

Lorenzo Forni and Massimo Tavoni

How to Overcome the Short-term Costs of the Climate Transition?

THE BENEFITS OF THE GREEN TRANSITION

Understanding the economic implications of transitioning toward a climate-resilient future is intricate and complex. Yet, there is now consensus that such a transition is economically favorable if well executed. The latest assessment report of the IPCC states for the first time that the economic benefits of stabilizing climate change at safe levels outweigh the costs, provided policies are well designed and international cooperation holds.

The economic case for climate action arises because the economic repercussions of climate-induced events are profound. Natural disasters bring immediate damages and long-term economic downturns, affecting infrastructure and human lives. The economic costs associated with rising global temperatures are uncertain but expected to be significant, and higher than those needed to transition to net-zero (Drouet et al. 2022). Investments dedicated to climate adaptation involve two main areas: preventive measures, like bolstering infrastructure; and remedial actions, which encompass post-disaster relief and rebuilding. Catalano et al. (2020) emphasized that proactive, preventive interventions spur higher GDP growth when juxtaposed against remedial measures or outright inaction. However, the steep initial costs of such preventive measures and budgetary constraints have led many nations to prioritize post-disaster interventions, often complemented by international financial assistance.

It is worth noting that there is a disparity in how different economic models perceive and account for climate impacts. For instance, most models used in ex-ante evaluation of climate policies focus only on the net-costs of the transition without including climate damages. Such omissions render these models unable to quantify the negative growth ramifications associated with escalating temperatures and subsequent natural disasters. In contrast, Integrated Assessment Models adeptly encapsulate the harmful growth effects of rising temperatures and associated climatic disruptions. As illustrated by Catalano et al. (2021), these models show that scenarios championing emissions reduction outperform “business-as-usual” models regarding long-term economic growth.

The second compelling reason for advocating for a shift toward renewables stems from their inherent sustainability. According to the International Energy Agency, solar energy has become the cheapest source of electricity generation in human history, a process arguably accelerated by climate protection policies.

KEY MESSAGES

- **Transitioning to a climate-resilient future can offer significant economic benefits when compared to maintaining current emissions levels. Renewables and electrification promise reducing dependence on fossil fuels, benefiting both the environment and human well-being**
- **The transition to a green economy, however, faces short-term challenges, including stranded assets and skill obsolescence. Overcoming these obstacles requires securing public buy-in, addressing the disparity between private costs and societal benefits, and developing comprehensive policy strategies**
- **Public acceptance of climate policies hinges on perceived fairness and policy efficacy, with effective communication about benefits playing a pivotal role. While carbon revenue recycling can gain short-term public support, a holistic approach, integrating various mitigation strategies and transparent communication, is vital for a sustainable transition**
- **Several authors emphasize the importance of aggressive early action for a successful green transition, highlighting the momentum and cost reductions achieved with the diffusion of green goods and technologies**
- **Challenges such as political divides, economic disparities, and the interplay between market and government failures can potentially hinder the positive feedback loop and derail green transition efforts. To ensure success, a concerted effort from both the public and private sectors, backed by rigorous research to understand societal behaviors and attitudes, is necessary**

Unlike fossil fuels, renewables predominantly harness solar power, eliminating the need to extract, import, and process vast quantities of nonrenewable resources. This shift carries pronounced distributive implications across nations. Countries that traditionally import oil, including numerous European nations and emerging giants like China and India, stand to gain substantially in the long run. These countries can bolster their energy autonomy by cutting down on energy import expenses, thereby fortifying their economic resilience. Conversely, nations endowed with rich fossil fuel reserves and extensive processing infrastructures might encounter challenges. They face the risk of considerable stranded assets and the accompanying economic repercussions as the global momentum leans toward green energy alternatives.

Yet, it is pivotal to recognize that the advantages of transitioning to greener energy sources extend beyond mere economic metrics. The broader environment, encompassing natural capital and biodiversity, can reap significant rewards from such a shift. Measures ensuring forest conservation, water preservation, pollution reduction, and the protection of diverse natural habitats play a crucial role. These actions not only safeguard our planet's invaluable biodiversity but also complement the economic dividends of a green transition. This is especially true for air pollution, whose health impacts have significant repercussions for well-being and productivity (Aleluia et al. 2018).

