Sukuk and environmental challenges: evaluating the impact of climate policy uncertainty on major sukuk indices

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Abstract

Purpose – This paper aims to investigate the dynamic interaction between global sukuk markets and climate policy uncertainty (CPU), examining how Islamic financial instruments respond to climate-related policy shifts. It explores the potential of Islamic finance to support sustainability-linked investment and contribute to ecological resilience by analyzing sukuk performance in the context of evolving environmental policies. As a result, it is aligned with the Sustainable Development Goals (SDGs), specifically SDG 13 (Climate Action), SDG 9 (Industry, Innovation, Infrastructure) and SDG 17 (Partnerships for the Goals).

Design/methodology/approach – The analysis uses continuous wavelet transform methods to examine time–frequency relationships between CPU and 15 sukuk indices across diverse regions from 2010 to 2024. This technique captures both short- and long-term comovement patterns, which allows an in-depth understanding of the market response to evolving policy dynamics. The results reveal nuanced responses of sukuk markets to crisis-driven events and global climate policy signals.

Findings – The results reveal that sukuk markets exhibit heightened sensitivity to climate policy shifts, particularly during global environmental events such as conference of the parties (COP) summits and the COVID-19 pandemic. Sukuk are especially responsive over longer time horizons, suggesting they can absorb and reflect structural sustainability concerns and are well positioned to advance sustainable finance. These findings suggest that sukuk serve as asset-backed, adaptable instruments that promote intergenerational equity, one of the principles of sustainable development described by the United Nations

Practical implications – Global and regional sukuk have the potential to act as effective hedging instruments during periods of heightened climate policy uncertainty, especially as environmental awareness grows and green sukuk markets expand. These findings are particularly relevant for countries aiming to

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integrate sukuk into their sustainable development strategies, notably those facing high climate vulnerability. To support this, regulatory bodies should ensure that sukuk issuance and investment practices align with established environmental, social and governance standards.

Social implications – The findings offer valuable insights for ethical and faith-based investors who seek to align their portfolios with environmental sustainability and social responsibility. It reinforces the role of Islamic finance in advancing inclusive, values-driven investment practices.

Originality/value – This study presents a novel analysis of the relationship between CPU and major sukuk markets. It fills a critical gap in the sustainable finance literature by demonstrating how sukuk can serve as a bridge between Islamic finance and climate-aligned investment. In doing so, the study offers a credible pathway toward inclusive and resilient financial systems grounded in the principles of the Islamic Moral Economy framework. The paper provides original insights into how Islamic financial instruments directly contribute to achieving SDG 13, SDG 9 and SDG 17.

Keywords Sukuk indices, SDG, Islamic finance, Climate policy uncertainty, Wavelet analysis

Paper type Research paper

1. Introduction

Sukuk emerged as a fundamental financial instrument, offering a Shari'ah-compliant alternative to traditional debt. Their design ensures that investments are linked to tangible assets and adhere to ethical standards. In recent years, sukuk have gained attention as a means of supporting sustainable finance. Both the United Nations and the World Bank have highlighted their potential to advance the Sustainable Development Goals (SDGs) and encourage environmentally responsible growth (Ahmed *et al.*, 2015). Increasingly, sukuk are used to raise funds for projects that tackle climate change, empower local communities and promote social and economic progress (Heine *et al.*, 2019; Hasan *et al.*, 2022; Mensi *et al.*, 2022; Raeni *et al.*, 2022). One key feature of sukuk is that the underlying assets must contribute to environmental, social or economic development. This emphasis on sustainability and ethical investment sets sukuk apart in the global financial system.

Despite these advantages, the effectiveness of sukuk in promoting sustainability is shaped by wider market forces and policy environments. In particular, climate policy uncertainty (CPU) has become a significant concern for global financial markets. Unpredictable changes in climate regulations can create volatility and increase risk, affecting investment decisions and market stability. Research shows that uncertainty about climate policy can affect how firms approach environmental strategies and shift investor preferences toward more sustainable assets (Lopez *et al.*, 2017; Pástor *et al.*, 2021; Hsu *et al.*, 2023). As a result, the financial sector must constantly adapt, looking for instruments that provide both stability and support for sustainability. Recent studies have also highlighted the impact of CPU on stock price synchronicity and the performance of green versus brown energy stocks, especially during periods of crisis (Bouri *et al.*, 2022; Li *et al.*, 2024).

Given these dynamics, sukuk serve as key instruments for sustainable finance, offering effective means to address risks associated with climate change (Hasan *et al.*, 2022; Raeni *et al.*, 2022). Because sukuk are rooted in ethical principles and are tied to real economic activity, they are particularly well-suited to periods of uncertainty surrounding climate policy (Aassouli *et al.*, 2018; Billah *et al.*, 2024a). Islamic green finance and sukuk have the potential to channel investment toward initiatives that strengthen climate resilience and facilitate the transition to a low-carbon economy (Achyar, 2025). Recent studies have also shown that CPU significantly affects financial markets, influencing both investment strategies and the performance of climate-aligned investment instruments (Bouri *et al.*, 2022; Li *et al.*, 2024). Notably, empirical evidence suggests that while sukuk are distinctive assets, their price dynamics are influenced by financial market uncertainty. However, they appear less sensitive to economic uncertainty (Reboredo and Naifar, 2017). By examining the relationship between CPU and major sukuk indices, this study offers new insights into how sukuk markets respond to climate-related risks. In doing so, it adds to the growing literature at the intersection of Islamic finance and environmental challenges and demonstrates the novelty of focusing on sukuk in the context of CPU.

To explore these issues in depth, this paper addresses several key research questions:

RQ1. Are CPU and sukuk indices correlated at different time scales (e.g. short-term vs long-term)?

RQ2. How does the relationship between CPU and sukuk indices evolve over time, particularly during periods of economic instability or climate-related events?

RQ3. Does CPU drive sukuk indices, or do sukuk indices influence CPU in terms of the lead-lag relationship?

To answer these questions, the study uses wavelet coherence analysis, which is a novel methodology in this context. This approach provides new insights into the resilience and behavior of sukuk markets under climate-related risks. It offers a distinct contribution to the literature at the intersection of Islamic finance and environmental challenges.

Four significant contributions are made in this study. First, prior research has mainly examined the impact of CPU on conventional financial markets (e.g. Ji *et al.*, 2024; Tedeschi *et al.*, 2024; Athari and Kirikkaleli, 2025). Other studies have explored how Islamic values influence sustainable practices and corporate social responsibility (CSR) within Islamic finance (e.g. Abubakar, 2016; Khan, 2016; Ramzan *et al.*, 2021; Shu *et al.*, 2021; Al-Doseri and Aldhmour, 2024; Alghafes *et al.*, 2024). This paper addresses a critical gap by investigating the ecological and environmental challenges specific to the Islamic finance sector, particularly in the context of sukuk. It provides a novel exploration of the relationship between CPU and major sukuk indices, an area that has not been previously studied. Second, this paper further advances the growing body of research at the intersection of finance and environmental policy. It analyzes how climate risk and uncertainty influence various market segments and time horizons. This analysis builds on prior findings that highlight the heterogeneous effects of CPU (e.g. Lopez *et al.*, 2017; Choi *et al.*, 2020a; Engle *et al.*, 2020; Hsu *et al.*, 2023; Ahmed *et al.*, 2024; Zhao *et al.*, 2025). Third, our paper contributes to the broader discussion about sustainable development by showing how sukuk, with their asset-backed structure, function as adaptable financial instruments. These instruments, based on Islamic finance principles, promote long-term stability and promote risk sharing, making them relevant for climate-vulnerable economies (Aassouli *et al.*, 2018). Investing in sukuk can help finance infrastructure and social development while avoiding activities that harm the environment, aligning with the SDGs 9 (Industry, Innovation, Infrastructure) and SDG 13 (Climate Action) (Paltrinieri *et al.*, 2020; Khokher, 2021; Obaid *et al.*, 2024). Sukuk also contribute to SDG 17 (Partnerships for the Goals) by attracting capital from socially responsible and faith-based investors (Ahmed, 2017; Mahama and Yakubu, 2025) The study highlights that Islamic finance can promote inclusive, values-based financial systems that are long-term sustainable by embedding the Islamic Moral Economy (IME) framework, which mandates that financial activities serve the public good (maslaha) (Asutay, 2013; Mergaliyev *et al.*, 2021). Finally, this study uses the Continuous Wavelet Transform (CWT) to identify patterns and relationships between CPU and sukuk indices. This approach emphasises the significance of both temporal and cross-sectional dimensions. These dimensions are important for understanding the impacts of policy uncertainty on Islamic financial markets.

This research uses a comprehensive data set spanning over 14 years. It includes 15 sukuk indices with diverse structures, regions and currencies, such as USD, GBP and local currencies like the Malaysian ringgit. These features allow the study to offer robust insights into the resilience and dynamics of sukuk markets in the face of CPU.

Our findings show that the relationship between CPU and sukuk indices is both dynamic and complex. Changes in CPU often precede movements in sukuk markets across different time frames. This relationship is strongly influenced by global events, such as the COVID-19 pandemic and major climate-related events. This suggests that CPU can shape investor sentiment, alter perceptions of risk and influence how funds are allocated to sustainable investments. When CPU rises, uncertainty about future regulations, carbon pricing and environmental policies also increases. In periods of heightened CPU, demand for these instruments may grow as investors look for ways to protect their portfolios from climate-related risks (Liu and Lai, 2021; Mensi *et al.*, 2022). CPU can also affect the supply side, prompting governments and corporations to issue more sukuk to finance projects that meet new or changing climate policy requirements, such as renewable energy and sustainable infrastructure (Aassouli *et al.*, 2018; Paltrinieri *et al.*, 2020). Thus, sukuk particularly structures (such as ijara, *murabaha* and mudaraba) can serve as effective hedging tools in markets experiencing elevated CPU, especially during periods of heightened environmental awareness and the growth of green sukuk. Our findings are likely to appeal to ethical investors seeking to understand the impact of their investments on the environment and to make a social difference (Aassouli *et al.*, 2018).

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature, establishing the theoretical and empirical context for our study. Section 3 details the data sources and methodology used. Section 4 presents the results and offers a discussion of the key findings. Finally, Section 5 concludes the paper and outlines the implications of our research.

2. Literature review

Contemporary environmental challenges and sustainable development have emerged as critical areas of focus in the global debate regarding both economic growth and social progress. The world has witnessed environmental degradation and the depletion of natural resources (Huo and Peng, 2023). It is believed that prioritizing economic growth over social and environmental objectives is a key contributor to ecological degradation (Elkington and Rowlands, 1999). Therefore, the urgency to address these issues and protect our environment is paramount. Nevertheless, there remains a lack of consensus among economists, policymakers and researchers on the most effective approach. This literature review explores the emerging debates surrounding sustainable development, environmental, social and governance (ESG), CPU and the role of Islamic finance in addressing these issues. We aim to shed light on the pathways to achieving a more sustainable future with a special focus on the role of sukuk.

2.1 Economic theories and ecological concerns

Lord Stern, the former chief economist of the World Bank, described environmental damages as “the greatest and widest-ranging market failure ever seen” (Stern, 2008). Efforts to address environmental issues have predominantly focused on implementing policy indicators. They have paid less attention to tackling the underlying relationship between economic activities and environmental health (Vatn, 2007). Subsequently, design theorists consider the prioritization of profit-driven preferences over sustainable alternatives a key factor contributing to ecological concerns. Their design approach supports the sustainable degrowth agenda, considering an ecological–economic framework (Gaziulusoy and Houtbeckers, 2018; Akbulut, 2021).

This aligns with the argument to move away from profit-driven choices, focusing on qualitative well-being over traditional economic growth measures (Elkington and Rowlands, 1999). Furthermore, Paltrinieri *et al.* (2020) state that CSR offers a compelling stakeholder-oriented framework as an alternative to profit-driven theory.

Extending this line of critique, heterodox economists such as Martinez-Alier (2002, 2025) and Spash (2012) have shown that the design of current economic systems and institutions often leads to lasting environmental harm and deepens social inequality. They argue that relying on the assumption of "perfectly competitive markets" is insufficient for ensuring equitable resource distribution and environmental protection. Instead, addressing power imbalances, market concentration and institutional inertia is viewed as essential for meaningful reform (Spash, 2012; Klitgaard, 2013; Spash and Morgan, 2025).

Similarly, ecological economists, including (Daly, 1990, 2017; Costanza *et al.*, 1998) have long argued, tend to sideline environmental priorities, leaving current systems ill-equipped to address the intertwined challenges of the Anthropocene. For instance, Daly (1990) advocates for a steady-state economy that respects ecological limits, while Costanza *et al.* (1998) stress the importance of valuing ecosystem services in economic decision-making. This shortcoming has brought renewed attention to the role of ecologically engaged design in both sustainable development and green finance. Furthermore, Boehnert (2018) underscores the urgency of reorienting economic theory and practice to place ecological and social concerns at the center, rather than treating them as marginal issues. Recent research strongly supports this view that reorienting economic theory and practice to prioritize ecological and social concerns (Washington and Maloney, 2020; Jackson *et al.*, 2024; Tayyab *et al.*, 2024; Schulze Waltrup, 2025). In this context, integrating economic principles that actively promote ecological preservation and enhancement is essential. This approach is not just desirable, but necessary for meaningful progress toward sustainability. For instance, Holt (2005), writing from a post-Keynesian perspective, frames sustainability as the ability to resolve economic issues (such as poverty) without exhausting or degrading natural resources. He further notes that robust ecological systems are indispensable for sustaining economic opportunities over the long term.

