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The sound of shocks: Does the market sentiment react to Economic Policy Uncertainty, energy prices and ESG shocks?

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ABSTRACT

This paper examines the reaction of Market Sentiment to Economic Policy Uncertainty (EPU), energy prices and ESG shocks in the United States. Using monthly data from November 2002 to March 2025, we employ a simple recursive Structural Vector Autoregression (SVAR) model, complemented by the Climate Policy Uncertainty index as the exogenous variable for robust identification. Our findings reveal that EPU shocks significantly increase financial market volatility and dampen ESG sentiment over the medium term. The demand-driven shock from energy prices reduces financial volatility and ESG uncertainty. The Historical Decomposition highlights a shift in systemic drivers post-pandemic, with EPU emerging as the dominant source of financial and sustainability-related sentiment shifts. These findings underscore the evolving channels through which macroeconomic instability shapes investor behavior and sustainability expectations.

1. Introduction

Governments worldwide are intensifying their commitment to a low-carbon transition, enacting increasingly stringent environmental policies ranging from carbon taxation and emissions trading schemes to renewable energy subsidies. Even amid the climate crisis, these measures are becoming, so to speak, the foundation of the financial markets themselves, especially concerning energy pricing and investor perceptions. Increasingly layered and intricate in their workings, the environmental regulations demand an understanding of the policy-market-sentiment interplay functions for designing ways climate strategies can become viable.

A growing literature strand discussed the Environmental Social Governance market sentiment (ESG, see Serafeim, 2020), which basically emphasizes the willingness of investors to carry on investments that include sustainable options like green bond (Löffler et al., 2021), portfolio diversification in clean energy companies (Kuang, 2021) and the continuing investments in ETFs which track specific sustainable sectors (Fiordelisi et al., 2023). Hashimoto and Huettinger (2024) proposed the segmentation of sustainable finance into the ESG market and Social and Sustainable Investments (SSIs) to differentiate the 'self-love' driven by ESG purposes and 'sympathy' dictated by SSIs.

Meanwhile, economic policy uncertainty (EPU) has emerged as a significant macro-financial variable that influences corporate and investor decisions, with contemporary effects on energy prices. Introduced by Baker et al. (2016), the EPU index captures the unpredictability of economic policy based on media coverage and has been widely adopted to assess its real and financial effects. Empirical studies have linked EPU to energy-price volatility, finding that heightened policy uncertainty often coincides with jump components in oil returns and dampened price stability (Liu et al., 2023). Ren et al. (2023) document how heightened policy uncertainty dampens green-innovation activity while influencing financial-market sentiment. Parallel research has investigated how EPU influences ESG preferences. Using Chinese A-share data, Wu et al. (2024) show that higher policy uncertainty spurs firms to bolster their ESG disclosures, perhaps as a strategic response to supervisory scrutiny and stakeholder pressure. Similarly, studies in green finance contexts link the effectiveness of policy tools to foster ESG improvements — firms under high uncertainty contexts may delay investments in clean technologies or social-governance enhancements to preserve flexibility and vice versa. Recently, to directly study the role of energy uncertainty, Xu et al. (2021) propose a global energy-market uncertainty index to demonstrate its dynamic impact on commodity prices.

From a methodological standpoint, the empirical investigation of energy markets has often relied on Structural Vector Autoregressive (SVAR) models. Seminal contributions by Kilian (2009), Kilian and Park (2009) show that oil prices reflect both supply and demand shocks, each carrying distinct implications for macroeconomic policy. SVAR frameworks are particularly suited to disentangling these structural forces, as they allow for the decomposition of reduced-form residuals into economically meaningful components. For example, Kilian and Murphy (2014) report that changes in oil price expectations exert

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significant and persistent effects on real oil prices, even when such expectations are not observable in the information set. Wang and McPhail (2014) demonstrate how energy price shocks hurt productivity in the short term but contribute to increased volatility in the commodity market. Calcagnini et al. (2016) argument about the increasing persistent role of energy intensity and pollution to sully shocks, demonstrating how VAR residuals are combinations of structural supply and demand shocks. Roughly, these studies highlight that the energy market is crucial for policymakers, leading regulators and stakeholders in these fields to monitor the increasing role of sustainable products constantly. In other words, while fossil fuels were crucial force drivers in the last decade, sustainable energy products could replace them, and their shocks could produce significant reactions from the real side of the economy.

