Symposium:
The Economics of Climate Change: The *Stern Review* and Its Critics

An Even Sterner Review: Introducing Relative Prices into the Discounting Debate

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Introduction

The *Stern Review* (2006) has come to symbolize something of a dividing line in the evolution of the common appreciation of the climate problem. It is fair to say that during the last decade, there has been a gradual but uneven increase in the perceived gravity of anthropogenic climate change, among scientists and, with some time lag, the general public. However, save the United Nations' Intergovernmental Panel on Climate Change (IPCC) assessments (see for example, IPCC, 2001, 2007a, b), the *Stern Review* is the first major, official economic report to give climate change a really prominent place among global problems. The political backing of the *Stern Review* in the UK—at its first presentation, Sir Nicholas Stern was flanked by both Prime Minister Tony Blair and Chancellor Gordon Brown—has been impressive and one of the factors commanding attention.

Still, the *Stern Review* has been criticized on a number of accounts. The criticism has regarded both the manner in which the results are presented and the methodology underlying them, especially when it comes to the *discount rate* used when analyzing the future economic benefits and costs of climate change.

The reason for the preoccupation with the discount rate, a seemingly trivial parameter, is simple: since the impacts of climate change will mostly be felt in the future (because emissions of greenhouse gases are rising and because of the inertia of the climate system), the rate at which we discount the future will have a huge impact on the level of emissions reduction that

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is economically warranted today. A simple example illustrates this point. If we use a discount rate of 1 percent, the discounted value of $1 million 300 years hence is around $50,000 today. But if we use a discount rate of 5 percent, the discounted value is less than 50 cents! Note how this difference is strongly nonlinear—in this example, the discounted value is changed by a factor of 100,000 when the discount rate is changed by a factor of five.

Although a relatively simple concept in economics, the discount rate debate cuts to the core of many fundamental questions regarding global environmental change: how much weight should we put on the welfare of future versus current generations? Will growth continue so that future generations are all richer than we are today? How important is the distribution of impacts (i.e., how should we value costs that disproportionately fall upon the poor or the rich)? Consequently, when it comes to analyzing climate change policy, we are far from a consensus in the economics literature on which value to choose for the discount rate.

The main argument of this article is that results similar to the *Stern Review* can be obtained, even without making the assumptions concerning the discount rate that have been so strongly criticized, by taking into account the neglected but important fact that *relative price changes* are an inherent aspect of economic growth. More specifically, we show that rising relative prices can have important implications for the efficient level of climate change mitigation. Briefly, because the rate of growth is uneven across sectors of the economy, the composition of economic output will inevitably change over time. If output of some material goods (e.g., mobile phones) increases, but access to environmental goods and services (e.g., access to clean water, rain-fed agricultural production, or biodiversity) declines, then the relative price of these environmental amenities should rise over time. The result will be augmented economic damages from climate change, which means that higher levels of climate change mitigation would be warranted today. We conclude by arguing that *even more restrictive stabilization scenarios* than those discussed in the *Stern Review* can be justified on economic grounds.

The article is structured as follows. In the second section, we discuss the metric used by the *Stern Review* to present future costs. In the third section, we make some observations concerning the rate of discounting and its determinants, both in the *Stern Review* and in the broader literature. Further, we introduce our main contributions: the effect of higher nonmarket damages and unbalanced growth on relative prices and the importance of these factors for the value of future climate damage. Using a well-established climate model, the Dynamic Integrated Model of Climate and the Economy, or DICE (Nordhaus 1994), in the subsequent section, we illustrate the effect of making different assumptions regarding discount rates and incorporating relative price changes on efficient levels of emission abatement. In the sixth section, we discuss the estimates of the economic impacts of climate change on precisely those nonmarket goods and services whose prices we expect to rise over time. Finally, in the last section, we discusse our findings and conclude.

The *Stern Review*'s Presentation of Damage Estimates

One of the features of the *Stern Review* that has stirred controversy concerns the way it presents the estimated damages from climate change. While earlier studies (e.g., Nordhaus 1994) have estimated costs of climate change impacts on the order of 1 percent of future GDP, the *Stern Review* boldly asserts that business-as-usual (BAU) emissions of greenhouse