Nevertheless, while the sustainable development approach encompasses a holistic framework that integrates economic, social and environmental considerations, some authors express concern about its effectiveness (e.g. Gupta *et al.*, 2015; Gupta and Vegelin, 2016; Bowen *et al.*, 2017; Castro *et al.*, 2021). They argue that SDGs and ESG measures might diverge from the original goals of sustainable development. This divergence could potentially lead to a trade-off in favor of economic growth over ecological and social concerns.

To address these issues, Gupta and Vegelin (2016) suggested adopting the concept of "inclusive development." This concept necessitates regulating financial institutions. It also requires restructuring current investment instruments to be greener and more environmentally friendly. Furthermore, they added that national and global engagement from all stakeholders is essential in defining and using these instruments. The following section discusses how Islamic finance perceives the relationship between economic and ecological matters as analogous.

2.2 Theoretical framework of Islamic finance and sustainable development

The IME is the normative framework underlying Islamic finance-based intermediation. It is the basis for both Islamic finance theory and practice. A stakeholder governance model is required for resource allocation within Islamic boundaries (Asutay, 2007a, 2025a). Accordingly, the extended stakeholder theory of the IME offers the most compelling framework for exploring the relationship between sukuk (Islamic bonds) and environmental change. Mergaliyev *et al.* (2021) emphasize the importance of integrating higher ethical objectives and stakeholder interests in governance and performance assessment for Islamic banks, highlighting a Maqasid al-Shari'ah-augmented model. Likewise, Karbhari *et al.* (2021) underscore the relevance of institutional theory to Shariah governance, emphasizing the need for robust stakeholder-oriented models in Islamic financial institutions. Furthermore, Platonova (2013) and Relano (2023) emphasize the multidimensional nature of stakeholder engagement in Islamic finance by emphasizing CSR and ethical considerations In light of these contributions, one point is clear. The IME's stakeholder governance model is widely regarded as a foundational approach. It is used to analyze Islamic finance, sukuk and environmental concerns.

While the IME's stakeholder governance model is foundational within Islamic finance, it is also instructive to consider its relationship to conventional finance frameworks. There are parallels between the IME and the conventional finance stakeholder governance frameworks. Nevertheless, IME's approach is distinguished by its comprehensive and obligatory nature. This contrasts with the more voluntary orientation of stakeholder engagement in conventional models. Examples of such models include the SDGs (Obid and Naysary, 2014; Karbhari *et al.*, 2021). Unlike conventional finance, in which investments are classified as socially and environmentally responsible (Dorfleitner *et al.*, 2017), the IME requires that all Islamic financial transactions intrinsically promote *maslaha* (public interest)[1] and safeguard the welfare of a wide range of stakeholders (Asutay, 2013; Platonova, 2013; Mergaliyev *et al.*, 2021). As a result of this mandatory ethical orientation, Islamic finance is consistently aligned with both social justice and environmental stewardship.

Recall that stakeholder theory posits that businesses and financial institutions should consider the interests of all stakeholders, not just shareholders. In the case of sukuk, issuers must align their investments with the ethical and social expectations of investors, governments and communities. They need to consider the interests of all stakeholders in the financial decision-making process. This includes positive and proactive involvement with environmentally sustainable projects (Alam *et al.*, 2023; Elsayed *et al.*, 2023; Paltrinieri *et al.*, 2023). This approach mandates that Islamic finance not only delivers Shari'ah-compliant returns but also actively supports sustainable and inclusive development. The identified normative principles have become legally binding within the framework and business model of Islamic finance (Gupta and Vegelin, 2016; AlKhazali *et al.*, 2024; Shah *et al.*, 2024). Financing projects deemed detrimental to the community, nature and animal welfare is prohibited (e.g. environmental degradation) (Kammer *et al.*, 2015; Caporale and Helmi, 2018; Caporale *et al.*, 2020). Instead, Islamic finance prioritizes investments that foster environmental stewardship, social justice and the fair distribution of resources (Obaidullah, 2018). The profit-loss-sharing paradigm and avoidance of harmful activities further reinforce the sector's commitment to minimizing environmental risks and promoting long-term ecological balance (Helmi, 2016).

Building on this, Asutay (2013, 2025b) discusses in detail the ontological base of IME. He explains that this foundation is expressed through the concept of *tawhid*. Tawhid signifies complementarity and unity among all stakeholders in a business or transaction, including financial interactions. This complementarity seeks to prohibit harm (*darar*) and promote public welfare (*maslaha*). Consequently, under the *tawhidi* principle, the interests of all stakeholders must be considered (Tripp, 2006). This obligation arises from the notion that the IME asserts God created the world with a balanced order (*mizan*), which must be upheld, as this balance represents the fundamental condition for achieving perfection in the complementarity among all stakeholders for unity (Llewellyn and Khalid, 2024; Asutay, 2025a). Within the IME theoretical framework, maintaining a balanced state requires treating all stakeholders as *amanah*, or trusts from God. This means their interests must be represented in all transactions, including financial ones. In this way, the *amanah* or care for the interests of all stakeholders, can be fulfilled (Asutay, 2013).

Moreover, the holistic and ethical nature of stakeholder engagement is also supported by other scholars. For example, Mergaliyev *et al.* (2021) emphasize that Islamic banks must protect stakeholder interests through integration of Maqasid al-Shari'ah into governance and performance assessment. Furthermore, Tripp (2006) and Şencal and Yılmaz (2023) emphasize the fundamental role of substantive morality, and the challenges associated with maintaining ethical balance. According to Karim (2010) and Platonova (2013), CSR and treating stakeholders as trusts (*amanah*) are critical elements of Islamic finance. Kuran (1996) and Choudhury (2008) provide critical perspectives on the global and practical implications of these ethical principles. In sum, these contributions demonstrate that IME's stakeholder model is rooted in *tawhid* and *mizan* and is widely recognized in the literature as a multidimensional, ethically grounded approach.

Consequently, IME necessitates that every transaction yield justice (*adalah*) between all stakeholders, ensuring that their well-being can be achieved (Asutay, 2013, 2025a). If the justice condition does not deliver the ultimate welfare of all stakeholders, then *ihsan* becomes necessary. Ihsan refers to maintaining the equity of the initial equilibrium. It requires a corrective mechanism, known as *islah*, to operate. This mechanism brings any deviation back to the *mizan* or balanced order condition (Aassouli and Asutay, 2022). Islamic finance emphasizes justice and corrective action as central to social welfare and maintaining balance (Chapra, 2007; Dusuki and Abdullah, 2007; Haniffa and Hudaib, 2007; Al-Doseri and Aldhmour, 2024). As part of the IME theoretical framework, tazkiyah suggests an important idea. Growth is attainable only by ensuring harmony among the interests of all stakeholders in any transactional decision-making. This is due to the IME condition of rububiyah. Rububiyah posits that God created all stakeholders with a pathway to achieve their perfection. This pathway is identified by *mizan* or the condition of balanced order (Asutay, 2012, 2025b).

IME advances an embedded economic and financial paradigm that fosters ethical behavior at both individual and organizational levels as a prerequisite for all transactions. This principle is articulated through the maqasid al-Shari'ah methodological framework. The framework interprets that every transaction in every aspect of life must promote the well-being of all identified stakeholders. This must occur within the normative context (Asutay and Yilmaz, 2018; Aydin, 2018; Şencal and Yılmaz, 2023). Thus, *maqasid al-Shari'ah* requires that every transaction must enhance "faith, self, intellect, posterity, social entity, wealth, and environment (ecology)" (Asutay and Harningtyas, 2015; Mergaliyev *et al.*, 2021).

Thus, as identified by Asutay (2007a Asutay 2007b,2013, 2025a, 2025b) and Aassouli and Asutay (2022), sustainable development is an inherent and embedded outcome of the IME theoretical paradigm. Therefore, Islamic financial institutions are expected to implement Shari'ah governance. This ensures that Islamic financing transactions are conducted with negative screening. They must avoid interest (*riba*), uncertainty (gharar), speculation and gambling (maysir) (Ayub, 2009). The IME logic, as discussed thus far, further requires positive screening to ensure contributions to the well-being of all stakeholders, including the environment.

By embedding Islamic ethics within financial practices, IME ensures that financing transactions (such as sukuk) are directed toward environmentally friendly projects. This is achieved by prioritizing investments that avoid societal harm and ecological disruption, focusing instead on sustainability for all stakeholders (Hassan *et al.*, 2025; Taghizadeh-Hesary *et al.*, 2025). Therefore, every transaction must align with Islamic ethics, regardless of whether it is categorised as green (Islamic) financing or green sukuk. These ethical principles inherently fulfil global sustainable development expectations (Asutay, 2025a, b; Alam *et al.*, 2016).

This theoretical framework implies that each sukuk, like any other Islamic financial transaction, has a specific purpose. Sukuk are designed to finance projects such as renewable energy, climate adaptation and sustainable infrastructure. The aim is to create justice or *adalah*, in accordance with the principles of *tawhid*. This extended stakeholder-based IME theory supports an important idea. Islamic financing and capital markets are expected to play a crucial role in addressing environmental challenges. They can do this through innovative financing that helps mitigate climate change and promote sustainable development (Aassouli and Asutay, 2022).

Against this theoretical framework, the sustainable development implications of sukuk are examined in this paper. In other words, empirical results will help clarify the nature of sukuk transactions. They will show whether sukuk fulfil the IME logic. Alternatively, they may remain within market logic-based financial transactions that lack purpose. The foundational principles of Islamic finance (such as asset-backing, risk sharing, ethical screening and the prohibition of harm) align with the objectives of sustainable development (Ahmed, 2017). Islamic finance fundamentally promotes ethical and sustainable investments that relate to environmental protection and long-term ecological balance (see Figure 1). This ethical orientation aligns closely with key United Nations SDGs, particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 13 (Climate Action) and SDG 17 (Partnerships for the Goals). The following section will explore the ongoing debates surrounding sukuk and their contribution to ecological sustainability.

2.3 Sukuk and sustainable development

Sukuk are financial instruments that adhere to Islamic finance principles. They represent shares and rights in tangible assets or equities of a given investment. Investors in sukuk hold ownership claims on the underlying assets. These investors receive either variable returns or predetermined fixed returns. Variable returns are seen in musharakah or mudharaba sukuk. Predetermined fixed returns are found in *murabaha* or *Ijarah* sukuk (Ahmed and Elsayed, 2019). The risk-sharing method of sukuk has the potential to sustain the stability of financial markets (Ahmed *et al.*, 2015). Sukuk differ from conventional bonds in three keyways:

(1) ownership of underlying assets or projects;
(2) returns are contingent on the performance of the underlying asset, meaning losses are shared; and
(3) they are more complex in both structure and nature (Naifar and Hammoudeh, 2016a; Billah *et al.*, 2023; Paltrinieri *et al.*, 2023).

Beyond these structural distinctions, sukuk have a unique design requirement. The associated assets must contribute to environmental, social or economic development. As a result, sukuk focus on financing projects that tackle climate change, empower women, support agriculture, enhance education, alleviate poverty and promote accountability (Hasan *et al.*, 2022; Raeni *et al.*, 2022). Therefore, they naturally align with the SDGs. For instance, Mahama and Yakubu (2025) examine the effect of Green Sukuk investments by Islamic banks on sustainable development in the UAE. Their analysis shows that Green Sukuk have a significant positive impact on the SDG Index. In addition, Ali *et al.* (2024) examine the

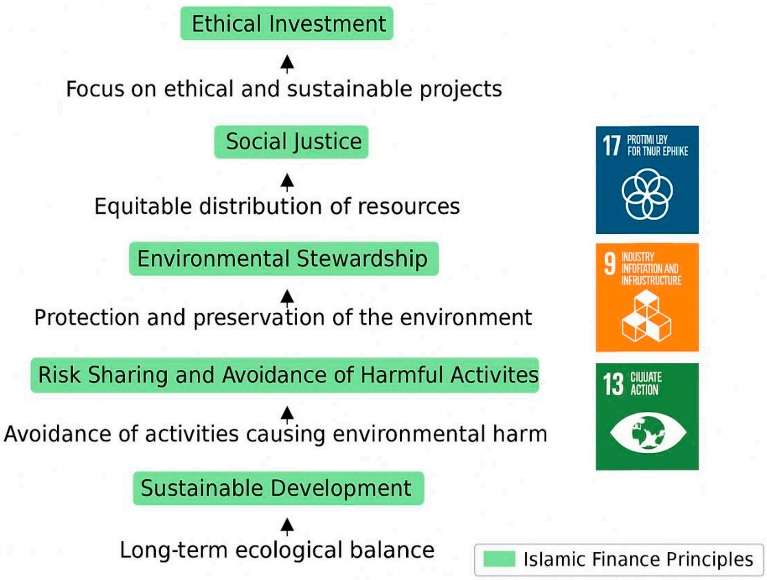


Figure 1. Core principles of Islamic finance and ecological sustainability
Source: Authors' own elaboration

economic, social and financial perspectives of green sukuk in Indonesia. They find that green sukuk issuance positively affects economic growth, social development and financial performance. Thus, Sukuk have two fundamental characteristics. These features make them an appealing option for financing projects aimed at sustainable development. First, the requirement for asset backing strengthens their connection to the real economy. This feature broadens the range of sectors that are eligible for financing through the issuance of sukuk. Second, they can be structured in various ways using single or hybrid Islamic contracts. This flexibility offers significant opportunities for innovation and addressing specific financing needs. However, the complexity involved may lead to a lack of standardization, and consequently, higher transaction costs (Ahmed *et al.*, 2015; Ahmed and Elsayed, 2019; Okumuş, 2024).

