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# Can or Should We Assess the Growth Impacts of Climate Protection?

## KEY MESSAGES

- **Predicting long-run growth effects of decarbonization is subject to high uncertainty**
- **Awareness of limitations of growth forecasts should be raised**
- **Scientific communication should aim at forecasts being misused in the political debate**
- **Comparative analysis of growth effects can have value for policy design**
- **A focus on absolute limits to growth can potentially be detrimental to decarbonization**

The discussion about climate targets, whether on a European or on a national level, is more often than not accompanied by the question of what the implications are going to be on economic growth and other key economic variables. There is also a growing number of people who argue that economic growth and reaching climate neutrality cannot go hand in hand and that so-called green growth is not possible. The following article first addresses the question of the predictability of growth impacts of climate change as well as decarbonization. It then briefly addresses growth skepticism and the stipulation that growth should be limited.

## IMPACT OF CLIMATE CHANGE ON ECONOMIC GROWTH

Assessing the growth impacts of climate protection should take into account not only the impact of climate policy on the economy but also the question of what would happen in the absence of climate policy. Therefore, the comparison of a world with and without climate policies should consider the damage that we can avoid by pursuing climate policy to limit the temperature increase. The Intergovernmental Panel on Climate Change (IPCC), as an aggregator of scientific knowledge in this area, provides some answers on the question of climate impacts on the economy. It stresses that "under high warming (>4°C) and limited adaptation, the magnitude of decline in annual global GDP in 2100 relative to a non-global-warming scenario could exceed economic losses during the Great Recession in 2008–2009 and the COVID-19 pandemic in 2020" (IPCC 2022, 67) where the "severe risks are more likely in (typically hotter) developing countries" (IPCC 2022, 67). However, it also states that "estimates of the global effects of climate change on aggregate measures of economic performance and gross domestic product (GDP) range from negative to positive, in part due to uncertainty in how weather variability and climate impacts manifest in GDP" (IPCC 2022, 54). Of course, the impact of climate change will also depend on the economic, technological, societal, and institutional means of adapting to climate change, which vary from region to region.

Even with adaptation, however, limiting temperature increases will likely avoid substantial damage and, while relatively low increases in temperature might have positive effects on the economy in some regions, limiting climate change to such temperature increases seems hardly realistic given that temperatures have already increased by about 0.8 to 1.3°C compared to preindustrial times (IPCC 2023).

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## IMPACT OF CLIMATE PROTECTION ON ECONOMIC GROWTH

Like the impacts of climate change, the impacts of the decarbonization and transformation of economies are subject to uncertainty. Technological development and the costs of alternative technologies matter. At the same time, the impact on economic performance and growth will be determined by the choice and implementation of policy instruments as well as by the question of whether these policies are implemented unilaterally or globally. Most assessments come to the conclusion that reducing emissions will be costly in the short run and potentially have at least a negative transitory effect on growth (e.g., IMF 2022).

### Impact of Climate Policies

The IMF (2022) highlights the potentially very heterogeneous impact of different policy packages on GDP development as well as other macroeconomic indicators. This holds true despite the fact that the policies considered by the IMF differ solely with respect to the use of revenues from the only climate policy instrument employed, namely gradually increasing

the price put on greenhouse gases. In the real world, however, policy packages are much more complex. The policy mix consists of an almost unmanageable number of individual – often technology- and even region-specific – measures, whose overall effect on the macroeconomy is not entirely estimable. Even highly advanced numerical models cannot account for this diversity and quantity of measures, making it hard to assess the interaction effects of the policies.

Regarding policy design, economic logic compellingly suggests that technology-open emission reductions, as for example accomplished by carbon pricing, will lead to minimal-cost decarbonization pathways by incentivizing usage of the cheapest emission reduction technologies first. In comparison, the efficiency of technology-specific regulation relies on the regulator's usually incomplete knowledge about abatement costs and technology development potential. It thereby runs the risk of incurring higher costs and thus negative GDP and growth effects for the same emission reduction.

However, disruptive technology switches, for example from fossil-based to hydrogen-based steel production, might require additional support in the form of R&D and innovation policies as laid out by Acemoglu et al. (2012). Also, some technologies require infrastructure as in the case of hydrogen or charging stations for EVs. Fast scaling up of these technologies is unlikely to happen when relying on private investment only, especially in early stages. Given the limits of public budgets, however, this not only requires a smart incentive system to activate private capital, but might also limit how many technologies could be supported simultaneously. In this context, technology-specific regulation can have a signaling effect that might trigger investment with lower public support.

It is, however, not only the policy mix that determines growth effects but also uncertainties regarding its implementation that are usually accompanied by delays to the transformation. The IMF (2022) showed that delaying emission reductions while still aiming to reach the climate targets will shorten the time frame for the transformation and thus very likely increase its cost in terms of GDP.

## Impacts of Technological Development

The policy mix naturally also influences the type of technologies that attract investments and the rate at which they are adopted. However, it is unclear how costs of low-carbon technologies will develop in the future. For some technologies, like PV and onshore wind, large cost reductions have already been achieved through learning and upscaling. While we are likely to see some more cost decreases, forecasts of future cost developments are less prone to large errors than those for a number of other technologies that we will also have to rely on in the future. Without going into too much technological detail, just consider hydrogen-based steel production or alternative power sources for aviation. At the moment, some of these technologies exist only on the prototype level, making forecasts about their future cost and thus contributions to value added highly uncertain. As a consequence, the technological path toward climate neutrality is by no means predetermined. While we will, for example, surely see more electrification (transport, heating, industry), there is still considerable uncertainty regarding the choice between, for example, electricity or hydrogen/e-fuels for a number of uses (e.g., in transport and process heat; see Ueckerdt et al. 2021). Models used to assess the GDP and growth effects of decarbonization often do not account for these uncertainties or, if they try to, open up a large range of potential GDP impacts.

