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c/o Professor Lingxiao Yan
& Professor Bronwyn Wake
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Dear Professor Yan and Professor Wake,

We wish to submit an original research paper entitled “European Carbon Market Connectedness and Risk Contagion: A Study of Return and Volatility Dynamics Between Post-Phase II European Union Allowances (EUAs) and Financial Markets and their Potential for Portfolio Diversification”.

This paper addresses the problem of how to accelerate decarbonization efforts via European emissions trading markets in support of the EU’s climate targets. Studies have shown that emissions trading can help reduce abatement costs and dampen the negative impacts of emission reductions, especially on the energy sector. They have also shown that despite various advanced econometric and AI techniques, reliable forecasting of EUA’s price behavior is elusive. This elusiveness is largely due to nonstationarity and nonlinearity, and is related to the policy uncertainty and revisions to expectations in response to global economic environment. It is also likely that that information shocks transmit between markets which in turn would contribute to forecasting difficulty. Studies that have looked at these interlinkages have shown stronger positive relationship with energy markets, and less strong but positive relationship with equities.

In the interim, however, there has been a number of exogenous shocks including Brexit, Covid-19, and Russia-Ukraine war, and policy shocks such as Fit for 55, RePowerEU, and expansion of Phase IV of EU-ETS to new sectors. Accordingly, we need to understand how the EU-ETS behaves in the face of such successive shocks and whether the diversification benefits would still hold and thus continue to help the EU’s climate goals. In this regard, we uniquely expand the markets in consideration and include European sovereign and corporate bonds and non-energy commodities including metals, in addition to European and global equities and energy markets such as oil, coal, and gas in order to enable a comprehensive examination of cross-market interdependencies, and expand the coverage to include Phase IV to date. Using the Diebold-Yilmaz connectedness model, and supplementing it with Pairwise Connectedness Index, we show that both in static and dynamic

terms the EUAs largely remain independent of other financial markets except for coal and natural gas, where there appears a weak connection between coal and natural gas itself as well, which can be attributed to fuel switching in the sector. We also show that in times of exogenous shocks, the returns and volatility of EUAs become briefly connected with equity markets, fixed income, metals and non-energy commodities, before relatively quickly returning back to being independent again. We see a similar pattern regarding connectedness with gas and coal when exogenous shocks occur, though after a brief spike the relationship reverts to their long-term connectedness levels. Especially when we look at the behaviors from 2021 onwards – when successive policy shocks occur - we observe that the impacts of these shocks are lower in magnitude but longer in duration. This pattern likely due to policy factors that accelerate the deployment of renewable energy and phasing out of coal. Our findings are significant because we demonstrate that while having some connection with coal and gas markets, the EUAs remain largely independent of not just equities but also fixed income, metals and other non-energy commodities, and oil, except briefly in times of exogenous stress. This means, financial institutions with non-energy portfolios can improve their risk adjusted returns by participating in the EU-ETS. Such increased participation would in turn accelerate the pace of decarbonization and help the EU in achieving its climate goals. Thus, if implemented by financial institutions, the findings of this research can translate into a large, direct impact.

Since our study deals with EU-ETS in pursuit of achieving EU climate targets and market connectedness, we believe it is in alignment with the aims of Nature Climate Change, and thus may be a good fit for publication in your journal. We feel that the findings of our study will be highly relevant to your audience since not only it can open the door for further research into portfolio integration of EUAs in accelerating decarbonization but also engender real impact towards that goal via carbon markets.

We confirm:

- that the article “European Carbon Market Connectedness and Risk Contagion: A Study of Return and Volatility Dynamics Between Post-Phase II European Union Allowances (EUAs) and Financial Markets and their Potential for Portfolio Diversification” has not been published elsewhere, and it reflects original research conducted by its authors;
- that there are no related manuscripts either of us have under consideration or in press elsewhere; and
- that none of us had any prior discussions with a Nature Climate Change editor about the work described in the manuscript nor have any conflict of interest to disclose concerning this study.

Thank you for your valuable time for considering our manuscript.

Sincerely,

Emre Usenmez¹ and Carlos Arcila Barrera

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