Further to this, Aassouli *et al.* (2018) argue that green sukuk is designed to mobilise funds from various sources. These funds support a diverse array of environmentally sustainable projects. Such projects include those in transportation, renewable energy and marine resources. The ultimate aim is to assist the transition toward a low-carbon economy and achieve net-zero emissions. They represent a stable and ethical long-term investment in sustainable projects. These projects aim to address climate change and ecological degradation. In addition, green sukuk are Shariah-compliant assets. These investments align with the principles of Maqasid Shariah, aiming to promote ecological preservation and social welfare (Abubakar, 2016; Obaid *et al.*, 2024; Okumuş, 2024). A recent study by Suriani *et al.* (2024) examines the impact of global green sukuk on climate change. They find that global green sukuk help reduce the adverse effects of climate change in both the short and long term. Furthermore, economic growth increases carbon emissions and trade openness has no impact.

Recent research has examined the link between Islamic financial instruments and environmental or market challenges. These studies offer important insights into their risk dynamics and diversification potential. Billah *et al.* (2024a) analyze the connection between four key green bond indices and Islamic financial sectors, highlighting their hedging abilities. The findings indicate notable downside risk connectivity and spillover across different risk scenarios. Short-term interconnections show a stronger impact compared to long-term ones. These dynamics change over time. They are shaped by global events such as the Shale Oil Revolution, the US–China trade war, the COVID-19 pandemic and the Russia-Ukraine conflict.

In a similar way, Billah *et al.* (2024b) investigate tail-risk spillover between sukuk and conventional bond markets using the TVP-VAR framework. They discover that sukuk markets show lower connectedness across all frequencies, offering investors improved diversification opportunities. In addition, Billah *et al.* (2024c) explore the spillover effects between green bonds and Islamic banking stocks in 11 countries. Their results suggest a moderate degree of interconnection. There is low connectedness in the long and medium term. Specific Islamic banking markets in each country display resilience against external disruptions. Alahouel and Loukil (2022) use a bivariate wavelet analysis to examine the comovements between stock and sukuk indices. Notably, their findings indicate evidence of contagion effects across assets, suggesting that financial uncertainty plays a significant role in shaping stock-sukuk comovements. They find that financial uncertainty reverses stock-sukuk correlations in the short term, but aligns them in the long term,

Collectively, these studies underscore the context-sensitive and dynamic nature of risk connectivity within Islamic financial markets. They highlight the capacity of these markets for diversification and resilience when facing environmental and geopolitical challenges. However, Naifar *et al.* (2017) focus on the impact of both regional and global uncertainties, including financial and economic factors, on the return patterns of conventional bonds and sukuk. Their results indicate that sukuk returns predominantly remain unaffected by both global and regional economic policy uncertainties. This holds true in all market environments except for bearish markets. In bearish markets, a causal relationship is observed.

Furthermore, Erragragui and Revelli (2016) establish a positive link between ESG screening and the returns from Sharia-compliant stocks. Paltrinieri *et al.* (2020) reveal a positive yet nonlinear correlation between ESG scores and the Islamic finance development indicator. This finding is based on a study involving 16 countries, both emerging and advanced. The study included data from 224 banks. Notably, the social factor emerges as the primary contributor to this relationship, attributed to the ties between Islamic finance and tangible projects. They concluded that Islamic finance has the potential to significantly advance sustainability and its related advantages.

Several empirical studies have examined the investment performance of firms with high and low ESG ratings (Mollet and Ziegler, 2014). Other researchers have compared the performance of socially responsible indices with that of traditional indices (Tripathi and Bhandari, 2015; Jonwall *et al.*, 2024). Furthermore, Elsayed *et al.* (2024) explore the effect of oil shocks on ESG, clean and green markets using a wavelet approach. Their findings reveal that both ESG investment and green bonds have the potential to serve as hedges against oil shocks across various time horizons. Helmi *et al.* (2024) argued that adopting clean energy resources can influence a nation's energy security. It can also affect the country's competitive position within the global energy landscape. In recent years, sukuk have transitioned from a niche market to one of the most significant developments in the financial markets. It has grown from US$50bn to over US$120bn during the period from

2005 to 2025 (Figure 2). This substantial growth reflects the increasing demand for Shariah-compliant financial instruments. Thus, sukuk offer a sustainable alternative to conventional bonds for investors seeking to align their portfolios with ethical investment. Zulkhibri (2015) stated that sukuk provides an alternative method for corporations to raise capital and promote sustainable economic development. Furthermore, Yuliani *et al.* (2022) argued that sukuk could be used by governments to create a conducive investment ecosystem.

2.4 Climate policy uncertainty and market effects

Climate risk has been shown to influence investment strategies among both individual and institutional investors, as highlighted by Engle *et al.* (2020). CPU refers to the unpredictability associated with regulatory and policy measures aimed at addressing climate change (Zhao *et al.*, 2025). This uncertainty stems from the evolving nature of climate policies, which are shaped by political, economic and social factors.

This evolving policy landscape has tangible effects on market behavior. The uncertainty surrounding climate policy regulations positively affects firms' decisions to reduce their carbon emissions (Lopez *et al.*, 2017). This dynamic indicates a shift in investor preferences. During periods of heightened concerns regarding climate change, investors move away from carbon-intensive ("brown") firms. Instead, they prefer environmentally sustainable ("green") firms (Pástor *et al.*, 2021). Furthermore, retail investors tend to divest from carbon-intensive companies during episodes of extreme heat (Choi *et al.*, 2020a). Similarly, institutional investors adjust their portfolios to account for climate risks by reducing equity holdings in high-emission firms (Choi *et al.*, 2020b). Hsu *et al.* (2023) also identify a notable impact of ecological threats and regulatory uncertainty on the returns of emission-related investment portfolios.

Moreover, the uncertainty related to climate policy may have substantial consequences for financial markets. For instance, Li *et al.* (2024) examine the effect of CPU on stock price

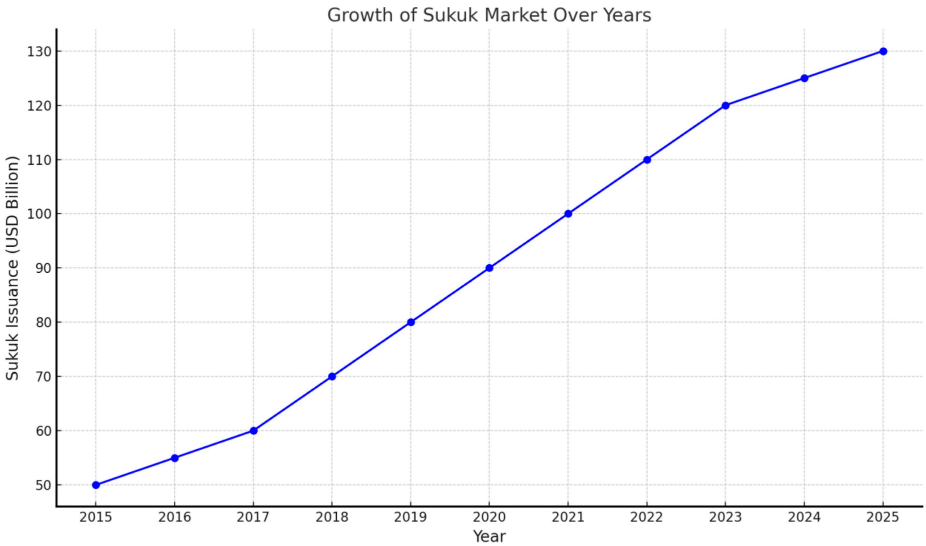


Figure 2. Sukuk growth (2015–2025)
Source: Zawya, IFIS (2025); figures for the year 2025 are estimates

synchronicity in China. They confirm a significant and negative impact of CPU on stock price synchronicity. Bouri *et al.* (2022) find that CPU plays a critical role in influencing the relative performance of green energy stocks compared to brown energy stocks. Notably, the impact of CPU is positive. This effect becomes particularly pronounced during periods of crisis. Examples include the 2008 Global Financial Crisis and the COVID-19 pandemic. In this context, the CPU index serves as a valuable additional tool for capturing CPU at the macroeconomic level. Furthermore, Arouri *et al.* (2025) find that CPU weakens the relationship between oil price changes and GCC stock market returns, with this effect being particularly strong when CPU is high. They also show that, except for Qatar, this negative moderating role of CPU is consistent across all GCC countries. This finding raises questions about the effectiveness of GCC stock markets as a hedge against global climate policy risks.

In the context of Islamic finance, sukuk offer a unique opportunity to connect investment strategies with ecological and environmental issues. The principles of Islamic finance suggest that sukuk are attractive instruments for mitigating climate risks. CPU continues to influence investment decisions. Consequently, sukuk, particularly structures such as ijara, *murabaha* and mudaraba, can serve as viable alternatives for investors aiming to support green initiatives (Aassouli *et al.*, 2018). This underscores the potential of sukuk to play a pivotal role in addressing climate-related challenges and promoting a transition toward a more sustainable financial system.

While empirical studies directly addressing the relationship between sukuk and CPU are scarce, several related works offer valuable insights. Paltrinieri *et al.* (2020) emphasize the positive relationship between ESG scores and Islamic Finance Development Indicators. They highlight the role of Islamic finance in promoting sustainable projects. Similarly, Asl *et al.* (2022) note that Shariah-compliant stock markets are increasingly aligning with environmental sustainability objectives.

In addition to these perspectives, research on green sukuk provides further insights. For example, Liu and Lai (2021) demonstrate the potential of green sukuk to channel funds into environmentally sustainable initiatives. Mensi *et al.* (2022) explore the interconnectedness between green sukuk and other financial instruments. Beyond environmental themes, studies on economic uncertainty and sukuk also offer relevant perspectives. For example, Naifar and Hammoudeh (2016b) find that sukuk returns are influenced by global and regional economic uncertainty. This influence reflects the distinct risk-return characteristics of sukuk compared to conventional bonds. Alam *et al.* (2023) further show that sukuk exhibit resilience during periods of financial instability. This resilience underscores their appeal as a stable investment option in uncertain economic conditions. Although these studies do not specifically address CPU, they offer important insights. Collectively, they highlight the growing importance of sukuk in managing various forms of uncertainty. This provides a strong basis for this paper's focus on the unexplored relationship between CPU and sukuk.

3. Data and methodology

3.1 Data set and sukuk index selection

This research examines the relationship between sukuk markets and CPU by constructing sukuk indicators from daily data across fifteen sukuk indices. The sample period for each index begins on the earliest available date for that specific index, with all series ending on September 30, 2024 (see Table 1). Data is sourced from Bloomberg Professional Service for sukuk indicators.

Table 1 provides a summary of various indices, including global, Malaysian and GCC indices, offering a comprehensive view of sukuk markets. The CPU total score serves as the dependent variable and acts as a proxy for environmental pillars. The data set corresponds to

Table 1. List of sukuk indices, tickers and explicit names

Number	Ticker	Explicit name	Start date	Type	Liquidity
1	DJSUKUK	Dow jones sukuk price return index	30/09/2010	Global	Moderate
2	ISLA1V	The index comprises Malaysian corporate credit Islamic-type papers with remaining maturities greater than one year	30/09/2010	Reginal (Malaysia)	Low
3	ISLA5V	The index comprises Malaysian Corporate Credit Islamic-type papers with remaining maturities of one year to five years	30/09/2010	Reginal (Malaysia)	Low to very low
4	ISLA5AV	The index comprises Malaysian Corporate Credit Islamic-type papers with remaining maturities greater than five years	30/09/2010	Reginal (Malaysia)	Very low
5	SBKU	FTSE ideal ratings sukuk index	30/09/2010	Global	Moderate
6	SBKBU	FTSE ideal ratings broad US dollar sukuk index, in USD terms	03/01/2011	Global	Moderate to low
7	DJSUKB	Dow Jones Sukuk AP FIGI BBG003TNNKV7 Index	02/01/2013	Global	Moderate to low
8	SBKU0P	FTSE Sukuk Index 10 + Yr USD	29/03/2013	Global	Low
9	I30740US	Bloomberg EM GCC USD sukuk total return index unhedged USD	31/05/2013	Reginal (GCC)	Moderate
10	I38310	Bloomberg global agg sukuk unh USD	31/05/2013	Global	Moderate
11	JPEIEMSI	J.P. Morgan global IG sukuk index total return	30/12/2016	Global	High
12	DJSUKO	Dow jones sukuk index OAS	16/02/2017	Global	Moderate
13	I37338	Bloomberg global agg USD sukuk unh USD	02/01/2019	Global	Moderate
14	SPSK US equity	SP FUNDS DOW JONES GLOBAL SUKUK	31/01/2020	Global	Moderate
15	I35842	Bloomberg global aggregate sukuk ex MYR unh USD	31/01/2020	Global	Moderate

Note(s): The CPU index is collected from the publicly accessible website https://www.policyuncertainty.com [Link to Economic Policy Uncertainty Index] [Link to the website of [Economic Policy Uncertainty]. sukuk indicators are retrieved from Bloomberg Professional Service. All series end on September 30, 2024

Table 2. Descriptive statistics

Index	Mean	Median	Sigma	Kurtosis	Skewness	Range	Minimum	Maximum
Group 1: Indices starting on 03/01/2011								
CPU	154,506	145,282	71,471	0.108	0.699	373,197	38,092	411,289
DJSUKUK	0.000002	0.000011	0.000571	14.034	−1.010	0.0102	−0.00588	0.00434
ISLA1V	0.000082	0.000000	0.00103	361.526	4.087	0.0505	−0.0224	0.0281
ISLA5V	0.000067	0.000000	0.000598	582.684	5.788	0.0378	−0.0174	0.0204
ISLA5AV	0.000092	0.000000	0.00107	215.018	1.649	0.0501	−0.0248	0.0253
SBKU	0.000062	0.000082	0.000583	21.764	−1.581	0.0122	−0.00783	0.00438
SBKBU	0.000073	0.000093	0.000540	24.930	−1.857	0.0111	−0.00672	0.00442
Group 2: Indices starting on 31/05/2013								
DJSUKB	−0.000006	0.000000	0.000609	11.431	−0.897	0.0103	−0.00598	0.00436
SBKU0P	0.000064	0.000000	0.00225	41.944	0.623	0.0601	−0.0227	0.0374
I30740US	0.000064	0.000046	0.000624	55.317	−1.778	0.0184	−0.0104	0.00796
I38310	0.000054	0.000000	0.000907	156.470	−2.068	0.0334	−0.0218	0.0116
Group 3: Indices starting on 17/02/2017								
DJSUKO	−0.000111	−0.000214	0.0195	5.425	0.288	0.236	−0.0972	0.138
JPEIEMSI	0.000055	0.000053	0.000688	25.351	−1.886	0.0135	−0.00878	0.00472
Group 4: Indices starting on 31/01/2020								
I37338	0.000032	0.000023	0.000675	6.821	−0.656	0.00824	−0.00451	0.00372
SPSK_USE	−0.000032	0.000000	0.00158	3.558	−0.025	0.0168	−0.00810	0.00869
I35842	0.000048	0.000000	0.00134	325.208	−8.754	0.0514	−0.0325	0.0189

Note(s): Sukuk indices are grouped by the start date of their sample periods, with sample sizes of 3,586, 2,956, 1,987 and 1,216 for Groups 1–4, respectively. All series end on September 30, 2024. See, Figure A1 and Table A2 in the Appendix 1
Source(s): Authors’ own work

the availability of the CPU index, developed by Gavriilidis (2021). This index uses the scaled frequency of articles from eight leading US newspapers focusing on climate policy. The CPU index data is publicly accessible at www.policyuncertainty.com [Link to Economic Policy Uncertainty Index] [Link to the website of [Economic Policy Uncertainty].].