Another critical dimension concerns the role of investor sentiment in shaping energy market dynamics. Recent studies have explored how textual analysis, search volume indices, and survey-based indicators capture shifts in market mood. Fasanya et al. (2022) show that sentiment indicators can forecast returns and volatility in energy futures markets, though the effect varies by commodity. Maghyereh et al. (2020) document that short-term oil returns are relatively more sensitive to sentiment during turbulence than normal conditions. Song et al. (2019) claim that market sentiment can explain the return and volatility of renewable stocks. However, Liu and Hamori (2021) find the opposite result: investor sentiment has a weak impact on clean energy stocks. Therefore, more in-depth study is needed to investigate this fact.

In light of this growing body of research, several gaps remain. First, while many recent studies adopt generalized impulse response frameworks or spillover indices to model energy market dynamics (e.g., Ma et al., 2022; Liu and Yan, 2024), fewer employ a SVAR approach that explicitly integrates both EPU and ESG dimensions. This integration is crucial for understanding whether uncertainty in environmental policy has structural effects on energy prices and financial behavior. Second, several studies build their model using mostly endogenous variables (Nguyen et al., 2020; Hu and Borjigin, 2024), which may limit their ability to isolate exogenous policy shocks. We address this limitation by introducing an external instrument for climate policy uncertainty, enhancing the identification strategy and the results inferential robustness. Finally, our results offer several interesting discussions from both a policy and an investor perspective.

In a nutshell, we find that EPU dampens ESG sentiment in the medium term, and economic instability produces changes in market sentiment. Moreover, higher global energy prices reduce ESG-related uncertainty after about five months, as economic growth stabilizes ESG expectations. The lag reflects the time necessary for businesses and policymakers to adjust their strategies. In addition, a significantly different decomposition of structural shocks emerged.

The rest of the paper proceeds as follows. Section 2 describes the dataset and the methodology used, while Section 3 discusses the main results obtained. Section 4 concludes.

2. Data and methodology

To assess whether economic policies can effectively curb climate change while simultaneously influencing investor behavior and energy prices, we incorporate several variables into our analysis. Our study includes monthly data from November 2002 to March 2025 for a total of $T = 269$ observations, and it focuses on the United States, given its central role in the global economy. We first include the Economic Policy Uncertainty index (EPU), developed by Baker et al. (2016). This newspaper-based index measures economic policy uncertainty by analyzing the economic uncertainty terms in major US journals.

Furthermore, to capture the dynamics of the energy market, we use the Energy Price Index (EPI), sourced from FRED. In order to include an ESG-related measure that aligns with the newspaper-based nature of the EPU, we employ the ESG index from Ongan et al. (2025), available at the ESGwebpage. This index is constructed through text-mining techniques applied to the Economist Intelligence Unit's monthly country reports, tracking the frequency of ESG-related terms and uncertainty signals.

In addition, to capture market sentiment, we include the Equity Market Volatility (EMV) index (SEN, Baker et al., 2019), retrieved from the EMVwebpage. The SEN index combines information from the CBOE Volatility Index (VIX) and the realized volatility of S&P500 returns. It is a newspaper-based measure and a reliable proxy for financial market sentiment and uncertainty. Following Baker et al. (2019) and Ahmed and Sleem (2024), we interpret the EMV index as a proxy for investor sentiment, acknowledging that volatility often reflects investors' reactions to uncertainty and risk perception. While volatility is not a direct measure of sentiment in the behavioral sense, prior literature has shown that spikes in EMV are strongly associated with shifts in investor confidence, market fear, and risk appetite, thereby serving as an effective proxy for short-term sentiment dynamics in financial markets.

These measures are considered the endogenous variables of the models and their dynamics are presented in Fig. 1.

To enhance the reliability of our results and recognizing the close connection between policy dynamics and climate change, we introduce an additional control (exogenous) variable: the Climate Policy Uncertainty index (CPU, Gavriilidis, 2021), available from the CPUwebpage. Although a growing body of research examines the direct links between CPU and various financial variables (see, for instance, Kayani et al., 2024), we incorporate it here to ensure that our findings are robust and account for climate-related policy uncertainty, which is particularly relevant for the scope of our study.

We treat the CPU index as an exogenous control, following the assumption that macro-level climate policy uncertainty evolves independently of short-term variations in financial sentiment. While firms' ESG behaviors may eventually influence long-term regulatory frameworks, the monthly frequency of CPU updates, combined with its construction based on global newspaper coverage, ensures that it reflects broader political and regulatory narratives rather than immediate ESG market movements. Thus, contemporaneous feedback effects are unlikely to bias our identification strategy.

