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Introduction

In the summer of 2022, climate change seemed more palpable than ever. As I was writing these lines, fires were consuming the French Landes, Europe's largest artificial forest. Apocalyptic images of raging blazes, displaced people and animals, devastated land, and burned trees fed the news. For the public, forest fires incarnated global warming: they blended the temporality of a threatened future and the causality of heat waves and drought. In the media, experts described forest fires as both a cause and consequence of global warming: "while global warming explains why forest fires are becoming more frequent and intense, such fires can in turn accelerate the rise in temperatures," warned a professor of environmental geography; the thousands of hectares of forest going up in smoke are like "a carbon bomb exploding," alerted a forest scientist (Seibt 2022). When fires resumed less than a month after they had been controlled by firefighters, French Prime Minister Élisabeth Borne declared in front of journalists the "urgency" of the situation and the will "to act on all fronts, in order to fight even better in the future and prepare ourselves for events that we know very well are related to climate change" (*Le Monde* 2022).[1]

If forest fires incarnated global warming, reactions to them bore resemblance to what is often referred to as climate action (or, more critically, inaction) and its temporalities. Firefighter's interventions signaled the urgency of action to be taken. Questions about whether the fires could have been avoided led to doubts about current forest

management practices, revealed the fragility of monocultural plantations, and pointed to the likely adaptability of certain kinds of vegetation to global warming. Discussions focused on the urgency of saving the present and the preparedness for a warming future. As in debates on climate change (in)action, the possibility that this future could be acted upon was blurred.

This book is devoted to one of the reasons why we can or cannot act on the future. It is a reason at once mundane and highly technical and thus seemingly both beneath notice and difficult to grasp. One objective of this book is to show that it nevertheless deserves our scrutiny. The reason why we can or cannot act on the future is embodied in an instrument we use to look to the future. It is a technical approach to dealing with what may come—to which I will nevertheless refer under its vernacular name: *discounting*. Discounting is an economic calculation that companies and governments (some would say individuals, too) make to decide about things by determining how valuable they are. The value of things, the calculation goes, comes from the flows of costs and revenues or benefits that they are likely to generate in the future. As future flows are brought in the present, they are devalued due to their distance in time and their uncertainty. Discounting deserves our scrutiny, this book argues, because its mundaneness hides significant consequences for how we have come to conceive of the future and because its technical aspects hide fundamental political questions about the capacity of certain actors and the incapacity of others to picture the future and act on it.[2]

I will not start this introduction by describing discounting; its description, both as a theory of action and a theory of value, is the object of the first chapter of this book.[3] In this introduction, I will acquaint the reader with discounting in two steps. First, and briefly, I will present one instance in which discounting came under the spotlight and became explicitly the object of a debate—highly technical but at the same time blatantly political—that revolved around the problem of climate (in)action. Second, and at more length, I will discuss the

three troubles with discounting that this debate quite readily reveals. These can be formulated as the following three questions: Is the future worth less than the present? Is the future what matters? Should everybody look to time and to value in that way? In other words, I will discuss discounting as a mode of valuing the future, as a way of futureing value, and as a general form of action. Finally, I will explain how these problems—the definition of and the troubles with discounting—are addressed in the five chapters of the book.

DISCOUNTING AND THE PUZZLE OF CLIMATE (IN)ACTION

One of the rare moments in which the economic technique of discounting came under the spotlight was in a heated debate on climate (in)action known as the Stern/Nordhaus controversy. The story starts with the following paradox: while today climate change is supported by sound scientific evidence and materialized in observable and impressive events such as forest fires, we seem incapable of taking action against it. The "we" in question encompasses a wide range of people and institutions in developing and developed countries, Europe and the United States, older and younger generations, right and left governments, that vary in their willingness and ability to act.[4] The interesting question for us here is not who acts or does not act, but how and why they do so. And the interesting finding is that climate inaction is perfectly justified by the tools and procedures that governments use for the sake of making decisions with objectivity and for the general interest. In other words, climate action is at odds with rational decision-making. How come?

Today, public policies are analyzed in terms of their costs and benefits: a good policy, or rather a policy worth implementing, is a policy whose benefits outweigh its costs. Through the lens of cost-benefit analysis, climate change policy would incur, for example, the costs of reforming production processes and consumption patterns in order to reduce emissions. It would be worth implementing if the costs are at

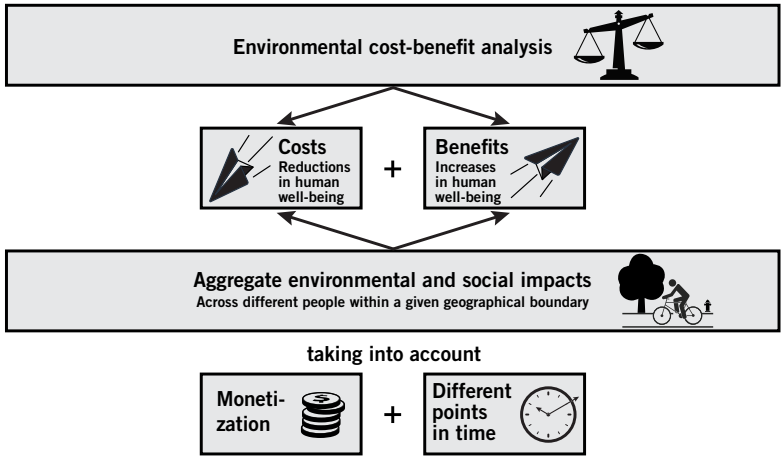


Figure I.1. Illustration of cost-benefit analysis in environmental policy (OECD 2018). Redrawn by Virge Kask.

least compensated by the benefits it will generate in the future. But how to compare future benefits and present costs? How to *balance* them, as suggested by the weighing scales image recurrent in expositions of cost-benefit analysis in public policy (fig. I.1)?