THE SHORT-TERM COSTS THAT ARE SLOWING THE TRANSITION

While the advantages of the green transition appear evident, its journey is fraught with numerous obstacles. A transition of this magnitude and depth inevitably implies costs that are either economic, political or hedonic. The concept of “stranded assets” is an often-quoted example of these transitional expenses. As we grapple with the urgency of environmental challenges, certain assets, despite being operational, may become redundant before completing their anticipated lifecycle. This spectrum of stranded assets ranges from apparent candidates like fossil fuel reserves to broader categories like equipment slated for early retirement. For instance, firms producing components for combustion-engine vehicles face considerable risks with the rapid diffusion of electric vehicles. Similarly, buildings with poor energy efficiency might necessitate significant investments to enhance their efficacy or risk plummeting in market value. Both cases highlight the economic advantages of the green transition: electric vehicles are three times more efficient than international combustion engines. And energy-efficient buildings can help save on energy bills.

Alongside assets, there is a parallel risk of skill obsolescence and the need for new competencies. As specific sectors scale down in alignment with green objectives, the workforce, adept in those sectors,

might discover their skills becoming increasingly irrelevant - requiring layoffs or reskilling. However, for both capital and skills, the need for renewal to sustain economic progress and create new industrial and occupational sectors suggests ways the energy transition can be beneficial in the short term, provided it can foster industrial progress toward more productive activities. In this sense, the transition toward renewable energy and electrification would have happened anyway as nonrenewable scarcity increases; the green transition is significantly accelerating this process given the urgency of the climate challenge.

The transition adjustments manifest in political or financial terms and ripple through economies, sectors, and households. Understandably, there is hesitation to shoulder the initial costs, juxtaposed against the broader and collective benefits of reduced emissions and cleaner, domestic energy sources. The traditional view from economics is that while businesses and households grapple with these immediate financial implications, potentially with some assistance from public coffers, the advantages of their actions – reduced emissions and a healthier environment – benefit society at large. This discrepancy between private costs and public benefits underscores a classic economic conundrum: the challenge of externalities. When individuals or entities do not directly reap the full rewards of their positive actions or, conversely, bear the brunt of their adverse actions, they might be less incentivized to act responsibly. This inherent discord paves the way for “free riding” behavior, where economic agents evade bearing the costs, hoping others will step up, thereby exacerbating the challenges of the green transition.

Though these arguments are still valid, especially in the international context, the rapid advancement of low-carbon technologies and increased geopolitical energy risks offer a fresh look into the economics of short-term climate action. Many of the actions and strategies needed to reduce emissions - at least initially - are now affordable and in most cases more efficient than fossil fuels, especially for regions - like Europe - that depend almost entirely on imports. The shift from environmental to industrial policy is evident as major economies compete in a global clean energy race for technology supremacy and market share acquisition.

Navigating the complexities of the green transition needs to account for the iron laws of climate dynamics. We are grappling with the aftermath of historic emissions that have lingered in the atmosphere, already causing a temperature rise of over one degree Celsius. This shift, regrettably, is near irreversible. The emissions of today promise further warming, making the journey even steeper. While slashing emissions can decelerate the rate of temperature escalation, the ambitious goal of net-zero emissions, at its most optimis-



Lorenzo Forni

is Professor of Economic Policy at the University of Padua and Head of Prometeia Associazione Think Tank. His research interests include the economic impact of fiscal policy, economic crises, sovereign debt restructuring, and macroeconomic aspects of climate change.



Massimo Tavoni

is Professor of Climate Change Economics at Politecnico di Milano and Director of the European Institute on Economics and the Environment (EIEE) part of CMCC. His research is about the economics and modeling of the low-carbon transition and of environmental impacts.

tic, would merely stabilize temperatures at elevated levels. In other words, the efforts and investments poured into emission reductions today are juxtaposed with a relentless upward trajectory in global temperatures. This dichotomy underscores an urgent need: not only to achieve net-zero emissions, but also to address excess CO₂ concentrations using negative emission technologies, without diminishing mitigation efforts.

Yet, the challenges do not end with the generational equity concerns or the complexities of externalities. Public awareness, or the lack thereof, exacerbates the difficulty. Many remain uninformed or apathetic about the climate crisis despite the global stakes. Organizational hurdles further impede progress. The logistical challenges of securing permits for large-scale renewable energy projects are significant. Furthermore, while there is broad consensus about the need for renewable energy, local opposition often arises when these projects are slated for specific regions – a phenomenon aptly coined “not in my back yard” (NIMBY). The influence of powerful lobbying groups, with vested interests in maintaining the status quo, further muddies the waters. They often wield considerable sway in shaping public opinion and policy directions which lock in fossil energy and make the transition more difficult. And as if these weren't enough, there is considerable debate about the best policy strategies. Should the emphasis be on carbon pricing, serving as a deterrent to carbon-intensive activities? Or should the focus shift to incentivizing innovation and fostering nascent sectors and technologies? This highlights the necessity of building upon the increasing consensus that a comprehensive policy portfolio, encompassing market instruments, regulation, and innovation, is essential to address the climate challenge. Communicating the scope of such a policy reform is challenging and demands substantial political will which is severely compromised by several weaknesses.