Rather than relying on overly complex (and often unnecessarily convoluted) methodologies, we employ a Structural Vector AutoRegressive (SVAR) model, which addresses our research questions:

- H1: What is the impact of Economic Policy Uncertainty on ESG sentiment?
- H2: Historically, how can economic and financial shocks be disentangled?

Suppose a standard VAR model

$$\boldsymbol{y}_t = \sum_{i=1}^{p} \boldsymbol{\Phi}_i \boldsymbol{x}_{t-i} + \boldsymbol{u}_t \tag{1}$$

where $\boldsymbol{x}$ contains the endogenous variables ($\boldsymbol{y}_t$) and the contemporaneous CPU, p is the lag order fixed minimizing the Akaike Information Criteria and $\boldsymbol{u}_t$ is the one-step ahead error vector. For simplicity, the Structural VMA can be obtained as:

$$\boldsymbol{y}_t = \boldsymbol{\Phi}(L)^{-1} \boldsymbol{u}_t, \tag{2}$$

and the identification of structural shocks follows a standard recursive scheme:

$$\boldsymbol{u}_t = \boldsymbol{C} \boldsymbol{\varepsilon}_t \tag{3}$$

where the order of the variable is described as follows:

$$\begin{bmatrix} u_{t,\text{EPU}} \\ u_{t,\text{EPI}} \\ u_{t,\text{ESG}} \\ u_{t,\text{SEN}} \end{bmatrix} \begin{bmatrix} c_{1,1} & 0 & 0 & 0 \\ c_{2,1} & c_{2,2} & 0 & 0 \\ c_{3,1} & c_{3,2} & c_{3,3} & 0 \\ c_{4,1} & c_{4,2} & c_{4,3} & c_{4,4} \end{bmatrix} \begin{bmatrix} \varepsilon_{t,\text{EPU}} \\ \varepsilon_{t,\text{EPI}} \\ \varepsilon_{t,\text{ESG}} \\ \varepsilon_{t,\text{SEN}} \end{bmatrix}. \tag{4}$$

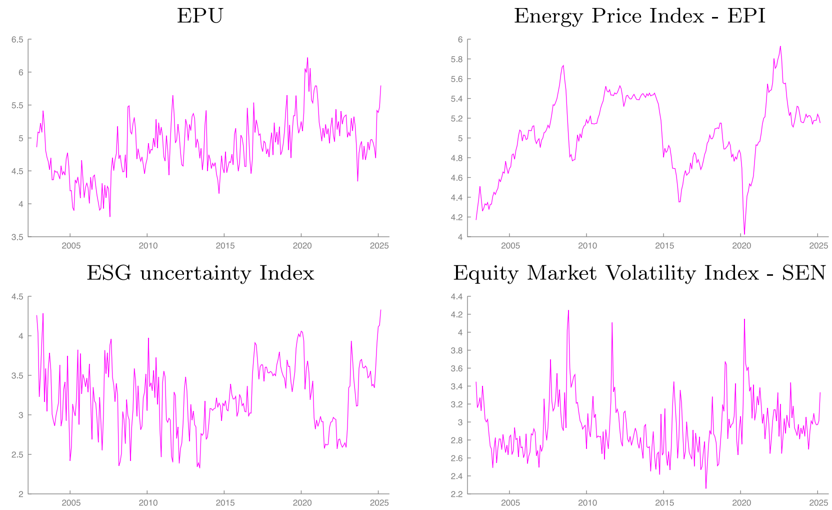

Fig. 1. Timeseries used.

Since we refer to the Cholesky triangulation, the order of the variables is crucial and could influence the results. To rely on a reliable identification, we follow the literature to order the variables from the most exogenous. Indeed, it has been shown that economic policy uncertainty has spillovers on market sentiment (Ren et al., 2023), on energy prices (Liu et al., 2023) and, recently, on sustainable investments such as ESG (Wu et al., 2024); while the opposite direction is no further supported (Antonakakis et al., 2014; Shaikh, 2022; Darsono et al., 2022). Therefore, we place EPU as the most exogenous variable in our system. One can argue about the direction of the effect between EPU and market sentiment. However, investors' reaction follows the assimilation of economic news, which is represented by the newspaper nature of the EPU. Indeed, Lamont and Stein (2006) and Mian and Sankaraguruswamy (2012) have shown how investor sentiment reacts to economic policy news, but the reverse may have some lagged effects.