In order to treat as commensurate benefits and costs that occur in different points of time more or less distant in the future, standard cost-benefit analysis makes use of discounting. The monetary value of an event (a cost or a benefit) that occurs at a certain point in time is reduced by a certain factor called the discount rate. The logic is the same as that of the rate of interest: money set aside today is equivalent to "more money in the future," because it can be put in a savings account and multiplied by the rate of interest. In discounting, however, the arrow of time is reversed: money expected in the future is equivalent to "less money today," because this "less money today" is supposed to be able to produce that "more money in the future."

The logic is certainly not easy to grasp when one is not familiar

with discounting, but let us try to embrace it in order to follow its implications. Reversing the arrow of time entails reversing the arithmetical operation. Moving from the present to the future, one multiplies by the rate of interest; moving from the future to the present, one divides by the discount rate. Moving from the present to the future, value expands: this reflects ideas of economic growth and technological progress. Moving from the future to the present, value shrinks: it is "capitalized," as I will explain below, that is, folded back into the capital that is supposed to produce it. As a FHWA (Federal Highway Administration) report on cost benefit analysis explains, there is a "time cost of money" that reflects "the impact of time on the value of future benefits and costs": "Money spent or earned today is more valuable than the same amount of money promised in a future year since the money earned today can be invested and earn additional revenue in the interim years. Therefore benefits and costs accruing in later years of an analysis are often valued at a discounted rate" (Sallman et al. 2012, p. 14).

Usually, the discount rate used for events occurring at different points in time is the same, but the power given to the discount rate is greater the more distant an event is in time. With a discount rate of say 5 percent, the monetary value of an event worth $100 is reduced by 1.6 (1.05 to the power of 10) if the event occurs in 10 years. However, it is reduced by 132 (1.05 to the power of 100) if the event occurs in 100 years. As a result, $100 in 10 years is worth $63 today, but $100 in 100 years is worth $0.80 today. In other words, the "present value" of $100 in 100 years is $0.80. The reduction effect is dramatic. Climate change policies incur costs that are proximate in time ("act now…") and generate benefits that are very distant in time ("…to save the future") and are therefore heavily discounted. The value of such policies—obtained by subtracting discounted future costs from discounted future benefits—turns out to be null, if not negative. Hence, they are not worth implementing. This is how rational decision-making leads to climate inaction.

The *Stern Review on the Economics of Climate Change* (Stern 2007), a 700-page report released for the government of the United Kingdom

in 2006 by economist Nicholas Stern, spotted the problem and created a commotion by proposing a fundamental change in discounting to allow for reaching the conclusion that it is worth acting now to save the future. As the review's summary of conclusions explains, "there is still time to avoid the worst impacts of climate change, if we take strong action now." The costs of inaction are estimated: "if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever" (p. vi). And so are the costs of action: "the costs of action—reducing greenhouse gas emissions to avoid the worst impacts of climate change—can be limited to around 1% of global GDP each year" (p. vi). The result of the math is that "the benefits of strong, early action considerably outweigh the costs" ("Summary of Conclusions," p. vi, and "Executive Summary," p. ii).

The trick that allowed the *Stern Review* to reach such a conclusion lay in the redefinition of the discount rate. Discounting, the review explains, has two justifications in the theory of economics: one relates to the idea that in the future, people will be richer and will therefore give less worth to an additional amount of money; the other relates to the idea of "pure time preference," according to which "people prefer to have good things earlier than later" (p. 31). The problem, the *Stern Review* notes, is that when it comes to climate change, the "people" in question are not the same. We are not in a situation in which one individual is deciding whether she should consume now or save for later. We are in a situation in which current generations are deciding to consume now and thereby depriving not themselves, but future generations, of the possibility to consume later, the "later" of current generations being actually the "now" of future generations. Therefore, the review proposes, "we have to ask how [future generations] should be represented in the views and decisions of current generations." For both ethical and logical reasons, and referring to the work of economists such as Frank Ramsey, Amartya Sen, and Robert Solow, the review formulates the following solution:

> We take a simple approach in this Review: if a future generation will be present, we suppose that it has the same claim on our ethical attention as the current one.
>
> Thus, while we do allow, for example, for the possibility that, say, a meteorite might obliterate the world, and for the possibility that future generations might be richer (or poorer), we treat the welfare of future generations on a par with our own. (Stern 2007, p. 31)

This methodological choice results in a lower discount rate and in the possibility to conclude that the benefits of climate change policy, albeit distant in the future, can compensate its costs, overvalued by their proximity in time. Climate action is thus justified. More than that, it becomes urgent.

Climate policy clearly is viewed in current approaches to it as an investment strategy.[5] The *Stern Review* makes that point when exposing its conceptual framework: "Mitigation—taking strong action to reduce emissions—must be viewed as an investment, a cost incurred now and in the coming few decades to avoid the risks of very severe consequences in the future" ("Executive Summary, p. i). However, viewed as an investment strategy, its treatment of discounting was deemed "extreme" by another leading economist, William Nordhaus (2007). In an article published in *Science*, Nordhaus argued that the *Stern Review*'s conclusions "about the need for urgent and immediate action will not survive the substitutions of assumptions that are consistent with today's marketplace real interest rates and savings rates" (p. 202). For him, the discount rate "that enters into the determination of the efficient balance between the cost of emissions reductions today and the benefit of reduced climate damage in the future" should be "the return on capital." And this return on capital, "which measures net yield on investments in capital, education and technology," is "observable in the marketplace."

