On The Relative Long-term Future Importance of Investments in Economic Growth and Global Catastrophic Risk Reduction

Pedro Adami Oliboni

The College of Wooster
Mathematics and Philosophy

Introduction

Decisions involve opportunity cost. When we decide to spend our time or resources on one thing, we have less to spend on something else. Yet, many causes seem worthy of our efforts. This project concerns two interconnected causes that are of high importance: economic growth and global catastrophic risk reduction.

We can roughly divide the benefits of these two kinds of investments as follows.
Economic growth: improvements in quality of life, expands future opportunity set.

Global Catastrophic Risk Reduction: prevents/mitigates short-term suffering, prevents/mitigates negative economic shocks, prevents existential threats.

My project concerns the optimal allocation of resources between these two causes at each point in time.

- This is a moral question, a question about how we *ought* to allocate resources
- I analyse the presuppositions used by standard economics methodology used for problems of dynamic allocation of resources
- I elaborate my own economic model in order to make clear the assumptions necessary for capturing the trade-offs between these two causes

Motivation

It is common practice in economic and public policy assessments of climate change to discount benefits to future generations. The use of such discount rate, however, is very controversial.

- A pure time-preference discount rate goes against intertemporal impartiality

Motivated by intertemporal impartiality, my IS focuses on the trade-offs between economic growth and global catastrophic risk reduction.

Global Catastrophic Risks

A global catastrophic risk (GCR) is the risk of large scale catastrophe, such as one that "caused 10 million fatalities or 10 trillion dollars worth of economic loss" (Bostrom & Ćirković 2008).

A few kinds of GCRs are Environmental change, Emerging technologies, Pandemics, Natural disasters.

Courtesy of Advance Local Archive

Existential risks are a subset of global catastrophic risks. As defined by Bostrom and Ćirković, "an existential risk is one that threatens to cause the extinction of Earth-originating intelligent life or to reduce its quality of life (compared to what would otherwise have been possible) permanently and drastically" (Bostrom & Ćirković 2008).

Intertemporal Impartiality

The value of a life does not depend on whether a person is in America or Africa. In the same way, the value of a life does not depend on where a person is temporally located. This is the essense of intertemporal impartiality, the thesis that what happens in the far future matters just as much as what happens in the near term future.

Intertemporal impartiality implies it is extremely important to make sure the far future goes as well as possible.
Humanity may survive for the next millions and billions of years. This would include many orders of magnitude more lives than currently are. Intertemporal impartiality would then imply that the badness of an extinction event would be significantly worse than the sum of the badness of each individual deaths it would cause since it would also prevent an incredible number of people from ever existing.

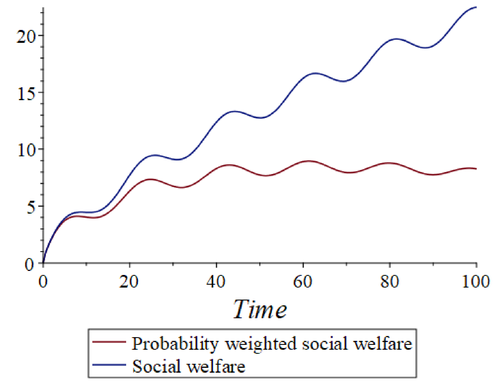
Social Welfare

A social welfare function is commonly used in cost-benefit analysis related to the intergenerational issue of climate change.
This function weighs the impacts of a policy based on how it affects the aggregate of value from now to a certain point in the future, which may be infinity.
This is the social welfare function used in this project

$$\int_t^\infty e^{-\rho t} \cdot u\left(\frac{C_t}{L_t}\right) \cdot L_t dt \qquad (1)$$

- $u\left(\frac{C_t}{L_t}\right)$ is the instantaneous utility (wellbeing) function for the representative person - it is a function of per capita consumption $\frac{C_t}{L_t}$ at period t
- L_t is population and multiplies our utility function to give the total wellbeing at period t
- $e^{-\rho t}$ is perhaps the most controversial. It is the discount factor.

Discounting has generated a lot of discussion in matters of public policy. Normally, this is used to discount benefits according to how far into the future they occur. However, *intertemporal impartiality* implies the importance of benefits and harms is independent of when they occur.
We can reinterpret discount factor as a ***probability weight***. We face existential risks which we can do nothing about. The probability weigh then weighs each period according to how likely humanity is to survive such risks up to a given point.



Model for Optimal Allocation

My model attempts to formalize the relationship between economic growth and global catastrophic risk reduction. Given a social welfare function, the model outputs how much an economy should invest in economic growth and reducing global catastrophic risks at each instant of time.
Model components:

- A production function indicates how much output an economy produces given a stock of labor and capital $AK_t^\alpha L_t^{1-\alpha}$
- Part of the output goes towards consumption C_t (which affects societal welfare) and part of it is invested in risk reduction I_t
- At each instant, part of the output has an expected destruction to global catastrophic risks, which is given by: $B_t e^{-\omega I_t} K_t$
- Putting it all together, $\dot{K}_t$ is the instantaneous change in capital (what is left from what was used elsewhere):

$$\dot{K}_t = AK_t^\alpha L_t^{1-\alpha} - B_t e^{-\omega I_t} K_t - C_t - I_t$$

- Labor stock is modelled as identical to population. It changes as a result of a fixed population growth rate n and an expected destruction from global catastrophes of $B_t e^{-\omega I_t} L_t$. We get:

$$\dot{L}_t = (n - B_t e^{-\omega I_t}) L_t$$

Important assumptions in accounting for the relationship between catastrophic risk and economic growth:

- There must be a way to individuate investments in economic growth from investments in global catastrophic risk reduction
- We must have sufficient information about expected output given resources in the economy and about expected risk reduction given a certain amount invested
- The likelihood and consequence of different global catastrophic risks must be reliably estimated