To determine the ordering of the rest of the variables, we treat the energy price index as exogenous with respect to the ESG sentiment. This choice reflects the premise that ESG preferences are primarily driven by regulatory frameworks, long-term investment priorities, and institutional mandates rather than short-term fluctuations in financial markets. Given the increasing substitutability between clean and fossil energy sources, the energy price index incorporates price variation across both categories. Consequently, changes in energy prices – regardless of the source – can influence sustainable investment behavior (see Fu et al., 2024). For instance, a rise in fossil fuel prices may incentivize a shift toward cleaner energy alternatives, thus stimulating interest in ESG-aligned financial products due to their environmentally favorable attributes. Moreover, energy prices are commonly understood to be a structural component of the overall stock market. Several studies have documented a unidirectional transmission mechanism from energy price shocks to general investor sentiment (*e.g.*, Apergis et al., 2018; Ahmed and Sleem, 2024), reinforcing the plausibility of this ordering in our identification strategy.

A similar rationale applies to the relationship between ESG and traditional market sentiment. Naseer et al. (2024) demonstrate that ESG integration contributes to reduced stock market volatility, while Sabbaghi (2023) highlight the role of ESG-related disclosure practices in shaping investor expectations. These findings suggest a potential causal path from ESG developments to broader market sentiment dynamics.

Alternative identification techniques are rather premature in this case. Some applied works rely on the "set-identified" identification for VARs. For example, a growing applied literature relies on the sign restrictions (Fry and Pagan, 2011), which fix the sign of the structural matrix ***C*** and maintain a recursive structure.[1] Alternatively, Kilian and Murphy (2014) develops a more general case involving so-called "elasticity" constraints. However, we believe that there is no established literature to identify the model using these alternatives, while recursive estimation is, in our case, the most appropriate technique. In the future, when the literature is established, alternative identifications can be pursued.

3. Results

Fig. 2 shows the Impulse Response Functions (IRFs) for $H = 24$ horizons which roughly corresponds to 2 years. The VAR model described in Eq. (1) is based on a lag order of $p = 2$ following the Akaike Information Criteria (AIC).[2] We also report a 90% bootstrapped confidence bands and the median IRF obtained from the bootstrap resampling.

Structural identification enables the economic interpretation of shocks within the system. Specifically, a positive shock to the EPU index can be interpreted as a sudden increase in uncertainty surrounding national government stability. Such a shock may stem from unexpected events related to fiscal policy decisions, political instability, or broader uncertainty regarding the government's coherence and policy direction. In the US context, the recent Trump administration has pursued diverse policies from the previous administration, with important implications for the real economy.

When a positive structural shock affects the EPU index, the highest response in magnitude terms appears in the market sentiment proxy. Since this variable tracks the behavior of the VIX and the S&P500, a value increase reflects heightened uncertainty, often associated with substantial investment opportunities driven by market volatility. In this case, the impact of the EPU shock dissipates within approximately four months. An interesting result emerges in the ESG response: it is statistically significant and negative from the first to the sixth month after the shock occurrence. This finding carries important economic implications, as it suggests that economic instability can undermine sustainable development efforts, consistent with the insights of Ren et al. (2023). In contrast, we find that a shock to EPU has no significant

[1] For a more general work see Antolín-Díaz and Rubio-Ramírez (2018).

[2] The results are qualitatively identical and are available upon request considering a lag of $p = 1$ that minimizes the Bayesian information criterion (BIC).