What does one see when she "observes" the discount rate "in the marketplace," as Nordhaus suggests doing? A number much higher

than the *Stern Review*'s, which was 1.014 per cent. The difference between the *Stern Review*'s "prescriptive" rate and Nordhaus's "descriptive" rate—for it is supposed to be observed in the market—accounts for the discrepancy between the *Stern Review*'s proposal, which suggests "global emissions reductions of between 30 and 70% over the next two decades, objectives consistent with a carbon tax of around $300 per ton today," and standard economic models, whose recommendations lead to a ten times lower carbon tax and a gradual tightening of climate policy over time (Nordhaus 2007, p. 201).

The Stern/Nordhaus controversy, and more broadly the debate over prescriptive versus descriptive discounting, has been widely analyzed in the literature of economics and law (Goulder and Williams 2012; Kelleher 2017; Weisbach and Sunstein 2009). When Nordhaus won the Nobel Prize in Economics in 2018, the debate spilled over in the broader literature. The levels and the theoretical justification of the discount rates defended by Nordhaus were not the only things that were criticized, either. Joseph Stiglitz commented that Nordhaus's economics of climate change is not only "badly flawed," but in fact "dangerous because we don't have another planet we can go to if we mess this up" (AFP 2020). The very idea that climate change policy can be treated in the terms of cost-benefit analysis appeared puzzling. Are cost-benefit analyses appropriate when "we are considering the possibility of human extinction" (Mann 2022)? Can we consider that "reducing CO_2 emissions is but an element in a strategy of investment in the future, next to capital accumulation: one sacrifices a few points of GDP now in order to gain other points of GDP in hundred years"? (Pottier 2018)

THE TROUBLES WITH DISCOUNTING

In a critical discussion of Nordhaus's legacy in the debate over discounting, Geoff Mann writes that while "discounting is a crucial element in all investment decisions," even "at first glance, there's something troubling about discounting. On what grounds can future

states of the world be considered less important, less valuable, than the present" (Mann 2022)? Thus, as we've seen, discounting is troubling, first, because it rests on the questionable assumption that the future is worth less than the present—an assumption that, as the Stern/Nordhaus controversy indicates, becomes even more perplexing today, in an epoch permeated by concerns such as climate change and sustainable development, which are all about making the future count. However, there are also (at least) two more troubles with discounting.

The second trouble is at odds with the first: although discounting devalues the future, it nevertheless assumes that it is the future that counts—that it is the future that we should look to when we make decisions about the present and when we search for the value of things. Consequently, discounting also erases the past and the present as guides for action and sources of value. In other words, if discounting is troubling due to how it values the future, it is no less troubling because of how it futurizes value, that is, treats the future as the locus of value.

The third trouble with discounting is its association with investment as a way to think about making decisions. It assumes everyone behaves or is to be made to behave like an investor and that looking to the future to make decisions about different courses of action always means considering these courses of action and the things upon which they bear as *investments*. Corporations have their discount rates, indicated by their financial departments. Likewise, governments have their social discount rates, which they may observe in the market (as Nordhaus suggests) or decide upon themselves (as Stern suggests).[6] Individuals, too, according to economic science, have their own discount rates, which explain their decisions about the more or less "green" qualities of the goods that they purchase and more broadly about the amount of money that they save, consume, or keep for investment.[7] As I will argue below, the pervasiveness of investment as a worldview and a style of action is thus entangled with discounting as a general form. But first, let us consider each of these troubles in more depth.

IS THE FUTURE WORTH LESS THAN THE PRESENT?

Why is the future assumed to be worth less than the present? This is the first thing that troubled me about discounting when I encountered this technique. I was studying the biotechnology market and wondering how, practically, biotech start-ups and pharmaceutical companies could agree on a price when they were exchanging, for millions of dollars, promises—in PowerPoint presentations, pitches, and business plans—about future drugs that barely existed at the moment when the transaction was taking place. The price of a future drug, I was explained, is based on the calculation of its "net present value" (NPV), defined as the sum of the flows of costs and revenues that the drug will generate in the future, discounted at the proper discount rate. The trouble, my interviewees added, is that when the drug development projects that are being bought and sold are at an early stage, and the hoped-for resulting drugs are distant in time—sometimes as long as ten years from the moment of the transaction—the future revenues that they are expected to yield get discounted so much that they cannot weigh against the development costs more proximate in time.

The problem that these managers formulated was akin to the problem encountered by climate change policy that I discussed above. Certainly, the time scale was shorter: ten instead of a hundred years. And the consequences seemed less dramatic: the risk that discounting made humanity run was not extinction, but less innovation. Because discounting gave less weight to the future than to the present, it automatically favored projects that were less innovative and quicker to bring to market. It threatened innovation and instituted short-termism.

