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Climate Policy Uncertainty and Infectious Disease Risk: An Evidence for Islamic Dow Jones Index

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Abstract

Climate change and infectious diseases have emerged as two of the most significant challenges facing the world and its economic systems today. Recent studies have increasingly focused on understanding how phenomena such as the COVID-19 pandemic and the climate change crisis—including rising greenhouse gas emissions and uncertainties in climate policy—affect macroeconomic variables and capital markets. Many experts assert that climate change poses a serious threat to human civilization. In light of these pressing concerns, this paper examines the impact of Climate Policy Uncertainty (CPU) and Infectious Disease Risk (IDR) on the Islamic Dow Jones Index (IDJ). To achieve this, the study utilizes monthly data spanning from January 2016 to March 2021 and employs a Structural Vector Autoregressive (SVAR) model. Additionally, Contour Plot graphs are applied to estimate the interaction effects on the IDJ. The findings reveal contrasting impacts of the CPU and IDR indices on the IDJ. Specifically, an increase in the CPU index leads to higher utilization of the Earth's resources for producing goods and services by companies included in the index, resulting in a positive effect. Conversely, a rise in the IDR index exacerbates economic recession, thereby causing a decline in the IDJ.

Keywords: Climate Policy Uncertainty, Infectious Disease Risk, Islamic Dow Jones Index.

JEL Classification: Q54, I19, G1.

Introduction

In recent years, researchers have increasingly shifted their focus to the risks posed by climate change and infectious diseases. Companies, too, have adapted their models in response to market demands and shareholder expectations by integrating environmental programs and social practices. In the age of global warming, climate change has become a crucial factor influencing both human daily activities and ecosystems. Numerous international studies have highlighted critical challenges arising from climate change (e.g., Tjernström and Tietenberg, 2008; Carlsson et al., 2012; Dienes, 2015; Ziegler, 2017). Addressing this global issue, climate uncertainty, and broader environmental protection remains a top priority for nations worldwide (e.g., Pew Research Center, 2019).

Concerns about environmental pollution and climate change have driven individuals and societies to adopt various measures, such as purchasing energy-efficient devices, reducing meat consumption, and utilizing renewable resources (e.g., Lange et al., 2017; Schwirplies, 2018). Financial investment has also emerged as a prominent form of pro-environmental activity. The market for sustainable or socially responsible investments (SRIs)—which apply ecological, ethical, and social standards to select sustainable companies—has grown exponentially in recent years (e.g., Mollet & Ziegler, 2014; Peillex & Ureche-Rangau, 2016). For example, according to the US SIF (2018), US-based assets under SRI management increased by 38% between 2016 and 2018, underscoring these investments' growing prevalence and importance.

At the same time, infectious diseases such as COVID-19 represent a significant global economic challenge. The rapid spread of the virus resulted in over 5,049,497 reported cases and 367,230 deaths worldwide, with a mortality rate of 6.07% (WHO, 2020; Gormsen & Koijen, 2020; Lekhraj Rampal & Seng, 2020; Peters et al., 2020). Pandemics do not affect all individuals or economies uniformly (Duncan & Scott, 2005; Carlsson-Szlezak et al., 2020; Buklemishev, 2020; Papava & Charaia, 2020; Mogaji, 2020; He et al., 2020). For instance, the United Kingdom has experienced heightened economic volatility due to investment uncertainties.

The COVID-19 pandemic significantly impacted stock market performance globally. International stocks represented by the S&P Global BMI declined by 22.3% in the first quarter of 2020. However, the S&P Global BMI Shariah exhibited a comparatively smaller decline of 17.2%, outperforming its conventional counterpart by over 500 basis points. This pattern was consistent across key regions, with the S&P Shariah outperforming its counterpart by 2.7%. Similarly, the Dow Jones Islamic Market (DJIM) Europe and DJIM Emerging Markets outperformed their conventional counterparts by over 8.0%.

Investor behavior reflects this trend, as many choose to invest more when higher profits are likely. Consequently, Shariah-compliant market indicators have proven to be effective (Rehman et al., 2020; Balcılar et al., 2015; Hammoudeh et al., 2014). Amid crises like the COVID-19 pandemic, investors tend to (1) question stock returns and exercise caution and (2) seek information on the principles of Shariah-compliant investment structures, which demonstrate greater resilience during viral crises (Balcılar et al., 2015). Differences between Shariah-compliant and non-compliant indicators, particularly regarding screening criteria and financial features, have been well-documented (Farooq & Alahkam, 2016).

In recent decades, Islamic finance has undergone unprecedented growth, with total assets increasing from $200 billion in 2003 to a projected $4 trillion by 2030 (Alam & Seifzadeh, 2020).