Fifteen sukuk indices were selected as independent variables to provide comprehensive market coverage (Billah *et al.*, 2023). The selection includes global indices such as the Dow Jones Sukuk Price Return Index, Bloomberg Global Agg Sukuk Index and SP Funds Dow Jones Global Sukuk Index. Regional representation includes the Bloomberg EM GCC USD Sukuk Total Return Index for the GCC region and Malaysian indices (ISLA1V, ISLA5V and ISLA5AV) covering Malaysian corporate sukuk across different maturities.

The data set captures various sukuk structures including ijara, *murabaha* and mudaraba through indices like the Bloomberg Global Aggregate Sukuk ex MYR Index, which extends coverage beyond Malaysia (Paltrinieri *et al.*, 2020; Billah *et al.*, 2023). Investment-grade representation is ensured through the FTSE Ideal Ratings Sukuk Index and J.P. Morgan Global IG Sukuk Index. By integrating indices from Bloomberg, Dow Jones and SP Funds, the selection accurately reflects the broader sukuk market.

Most selected indices use market capitalization-weighted methodology and represent Total Return indices, accounting for both price changes and income from underlying assets. The Dow Jones Sukuk Price Return Index focuses solely on price return, while the Dow Jones Sukuk Index OAS evaluates credit risk through yield spreads against risk-free benchmarks. New sukuk issuances are promptly added to appropriate indices, ensuring comprehensive market representation.

Regarding liquidity, the data set includes sukuk with varying liquidity levels. *Murabaha*-based sukuk, particularly Malaysian corporate sukuk, tend to be illiquid due to their “buy-and-hold” investor strategy, which limits secondary market trading. However, indices like the FTSE Ideal Ratings Sukuk Index feature sukuk with minimum US$200m issuances, providing relatively liquid assets. Investment-grade sukuk in both the FTSE Ideal Ratings and J.P. Morgan Global IG indices attract broader investor participation, enhancing liquidity and serving as benchmarks for the most liquid sukuk available.

3.1.1 Trends in climate policy uncertainty and all the indices. This subsection outlines the overall behavior of the CPU index and each Sukuk index, as observed from their respective plots [2]. Figure 3 depicts the progress of the CPU index from April 2011 to July 2024. Significant peaks are evident throughout the sample period, coinciding with critical events related to climate policy. For instance, the CPU index increased in November 2016 (following the Paris Agreement), June 2017 (when President Donald Trump announced the USA’ intention to withdraw from the Paris Agreement), September 2019 (during the Global Climate Strikes), November 2021 and again in 2023 (with COP26 and COP28 held in Glasgow and Dubai, respectively), and in July 2024 (to record-breaking global temperatures), among other events. These developments have collectively intensified uncertainty in global climate policy, impacting international cooperation and the trajectory of climate action.

Figure 4 depicts the returns of three Malaysian Sukuks: ISLA1V, ISLA5V and ISLA5AV. These returns exhibit fluctuations in response to various shocks, with notable peaks occurring in April 2012 for all three indices, in March 2015 specifically for the ISLA1V index and in January 2018 for the ISLA5V index. Additional fluctuations, although smaller in magnitude, are primarily observed during the COVID-19 pandemic and the Ukraine–Russia conflict in early 2022.

Figure 5 shows that the three Sukuk, DJSUKUK, SBKU and SBKBU, exhibit comparable price trends and responses to shocks; however, DJSUKUK displays a lesser

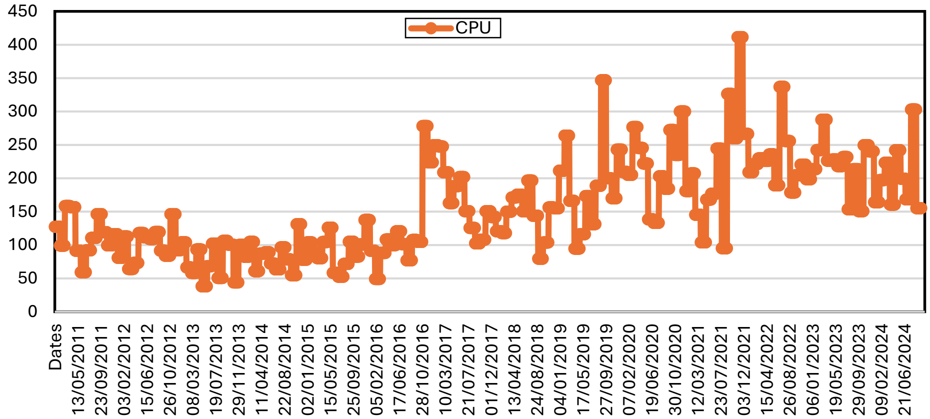


Figure 3. Climate policy uncertainty (CPU) index (03/01/2011–30/09/2024)

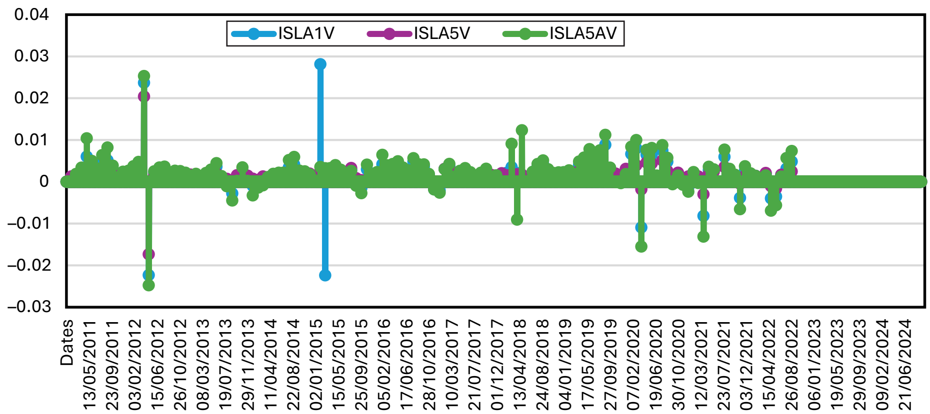


Figure 4. Malaysian sukuk indices: ISLA1V, ISLA5V and ISLA5AV (03/01/2011–30/09/2024)

magnitude than the other two. Compared to the SBKU0P index, the DJSUKB index has significantly lower volatility, indicating increased stability and better resilience to shocks, along with modest or moderate returns (refer to Figure 6).

Figure 7 illustrates that the I30740US index, depicted in blue, shows steadier returns with fewer fluctuations compared to the I38310 Sukuk index. This suggests reduced volatility and a potentially more conservative approach in relation to its counterpart.

In Figure 8, the JPEIEMSI (green line) exhibits significantly lower volatility compared to DJSUKO (orange line), particularly from 2020 onwards. This indicates that DJSUKO is more sensitive to external shocks such as COVID-19, the postpandemic high inflation and supply chain bottlenecks, the Ukraine–Russia war and the 2023 oil price shocks stemming from OPEC oil production adjustments and global energy transition policies.

In Figure 9, the sukuk index from I37338 displays a higher frequency of peaks and troughs, albeit with smaller magnitudes. Notably, the more significant drops can be observed during the COVID-19 pandemic and the Ukraine–Russia war.

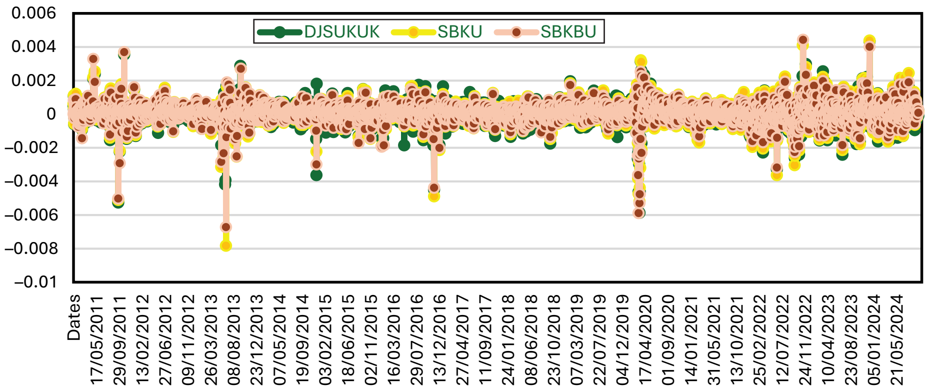


Figure 5. Sukuk Returns Indices: DJSUKUK, SBKU and SBKBU (03/01/2011 - 30/09/2024)

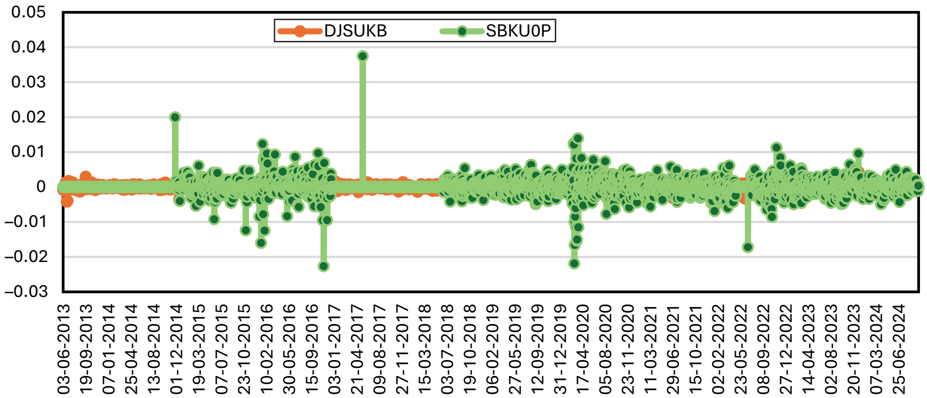


Figure 6. Sukuk returns indices: DJSUKB and SBKU0P (03/06/2013–30/09/2024)

In Figure 10, the I35842 Sukuk index, depicted in blue, displays more pronounced spikes and dips in returns, particularly during the COVID-19 period (early 2020). However, it maintained low volatility after 2021, indicating that Sukuk has been less affected by global shocks such as the 2023 oil price shocks due to the OPEC oil production adjustments.

In Figure 11, the SPSK US Equity index, depicted in green, exhibits greater fluctuations in returns, especially during the COVID-19 period (early 2020) and in August 2023 and December 2023. This indicates that Sukuk, like equity, has been affected by global shocks, such as the oil price shocks of 2023 resulting from OPEC's oil production adjustments.

3.1.2 Descriptive statistics. Table 2 presents the general statistics of CPU and the Sukuk indices, organized into four groups according to the start date of their respective sample periods. Focusing first on Group 1, which includes indices with the longest available history, the CPU index exhibits a mean value of 154,506 and a median of 145,282, with a standard deviation of 71,471. The relatively close alignment between the mean and median suggests a distribution that is not heavily skewed, a finding supported by the skewness value of 0.699. The kurtosis of 0.108 further indicates a distribution that is flatter than the normal

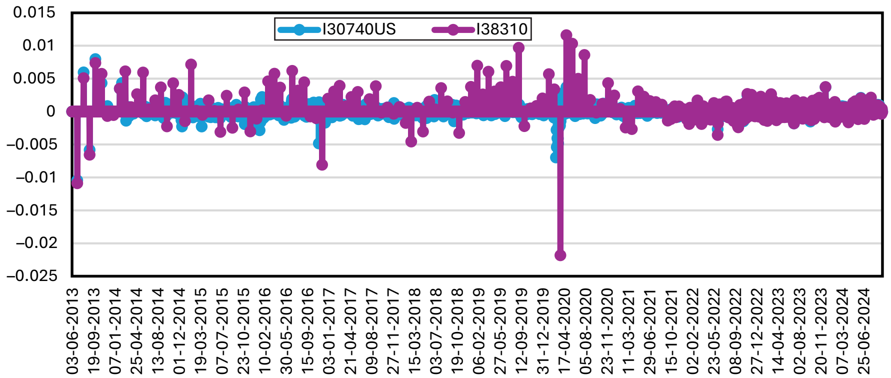


Figure 7. Sukuk returns indices: I30740US and I38310 (03/06/2013–30/09/2024)

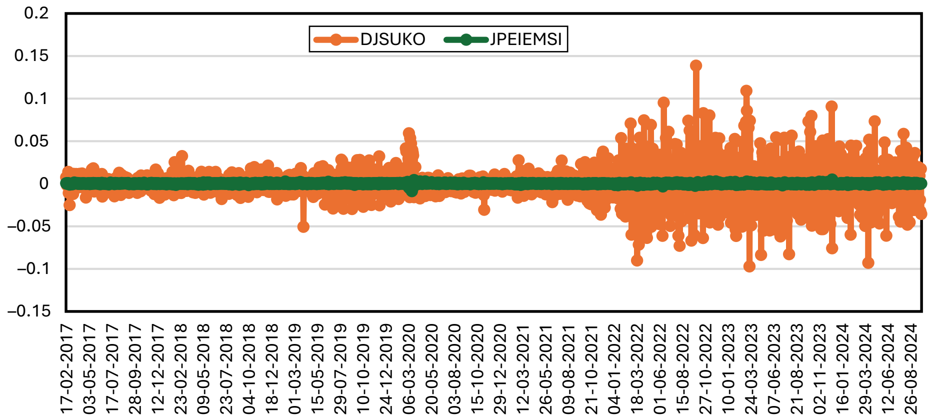


Figure 8. Sukuk Returns indices: DJSUKO and JPEIEMSI (17/02/2017–30/09/2024)

distribution, with fewer extreme values. The CPU's range is substantial, spanning from a minimum of 38,092 to a maximum of 411,289, reflecting considerable variability in CPU over the sample period.

