The impact of financing conditions on global deep decarbonization

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Overview

Integrated assessment models (IAMs) are key for informing mitigation pathways and policies but usually do not reflect differences in financing conditions between countries and sectors.[1] Recent studies have shown that addressing this issue for the power sector can alter IAM and energy system model outcomes considerably.[2,3,4] However, a comprehensive assessment of how financing costs shape decarbonization pathways and costs across all climate-relevant sectors is missing.

Methods

To address this gap, we derive empirical country- and sector-specific cost of capital estimates for energy-intensive industries, transport, and the energy sector. Leveraging the widely used NYU Damodaran database[5], we estimate country risk premiums based on historical ratings and derive the sector-specific cost of equity, cost of debt, and debt shares by matching all climate-relevant sectors to industry-specific estimates based on publicly listed companies. Then, we implement these cost of capital estimates into the IMAGE IAM [6], which models decarbonization options and technologies in a wide range of climate-relevant sectors for 26 regions through 2100. Furthermore, we project the financing cost effects of continued economic growth based on statistical relationships between countries' income per capita and credit risk and incorporate the cost-reducing effect of international climate finance, such as concessional loans and grants, for developing countries [7,8].

Results

We find that financing conditions differ considerably across climate-relevant sectors and are most favorable for low-risk industries like energy network operators, while the cost of capital is highest for the steel sector. When incorporated into IMAGE, sector and country risks delay or deter decarbonization in several industries and alter technology mixes and regional market shares, such as for hydrogen production. Depending on the underlying socio-economic scenario, continued economic growth in the Global South mitigates country risk to an important extent. However, it is insufficient to bring financing conditions down to levels observed in advanced economies. Therefore, increasing international climate finance remains paramount for accelerating deep decarbonization in developing countries and reducing their share in overall mitigation costs.

Conclusions

Our results highlight that realistic and granular financing conditions in IAMs and similar models are key to assessing decarbonization pathways and costs, particularly when it comes to the relative importance of competing technologies and regions in climate-relevant sectors. Moreover, we provide a simple, yet comprehensive way of capturing the feedback of economic development on domestic financing conditions that can be easily incorporated into IAMs and energy system models. For policymakers, our results highlight the need to provide developing countries with concessional climate finance across all climate-relevant sectors and can inform the ongoing debates around the New Collective Quantified Goals for Climate Finance under the Paris Agreement.

References

[1] Lonergan, K. et al. (2023). Improving the representation of cost of capital in energy system models. *Joule* 7, 469-483.

[2] Polzin, F. et al. (2021). The effect of differentiating costs of capital by country and technology on the European energy transition. *Climatic Change* 167, 26. https://doi.org/10.1007/s10584-021-03163-4

[3] Calcaterra, M. et al. (2024). Reducing the cost of capital to finance the energy transition in developing countries. *Nature Energy* 9, 1241-1251. https://doi.org/10.1038/s41560-024-01606-7

[4] Briera, T. et al. (2024). Reducing the cost of capital through international climate finance to accelerate the renewable energy transition in developing countries. *Energy Policy* 188, 114104. https://doi.org/10.1016/j.enpol.2024.114104

[5] Damodaran, A. (2024). Damodaran dataset (version: July 2024 update). https://pages.stern.nyu.edu/~adamodar/

[6] van Vuuren, D. et al. (2021). The 2021 SSP scenarios of the IMAGE 3.2 model. Preprint at https://eartharxiv.org/repository/view/2759/

[7] Klusak, P. et al. (2023). Rising temperatures, falling ratings: The effect of climate change on sovereign creditworthiness. *Management Science* 69, 7151-7882. https://doi.org/10.1287/mnsc.2023.4869

[8] Buchner, B. et al. (2023). Global landscape of climate finance 2023. https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/