In essence, the road to a green economy is generally advantageous but also fraught with multifaceted economic, social, organizational, and political challenges. Yet, despite these hurdles, the imperative for transition remains clear and compelling. The intricate challenges culminate in one overarching problem: securing public buy-in for climate policies. When individuals face immediate sacrifices and an uncertain future, rallying them behind climate initiatives is a formidable task. So, how do we bridge this disconnect between short-term sacrifices and long-term advantages?

PUBLIC ACCEPTANCE OF CLIMATE POLICIES

Recent studies offer fresh perspectives on how public acceptance of climate policies, especially carbon pricing, can be fostered. A salient theme from this literature is the pivotal role of perceived fairness and

policy efficacy. As posited by Bergquist et al. (2022), the public's perception of a policy's fairness and effectiveness emerges as a cornerstone in determining its acceptance. In other words, if people believe that a carbon tax is not just equitable but also effective in achieving its environmental goals, they're more likely to support it.

Dabla-Norris et al. (2023) delve deeper into this aspect, highlighting that the underlying beliefs about the tangible outcomes of such policies, be it their costs, benefits, or their progressive nature, are instrumental in molding public sentiment. An important insight from their research is that the way the revenue from carbon pricing is utilized plays a decisive role in shaping its public perception. If the revenues from such initiatives are funneled into rectifying distributional disparities or into the economy via green infrastructure projects and low-carbon technology subsidies, public endorsement is likely to be higher. Their study underscores the profound impact of strategic communication. Simply put, if the public is made acutely aware of a policy's benefits and effectiveness, their support swells.

Further accentuating the importance of equitable distribution, Colantone et al. (2023) spotlight the distributive repercussions of green policies. Their research suggests that the political viability of such initiatives is linked with their distributional outcomes. In essence, policies that are perceived as imposing undue burdens on specific segments while benefiting others disproportionately are less likely to secure widespread public endorsement.

In synthesis, while steep, the road to winning public support for green transitions is not insurmountable. Through a blend of equitable policies, strategic communication, and a genuine commitment to sustainability, it is possible to align public sentiment with the long-term imperatives of a sustainable future. The dichotomy here is the tug-of-war between short-term appeasement and long-term transition objectives. The sentiment of fairness becomes paramount in this discussion. When people feel they are being treated justly, they are more likely to buy into an initiative, even if it demands personal sacrifices. Recycling carbon revenues is one such avenue that holds promise. When citizens can see tangible benefits from policies, such as receiving direct financial transfers, reductions in their taxable income, or community-level programs that directly improve their surroundings or quality of life, their resistance to such policies may diminish. This approach capitalizes on the political economy of the situation by giving people an immediate reward, or at least a cushion against the short-term costs.

EVIDENCE ON CARBON REVENUE RECYCLING

Carbon revenue recycling, while a seemingly attractive strategy to gain public support for carbon pricing, is not a one-size-fits-all solution. It is evident from

the mixed results in the literature that the success of such policies can vary significantly based on regional differences, cultural perspectives, and political leanings. The literature is divided. Mildenerger et al. (2022) find limited evidence that individual, or household, rebates have increased public support for carbon taxes in Canada and Switzerland. Similarly, Fabre and Duenne (2022) find that after the Yellow Vests movement, French people would largely reject a tax and dividend policy, i.e., a carbon tax whose revenues are redistributed uniformly to each adult.

Some studies find mixed evidence. For example, Jagers et al. (2021), based on survey experiments administered in the United States, Canada, and Germany, find that while public opinion is sensitive to the cost attributes of carbon taxes, in some cases, opposition to carbon taxes can be offset by a reduction in income taxes. However, these effects tend to be modest in size, limited to some ideological groups, and varied across countries. They also show that fairness perceptions are a crucial mechanism linking revenue recycling to carbon tax support in all countries examined.

Finally, other studies find more support for revenue recycling. Beiser-McGrath and Bernauer (2019), for example, based on choice experiments with representative samples of citizens in Germany and the United States, find that revenue recycling could help achieve majority support for carbon tax levels of up to USD 50–70 per metric ton of carbon, but only if other countries join forces and adopt similar carbon taxes. Nowlin et al. (2020) argue in the case of the US that conservatives and Republicans are more supportive of a carbon tax when revenues go toward a tax rebate or deficit reduction.

