedented escalation of energy and agricultural prices that accompanied the speculative bubble. This market tension resulted from the spread around the world of a commodity-intensive development model that exerts growing pressure on energy and agricultural resources. But with oil priced at $140 a barrel (in July 2008) and wheat at $450 a tonne (in April 2008), how can the continuity of energy and food supplies be assured? The answer is that it cannot, and this is precisely what induced the fall in world demand that led to the economic recession and the collapse in all commodities and financial asset prices.

Are our societies consequently doomed to the fate of the rubber barons?

The great crises of capitalism mark historical turning points. The depression of the 1930s led to a break with free-market principles by strengthening the role of the state through Keynesian policies of acting on demand and through regulating the financial system. This type of system flourished in the post-war period, 'les trente glorieuses' as the French call it, up until the two oil shocks when the economy sunk into a second major recession. This new crisis resulted in the

pendulum swinging back towards the market, championed by Ronald Reagan and Margaret Thatcher, with the opening up of national economies to the free movement of capital. A new era of growth then started, stimulated by the rise in power of the emerging economies, which were swift to join the onward march of globalized capitalism. Millions of people in the emerging world were able to escape poverty and the middle class expanded, aspiring to the same living standards as their peers in the industrialized countries. With this latest crisis, the historical epoch of financial globalization has reached its limits. We have arrived at a new historic turning point for capitalism. The thesis of this book is that climate change will play a major part in what comes next.

Over the past few years, the issue of climate change has had wide media coverage, contributing to a collective awareness of the climate risk arising from the accumulation of our greenhouse gas emissions in the atmosphere. It is nevertheless difficult for the media to avoid being a mouthpiece for two opposed – and mistaken – stereotypical reactions in the face of climate change: catastrophism and climate scepticism.

Catastrophism is used, to a greater or lesser extent consciously, by some proponents of large-scale action to reduce greenhouse gas emissions. It sets out from the fact that past trends are not sustainable and are leading to major disruptions that could even result in the extinction of the human species. This anxiety-provoking approach would mobilize support if fear actually led to action. But in our society where the boundary between the virtual and real worlds is sometimes hard to discern, it quickly becomes counter-productive. In the digital era, the latest disaster film about climate change is no more an incentive to action than the release of the most recent *Star Wars* DVD.

Another undesirable effect of catastrophism is that it paves the way for the climate sceptics. The work of climatologists shows how difficult it is to forecast the reactions of the climate system to the accumulation of greenhouse gas emissions. This difficulty stems from the many

uncertainties that enter into the work of researchers and scientific debate. The climate sceptics would like to conduct this debate on the media stage, rather as if one was to put Pythagoras's theorem to the vote on a TV show. All this would be of little significance if the climate sceptics' line did not have a harmful effect. It is sowing doubt in many people's minds and among decision-makers, for whom it is always tempting to postpone action in the name of uncertainty.

Between catastrophism and climate scepticism lies the responsible approach, and it is this that the present work attempts to adopt. Climate change is here treated as a risk. We ask what is the right way to take account of this risk in economic life.

To come up with an answer, we first draw upon the study of economic instruments that have already begun being constructed. At an international level, climate negotiations began in 1992, at the Rio de Janeiro Earth Summit. It gathered pace with the signing of the Kyoto Protocol in 1997 and its coming into force in 2005, which introduced new economic instruments. In that context, in 2005 Europe launched a carbon trading market, which puts a price on carbon dioxide (CO_2) emitted into the atmosphere. The Copenhagen Conference of December 2009 did not bring the progress that many people were expecting in terms of commitments from the large emitter countries. But it opened up new roads for possible cooperation among countries that will be followed if the appropriate economic instruments are set up.

The book also draws on the work of economists who have addressed the subject before us. Such work raises the question of discount rates. Action against climate change generates short-term costs, while its benefits stretch out over the very long term. The use of a discount rate giving a future price to its equivalent today enables us to compare the cost and the benefit that are so separated in time. The lower the discount rate, the more economic calculation demands action be taken quickly, and vice versa. But how do we set this rate? The role of the economist is to clarify this choice that citizens and their political

representatives must make in agreeing on a rate that reflects the real importance attached to future generations. This book has no new light to shed on this question. It assumes that climate change will lead our societies to re-evaluate the importance of the long term and explores ways in which effective action can be taken.

Chapter 1 describes climate risk and shows why uncertainty, which is central to scientists' projections, cannot be grounds for inaction. Chapter 2 analyzes how the economic cards will be re-dealt as a result of climate change. It identifies areas of great vulnerability, calling for rapid international action to strengthen the adaptation capacities of the societies concerned.

What is at stake in the energy system is examined in Chapters 3 and 4. This system will have to adapt to the growing scarcity of fossil fuels beneath the ground. But there is more carbon in these deposits than the atmosphere can absorb without risk to the climate. A further constraint will therefore have to be introduced to protect the atmosphere, by capping the emissions resulting from the burning of fossil fuels. Such a cap enables a price to be allocated to emissions, as is shown by the European Union emissions trading scheme. This prototype could serve as the model for a world carbon market.

Chapters 5 and 6 look at the reorientation needed in agricultural and forest resources, which account for a third of the world's greenhouse gas emissions. This reorientation coincides with a deterioration in the global food situation. It will take different routes from those used for energy, by using project-based mechanisms, financed through the emerging price of carbon. The Kyoto Protocol's flexible mechanisms offer a prototype of what such a system might be in the future. The first large-scale test could be the Avoided Deforestation Financing Mechanism that has been discussed at an international level.