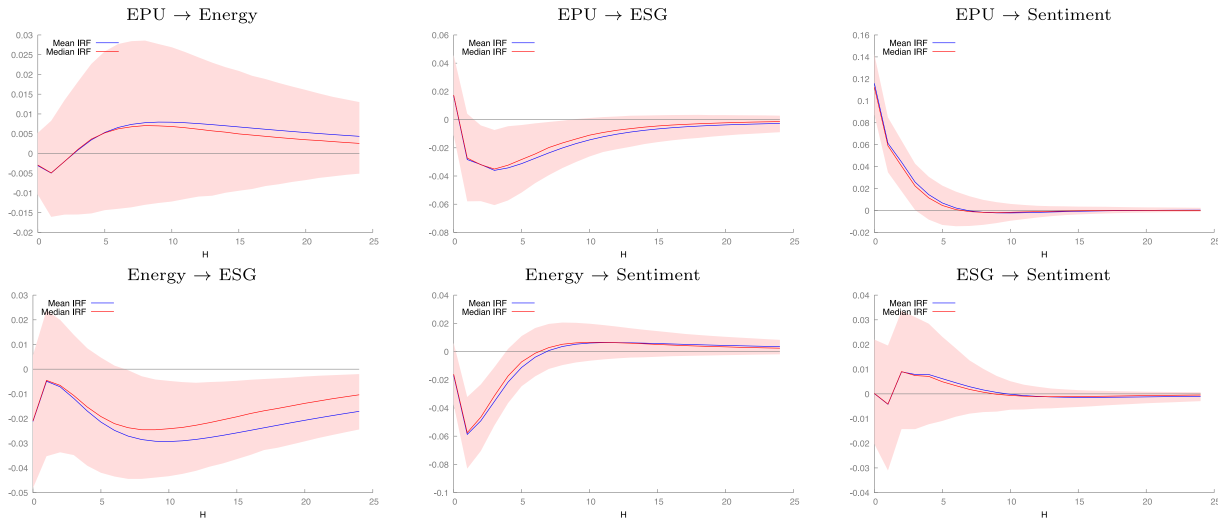

Fig. 2. Impulse Response Functions (IRFs). **Note:** The red shaded zone represents the 90% bootstrapped confidence band.

effect on energy prices by highlighting that the energy market is primarily influenced by other shocks, particularly demand and supply, as extensively discussed in the energy economics literature (Kilian, 2009).

When a structural shock affects the energy market, it can generate several notable responses in economic players. Specifically, we observe that an increase in global energy prices leads to a reduction in financial market volatility. Given the long time span of our sample, we interpret energy price movements primarily as demand-driven phenomena, while supply-side disruptions represent more recent and isolated episodes. In this context, the increase in global energy price likely reflects the enhancement of macroeconomic fundamentals: stronger demand, greater industrial production, and increased investment activity. Global shareholders tend to interpret robust global demand as a stabilizing force. This perception supports expectations of higher corporate earnings across sectors, including energy, manufacturing, and services, thereby reducing market uncertainty. This evidence reflects the reduction in risk premia and hurts the measures of financial market volatility.

Following the energy price shock, we also observe a lagged yet significant response in ESG-related uncertainty. Specifically, an increase in global energy prices leads to a decline in the ESG uncertainty index starting from the fifth month after the shock. We interpret this dynamic as reflecting the time required for macroeconomic conditions to influence sustainability expectations. As sustained higher energy prices are associated with stronger global demand and more favorable economic prospects, firms and policymakers experience reduced pressure on financial resources, enabling more consistent and credible commitments to ESG objectives. Over time, this improved macroeconomic environment contributes to anchoring expectations around sustainability strategies, thereby lowering uncertainty in ESG-related outcomes. The lagged adjustment underscores the forward-looking nature of ESG sentiment, which responds more slowly to macroeconomic fundamentals compared to traditional financial indicators. However, differently from the previous literature (Naseer et al., 2024), we find that ESG shocks do not have any significant impact on market sentiment.

Fig. 3 reports the Historical Decomposition (HD) of shocks for the endogenous variables considered. While the EPU case seems to have its own persistence dependence, in the other case, some interesting fact emerges.

The historical decomposition shows that the EPU has recently become the dominant factor in market sentiment shocks. In particular, the influence of the global energy price index, which was crucial until the COVID-19 pandemic, has declined since then. This change suggests a shift in the financial market landscape, where EPU-driven factors such as fiscal and monetary policy uncertainty, government stability and regulatory concerns have increasingly influenced investor sentiment. The declining role of energy prices after the pandemic reflects a reduced sensitivity to energy market fluctuations and underlines the growing importance of policy uncertainty in explaining market dynamics during periods of economic upheaval.

The same dynamic holds for ESG decomposition. It indicates how the influence of energy prices on ESG components was particularly remarked during the pandemic era. However, as policy uncertainty related to economic recovery, regulation and sustainability initiatives intensified, EPU emerged as a key driver of ESG uncertainty in the post-pandemic period. Therefore, this shift reflects the shift towards more structural economic concerns about government policies and long-term sustainability frameworks.