The sukuk indices in Group 1, such as DJSUKUK, ISLA1V, ISLA5V, ISLA5AV, SBKU and SBKBU, all display means, and median values close to zero. However, their higher kurtosis values, most notably for ISLA1V (361.526) and ISLA5V (582.684), signal the presence of heavy tails and frequent extreme observations. Skewness values vary across these indices, with ISLA1V and ISLA5V showing pronounced positive skew, while SBKU and SBKBU are negatively skewed, indicating asymmetry in the distribution of returns. The ranges for these indices are relatively narrow, consistent with the generally stable nature of sukuk prices.

The mean and median values for sukuk indices in Group 2 remain close to zero, while the standard deviations are generally higher than those observed in Group 1, particularly for SBKU0P (0.00225). Kurtosis values remain high, especially for I38310 (156.470), again highlighting the prevalence of extreme values. Skewness is mixed, with some indices exhibiting negative skew (I30740US, I38310) and others positive (SBKU0P).

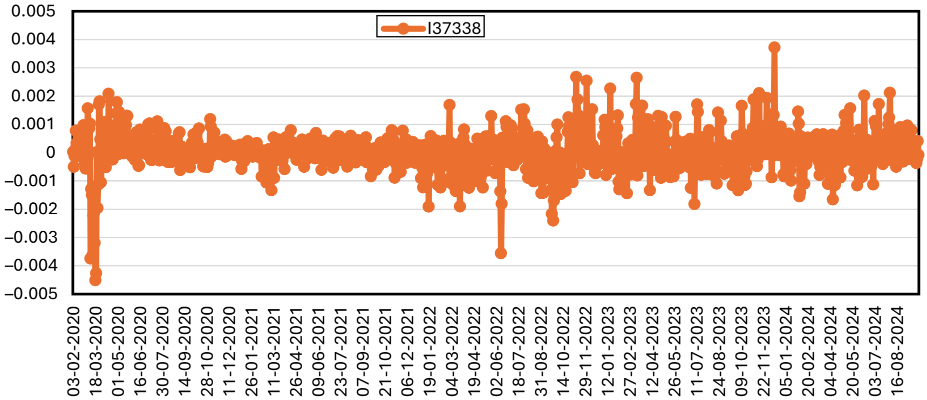


Figure 9. Sukuk returns index: I37338 (03/02/2020–30/09/2024)

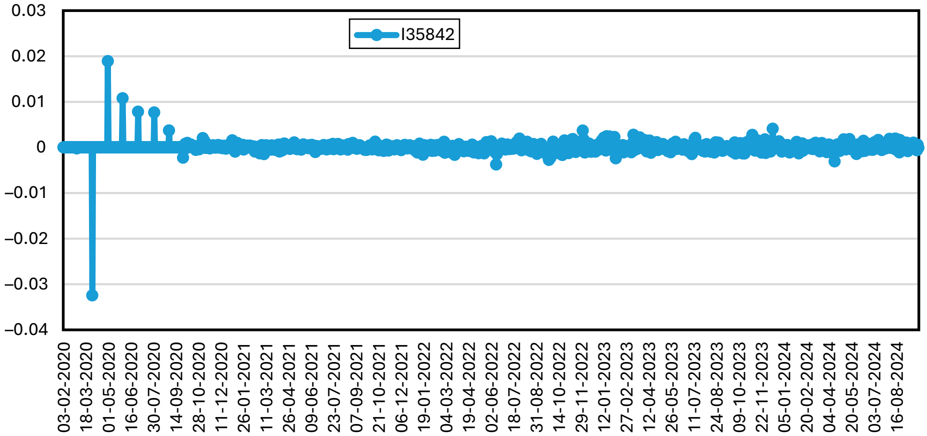


Figure 10. Sukuk returns index: I35842 (03/02/2020–30/09/2024)

Group 3 includes indices with sample periods starting in 2017. DJSUKO stands out with a relatively large standard deviation (0.0195) and a wide range (0.236), reflecting greater variability in this index. JPEIEMSI, while more stable, still displays high kurtosis (25.351) and negative skewness (−1.886), indicating a tendency toward extreme negative returns.

Finally, Group 4 covers indices with the shortest sample periods, beginning in 2020. These indices (I37338, SPSK_USE and I35842) continue the pattern of low mean and median values, but with notable differences in distributional characteristics. I35842, for example, exhibits extremely high kurtosis (325.208) and strong negative skewness (−8.754), suggesting a distribution with frequent, large negative outliers.

Overall, the descriptive statistics reveal that while sukuk indices tend to have low average returns and relatively stable price movements, their distributions are often characterized by high kurtosis and varying degrees of skewness. The CPU index, by contrast, displays greater variability and a more symmetric, reflecting the broader and more volatile nature of CPU over time.

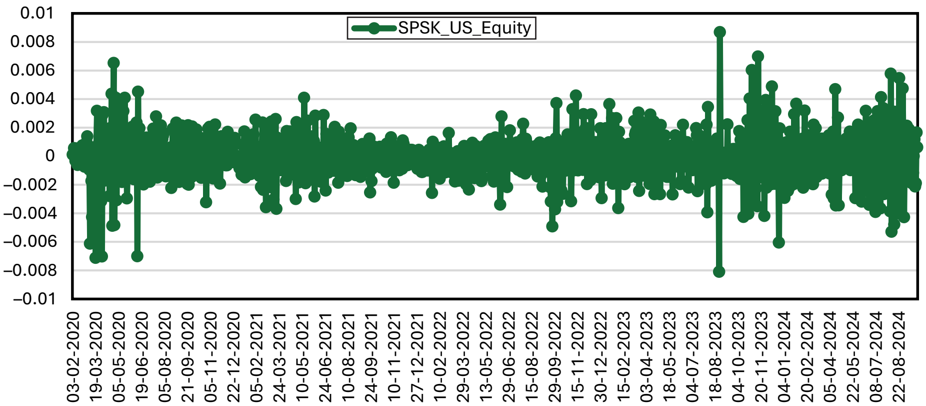


Figure 11. Sukuk returns index: SPSK_US_Equity (03/02/2020–30/09/2024)

3.1.3 Correlation matrix. In Table 3, CPU correlations with sukuk indices are shown. Most correlations are close to zero, with values ranging from slightly negative to slightly positive. For instance, ISLA5AV has the most negative correlation with −3.48%. As far as positive correlations go, I37338 has the highest value at 2.32%. Similarly, the global sukuk indices DJSUKUK and JPEIEMSI have very weak correlations with CPU, with −0.27% and 0.50%, respectively. According to these findings, sukuk indices in normal market conditions move independently of climate policy uncertainties. It is possible that this independence is due to the unique structure of sukuks, as well as conditions in other markets and regions.

A weak overall correlation does not mean, however, that a stronger relationship never exists. The impact of CPU on sukuk markets can increase during major global events or policy announcements, according to previous research and our own time-frequency analysis. There may

Table 3. Correlation matrix (CPU and sukuk indices)

Index	CPU (%)
DJSUKUK	−0.27
ISLA1V	−2.53
ISLA5V	−2.19
ISLA5AV	−3.48
SBKU	−0.31
SBKBU	−0.93
DJSUKB	0.43
SBKU0P	−1.04
I30740US	−0.27
I38310	0.05
I37338	2.32
SPSK_USE*	1.14
I35842	1.89
DJSUKO	0.67
JPEIEMSI	0.50

Note(s): These values represent Pearson correlation coefficients, which measure the strength and direction of linear relationships between CPU and the sukuk indices
Source(s): Authors' own work

be a stronger link between CPU and some sukuk indices during situations such as COVID-19 or climate summits. As these connections are not linear, it makes sense to use nonlinear models such as the wavelet coherence transform to study them. When relationships are complex or change over time, linear models may miss important dynamics. When there is high uncertainty or significant market events, nonlinear methods are better suited to uncover hidden patterns.

3.2 Econometric model

To examine the relationship between the CPU and major Sukuk indices, we use the wavelet coherence (scalogram) technique. For the former index, which is the CPU, it has been taken as an index in its full scale, while the return of each of the 11 indices is calculated as the first difference between the natural logarithm (ln) of two successive values of each Sukuk index as follows:

$$r_{i,t} = \ln \left[\frac{P_{i,t}}{P_{i,t-1}} \right] \tag{1}$$

where $r_{i,t}$ represents the logarithmic return for index "i" at time t and $P_{i,t}$ *and* $P_{i,t-1}$ are the "i" index prices at time t and t − 1, respectively.

The CWT allows the study of a signal in time and frequency domains simultaneously, thanks to both parameters: time (t) and scale (*s*). Based on the wavelet coefficients of the CWT, the correlation of the variations across different scales (s) and time (t), denoted by the variable $\rho_{xy}(s,t)$, between two variables x(t) and y(t) can be computed as follows (Grinsted *et al.*, 2004):

$$\rho_{xy}(s,t) = \frac{\left| S(W_{xy}(s,t)) \right|}{\sqrt{S\left(\left|W_x(s,t)^2\right|\right) \; S\left(\left|W_y(s,t)^2\right|\right)}} \tag{2}$$

where S(.) denotes a smoothing operator in both time and scale allowing for ensuring stability. The primary purpose of the smoothing operator is to average or smooth wavelet coefficients over neighboring time points and scales. This reduces the effects of fluctuations and random noise, resulting in more reliable and stable correlation estimates.

By using the Morlet wavelet, the W(s,t) represents the CWT of a time series $f(u)$ at scale s (controls the dilation of the wavelet) and time t (called translation as the time shift of the wavelet) is defined as:

$$W(s,t) = \int_{-\infty}^{\infty} f(u)\psi^*\left(\frac{u-\mathrm{t}}{s}\right)du \tag{3}$$

where $\psi^*(\cdot)$ represents the complex conjugate of the Morlet wavelet function ψ (.) expressed as a function of the standard deviation (σ) of the Gaussian envelope, controlling the width of the wavelet and the angular frequency of the oscillatory part (ω), which controls the number of oscillations within the wavelet. The Morlet wavelet allows researchers to analyze both the strength (amplitude) and timing (phase) of relationships between variables. This feature is useful for identifying dynamic interactions as well as lead-lag patterns. Therefore, Morlet wavelets are well suited for analyzing changing and potentially nonlinear connections in financial and economic data.

It is important to mention that the scale (s) parameter controls the dilation of the wavelet so that a large value of "s" catches low-frequency components whereas a smaller value of "s" captures high-frequency components. Intuitively, this can be compared to adjusting the focus of a lens. A wavelet captures fine details and short-term fluctuations at small scales. On a larger scale, it uncovers more persistent and low-frequency patterns (see Table A3 in the Appendix 1).

The CWT method is chosen for its exceptional capability to simultaneously analyze relationships across various investment horizons. This feature makes it especially effective in capturing the dynamic interactions between CPU and sukuk indices (see Figure A2 in the Appendix 1). In contrast to quantile-on-quantile regression, which only examines specific quantiles of two variables, CWT offers a more detailed analysis by revealing localized patterns, comovements and phase differences over different time frames (Rua and Nunes, 2009; Aguiar-Conraria and Soares, 2014; Addison, 2017; Jiang and Yoon, 2020). Wavelet coherence distinguishes between short-term shock effects and significant long-term factors, which is crucial for this research. The relationship between CPU and sukuk varies over time and is influenced by global events. By using CWT, this study uncovers complex dynamics and provides deeper insights into the time and frequency-based interactions that traditional methods frequently miss.

Wavelet techniques have gained considerable traction in economics and finance, as evidenced by studies from researchers like Saiti *et al.* (2016), Dewandaru *et al.* (2016), El Alaoui *et al.* (2017), Huang *et al.* (2023), Naeem *et al.* (2024) and Cao *et al.* (2025). In contrast to conventional approaches like Ordinary Least Squares, wavelet methods explore various frequency domains, offering a key advantage. By examining correlations across both time and scale, wavelet techniques uncover changes that may be missed in traditional correlation analysis (Reboredo and Rivera-Castro, 2014; El Alaoui *et al.*, 2016). In addition, wavelet coherence is highly effective for evaluating dynamic correlations, allowing for the analysis of comovements, dynamic relationships and possible shock transmissions between CPU and key sukuk markets, such as those in Malaysia and Indonesia, along with global sukuk markets. Emphasis is placed on the influence of major global financial shocks on sukuk markets.