Building on this context, the present study examines the effects of climate policy uncertainty (CPU) and infectious disease risk (IDR) on the Islamic Dow Jones Index (IDJI) and investigates the co-movement of financial markets. The paper is structured as follows: Section 2 provides an overview of the related literature. Section 3 discusses the research methodology and data collection process. Section 4 presents the study's results, while Section 5 concludes by emphasizing the significance of the key findings.

Literature Review

Among the studies on Shariah-compliant investments, relatively few focus on the Dow Jones Islamic Stock Market Index (DJIMI) (Al-Khazali et al., 2014; El Khamlichi et al., 2014; Ho et al., 2014; Charles et al., 2015; Shamsuddin, 2014; Jawadi et al., 2014; Ftiti & Hadhri, 2019; Charles et al., 2017). These studies often employ similar methods to compare DJIMI's performance with other indices, but differences arise due to variations in metrics and criteria used to assess performance. For example, Al-Zoubi and Maghyereh (2007) found that the Islamic index is less risky and performs better than the Dow Jones World Index. Hassan and Girard (2010) analyzed market performance and the time-varying risk-return relationship, concluding that DJIM outperforms conventional indices, with similar risk-reward profiles and diversification benefits across both.

Conversely, other studies, such as Hakim and Rashidian (2002), Miniaoui et al. (2015), Girard and Hassan (2008), and Hopner et al. (2011), identified only minor differences between the performance of conventional and Islamic indices. Tahir and Ibrahim (2020) reported that Shariah-compliant companies (SCCs) outperform their non-Shariah-compliant counterparts in terms of market returns and accounting practices.

Abduh (2020) investigated the fluctuations of standard and Islamic indices during periods of financial tension in Malaysia, finding that the Islamic index exhibited less volatility than conventional indices. Similarly, Haddad et al. (2020) explored the significance of persistent versus transient shocks and their internal and external components in driving DJIM volatility over the business cycle. They concluded that universal risk factors minimally influenced the seven Dow Jones Islamic stock indicators.

In another study, Boubaker et al. (2020) analyzed the co-movement of three commodities—oil, gas, and gold—with DJIM using Wavelet Squared Coherence (WSC). Their findings revealed a significant relationship between DJIM and oil prices, suggesting that investors should account for these commodity prices when making decisions.

On the broader topic of climate change, Chang et al. (2017) examined its impact on industrial sectors, noting that long-term shifts in global temperatures and precipitation patterns could reduce industrial production. They recommended increasing capital inflows into the industrial sector to counteract such effects and fostering interconnections between economic sectors. Arnell (2004) also investigated the relationship between meteorological factors and the manufacturing sector in the US, demonstrating that climate influences manufacturing outputs, which in turn affect the overall economy.

Additionally, the concept of global market integration has garnered significant attention in recent decades. Han, Liu, and Yin (2019) concluded that economic uncertainty in the US—a major global economy—can devalue unstable currencies while enhancing the value of stable ones. McIver and Kang (2020) highlighted that spillover effects among economies have become more pronounced since the recent financial crisis.

In summary, existing literature offers varied insights. However, it does not provide a comprehensive analysis of the combined effects of climate policy uncertainty (CPU) and infectious disease risk (IDR) on the Islamic Dow Jones Index (IDJI). Furthermore, government policies and regulations, which are subject to frequent amendments, continue to shape the fiscal strategies of various companies. Therefore, this study seeks to contribute new evidence on the impact of CPU and IDR on the IDJI.

Research Methodology

Data

Table 1 provides an overview of the data used in this research, which consists of monthly observations from February 2016 to March 2021. The dependent variable in this study is the Dow Jones Islamic Index (DJII), which tracks the performance of stocks traded globally, adhering to Islamic investment laws and principles. Companies included in this index must not derive more than 5% of their revenue from prohibited sources such as alcohol, tobacco, pork products, unconventional financial services, weapons and military equipment, and certain entertainment activities like gambling and casinos.

The index spans 61 countries, of which 13 are Muslim-majority, while the rest represent countries with religions other than Islam. Notably, 21% of the countries in this index are Muslim, but their weighted contribution to the index is only 1.1%. The total market value of this index is approximately $4.5 trillion, with Muslim-majority countries accounting for around $487 billion of that value (S&P Global).

The primary independent variables in this research are Climate Policy Uncertainty (CPU) and Infectious Disease Risk (IDR). Additionally, several sub-variables are included: World Geopolitical Risk (WGPR), Global Economic Policy Uncertainty (GEPU), US Equity Market Volatility (EMV), the Financial Stress Index (FSI), the Oil Volatility Index (OVI), the US Long-

Term Interest Rate (LINR), and the US Short-Term Interest Rate (SINR).

The main objective of this study is to examine the impact of risk and uncertainty factors on the Dow Jones Islamic Index (DJII) using the Structural Vector Autoregressive (SVAR) model. Moreover, the study explores the interrelationships between these variables through contour plot graphs.