I was sensitive to this critique of discounting and was happy to discover it resonating in the literature. In the practitioner literature devoted to the pharmaceutical industry or to the valuation of investment projects more broadly, I found that discounting calculations triggered controversies, that the definition of the discount rate and the

treatment of uncertainty were far from settled, and that other techniques, such as real options valuation,[8] were put forward as substitutes for discounting and the calculation of net present value. (See Doganova 2011, 2015.) Discounting created real troubles in the pharmaceutical industry. For some, discounting did not impede companies from engaging in long-term projects, but it made managers feel uncomfortable with the decisions that they were making and that looked like "bad" decisions, giving birth to projects with no apparent or even "negative" value. A manager from the research department of a pharmaceutical company complained in the pages of *Drug Discovery Today*: "Companies have undertaken negative NPV (net present value) projects consistently, citing strategic importance. These were not intrinsically 'bad' business decisions, but the valuation methodology produced negative figures. Correspondingly, however, some were uncomfortable with the purely subjective decisions taken in the face of negative valuations" (Pandey 2003, p. 968). Others attributed a stronger effect to discounting, arguing that it actually blocked long-term innovative projects. An article published in the *Harvard Business Review* and coauthored by the Harvard Business School strategy professor Clayton Christensen, the father of "disruptive innovation," listed discounting as one of the three "innovation killers" that "destroy your [company's] capacity to do new things." Among the three financial tools that act "as an accomplice in the conspiracy against successful innovation," the "indiscriminate and oversimplified use" of the net present values calculated through discounting was depicted as "a root cause of companies' persistent underinvestment in the innovations required to sustain long-term success" (Christensen et al. 2008, pp. 100–101).

Such accusations were not new. Already in the 1980s, as discounting was making its way into companies' decision-making practices until it became the most widespread tool for assessing investments, strategy scholars were whistleblowing. Again in the pages of the *Harvard Business Review,* two other Harvard Business School professors

established the link between discounting and insufficient investment. Through tools such as discounting, they argued, we—the United States, in this case—are "managing our way to economic decline" (Hayes and Abernathy 1980). This and related articles attracted a lot of attention among the readers of the *Harvard Business Review* and reached the pages of *The New York Times* (Wayne 1982).

Discounting thus weighs the present against the future in such a way that the present defeats the future. Far removed from companies' investment decisions and concerned with the future of democracy, rather than with economic growth and innovation, philosopher Daniel Innerarity identifies the problem of our relationship to the future as "the tyranny of the present":

> We find ourselves in a regime of historicity where the present is lord and master. This is the tyranny of the present, in other words, the tyranny of the current legislature, of the short term, consumerism, our generation, proximity, etc. This is the economy that privileges the financial sector, profits over investments, cost reduction over company cohesion. We practice an imperialism that is no longer related to space but to time, an imperialism of the present that colonizes everything. There is a colonization of the future that consists of living at its expense and an imperialism of the present that absorbs the future and feeds off it parasitically.... This present replaces the long term with the short term, duration with immediacy, permanence with transience, memory with sensation, vision with impulse. (Innerarity 2012, p. 8)

Innerarity attributes the tyranny of the present to an overall trend that characterizes our epoch, captured by notions such as presentism (Hartog 2003) and acceleration (Rosa 2013). The expansion of discounting clearly functions as one of the drivers or consequences of these phenomena. Discounting literally devalues the future and gives priority to the present, inducing short-termism or myopia, as with of the managers I described above. The discount rate creates an almost automatic link between valuation through discounting and shorter

periods for realizing value because time is viewed as something that has a cost. However, discounting could also be analyzed in exactly the opposite terms: as futurism, as opposed to presentism, because it posits the future as the ultimate source of rewards in the present, and as deceleration, as opposed to acceleration, because it delays action that we should take now to save the long-term future, waiting for more efficient future technologies and smarter and richer future generations to arrive.

The curious thing with discounting is thus that it can be and do many different, even opposite things. Following the development of this peculiar object requires us to abandon grand historical narratives about change in our experience of time or about the temporal structures of our societies and to examine, in moments when discounting is put forward as a solution to a problem or criticized and contested and transformed, how the relationship between the past, the present, and the future and the very matter of which these temporalities consist are put to trial and performed. As I will argue in the chapters that follow, viewed in this way, *discounting is a political technology* and *the future is a political domain*—that is, a domain over which actors struggle to acquire the capacity to act.

IS THE FUTURE WHAT MATTERS?

In light of its Janus-faced nature, it is no surprise that the second trouble with discounting is the opposite of the first. Discounting can devalue the future in relation to the present, but it also tells us that to know what we should do now, we should look to the future for the consequences of these decisions, expressed as flows of value. This second trouble is less palpable, though. I became sensitive to it as I was studying the early uses of discounting in forest management in the eighteenth and the nineteenth centuries in Europe, which I will discuss in Chapter 2. Discounting was open to criticism because it entailed envisaging the forest as capital and the forest owner as an investor, and in

doing so, it entailed acceleration: the forest seen as capital, processed through the gaze of the investor for whom time has a cost, was a forest managed with shorter rotation lengths, that is, a forest whose trees were felled at an earlier age. But forests also were the birthplace, or at least an early test bed, of the notion of sustainability (Hölzl 2010; Warde 2011) and of future-oriented valuation and management practices at odds with discounting's discounting of the future (Doganova 2018). The ensuing debates on the public versus private ownership of forests raised the following question: Who has a stake in the long-term management of the forest (Nordblad 2016; Vatin 2008)? Could the private owner, in spite of having a life span much shorter than that of the trees, manage a forest in line with the general interest of society? Or is the state the only "imperishable being," as one protagonist put it, to whom forests and their long-term futures could be entrusted?