The concept of carbon rent introduced in Chapter 7 allows the macroeconomic impacts of the carbon price to be better understood. Carbon rent, artificially created by mankind, imposes a quantitative constraint on the use of the atmosphere, but not on the development

of the economy. If well managed, it can shift resources towards actors who are most in need of them and could breathe new life into the economy through the triggering of low-carbon investment. Widening this rent implies growing cooperation among nations. Chapter 8, devoted to international climate negotiation, explores the conditions for its emergence.

ONE

Climate risk

November 2006, Moscow. The temperature is unusually mild. Animal species, governed by the rhythm of the seasons, are unsettled. The bears in the zoo are having trouble hibernating and need to be given additional food. Several species of migratory birds, which have left on their annual journey, are turning back. Disoriented ducks are engaging in courtship displays.

April 2007, France. With temperatures 4.7°C higher than the thirty-year average, it is the warmest April ever recorded by Météo France. Crops are particularly advanced for the time of year, up to three weeks early for grains. Strawberries and cherries from south-west France are already on the market. This earliness is no one-off occurrence. Since 1945, grape harvest dates have advanced by three weeks, even a month, in certain regions. As the French historian Emmanuel Le Roy Ladurie makes clear, variations in harvest dates, recorded in parish registers since the Middle Ages, are reliable evidence for historical fluctuations in temperature.

December 2007, New South Wales, Australia. The small town of Deniliquin invested in the largest rice production programme in the southern hemisphere. In its heyday, it was able to meet the needs of 20 million people around the world. But after five consecutive years

of drought, the factory has recently closed. Australian farmers have abandoned rice growing, with its heavy demand for water. The country's exports have fallen, which has contributed to food riots in Africa and the Caribbean. Of course, this is not the first time Australia has experienced drought. Older generations still pass down memories of the drought of 1902, which decimated the sheep and cattle population. Yet the succession of six exceptionally hot and dry years exactly conforms to the climate change scenarios described by scientists. Or is it simply a coincidence?

The Earth and its climate moods

All the indicators point in the same direction: for a century, our planet has been getting warmer. The measurements have shown an increase in average temperature of around 0.8°C since the end of the nineteenth century. This warming has not been continuous throughout the twentieth century. Between 1940 and 1970, the average temperature actually fell, which made some people think that the Earth was heading towards a new Ice Age. From 1970, warming restarted. It was more rapid than early in the century, with the temperature increasing by more than half a degree between 1970 and 2005. The current rate of increase is around 0.2°C per decade. If this rate were to continue, the terrestrial atmosphere would heat up by 2°C in the course of the twenty-first century alone.

Warming is uneven. It is more pronounced at high latitudes than near to the equator and more pronounced over land than over the oceans. The largest increase in temperature, of around 2°C over a century, has been observed in the extreme north-west of the American continent and in certain regions of central Asia. Conversely, a cooling of some tenths of a degree has occurred in certain regions.

The widespread melting of mountain glaciers and of the polar ice caps results directly from warming. Such melting has contributed to the rise in the average sea level, nearly 10 centimetres since 1960.

This rise is also attributable to the expansion of water due to the increase in average temperatures. The rise in sea levels has accelerated over the past twenty years, probably because of more rapid melting than forecasted of Greenland's continental glaciers and of some parts of Antarctica.

The heightened intensity of droughts in certain regions and the greater frequency of floods in others stems from the warming of the planet. This warming has changed the distribution of precipitation and also has an effect on river flows through its impact on glaciers. Other climatic events are modified, such as tropical storms and cyclones, the intensity of which has probably increased as a result of global warming. Finally, certain extreme events, such as tsunamis, are often mistakenly attributed to climate change; in fact, tsunamis are triggered by undersea seismic activity, which is completely independent of the terrestrial temperature. Not all natural catastrophes affecting human society are attributable to global warming.

What is the significance of an average warming of a little less than 1°C in a century? Such a change seems very small compared to the temperature changes that we adapt to from one season to the next or more simply from day to night. We should be wary of this type of comparison, which confuses two distinct disciplines. The short-term variability of temperatures in a given place is the concern of meteorology; their average evolution over time is the concern of climatology. Climatology is a younger discipline, the findings of which have been made known to the public by the Intergovernmental Panel on Climate Change (IPCC), a global network of scientists attached to the United Nations (UN).[1] In France, the work of the IPCC has been popularized by two internationally renowned scientists, Jean Jouzel and Hervé Le Treut.

[1] The IPCC was created in 1988, under the aegis of the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP).

Since 1988, the IPCC has been examining long-term climate variations. Their findings are conclusive: an increase of nearly 1°C in the average temperature in a century is extremely rapid, and much faster than temperature changes observed over known human history. The reason for this rapid increase is important. For the first time in the Earth's history, the climate is being changed by the activity of a living species – mankind – which has been able to exploit huge amounts of natural resources to its advantage.

On the track of past climates

How can we gain access to reliable data about past climates? The invention of the thermometer by Galileo dates only from the end of the sixteenth century. It was not until nearly three hundred years later, from the mid-1800s, that the first stations systematically measuring temperatures at the surface of the Earth were set up. Since 1979 their data has been complemented by data from satellites, which measure the temperature of the troposphere – that part of the atmosphere closest to the Earth's surface – by means of infrared imaging. It is this system of direct observations that supports the IPCC's diagnosis on global warming in the twentieth century.

Going further back than 1850, climate historians can explore other sources of information to reconstruct the climate puzzle. The archives of previous centuries are one source. In Europe, these enable us to go back to the Middle Ages and provide indirect climatic evidence, such as harvesting dates and observation of glaciers, or even direct testimony on the climate. Historians such as the Englishman H. H. Lamb and the Frenchman Le Roy Ladurie have meticulously scoured these archival accounts. They have matched them with information coming from other evidence of past climates: analysis of the growth rings of trees, or 'dendrology', which allow past climates to be deduced from tree trunks; observation of the traces left on rocks by ice, testifying to the historical advance or retreat of