As shown in Fig. 4, the Total Connectedness Index (TCI, Chatziantoniou and Gabauer, 2021) exhibits a declining trend across all forecast horizons.[3] This finding implies a decrease in the overall interconnectedness among system variables. The decreasing pattern may appear to dispute previous findings that the EPU has become a dominant driver of both market sentiment and ESG uncertainty. However, the decline in TCI suggests that while the influence of EPU has intensified, the structure of interdependencies between variables has become increasingly hierarchical rather than symmetrical. In particular, the post-pandemic environment appears to be characterized by a more centralized transmission mechanism, in which shocks from the EPU exert stronger direct effects, while reciprocal spillovers among other variables, such as energy prices and financial sentiment, have weakened. This outcome reflects the shift from a system characterized by extensive interconnectedness to one that is dominated by specific risk channels, with the EPU emerging as the predominant source of systemic influence.

4. Conclusions

This study investigates the evolving interrelationships among Economic Policy Uncertainty (EPU), energy prices, financial market sentiment, and ESG-related uncertainty within the US economy. Using a Structural Vector AutoRegressive (SVAR) framework, we disentangle the historical dynamics and shock transmission mechanisms underlying these key variables. Our findings provide novel insights about the

[3] The TCI is based on the Forecast Error Variance Decomposition (FEVD)

Fig. 3. Historical decompositions.

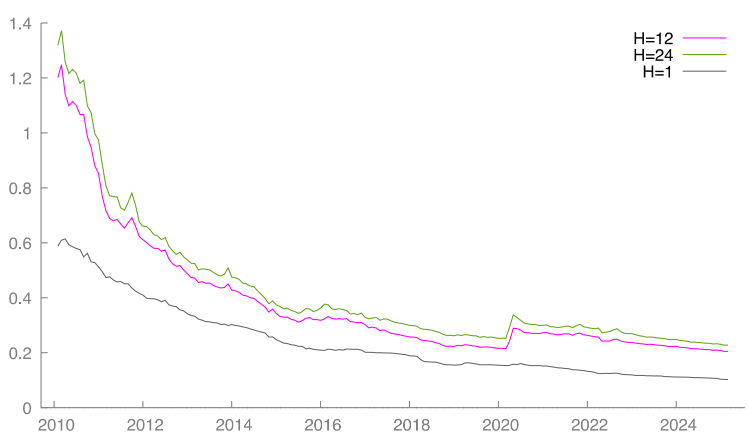

Fig. 4. Total Connectedness Index.

influence of macroeconomic uncertainty and its interaction with sectoral dynamics to shape financial and sustainability-related sentiment, particularly in the context of the recent economic disruptions.

First, our results highlight the increasing importance of EPU in driving market sentiment and ESG uncertainty. A positive shock to EPU generates a substantial and persistent increase in financial market volatility and simultaneously exerts a negative and significant influence on ESG sentiment over several months. This dynamic underscores the destabilizing role of policy uncertainty for traditional financial markets and forward-looking sustainability expectations.

Second, an increase in the Energy Price Index is associated with a decline in financial market volatility, interpreted as a reflection of stronger global macroeconomic conditions that underpin higher energy prices. The effect on ESG components appears with some lags: this result highlights the gradual nature through which improved macroeconomic fundamentals stabilize long-term sustainability expectations.

Third, the historical decomposition analysis reveals a shift in the sources of the perceived uncertainty. Before the COVID-19 pandemic, energy prices and policy uncertainty contributed meaningfully to variations in market sentiment and ESG uncertainty. The COVID-19 pandemic signs a shift in these perspectives given that, in the post-pandemic period, the influence of energy prices has markedly declined, while EPU emerged as the dominant shock measure. This change suggests that financial markets and stakeholders have become increasingly sensitive to policy-driven risks. In particular, heightened economic interventionism and regulatory debates surrounded recovery policies and climate-related initiatives.

Overall, these findings contribute to a deeper understanding of how economic uncertainty and sectoral shocks shape financial markets and ESG sentiment. They also suggest that future research and policy analysis should pay close attention to the concentration of risk channels, as heightened reliance on a few dominant factors may amplify vulnerabilities during periods of stress. Future studies could extend this framework to specific clean energy sectors like wind and solar sources. Moreover, from a methodological viewpoint, a time-varying method using Gibbs sampling could be used to disentangle the dynamic nature of shocks.

We acknowledge that our analysis focuses exclusively on the United States. However, we strongly believe that our results are particularly relevant given the country's important role in global energy markets, financial systems, and climate policy debates. Nevertheless, differences in institutional quality, market structures, and policy frameworks across countries may influence the transmission of uncertainty shocks. Therefore, caution should be exercised in generalizing our results to other economies.

CRediT authorship contribution statement

Marco Tedeschi: Formal analysis, Software, Writing – original draft, Data curation, Methodology, Visualization, Conceptualization, Investigation, Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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