In the mid-nineteenth century, scientific forestry, from which the first formulations of discounting, known as "the Faustmann formula" (Faustmann 1968), emerged, offered the hope to provide a clear answer to these questions by determining, by means of mathematics, the correct calculation of the value of a forest and hence its optimal management, in particular, the right moment to fell the trees and sell wood and timber on the market. At that time, this optimal management came to be defined as what maximized the "present value" of the forest, calculated by the flows of costs and revenues and discounted at the rate of interest, that it was likely to produce in the future. As the introduction to the English translation of the article in which the Faustmann's formula was published in 1849 notes (Gane 1968), the novelty of discounting as a valuation technique lay in the idea that the value of the forest stemmed from the future, rather than the present or the past.

This turn to the future was accompanied by a critique of the relevance of other temporalities to thinking about the value of forests. The critique took two different forms. The first was addressed to the present of the market (Muniesa and Doganova 2020): the value of the forest, the argument went, cannot be captured in the price of land,

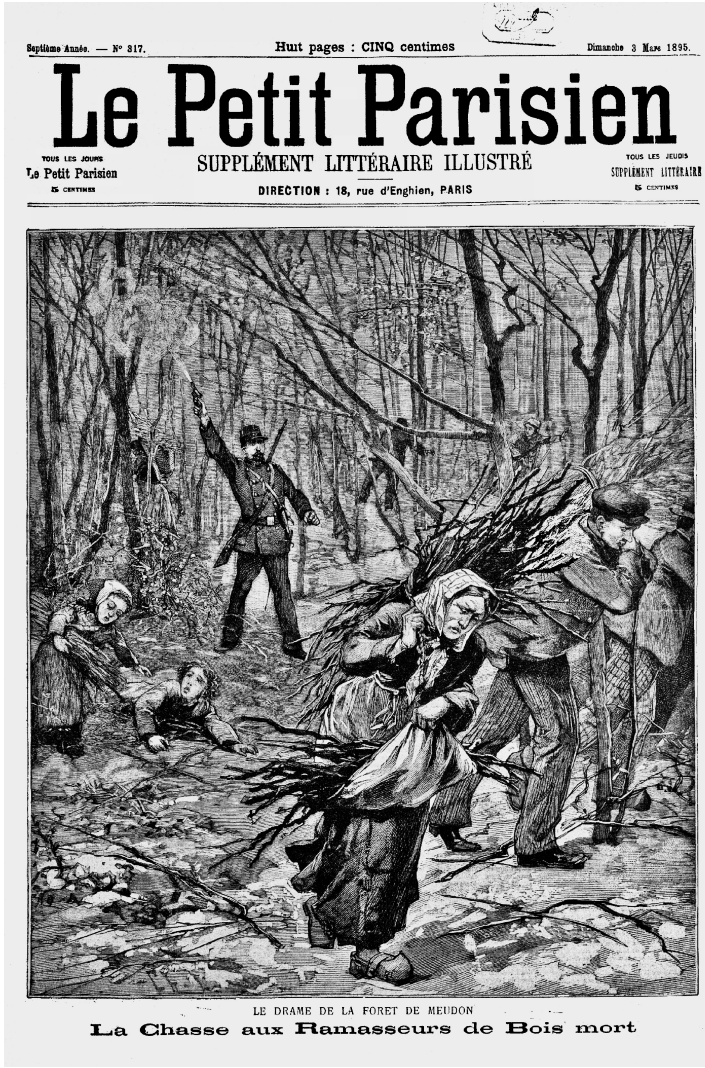
timber, or wood that the market displays at the moment when the valuation is made. The market's "principle of instantness" (Vatin 2005) produces a price that is different from what Faustmann called the forest's "economic value" and that finance later called "fundamental value" (Bryan and Rafferty 2013), a value that encompasses its future.

The second critique was less explicit, but more violent. It was addressed to the present of the poor people who lived nearby the forest (fig. I.2). As an editor of the *Rheinische Zeitung*, in 1842, the young Karl Marx involved himself in the debates on a "law on the theft of wood" that defined the gathering of fallen wood as "theft." Marx formulated the conflict that he observed in terms of rights and property: the conflict between "the right of human beings," whom the law deprived from their customary rights, and that of trees, behind which stood forest owners and the state." (Marx 1842).

Historian Richard Hölzl describes how future-oriented scientific forestry, supported by judicial and military interventions, affected the present practices of local populations:

> For the local population the new measures meant that it was increasingly denied access to a resource vital for its daily "politics of survival" (Shiva 1991). Without access to agricultural forest resources the people's ability to secure their livelihood in times of crisis shrank to a minimum. Long cycles of timber production guided the felling plans; coppices were eradicated; financial revenue became the guiding principle for the distribution of forest products and replaced the early principle of "necessity" (*Notdurft*).... Cultivation plans for afforestation meant that ever more patches of grassland...were closed to pasture, grass-cutting or litter collecting. (Hölzl 2010, p. 445)

We can reformulate the conflict described by Marx in terms of temporalities: the future of trees, forest owners, and the state, on one side, and the present of the poor, on the other. This conflict is very different from the one between present and future generations. It opposes those who live in the present, engaged with the necessity of survival, and



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Le Petit Parisien

TOUS LES JOURS
Le Petit Parisien
5 CENTIMES

SUPPLÉMENT LITTÉRAIRE ILLUSTRÉ

DIRECTION : 18, rue d'Enghien, PARIS

TOUS LES JEUDIS
SUPPLÉMENT LITTÉRAIRE
5 CENTIMES

LE DRAME DE LA FORET DE MEUDON

La Chasse aux Ramasseurs de Bois mort

Figure I.2. Hunting the wood gatherers. *Le Petit Parisien*, March 3, 1895 (Bibliothèque nationale de France).

those who can afford to look to the future. Keeping trees for the future is certainly an act of sustainability, but it is at the same time an act of extraction from the present. Here, reversing Innerarity's terms, it is the future that colonizes the present.

