Dynamic Relations Between green bonds, Pollution Allowance Policy, SRI and Uncertainty: A Time-Frequency Approach

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Abstract

This paper considers the dynamic of investing in socially responsible investments. Using the wavelet coherency procedure, the degree of co-movement and causality of green bonds, Pollution Allowance Policy, SRI and Uncertainty are investigated. In addition, the existence of volatility spillover across these indexes is assessed in the time-frequency domain using a novel procedure that involves combining the wavelet decomposition with a time-varying parameter vector autoregression model.

Keywords: Pollution Allowance Policy, *Asymmetric spillover measure*, *Connectedness*, *W-Q-TVP-VAR.*

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1. Introduction:

Since the introduction of the Sustainable Development Goals (SDGs), improving the standard of living of people by devising policies for sustainable development has been getting renewed attention. Accordingly, investing in socially responsible investments (hereafter, SRI) has witnessed an increasing interest attributable to investors choice to apply social, environmental and governance lenses to their investment (Rehman et al., 2022; Paek et al., 2013). In this pursuit, Green Bonds or Climatic Bonds started carrying a significant place in the global sustainability fora. These green bonds are considered a viable solution because of the rising demand for limited natural resources, which in turn creates a misbalance in the social strata (Umar et al., 2020; Shen et al., 2021).

The issue of SRI, however, is one of the most complex challenges facing investing today. In this vein, the investors are motivated by profit and primarily interested in reducing operational costs, and the implementation of climate-friendly solutions (e.g., renewable energy) can cause a short-run decline in their profit due to the high operation costs (Sinha et al., 2021). Given the latter, the developmental SDGs agenda has not yet been prioritized, and the importance of orienting the global capital markets for ascertaining the attainment of this agenda.

SRI challenges are, correspondingly, acute during the time of uncertainty. According to Sinha et al. (2021), uncertainty not only affected economic productivity and growth, but also it has also hampered the compliance that is typically expected towards social and environmental responsibility. From investors point of view, investing in SRI during uncertainty time contribute to the instability of future cash flows (just as any investment assets and commodities), and thus higher risk premiums and significantly higher financing costs for investors (Bradley, Pantzalis, & Yuan, 2016). Additionally, it may cause persistent stock price volatility (P´astor & Veronesi, 2013), making it impossible for investors to accurately judge the future growth prospects of firms and thus reducing direct investment in them. On the other hand, it reduces firm productivity (Li, Liang, & Zhang, 2021), hinders capital accumulation, and leads to deterioration in firms' financial position. As a results, the investors tend to withdraw their investments from the highly risk industry, and invest in the companies that remain stable (Ielasi et al., 2018; Kaiser & Welters, 2019; Karim et al., 2022).

Considering all mentioned perspective, the question somewhat remains unanswered as to how such initiatives as green bonds, renewable energy, and SRI might interact with uncertainties. In this quest, this study is motivated by the following reasons: (i) arming with the fact that identifying the interconnection source and intensity of the return spillover prove valuable to investors, financial intermediaries, regulators, and policymakers, we investigate the connectedness between green bonds, renewable energy, SRI, and

different sources of related uncertainties, which is a neglected topic. (ii) The two serious recent crises including COVID-19 pandemic and the Russian-Ukraine war have affected the economic and financial environment on global basis and though the effect on traditional asset classes is investigated, the sensitivity of socially responsible is yet to be found. Therefore, the considered sample encompasses three related uncertainty indexes, which provides a better opportunity to understand the transmission of shocks in these circumstances. (iii) data ranging from Sep., 2012, until Aug., 2022 (monthly basis). The selected sample period includes three crisis episodes, namely the Brexit vote shock, the COVID-19 pandemic crisis, and the Russian-Ukraine war, allowing us to understand how the dynamics of asymmetry change during these crisis periods. (iv) we apply a recent proposed method of connectedness with the ability to find asymmetries regarding the time and frequency simultaneously. The aim is to determine the overall connectedness in the system and identify which index is a net receiver or a net transmitter. Additionally, it captures the differences between good- (positive) and bad (negative) spillovers and provides asymmetries concerning time- and frequency connectedness. In the end, we provide robust estimations so our findings can be beneficial for investors, portfolio managers, and policymakers regarding risk management across the considered indices available in global markets.

Accordingly, in this paper, we are interested in answering the following questions: (1) are there co-movements and causality between green bonds, renewable energy, and SRI and uncertainties? (2) to what extent do major global events affect these indices? (3) What is the direction of the spillover between those indices; (5) Do negative spillovers spread more intensely than positive spillovers? Answering these questions contribute to three strands of literature: the connectedness amongst SRI-related indexes, the asymmetrical connectedness, and the impact of both health (COVID-19) as well as geopolitical conflict (the Russian-Ukraine war) on climate change.

To accomplish this task, we use a two-stage empirical methodology. First, the maximal overlap discrete wavelet transform is used to decompose the series returns into components associated with different time scale resolutions. In the second step, the dynamic connectedness between implied volatility shocks is studied using a time-varying parameter vector autoregression suggested in Antonakakis et al. (2020). The advantage of the suggested procedure is that it allows us to investigate how the structure of the volatility spillover varies over different time scales. The latter promote us to measure asymmetric short-run, medium, and long-run frequency spillovers. Understanding the asymmetry of spillovers across global markets has several significant implications for policymakers, asset allocation, risk management, and hedging (Mensi et al., 2021).