Despite CWT's valuable insights into the dynamics of time and frequency, there are several underlying limitations. An important limitation is the existence of edge effects, which can reduce the reliability of results near the edges of the time series. Also, the results of the CWT can be affected by the choice of wavelet function and parameter settings, such as scale and resolution. It also assumes that the underlying data are sufficiently sampled and stationary within local windows, which is not always true. It is therefore important to interpret findings cautiously, particularly at the edges of the data and when comparing results across parameter choices.

4. Results and discussion

We explore the relationship between CPU and major sukuk indices. This section presents the wavelet coherence (scalogram) analysis. Our findings are reported for four spans of data. We examine the CWT across several time scales, ranging from 4, 16, 64, 256, to 1,024 days, following the methodology outlined by Grinsted *et al.* (2004). To streamline the analysis, our study focuses on understanding the dynamics over various investment horizons, ranging from (4–16 days) short, (64 days) medium and (256–1,024 days) long-term timeframes.

Prior research suggests that CPU can have a significant and changing impact on financial markets. This effect is often most visible around major global climate events, such as the Paris Agreement and COP conferences. Studies show that policy uncertainty shapes Islamic financial instruments by influencing investor sentiment, risk perception and market efficiency (Naifar and Hammoudeh, 2016a; Pástor *et al.*, 2021; Bouri *et al.*, 2022). Periods of intense climate policy debate, or the introduction of new regulations, often lead to greater comovement and volatility in both conventional and Islamic financial markets (Cevik and Bugan, 2023). Given this background, we expect to see stronger coherence and clearer lead-lag relationships between CPU and sukuk indices during and after major climate policy events. We also anticipate that these effects will vary across different investment horizons and sukuk structures.

4.1 Continuous wavelet transform for climate policy uncertainty against the first set of sukuk indices: (2011–2024)

To streamline our analysis, we have set the starting date for the six sukuk indices to 03/01/2011, with the ending date reflecting the availability of CPU data on. Figure 12 (a)–(e) show the CWT analysis between the CPU index and several sukuk indices. The scalograms display prominent red zones. These red areas indicate periods of strong and persistent positive correlation between CPU and sukuk performance. This pattern appears across short, medium and long-term horizons, up to 256 days. The black arrows point upwards and to the left. This direction means that changes in CPU usually come before movements in the sukuk indices. In other words, shifts in CPU are quickly reflected in the sukuk market. Investors may adjust their expectations and risk assessments in response to new policy signals.

The economic significance of these findings is clear. A strong and persistent correlation means that sukuk markets are highly sensitive to changes in CPU. Both short-term traders and long-term investors in sukuk must pay close attention to policy developments, as these can directly affect market performance and risk. This is important for investors who want to manage risk or anticipate market movements related to global climate policy. These findings agree with previous research. Studies show that policy uncertainty can significantly impact Islamic financial instruments by shaping investor sentiment and risk perception (Naifar and Hammoudeh, 2016a; Pástor *et al.*, 2021; Bouri *et al.*, 2022). Monitoring climate policy signals is important for sukuk market participants, as these signals can serve as early indicators of market shifts.

In contrast, Figure 12 (f) shows a complex relationship between CPU and the global Sukuk index (SBKU). In 2017, CPU clearly leads the index (red zone). Around 2014, for the medium-term (64 days), the direction shifts, with the global Sukuk index leading CPU, as indicated by the downward and rightward black arrows. The strength of the connection varies over time. Strong to medium correlations appear in 2011–2013 and 2015–2018 (red and yellow areas). Conversely, the correlation weakens between 2018 and 2020 (blue areas), across investment scales from 64 to 1,024 days. These findings suggest that the relationship between CPU and SBKU is dynamic, changing over different periods and investment horizons.

4.2 Continuous wavelet transform for the second set of indices: (2013–2024)

In this section, we analyze the Continuous Wavelet Coherence between CPU and the second set of four sukuk indices (starting date in 2013). Figure 13 (a) and (b), shows a moderate but persistent relationship evidenced by less pronounced red zones in the scalograms. For instance, more yellow areas can be evident between 2020 and 2024 [see Figure 13 (a)]. This indicates that changes in CPU serve as a potential early indicator for sukuk market movements. Economically, this means that even moderate changes in policy uncertainty can affect investor decisions and sukuk pricing. Market participants may adjust their portfolios in response to these policy signals. By responding to shifts in CPU, sukuk can facilitate capital reallocation toward more sustainable sectors during periods of regulatory change. This

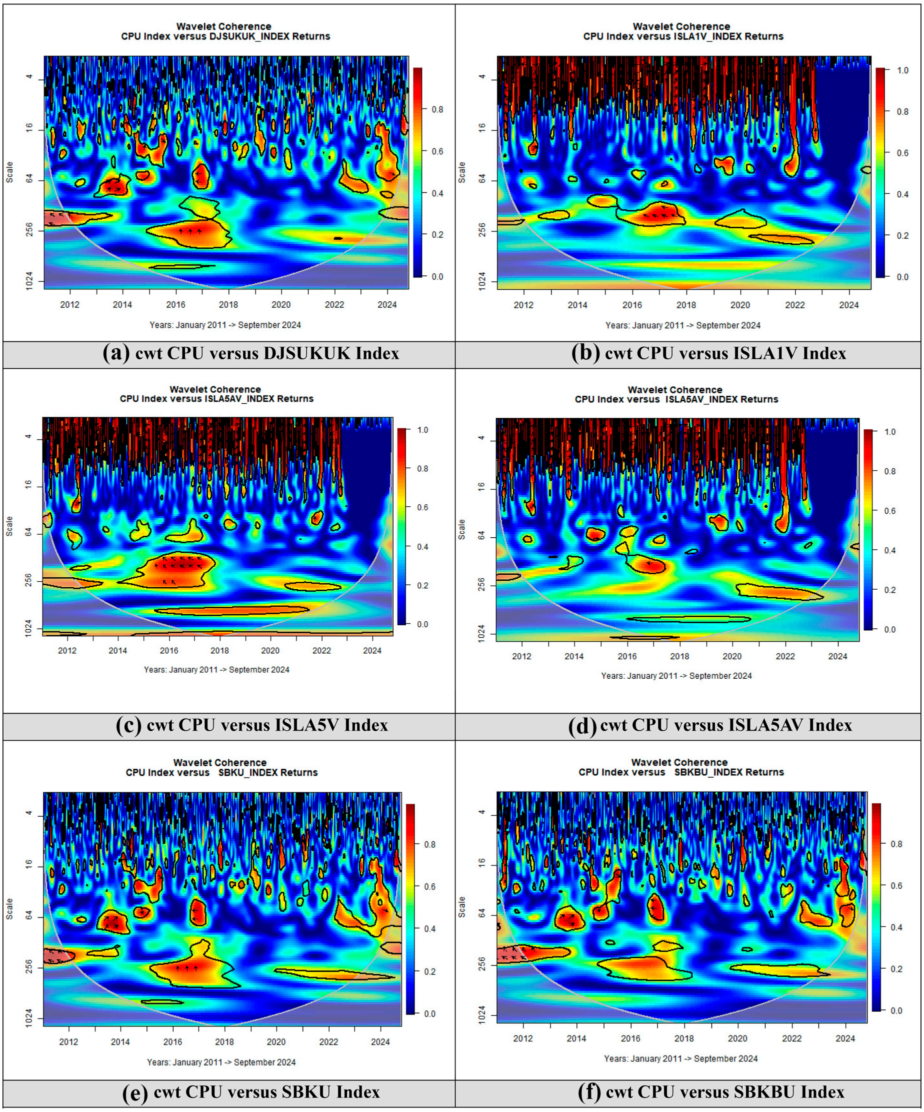


Figure 12. Continuous wavelet transform correlation of CPU versus six sukuk indices (2011–2024)

Note(s): The region above the cone of influence (defined by the parabola in gray color) shows the statistically significant areas in the scalogram. DJSUKUK Index is Dow Jones Sukuk Price Return Index; followed by three Malaysian Corporate Credit Islamic-type papers with remaining maturities, respectively, greater than one year (ISLA1V), of one to five years (ISLA5V Index) and greater than five years (ISLA5AV Index); SBKU Index is FTSE Ideal Ratings Sukuk Index; SBKBU Index is FTSE Ideal Ratings Broad US Dollar Sukuk Index, in USD terms

Source: Authors' own work; see data section for sources

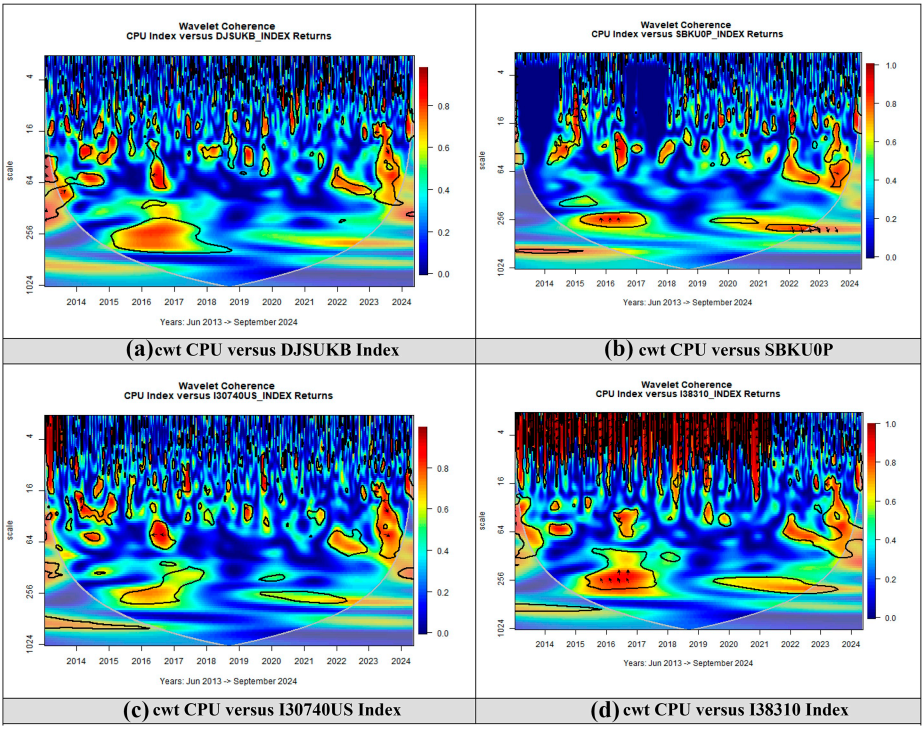


Figure 13. Continuous wavelet transform correlation of CPU versus four sukuk indices (2013–2024)

Note(s): The region above the cone of influence (delineated by the parabola in gray color) shows the statistically significant areas in the scalogram. DJSUKB Index is the Dow Jones Sukuk AP FIGI BBG003TNNKV7 Index; SBKU0P Index is FTSE Sukuk Index 10 + Yr USD; I30740US Index is Bloomberg EM GCC USD Sukuk Total Return Index Unhedged USD; I38310 Index is Bloomberg Global Agg Sukuk Unh USD

Source: Authors' own work; see data section for sources

dynamic interaction aligns with SDG 13 (Climate Action), as financial markets play an increasingly important role in managing climate-related risks and funding low-carbon transitions. Our findings align with the ones from Paltrinieri *et al.* (2020), who provide evidence that policy uncertainty often precedes movements in sukuk markets.

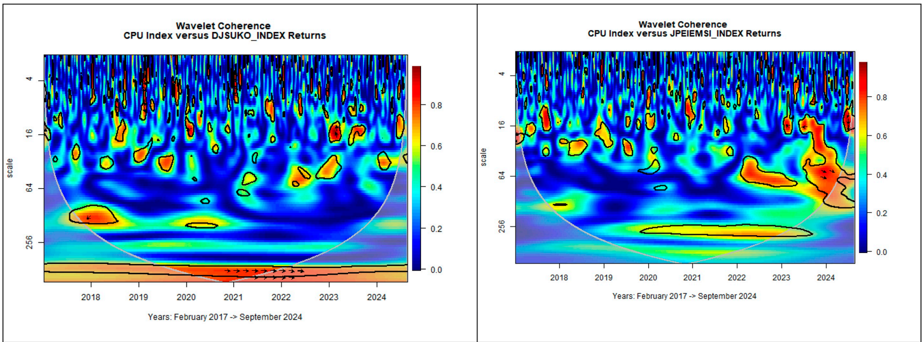
Figures 13 (c) and (d), reveal more intricate relationships in the I30740US and I38310 indices. The medium-term view (64 days) suggests quarterly market adjustment cycles. In Figure 13 (c), a notable negative correlation (antiphase) appears between 2016 and 2017. This period coincides with increased green sukuk issuances and greater awareness of environmental issues in Islamic finance (Aassouli *et al.*, 2018). These results indicate that sukuk markets may demonstrate resilience during periods of heightened CPU.

The asset-backed and Shariah-compliant structure of sukuk may explain their countercyclical behavior. Figure 13 (d) shows a stronger correlation over longer investment horizons (256 days) between 2016 and 2017. This points to a more significant long-term relationship between CPU and sukuk performance, consistent with the long-term nature of ecological risks (Hsu *et al.*, 2023). Sustained changes in CPU can have a lasting impact on sukuk market performance. This affects both pricing and risk over extended periods. The variation in effects across different investment horizons (medium vs long term) underscores the complex influence of CPU on sukuk markets. These findings contribute to the growing literature on the intersection of Islamic finance and environmental challenges, highlighting the potential of sukuk to address climate-related risks and promote sustainable development (Hasan *et al.*, 2022; Raeni *et al.*, 2022).