DISCOUNTING AS A GENERAL FORM

The endless expansion of discounting is troubling, too. Discounting can be found at the intersection of several trends whose universalizing and structuring ambition has been captured in the literature in terms of "the capitalization of almost everything" (Leyshon and Thrift 2007), "the value of everything" (Mazzucato 2018), "the asset condition" (Birch 2018), the "financialization of valuation" (Chiapello 2015), or "the time of investees" (Feher 2017, 2018). These terms signal that the configuration of things in view of them producing future flows of costs and revenues (things that can then be called capital, assets, or investments) is a transformation that is *general*, insofar as it affects "everything" (or "almost everything") and characterizes the advent of a new mode of being in the world and a new kind of epoch. It is this generality that has troubled me most in my exploration of discounting. How has discounting evolved from a *formula*, such as the Faustmann formula in forestry, to a *form*—a form of reasoning, a form of valuing, a form of relating to the future—that is ubiquitous enough to be described as "general"?

When I started writing this book,[9] I did not suspect that the exploration of discounting would lead me to so many different places and themes: from the biopharmaceutical industry and its uncertainty (Chapter 4), through forestry and sustainability (Chapter 2), and capital budgeting and financialization (Chapter 3), to mining and investor-state relations (Chapter 5). Nor did I suspect that all the moments that I was looking at as historical developments—in which discounting emerged, extended its territory, and triggered controversy—would resonate so vividly with moments in the present. At the core of the

debates that the exploration of discounting made me traverse resides one fundamental question: the relationship between temporality and valuation. In this relationship is nested the key to the third trouble with discounting. To understand this, we need to move back to its original formulations.

The first formulations of discounting as a technique used to value nonfinancial assets date back to the nineteenth century, not just in forestry, but in the mining industry and the emergence of the railroads, among other places. Although during that period discounting had already been expressed in formulas and had been discussed in the literature, in particular, as to its mathematical specification, for example, the use of simple or compounded rate of interest, its use remained specific to a few niches in the economy and their problems. It was only at the beginning of the twentieth century, in the work of North American economist Irving Fisher, that discounting was formalized as a universal definition of the value of capital, and capital itself was redefined as anything that could engage in a particular relationship with time, oriented toward the future. I will analyze in further detail Fisher's theory in Chapter 1 and present it only briefly here in relation with the problem of discounting as a general form.

In *The Nature of Capital and Income*, first published in 1906, Fisher proposed to define capital in a way that departed from previous debates among economists. These debates, Fisher argued, had never reached consensus on what capital is because they assumed that capital is "a particular kind or species of wealth" (p. 53). What is particular about capital, he proposed instead, is not its nature, but its relationship with time: capital is "wealth in a particular aspect with reference to time" (p. 53). Capital is a "fund" that produces "income," that is, a "stream" or a "flow of services through a period of time" (p. 52). Anything, then, could be capital: a dwelling house, which produces flows of services under the form of shelter or rent, a piano, which produces flows of music, and even bread, which produces flows of nourishment. The relationship between capital and income is the reverse of the

relationship between the value of capital and the value of income: physically, it is capital that produces income, but it is the value of income that produces the value of capital. For example, it is the orchard that produces the apples, but it is the value of the apples that produces the value of the orchard (Fisher 1907).

Fisher considers this reverse relationship between capital and income, when envisaged through their value, as a "fundamental principle" commanding that "the value of capital at any instant is derived from the value of the future income which that capital is expected to yield" (p. 188). This principle, he affirms, is "of fundamental importance for the theory of value and prices" for "it means that the value of any article of wealth or property is dependent alone on the future, not the past" (p. 188). He thus generalizes one aspect of the second trouble with discounting, its futurism as it appears in specific instances, into a fundamental economic principle.

The "fundamental principle" formulated by Fisher, which he calls "the principle of present worth" (p. 188) or "the principle of capitalization" (p. 205), entails a rupture with any temporality other than the future, that is, with the past and the present.[10] This radical orientation toward the future is entangled with a relationship to things through their value: capital is defined not through its physical properties, but through its valuation, which is entirely dependent on the future flows that it produces. That is why *anything* becomes capital as soon as it is projected in the future as a stream of flows. The discounting of these flows produces the value of the thing and indicates what should be done with it in a repertoire of actions that includes a range of options such as investing in it or abandoning it, selecting among competing proposals for investment, and shaping such flows to maximize value. It is this singular combination of temporality and valuation that produces the universalizing ambition of discounting as a way to describe all things.