However, while this might gain traction in the short run, does it compromise long-term objectives? From a purely efficiency-driven standpoint, using carbon revenues for more direct emission reduction methods seems more sensible. Investing in research and development (R&D), fostering green industries, or even directly intervening in emission-heavy sectors holds the potential for a rapid and significant reduction in emissions. Such strategies accelerate the shift toward a more sustainable economy. By redistributing carbon revenues back to the people, we may inadvertently be putting the brakes on the green transition. With more money in their pockets, consumers will naturally increase their consumption. In an economy still dominated by high-emitting technologies and not yet fully transitioned to green alternatives, this would mean a higher demand for emission-intensive products and services.

In essence, the dilemma is clear. On the one hand, there is the need to earn public support by ensuring perceived fairness, and on the other, the imperative to drive an efficient and rapid green transition. Striking the right balance requires nuanced policymaking, where immediate public benefits are coupled with a

concerted push for sustainable transformation. Policy architects need to consider the economic implications and the sociopolitical fabric that influences public opinion. We can only navigate the intricate challenges of transitioning to a green economy with this comprehensive approach.

Also, focusing solely on carbon revenue recycling can be a narrow approach when considering the broader picture. Carbon pricing is one instrument in the vast toolkit of mitigation strategies, and not all these tools come with fiscal revenues that can be channeled back to the public. For instance, regulations, standards, and incentives might not generate direct fiscal revenues but can still be pivotal in driving a country's green transition.

Moreover, redesigning crucial markets, like the electricity sector, is another way to allocate the benefits of the transition to specific groups. Furthermore, in an age of information overload, the narratives championed by interest groups, lobbyists, and incumbents can significantly influence public opinion. The challenge, then, is designing effective policies and ensuring they're communicated authentically and transparently to the public.

In conclusion, while carbon revenue recycling has its merits, it is imperative to understand its limitations and the broader context in which it operates. Relying solely on it as the primary strategy to gain public support might be overly optimistic. It should be considered as a part of a comprehensive suite of policy tools, each tailored to the unique circumstances and requirements of individual nations and their citizens, including both pre-distributive and re-distributive elements.

DO WE NEED A MORE AMBITIOUS APPROACH?

Van der Ploeg and Venables (2023) advocate a radical approach that underscores the need for an aggressive intervention at the very beginning of the transition toward a greener economy. By taking bold steps initially, the momentum created can sustain and propagate further green actions in the economy. Positive production complementarities are grounded in the reality that as green technologies proliferate, there are cost reductions due to economies of scale and ongoing innovation. We have seen this in action with solar panels, windmills, batteries, etc., which have drastically fallen prices as more units are produced and efficiencies are found.

However, as is the case with any technological revolution, the rise in efficiency of brown technologies might give a false sense of progress and deter innovation in the green space. Indeed, van der Meijden and Smulders (2022) and Smulders and Zhou (2022) caution against optimism in this regard, as an efficiency increase in brown technologies can delay technological improvements in the green ones. It is a delicate balancing act where progress in one sector

may inadvertently slow advancements in another, especially when accounting for political economy issues.

On the consumer side, green goods becoming “trendy” or normative as more people adopt them seems intuitive. Once a critical mass is achieved, these green goods can become the norm rather than the exception. Though the adoption of electric vehicles is an example of how fast things can abruptly change, whether these “positive tipping points” can be generalized remains largely speculative and needs empirical backing. Moreover, any perceived elitism or exclusivity around green goods can deter their widespread adoption. This is where government incentives can play a critical role, helping to normalize these goods in the eyes of consumers and make them more accessible.

However, even with these measures in place, challenges persist. Political divides, perceived elitism around green products, and economic disparities can hinder the kind of positive feedback loop van der Ploeg and Venables envision. This is further complicated when one considers the potential interaction between market failures (like information asymmetry) and government failures (like policy myopia). These issues can derail even the best-laid plans for a green transition. Besley and Persson (2021) show – in a model that entails positive strategic complementarities – that market and government failures can interact to prevent a welfare-increasing green transition from materializing or make an ongoing green transition too slow.

POLICY CONCLUSIONS

Van der Ploeg and Venables’s vision of radical climate policies is enticing. Start strong with aggressive carbon taxation and substantial renewable subsidies to push the economy toward the green equilibrium. As the production and consumption of green goods become more widespread, the necessity for aggressive policies diminishes. This is because positive strategic complementarities reduce production costs for green products as the amounts produced increase, while enhancing their perceived value, making consumers more inclined to purchase them. This proposal is predicated on the strength of the strategic complementarities they posit. While empirical evidence supports the production side of the equation, the consumption side remains more nebulous. It is, in essence, what the European Union 2030 policy package is trying to do: policy evaluation of this unique endeavor will tell whether this is working as expected.