4.3 Continuous wavelet transform for the second set of indices: (2017–2024)

Figure 14 examines the relationship between CPU and two majors global sukuk indices: the Dow Jones Sukuk Index OAS (DJSUKO Index, Figure 14 (a) and the J.P. Morgan Global IG Sukuk Index Total Return [JPEIEMSI Index, Figure 14 (b)]. In Figure 14 (a), the correlation between CPU and the DJSUKO Index is moderate, as indicated by the light red color on the scalogram. This relationship is most evident during the period from 2020 to 2022 at a long-term investment horizon of 256 days. The timing of this comovement coincides with the COVID-19 pandemic, a period marked by heightened global uncertainty and market volatility. Economically, this suggests that during major global shocks, even moderate increases in policy uncertainty can lead to noticeable changes in sukuk market performance. This observation is consistent with previous research showing that global shocks, such as pandemics, can amplify the influence of policy uncertainty on financial markets, including Islamic instruments like sukuk (Bouri *et al.*, 2022; Ahmed *et al.*, 2024).

In contrast, Figure 14(b) reveals a more complex and persistent correlation between CPU and the JPEIEMSI Index. This pattern is observed from 2023 to 2024 and spans a broader range of time scales, from short-term (16 days) to medium-term (128 days). The JPEIEMSI Index is distinguished by its diversified and global composition, which may contribute to its heightened responsiveness to international policy developments and climate-related events. Notably, the correlation strengthens in 2024 compared to 2023, suggesting increased sensitivity to specific events impacting CPU, such as COP28 in Dubai (2023) and COP29 in Baku, Azerbaijan (2024). During COP29, the Islamic Development Bank (IsDB)



(a) cwt CPU versus DJSUKO Index | **(b)** cwt CPU versus JPEIEMSI Index

Figure 14. Continuous wavelet transform correlation of CPU versus two sukuk Indices (2017–2024)
Note(s): The region above the cone of influence (delineated by the parabola in gray color) shows the statistically significant areas in the scalogram. DJSUKO Index is Dow Jones Sukuk Index OAS; and JPEIEMSI Index is Morgan Global IG Sukuk Index Total Return
Source: Authors' own work; see data section for sources

emphasized the growing importance of green sukuk as a tool for mobilizing climate finance globally. The economic significance here is clear: as climate policy discussions intensify, global sukuk markets become more responsive to policy signals and international developments. These findings are in line with a growing body of literature that highlights the significant role of climate-related events and policy initiatives in shaping financial market dynamics, particularly for sukuk and other Islamic financial products (Hsu *et al.*, 2023; Çatık *et al.*, 2025; Zhao *et al.*, 2025). These global environmental events-such as the COP summits and the COVID-19 pandemic-illustrate the responsiveness of sukuk to climate and policy stresses. This suggests that sukuk absorb and reflect the broader sustainability discourse. Consequently, sukuk promote financial system resilience and environmental preparedness, in line with SDG 9. The results underscore the need for investors and policymakers to closely monitor climate policy developments, as these can have both immediate and lasting effects on the performance of global sukuk indices.

4.4 Continuous wavelet transform for the second set of indices: (2019–2024)

Figure 15 shows the CWT analysis for the Bloomberg Global Agg USD Sukuk Unhedged USD (I37338 Index) from 2019 to 2024. The results reveal two main patterns. First, there are strong positive correlations at medium and long-term horizons (64–256 days) between 2022 and 2024. Second, weaker or negative correlations appear at short and medium-term horizons (4–64 days) from 2019 to 2022.

The economic significance of these findings lies in how investor behavior and market pricing respond to evolving CPU. The emergence of strong long-term correlations after 2021 suggests that investors are increasingly factoring climate policy developments into their long-term valuation of sukuk. Our findings are in line with those of Cevik and Bugan (2023), who also report that stronger long-term correlations may reflect increased investor attention to climate risk and regulatory changes during this period. Sukuk markets appear particularly responsive to structural changes in environmental policy based on their strong coherence over extended time horizons. This long-term sensitivity aligns with the United Nations definition of sustainable development. This definition refers to a model of progress that addresses current societal and economic needs while ensuring that the resources and opportunities available to future generations are not diminished (Schaefer and Crane, 2005; Mensah, 2019). Therefore, sukuk lend themselves well to sustainability-linked investment strategies to support long-term social and environmental goals. Sukuk are thus relevant to achieving SDGs 13 (Climate Action) and 17 (Partnerships for the Goals), because they enable ethical capital to flow toward climate-friendly initiatives.

In contrast, short-term market movements seem less affected by policy uncertainty, likely due to the influence of immediate financial factors (Antonakakis *et al.*, 2013). Changes in climate policy can shape investor expectations and risk assessments before these shifts appear in market prices. When new policies or regulatory debates arise, investors often adjust their portfolios early. They do this to prepare for possible effects on the economy and financial markets. As a result, sukuk prices may change in advance of the actual policy impact. This anticipatory behavior is well documented in the literature, where policy uncertainty has been shown to influence asset prices and market dynamics ahead of realized events (Naifar and Al Dohaiman, 2013; Chiang, 2019; Umar *et al.*, 2024). This highlights that the impact of CPU on sukuk markets changes over time and depends on the investment horizon.

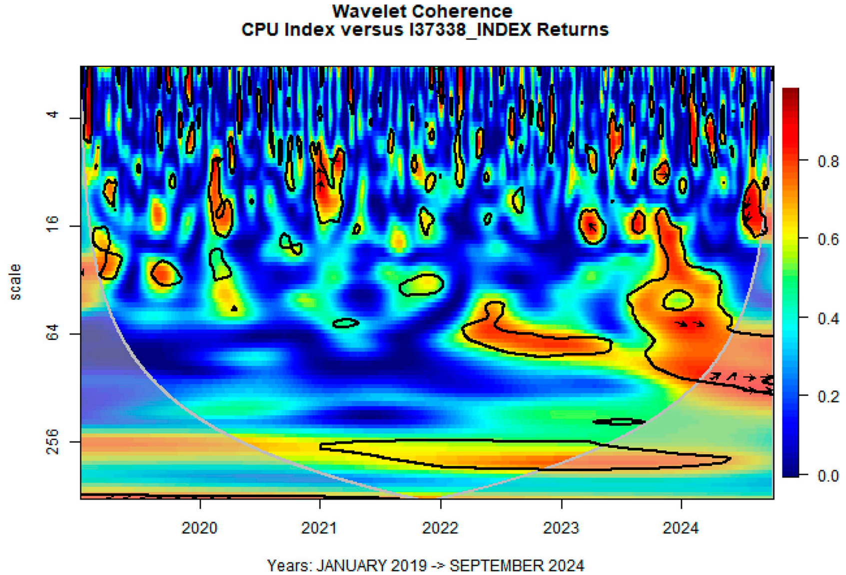


Figure 15. CWT correlation of CPU and I37338 Index (2019–2024)

Note(s): The region above the cone of influence (delineated by the parabola in gray color) shows the statistically significant areas in the scalogram. I37338 index is Bloomberg Global Agg USD Sukuk Unh USD

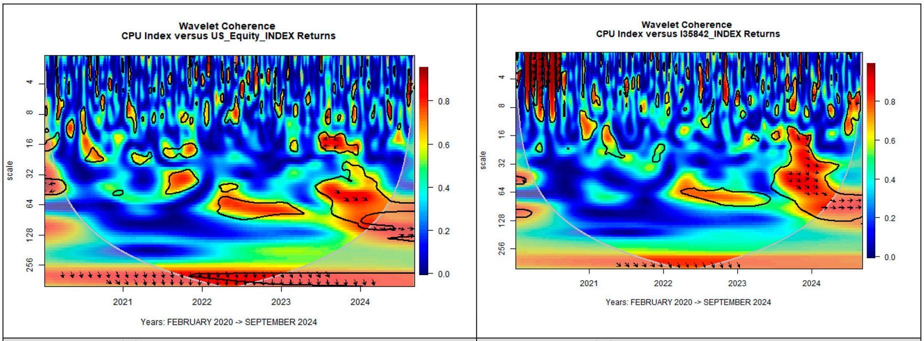
Source: Authors' own work; see data section for sources

4.5 Continuous wavelet transform for the second set of indices – 2020–2024

Figure 16 (a) focuses on equity sukuk. There is a strong correlation between the US Equity Sukuk Index and CPU from Q2 2022 to early 2023, especially at long horizons (above 256 days). Here, the index leads CPU. Economically, this suggests that equity sukuk markets are not only sensitive to CPU but may also act as early indicators of policy shifts. When these markets anticipate changes in climate policy, it can influence capital allocation, risk premiums and investment flows well before policy changes are officially implemented. Such anticipation could be due to the forward-looking nature of these markets and their sensitivity to policy and environmental developments (Naifar and Hammoudeh, 2016a; Pástor *et al.*, 2021; Bouri *et al.*, 2022).

Another strong correlation appears around 2024 at shorter horizons (32–64 days), again with the US Equity Sukuk Index leading CPU. This pattern may reflect quick market reactions to climate news or policy announcements, supporting the idea of efficient information flow (Aguiar-Conraria and Soares, 2014). At very short-term horizons (16 days), the relationship is weaker, possibly due to market noise or slower information absorption. Moderate impacts are also seen in 2021 and 2022 (32 and 64 days). These may align with periods of intense climate policy debate or major global events, showing the sukuk market's sensitivity to policy uncertainty. These results highlight the need to consider CPU in long-term sukuk strategies. Sukuk structures like ijara, *murabaha* and mudaraba may help manage risk, as suggested by observed negative (antiphase) relationships during some periods (Aassouli *et al.*, 2018; Hsu *et al.*, 2023).

For Figure 16(b), a strong correlation is seen around 2024 between the I35842 Sukuk Index and CPU. Here, CPU lags the index at horizons between 16 and 128 days. This lead-lag



(a) cwt CPU versus US Equity Index | **(b)** cwt CPU versus I35842 Index

Figure 16. CWT correlation of CPU versus two sukuk Indices (2020–2024)

Note(s): The region above the cone of influence (delineated by the parabola in gray color) shows the statistically significant areas in the scalogram. SPSK US Equity Index is SP FUNDS DOW JONES GLOBAL SUKUK; I35842 Index is Bloomberg Global Aggregate Sukuk ex MYR Unh USD

Source: Authors' own work; see data section for sources

pattern suggests that sukuk markets may signal upcoming changes in CPU. The economic significance is that Islamic financial markets can play a proactive role in shaping investor expectations and guiding capital flows in response to evolving climate policy. This finding is consistent with theories of information transmission and market efficiency (Aguiar-Conraria and Soares, 2014; Rua and Nunes, 2009;). Sukuk indices' ability to anticipate CPU changes highlights the role of Islamic finance in shaping investor expectations about climate policy.

To address the first research question, whether CPU and sukuk indices are correlated at different time scales, our analysis demonstrates that the strength and stability of this correlation depend on the investment horizon. Short-term correlations tend to be weaker and more volatile, while long-term correlations become more pronounced, particularly during periods of heightened CPU. This finding highlights that sukuk markets react differently to CPU depending on the time frame, which has important implications for both investors and policymakers.

Regarding the second and third research questions, how the relationship between CPU and sukuk indices evolves over time, and whether CPU drives sukuk indices or vice versa, our results show that this relationship is dynamic. Notably, it shifts during episodes of economic instability or climate-related events. The lead-lag analysis indicates that changes in CPU typically precede movements in sukuk indices, especially in times of high uncertainty. This suggests that sukuk markets are responsive to shifts in climate policy risk.

To sum up, our analysis shows that CPU has a heterogeneous effect on sukuk. The impact depends on the region, the structure of the sukuk and the time scale (see Table 4 for a summary of our findings). This effect is stronger for global sukuk indices than for regional ones, such as those from the GCC and Malaysia. Global events and international policy changes play a major role in shaping the sukuk market. In contrast, regional sukuk markets may be more insulated or influenced by local factors. This can dampen the effect of global policy uncertainty.

We also find that major shocks (e.g. political conflict, COVID-19 and Russia-Ukraine war) change the relationship between CPU and sukuk indices. Important global climate events, such as the Paris Agreement and COP29, as well as new climate policy rules,

Table 4. Summary of CWT analysis findings

Figure	Index/description	Period	Investment horizon	Main finding
12(a) and (b)	Six sukuk indices	2011–2024	Up to 256 days	CPU leads; strong, persistent correlation
12(f)	Global sukuk index (SBKU)	2011–2020	64–1,024 days	Dynamic, shifting lead-lag; variable strength
13(a) and (b)	DJSUKB, SBKU0P	2013–2024	64–256 days	Moderate, steady link (esp. 2020–2024)
13(c)	I30740US	2016–2017	–	Negative (antiphase) correlation
13(d)	I38310	2016–2017	Med. vs long term	Stronger long-term link
14	DJSUKO, JPEIEMSI	2020–2024	16–256 days	Moderate/complex; event-driven sensitivity
15	Bloomberg Global Agg USD Sukuk (I37338)	2019–2024	4–256 days	Positive at long/med-term; weak/negative short-term
16(a)	US equity sukuk	2021–2024	16–256 days	Index leads CPU; long-term/short-term contrast
16(b)	I35842 Index	2024	16–128 days	Strong; CPU lags index

Note(s): All indices listed are sukuk indices (see Table 1 for the list of Sukuk Indices, Tickers and Explicit Names. "Leads" means changes in One variable precede changes in the other (e.g. "CPU leads sukuk" means CPU changes come first). "Lags" means the opposite. "Antiphase" indicates a negative correlation, where the two variables move in opposite directions. Descriptions such as "complex, persistent" or "variable strength" highlight the nature and consistency of the observed relationships across different periods and market conditions
Source(s): Authors' own work

significantly influence this relationship. These events increase market volatility. They also change how investors behave. As a result, the strength and direction of the observed correlations shift. Our findings show that investors and policymakers should consider both global and regional factors. It is also important to account for unexpected shocks when managing risk and planning strategies in the sukuk market. These considerations should be integrated into portfolio construction to enhance resilience and optimize returns under changing market conditions.