What this does is sublate all particulars into that generalization, literally "discounting" them: not counting them as credible contributions to a thing's value. Thus, when Fisher writes that "the value of any

article of wealth or property is dependent alone on the future, not the past" (p. 188), he gives the example of the Panama Canal, whose value "is dependent upon the future expected services, taken in connection with the expected cost of completion" and not upon the past cost of building the canal (p. 188). When Fisher was writing these lines, the United States was taking over the project of the construction of the canal after a complex engineering, political, and military history of construction involving Colombia, France, and the newly independent country of Panama itself (fig. I.3).[11] In 1902, the United States had acquired the option to purchase for $40 million the assets of the French company that had started the construction works; then, in January 1903, it signed a treaty with Colombia that projected a $10 million payment up front and an annual payment to the country in perpetuity, but it was not ratified by the senate of Colombia. The United States then supported the separation of Panama from Colombia and signed a new treaty with Panama as soon as it became independent in November 1903. In 1904, the United States finally purchased the French equipment and paid Panama $10 million up front and an annual payment of $250,000 in exchange of the right to build and indefinitely administer the Panama Canal Zone. But in Fisher's principle of capitalization, the value of the Panama Canal had no longer to do with France, Colombia, or even Panama—it had to do only with the investors—in this case, the United States—who controlled its future.

SPECIFIC CASES

What engages me in this book is this literal discounting of other aspects of valuation by what Fisher called the "fundamental principle," "the principle of present worth," and the ways in which the twinned troubles of the devaluation of the future by the present and the colonization of the present by the future operate within it. Against the grain of the universalization of what Fisher terms "the principle of capitalization," analyzing discounting requires us to attend to specific cases

Figure I.3. W. A. Rogers, "The News Reaches Bogota," *New York Herald* (1903), depicts President Theodore Roosevelt building the Panama Canal while shoveling dirt on Colombia (Everett Collection Historical/Alamy Stock Photo).

in which discounting is put forward as a solution to a problem or is criticized and contested and transformed. Whether the future is worth less than the present, whether instead it is the future that matters, and whether discounting is a general form of relating to the future is an empirical question whose answers emerge in particular situations. Examining some of those situations is the task of the chapters that follow.

Chapter 1 presents a theoretical and methodological approach to discounting, treating it as a situated practice that takes place in particular moments in history and in particular situations in which it is put forward as a solution to problems whose formulations it contributes to shaping. The study of discounting needs to expose the assumptions

that underpin it, for it carries both a theory of value, characterized by its radically future-oriented temporality, and a theory of action, insofar as the value statements that it produces matter not so much as truth statements, but as action triggers. Approached in this way, discounting becomes a political technology, and analyzing discounting means dissecting its political qualities: how it dictates what is deemed valuable and hence worth existing, how it guides the allocation of resources, how it governs behaviors, and how it enables or constrains acting on the future.

Chapter 2 analyzes in further detail how the orientation to the future and the weight given to the present produced effects of exclusion and acceleration when, in Europe during the eighteenth and nineteenth centuries, forests started to be valued through the flows of the discounted expenses and revenues that they were likely to yield in the future. It attempts to denaturalize the reasoning that underpinned the development of discounting by highlighting the contradictions that its promoters faced. It further illuminates the troubles with discounting that I have begun to discuss above. The turn to the future raised the question of who is able to embrace the long temporality of the forest; at the same time, the view that time has a cost transfigured the forest into a capital whose value needs to be maximized and whose rotation durations need to be shortened. It examines, as all the subsequent chapters also do, what kind of imprint discounting leaves on some of the natural and technical objects that compose our world—here, not just forests, but factories (Chapter 3) and drugs (Chapter 4).

Chapter 3 follows the spread of discounting in US firms' investment practices since the 1950s and the controversies it triggered in the 1980s, pointing in particular to the role played by management consultants and strategy and finance scholars. It develops what Peter Miller and Christopher Napier (1993) call "genealogies of calculation," which, like all the chapters here, pay attention to the local conditions in which particular technologies of calculation emerge, the discourses with which these technologies are intertwined, the particular

characters and problems involved, and the ensembles of practices and rationales of which they become part.

Discounting was mobilized in the pursuit of rationality in management. Among the principles invoked to achieve rationality in management, theorized as the capacity to make decisions that are in the interest of the company's shareholders, two were the constitutive principles of discounting: the orientation toward the future as a source of value and the need to discount that future in comparison with the present. However, when it moved into firms' practices, discounting changed: the redefinition of the discount rate from the rate of interest to the "cost of capital," that is, the reward required by investors, resulted in the disappearance of the future as a matter of concern, that is, as something that counts, because when redefined as the cost of capital, discount rates markedly increased—the worth of the future decreased. This change did not go unnoticed; finance and strategy clashed in a battle over discounting that was a crucial prelude to the advent of financialization.

Chapter 4 takes us, a few decades later, to the thriving period of financialization and examines the contemporary use of discounting in the biopharmaceutical industry, focusing on the intricacies of the estimation of future cash flows and the determination of discount rates for drug development projects. It shows how the critique of discounting has altered: it no longer has to do with whether managers take the future into account in their investment decisions nor with the extent to which they espouse investors' expectations, but with the ways in which they treat the uncertainty of the future. The future is often characterized by its inherent uncertainty, but this uncertainty comes in two different versions—uncertainty as lack of knowledge and uncertainty as the investor's concern. Uncertainty as lack of knowledge is at first glance blatant in the biopharmaceutical industry, but a closer examination reveals how the use of discounting formulas and the metrological infrastructure on which they rely transforms uncertain futures into certain futures. Uncertainty as lack of knowledge seems

to vanish, but uncertainty reappears as the investor's concern, materialized in increased discount rates required by investors to shoulder the burden of uncertainty. Thus, once again, in the biopharmaceutical industry, if one judges by the level of the discount rates practiced by the companies operating there, the future appears to be worth much less than the present. But at the same time, the future is the temporality that drives this industry, characterized by its promissory dynamics and the role granted to biotechnology start-ups and venture capital in the development of drugs. The contradictory logic of discounting, simultaneously valuing and devaluing the future, permeates the biopharmaceutical industry. The contradiction resolves when the future is conceived not only as a temporal order, but as a political domain over which investors take control.