## The Impact of International Developments

A further complication in the assessment of the growth effect of decarbonization, especially on the national level, is the uncertainty regarding developments on international markets. This concerns the questions of competitiveness due to different climate policy ambition levels, different access to technologies, and the choice of climate policy instruments (just compare the Inflation Reduction Act in the US and the NextGenerationEU package). But this also concerns risks from geopolitical developments. The energy crisis following Russia's attack on Ukraine has demonstrated this clearly, and has also raised awareness of potential supply-chain risks from high supply-side market concentrations, for example with respect to raw materials.

In particular, the issue of future international cooperation raises a lot of questions. While cooperation will surely increase the chances of reaching the climate targets and will lower the global cost of decarbonization, short-term thinking about local economic advantages was a major factor in preventing efficient cooperation in the past. The shift in geopolitics toward an even more multipolar world following the energy crisis makes effective international cooperation even more unlikely. A strong climate club with unified carbon pricing as Nordhaus (2015) suggested does not seem to be a realistic short-term option, making the growth impacts of climate policy even more uncertain.

## Relative and Absolute GDP Impacts of Decarbonization

Accounting for all sources of uncertainty makes the GDP impacts of climate policy exceedingly difficult to predict, even in the rather short-term up to, say, 2030. Naturally, the longer the time frame, the more uncertainties arise. Efforts to assess GDP and growth effects of complex and long-term projects like combatting climate change should therefore being taken

with a large degree of caution – regardless of whether they are positive or negative. Modeling efforts can, however, still be of interest when the focus is less on absolute numbers and more on relative effects. For instance, how does one policy package fare compared to another or how might international cooperation affect the implications of climate policy. Also, careful and well-calibrated economic modeling might give insights into bottlenecks (e.g., due to low empirical values of substitution elasticities) as well as flexibilities (e.g., due to import substitution). Yet, the energy crisis has shown clearly, how important it is to delve deeper into the modeling and calibration assumptions made when assessing the impacts of a crisis or the even more complex impacts of decarbonization. Especially in the early stages of last year's crisis, forecasts of GDP effects varied widely (see e.g., German Council of Economic Experts 2022 and citations within). Without a very good understanding of the causes of these differences, the danger of misuse of the generated figures is high.

## CAN OR SHOULD WE GROW IN THE LONG RUN?

In the climate debate, however, the focus is often not on analyzes as described above. Rather, it is either on whether decreasing emissions and growth are incompatible per se or on whether growth impacts should be at the forefront of the debate.

### Development of $CO_2$ Emissions, Innovation and Economic Growth

A decomposition of the drivers of carbon emission changes in the Synthesis Report to the IPCC's Fifth Assessment Report shows that the increase in global emissions in the period 1970–2010 was primarily driven by the increase in GDP per capita and the increase in global population (IPCC 2014). At the same time, the energy intensity of GDP decreased substantially as did the $CO_2$-intensity of energy use. However, the latter two factors were not strong enough to offset the first two, and overall emissions increased as a result. Building on this kind of decomposition, the main argument behind growth skepticism in the context of climate and resources is that an absolute decoupling of emissions and GDP growth is not possible.[1] If that were indeed the case, GDP growth would necessarily go along with ever increasing emissions. However, even a shrinking economy would not lead to zero emissions without technical and social innovations. So, in order to stay within the planetary boundaries and stabilize global temperatures, we need to focus on incentives to innovate and transform our economy.

Now, incentives for innovation do not rely on a growing economy per se and could also be compatible with a zero-growth world in which firms compete, for example, for market shares. The question is whether growth is something that can – or should – simply be switched on or off. Growth is the endogenous outcome of interaction of agents on markets and thus the result of a process rather than an input. From an economic perspective, the challenge is to maximize welfare under given constraints set by a number of targets ranging from environmental to social. Whether or not long-run economic growth is possible under such restrictions is nothing we can sensibly predict. Putting the focus of policies on limiting growth might, however, have serious consequences with respect to the design of smart policies to incentivize innovative activities and thus to our potential to meet the climate targets. The focus should therefore rather be on creating a framework for economic activity that ensures that we can achieve the climate (and other sustainable development) targets while maintaining incentives to innovate.

### Is Economic Growth the Best Indicator for Welfare?

Much of the discussion about growth is, however, also driven by the question of whether ever increasing levels of GDP lead to an ever-increasing level of welfare – essentially, whether we should be focusing on growth at all. Results from empirical research on the impact on higher income on happiness or life satisfaction is at best mixed (see e.g., Easterlin et al. 2010 and Stevenson et al. 2008). Yet, no one can seriously question that perpetual growth at the expense of the climate or, more generally, the environment would naturally come at the expense of welfare. As John Stuart Mill stressed back in the 19th century: "If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, …I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compel them to it" (Mill 1852, 321). This is why getting the framework conditions for economic activities is so important. In Mill's words, economic development at the expense of the environment is to be avoided and not economic development per se.

[1] Absolute decoupling refers to a reduction of emissions in absolute terms even if GDP is rising.

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