For such policies to be successful, there needs to be a concerted effort from both the public and private sectors, backed by rigorous research, to understand societal behaviors and attitudes. It requires more investigation to understand consumer behavior and how to design policies that can foster these social norms on the consumption side. It must account for special interests’ strategic action in response to governmental

efforts. And to account for global geopolitical competition and its repercussions for the clean technology race. Only with this holistic approach can we hope to usher in a sustainable green transition that’s both inclusive and enduring. As climate policies hopefully become entrenched in societal goals, their impact on economic progress becomes endogenous and driven by policy choices and societal responses. The paradigmatic shift from correction of market failures toward a welfare-centered industrial strategy does not mean that the two visions of the green transition are mutually exclusive. By uniting the climate-environment cause with the recognition that policies need and can deliver benefits on a sufficiently wide basis we can help make progress on climate action. Independent and objective research on policy effectiveness is now more important than ever to support decision-makers in best allocating limited economic and political resources while recognizing the urgency of rapid action.

REFERENCES

- Aleluia da Silva Reis, L., L. Drouet and M. Tavoni (2022), “Internalising Health-economic Impacts of Air Pollution into Climate Policy: A Global Modelling Study”, *Lancet Planetary Earth* 6(1), 30-48.
- Beiser-McGrath, L. F. and T. Bernauer (2019), “Could Revenue Recycling Make Effective Carbon Taxation Politically Feasible?”, *Science Advances* 5(9), DOI: 10.1126/sciadv.aax3323.
- Bergquist, M., A. Nilsson, N. Harring et al. (2022), “Meta-Analyses of Fifteen Determinants of Public Opinion about Climate Change Taxes and Laws”, *Nature Climate Change* 12, 235–240.
- Besley, T. and T. Persson (2023), “The Political Economics of Green Transitions”, *The Quarterly Journal of Economics* 138, 1863–1906.
- Catalano, M., L. Forni and E. Pezzolla (2020), “Climate Change Adaptation: The Role of Fiscal Policy”, *Resource and Energy Economics* 59, February 2020, 101111.
- Catalano, M., L. Forni and E. Pezzolla (2021), “Fiscal Policies for a Sustainable Recovery and a Green Transformation”, *World Bank Policy Research Working Paper* 9799.
- Colantone, I., L. Di Leonardo, Y. Margalit and M. Percoco, M. (2023), “The Political Consequences of Green Policies: Evidence from Italy”, *American Political Science Review*, 1–19.
- Dabla-Norris, E., T. Helbling, S. Khalid, H. Khan, G. Magistretti, A. Sollaci and K. Srinivasan (2023), “Public Perceptions of Climate Mitigation Policies: Evidence from Cross-Country Surveys”, *IMF Staff Discussion Notes (SDNs) SDN/2023/002*.
- Drouet, L., V. Bosetti and M. Tavoni (2022), “Net Economic Benefits of Well-Below 2°C Scenarios and Associated Uncertainties”, *Oxford Open Climate Change* 2(1), <https://doi.org/10.1093/oxfclm/kgac003>.
- Douenne, T. and A. Fabre (2022), “Yellow Vests, Pessimistic Beliefs, and Carbon Tax Aversion”, *American Economic Journal: Economic Policy* 14, 81–110.
- Jagers, S. C., E. Lachapelle, J. Martinsson and S. Matti (2021), “Bridging the Ideological Gap? How Fairness Perceptions Mediate the Effect of Revenue Recycling on Public Support for Carbon Taxes in the United States, Canada, and Germany”, *Review of Policy Research* 38, 529–554.
- Van den Meijden, G. and A. J. Smulders (2017), “Carbon Lock-In: The Role of Expectations”, *International Economic Review* 58, 1371–1415.
- Mildenberger, M., E. Lachapelle, K. Harrison et al. (2022), “Limited Evidence That Carbon Tax Rebates Have Increased Public Support for Carbon Pricing”, *Nature Climate Change* 12, 121–122.
- Nowlin, M. C., K. Gupta and J. T. Ripberger (2020), “Revenue Use and Public Support for a Carbon Tax”, *Environmental Research Letters* 15, 084032.
- Van der Ploeg, F. and A. J. Venables (2022), “Radical Climate Policies”, *CEPR Discussion Paper* 17677.
- Smulders, S. and S. Zhou (2020), *Self-fulfilling Prophecies in Directed Technical Change*, Bundesbank, Mimeo.