One of the most illuminating examples of the ways in which the question of the relevance of the future as the locus of valuation is entangled with the issue of control over the future as a political domain is the object of Chapter 5, which focuses on the nationalization of Chilean copper mines and the calculation of the right price to be paid to investors as a compensation in the event of expropriation by the state. Salvador Allende, who nationalized copper mines in 1971, held the view that the price of the mines should reflect the past: the book value of the investment made by the companies that acquired the mines, minus the "excess profits" that they had generated through their operations. José Piñera Echenique, minister of mines in the government of Augusto Pinochet, introduced discounting in the Chilean mining law of 1981 as a response to Allende's calculation and an attempt to attract investors. In Piñera's view, the price of the mines should reflect the future. The price that investors should be paid if ever the mines were expropriated, Piñera's mining law guaranteed, would be equal to the flows of discounted future costs and revenues that they would have experienced if the mines had not been expropriated.

Inscribing in law that in the event of expropriation, the compensation of investors should be calculated as the net present value of the

costs and revenues that investors would have experienced had they not been expropriated produced a curious effect. It produced a new kind of future: a certain (that is, not uncertain) future entirely dominated by investors' expectations, which were granted the rare privilege to be met, no matter what the future might turn out to be.

In all of these cases, the book will argue, discounting—as a valuation device that considers things through the flows that they are likely to yield in the future and that simultaneously translates the value of these future flows in the present by means of the discount rate—has played a central role. It is through this device that forests, corporate projects, drugs, and natural resources have been *capitalized*. In light of the troubling effects of this process, in the conclusion of the book, I turn to the hopes that changing the discount rate or including social and environmental concerns into the cash flows to be discounted could reverse the process or at least "civilize" capitalization, as Michel Callon (2009) has argued for markets. As Jonathan Levy writes, "under capitalism, the process of capitalization has become so economically prevalent that it has become conceivable as a general form of strategic action and valuation" (Levy 2017, p. 501). To denaturalize discounting as a general form and free up other ways of acting on the future in response to the crises of the present, we require "prospective histories that explain how capitalization ever became a plausible way of relating the future to the present in the first instance," as he argues (p. 504). The chapters that follow are one attempt to examine how that happened and to begin to think otherwise about this practice, at once technical and mundane, that has so much influence on the world in which we live and in which we will live in the future.

CHAPTER ONE

What Is Discounting and How to Study It?

Imagine the following situation. A government wants to purchase forest land or a copper mine from a private owner who may be an individual or a multinational corporation. How should the price to be paid for this forest land or copper mine be calculated? Discounting is a way of determining the value of something in order to set its price. To do so, discounting looks at the future: it contemplates the flows of costs and revenues that the thing being valued is likely to generate over its lifetime and translates the value of these future costs and revenues in the present by applying to them a "discount rate": a number that is supposed to reflect the idea that "a euro tomorrow is worth less than a euro today" and that gets all the more important as the euro in question is distant in time. A just price for this forest land or copper mine, some would say, is a price that corresponds to the "present value" of such discounted future flows.

Now imagine a different situation. At a pharmaceutical company, a decision is to be made between two drug development projects proposed by the Research and Development department. Both look promising, but resources are limited, and the company has to decide which one to pursue and which one to abandon. Discounting is a way of making this decision by considering the drug development project as an investment and determining its value. The decision is supposed to be made rationally, rather than in managers' guts or heads, scarred with their feelings and subjectivities. Value, again, is calculated by

projecting the future flows of costs and revenues that the drug is likely to generate (the expenses incurred as the drug candidate moves along the successive phases of clinical development and then the sales that it will bring to the company once it reaches the market), each flow being reduced by a discount rate in order to be brought into the present—and all the more reduced as the flow is distant in time. The sum of these discounted future flows indicates the "present value" of the drug development project and provides our pharmaceutical company with a simple decision-making criterion: if the value of the project is positive, it is worth investing in, and if its value is negative, it should be abandoned. If two projects have positive values, the one to be selected is the one whose value is highest.

This fictional situation is certainly less complex than what a real situation would look like. Many projects would be competing, resources may not be so scarce, and decisions hardly rely on economic calculations alone. Still, discounting techniques are the most widespread tool that firms use to assess projects. The tool has a name: DCF, which stands for "discounted cash flow" analysis. To give one real-life example: in a survey on the valuation practices of US companies operating in different industries, 70 percent of the respondents (chief financial officers) declared they used DCF "always or almost always" to decide which projects to finance (Graham and Harvey 2001).

Another way to look at this is to open a corporate finance textbook. Such a textbook teaches aspiring managers the answer to the two basic problems that they will face: what a firm should invest in, including how much they should invest, and how the cash required for the investment should be raised (Brealey and Myers 1988). Present value is the unequivocal answer to the first problem. One-third of this particular textbook that I opened—which is known as the most authoritative reference in the field of corporate finance—is devoted to the exposition of the principles of discounting and the subtleties of its application and calculation. The study guide to the textbook rubs it in:

(continued...)

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