5. Conclusion

Sukuk provide a Sharia-compliant alternative to traditional debt while adhering to sustainable and ethical financing principles. The unique structure of sukuk, which is claimed to support environmental, social or economic development, is emphasized in this paper. These traits render sukuk effective financial instruments for tackling global ecological issues. Nevertheless, the growing uncertainty around climate policies poses substantial challenges for financial markets. Furthermore, it raises essential questions about the resilience in mitigating these risks. Our paper examines the intricate relationship between CPU and major sukuk through wavelet coherence analysis, using a sample of fifteen sukuk indices from 2010 to 2024.

The findings provide a thorough understanding of the complex, multifaceted relationship between CPU and sukuk indices. The analysis emphasises both synchronous and lagged connections, alongside distinct market behaviors. The interaction between CPU and sukuk is significantly shaped by global events, notably COVID-19 and important climate incidents. This suggests an increasing significance of climate-related policies and events, impacting global financial markets, including sukuk. Our findings add to current literature by illustrating the varying effects of CPU on different sukuk indices. In addition, they highlight the necessity of considering both temporal and cross-sectional dimensions in these analyses. Consequently, both global and reginal sukuk can be effective hedging tools against CPU, particularly during times of increased environmental consciousness and the rise of green sukuk. Sukuk present a unique chance to link investment strategies with ecological and environmental issues, underscoring their potential of sukuk to address climate-related challenges and to advance a more sustainable financial system.

In reflecting on the findings, the interplay between CPU and sukuk indices is both intricate and multifaceted, as demonstrated by the wavelet coherence analysis. The results reveal that CPU frequently precedes movements in sukuk markets across various time horizons, a pattern that resonates with the foundational principles of the IME (Asutay, 2007a, 2025a, 2025b). As discussed above, central to the IME framework are the values of justice (adalah), equity (ihsan) and the holistic well-being of all stakeholders, including the environment (Asutay and Yilmaz, 2018).

These principles provide a theoretical basis for the observed lead-lag dynamics, suggesting that CPU has a significant influence on sukuk markets by shaping investor behavior and perceptions of risk. This aligns with the findings of Bouri *et al.* (2022), who demonstrate that heightened CPU increases the attractiveness of green energy stocks to investors. Such shifts in investor preferences lead to a reallocation of capital from brown energy stocks to green energy stocks, enhancing the performance of the latter. Similarly, in the context of sukuk markets, CPU may drive investors toward more sustainable and environmentally aligned financial instruments, reinforcing the IME framework's emphasis on justice, equity and environmental well-being.

The IME's extended stakeholder governance model offers further insight into the diverse impacts of CPU on sukuk indices. Notably, the pronounced correlations observed at longer investment horizons (256-day) underscore the positioning of sukuk as instruments suited for long-term investment strategies, in alignment with the maqasid al-Shari'ah objectives of fostering sustainable development (Llewellyn and Khalid, 2024). The evolving relationship between CPU and sukuk indices, particularly during periods marked by the issuance of green sukuk, highlights the potential of these financial instruments to mitigate climate-related risks and advance environmental sustainability.

Furthermore, the *tawhid* principle in IME, which centers on unity and interconnectedness, offers important insights into how major global events impact the relationship between CPU and sukuk markets. Disruptions like the COVID-19 pandemic and the Russia-Ukraine conflict disturb the natural balance, known as *mizan*, within financial systems. In response, there is a need for corrective measures, or *islah*, to reestablish stability (Asutay and Harningtyas, 2015; Mergaliyev *et al.*, 2021).

The results of this study highlight the need for targeted policy actions to strengthen the role of sukuk in supporting climate resilience and sustainable development. Government and policymakers should develop a framework that includes financial instruments with tax incentives to safeguard the environment, such as green sukuk and delegated sukuk aimed at protecting wildlife and ecosystems. In addition, it is essential for governments to incorporate climate policy considerations into financial regulations to strengthen the sukuk markets' resilience against climate-related risks. Promoting the use of sukuk as a funding mechanism for environmental initiatives can further bolster global efforts to fight climate change.

Regulatory authorities need to guarantee that sukuk issuance and investments comply with ESG principles. This requires enforcing transparent reporting on the ecological effects of projects funded by sukuk and encouraging innovation in Islamic finance to tackle sustainability issues. In addition, regulators should work together on an international level to create standardised ESG criteria for sukuk, ensuring their credibility and applicability worldwide.

Our findings show that sukuk can effectively bridge Islamic finance and sustainable development, especially in regions vulnerable to climate change. By addressing CPU and promoting ethical finance, sukuk offer a practical tool for advancing both financial stability and environmental goals. These policy recommendations are grounded in the empirical evidence presented in this study and are relevant for countries seeking to leverage Islamic finance for sustainable development and climate action. Specifically, it links sukuk with environmental policy considerations to contribute to the achievement of SDG 13 (Climate Action), SDG 9 (Industry, Innovation and Infrastructure) and SDG 17 (Partnerships for the Goals).

As noted in the theoretical section, this paper examines the implications of sukuk issuance for climate-related issues in relation to CPU. The findings show that the positive impact of climate considerations through CPU depends on broader global conditions. However, the theoretical framework stresses that all Islamic financial activities, including sukuk, are expected to support climate health and sustainability. Moreover, Asutay and Yilmaz (2025) emphasise that Islamic finance has experienced market pressure to conform to conventional finance practices, leading to a compromise of its core values. Consequently, as indicated by Avdukic and Asutay (2025), the development implications within Islamic finance are somewhat limited. Likewise, sukuk should contribute to overcoming climate risk challenges, irrespective of global or local circumstances, as per the ontology of sukuk. Therefore, within its theoretical framework, sukuk, similar to other instruments of Islamic finance, has not sufficiently emphasised the conditions of IME to promote sustainable development, which includes formulating strategies to address climate risk.

The findings of this study highlight the importance for sukuk investors to incorporate CPU into their investment decisions. The growing focus on sukuk is likely to appeal to ethical investors who are concerned with the environmental and social impact of their portfolios. To build on these insights, further research is needed to enhance our understanding of the factors influencing these connections. Future studies should explore more thoroughly the changing dynamics of CPU and sukuk to ensure their ongoing relevance in tackling global environmental and financial issues.

This study demonstrates the potential of sukuk as a sustainable, Sharia-compliant financing instrument for addressing environmental issues. By examining the interplay between CPU and key sukuk indices, the results expose both simultaneous and delayed relationships, along with varying effects across diverse markets. These findings underline the necessity of considering both temporal and cross-sectional factors when evaluating the resilience of sukuk against climate-related risks.

A limitation of this paper is its lack of analysis on individual Sukuks. In addition, the research has excluded the aspect of currency risk, as it goes beyond the main goal of investigating how CPU affects Sukuk returns. This examination deliberately overlooks the effects of foreign exchange changes on Sukuks. However, it is widely recognised that investors often use hedging strategies, including "Currency Overlay Techniques," to effectively manage and reduce currency risk.

Future studies might examine Green Sukuk, which is specifically crafted to support projects that promote environmental sustainability. Focusing on Green Sukuk can yield valuable insights into how these financial instruments adapt to CPU and their impact on facilitating the green transition. In addition, such research may provide actionable strategies for using Islamic finance to tackle global sustainability challenges, contributing to a more sustainable future. Moreover, future inquiries could investigate the link between ESG risk scores and the sukuk markets within specific countries, offering a deeper understanding of how various ESG factors affect Islamic financial products.

In concluding, combining the IME theoretical framework with empirical data enhances the research by offering a detailed insight into the evolving relationship between CPU and sukuk markets. This integration highlights the natural compatibility of Islamic finance with the broader objectives of United Nations SDGs.

Notes

[1.] See Table A1 in the Appendix 1, where we define the key concepts in the Islamic Moral Economy.

[2.] Data sources for Figures 3–11: Sukuk indicators are sourced from Bloomberg Professional Service, and CPU index is collected from the publicly accessible website https://www.policyuncertainty.com [Link to Economic Policy Uncertainty Index] [Link to the website of [Economic Policy Uncertainty].].

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Appendix 1

Table A1. Key concepts in the Islamic moral economy

Concept	Definition	Reference
Justice (adalah)	The principle of fairness and equity in all dealings, ensuring rights and obligations are balanced and upheld	Dusuki and Abdullah (2007)
Public interest (maslaha)	The pursuit of actions and policies that promote the welfare and benefit of the community	Kamali (2008)
Balance (mizan)	The concept of maintaining harmony and moderation in economic, social and environmental spheres	Mirakhor and Askari (2010)
Harm (darar)	The principle of avoiding harm to oneself and others in all transactions and activities	El-Gamal (2006)
Tawhidi principle	The concept of the oneness of god, which underpins Unity, coherence and ethical conduct in all aspects of life and economics	Asutay (2012)
Amanah	The concept of trustworthiness and stewardship, emphasizing that all resources are a trust from god and must be managed responsibly	Dusuki and Abdullah (2007)
Ihsan	The principle of excellence and benevolence in all actions, going beyond mere compliance to achieve the highest ethical standards	Asutay (2012)
Tazkiyah	The concept of purification, both spiritual and material, aiming for holistic development and ethical conduct	Mirakhor and Askari (2010)
Rububiyah	The principle of God's lordship, emphasizing guidance, sustenance and nurturing of creation, which informs ethical economic behavior	Asutay (2007a, 2007b)
Maqasid al-shari'ah	The higher objectives of Islamic law, which aim to preserve religion, life, intellect, lineage and property	Kamali (2008)
Avoid interest (*riba*)	The prohibition of interest to ensure fairness and prevent exploitation in financial transactions	Caporale and Helmi (2018)
Uncertainty (gharar)	The prohibition of excessive uncertainty and ambiguity in contracts to promote transparency and fairness	El-Gamal (2006)
Gambling (maysir)	The prohibition of gambling and speculative activities to prevent harm and promote ethical financial practices	El-Gamal (2006)

Source(s): See last column for references

Table A2. Parameters Algorithm 1 – converting monthly data to daily business-day data

Element	Parameter	Description
1	Calendar	Defines nonworking days as Saturday and Sunday
2	Date format parsing	Set month in this format “Sep-10”
3	Business days only	Uses a specialized function to skip weekends
4	Value replication	Monthly values are copied to each business day

Source(s): Authors’ own work

Table A3. Used parameters for WTC

Element	Parameter	Value	Description
1	nrands	10	Number of Monte Carlo simulations for significance testing
2	mother	“morlet”	Type of mother wavelet: “morlet” (for financial time series)
3	Sigma	1	Used in computing the Morlet wavelet; 1 as default
4	lag	1	Autoregressive lag used for red-noise background model
5	lty.coi	1	Line type for the cone of influence (COI)
6	col.coi	“grey”	COI color
7	lwd.coi	2	Line width for COI
8	lwd.sig	2	Line width for significance contour
9	arrow.lwd	0.05	Arrow line width for phase
10	arrow.len	0.09	Arrow length for phase
11	plot.cb	TRUE	Show color bar (coherence scale)

Source(s): Authors’ own work

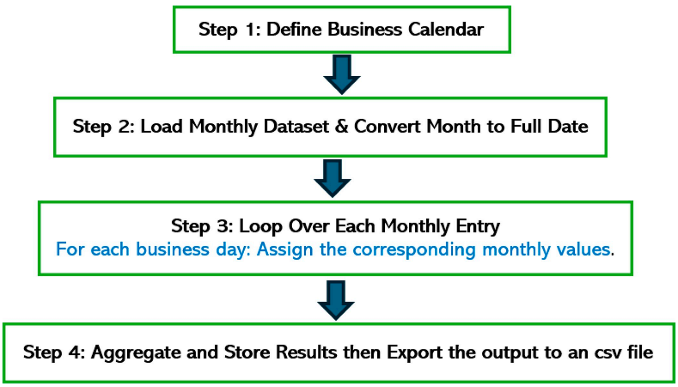

Figure A1. Algorithm 1 – convert monthly data to daily business-day data
Source: Authors’ own work

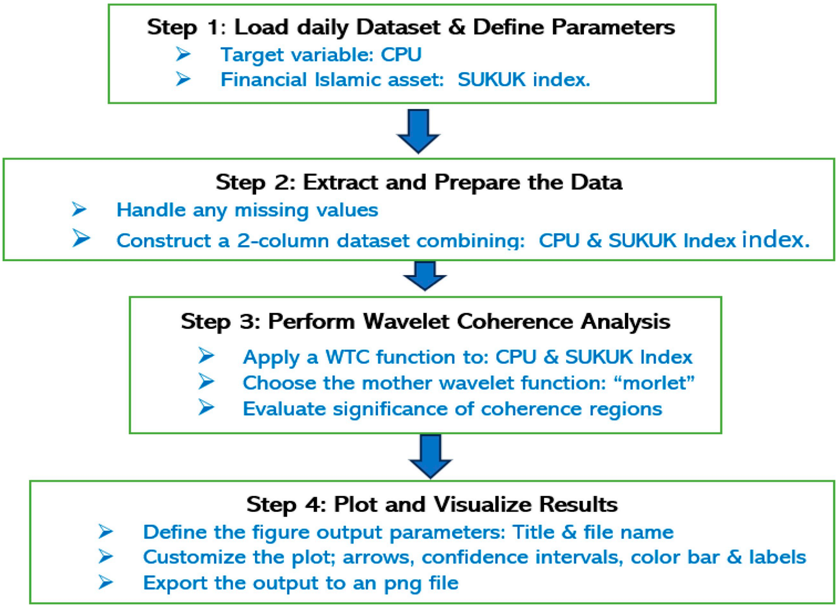

Figure A2. Algorithm 2 – wavelet coherence analysis between CPU and sukuk indices
Source: Authors’ own work

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