Table 1. Definition of Variables

Variable	Symbol	Source
Islamic Dow Jones Index	IDJ	S&P
Climate Policy Uncertainty	CPU	Economic Policy Uncertainty
Infectious Disease Risk	IDR	Economic Policy Uncertainty
World Geopolitical Risk	WGPR	Economic Policy Uncertainty
Global Economic Policy Uncertainty	GEPU	Economic Policy Uncertainty
US Equity Market Volatility	EMV	Economic Policy Uncertainty
Financial Stress Index	FSI	US Department of the Treasury
Oil Volatility Index	OVI	Federal Reserve Economic Data (FRED)
U.S. Long Interest Rate	LINR	OECD.Stat
US Short Interest Rate	SINR	OECD.Stat

Source: Research results

Table 2 presents the descriptive statistics for the data used in this study. The average value of the Dow Jones Islamic Index (IDJ) during the review period, spanning February 2016 to March 2021, was 5,315.350. Additionally, the average Global Economic Policy Uncertainty (GEPU) was 181.620, while the average Infectious Disease Risk (IDR) was 5.454. As shown in Figure 1, an increase in global climate policy uncertainty, coupled with higher fossil fuel consumption and production levels, coincided with a boom in the IDJ market, particularly in the early months of 2019. However, the outbreak of the COVID-19 pandemic in late 2019 and its widespread escalation in 2020 led to heightened infectious disease risk, causing the IDJ index to enter a recession. Following the global production and distribution of vaccines in mid-2020, the index began to recover, resuming its upward trajectory.

Table 2. Descriptive statistics

Variable	Mean	Median	SD	Min	Max	Obs.
IDJ	5315.350	5255.131	1166.607	3575.218	8369.518	63
CPU	181.620	170.260	104.475	37.720	629.020	63
IDR	5.545	0.0472	10.741	0.111	50.373	63
WGPR	143.224	125.739	55.078	65.414	380.596	63
GEPU	229.977	226.787	73.014	126.387	437.049	63
EMV	21.039	18.335	9.066	9.569	63.363	63
FSI	-2.317	-2.547	1.356	-4.018	2.413	63
OVI	40.382	34.403	22.735	21.587	165.059	63
LINR	1.990	2.090	0.724	0.620	3.150	63
SINR	1.280	1.250	0.836	0.100	2.690	63

Source: Research results

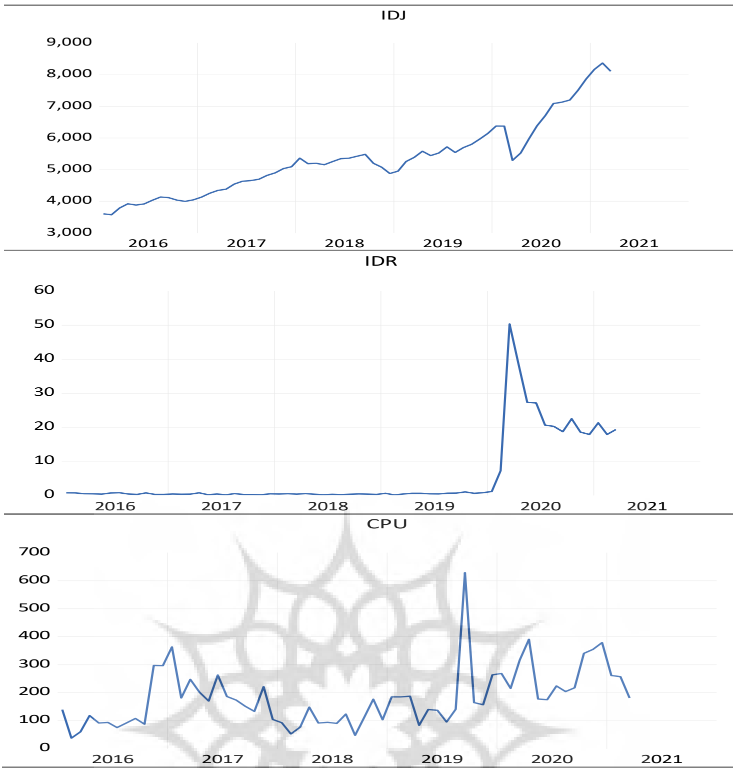


Figure 1. Time Series Trends of IDJ, IDR, and CPU

Source: Research results

Table 3 illustrates the correlation between the variables. Notably, there is a significant correlation between IDR (Infectious Disease Risk) and LINR (Long-Term Interest Rate), IDR and EMV (Equity Market Volatility), and IDR and OVI (Oil Volatility Index). These correlations can be explained by the economic impact of increased infectious disease risks, such as the outbreaks of Ebola and COVID-19 in 2019, which pushed developed economies into recession. In response, policymakers lowered interest rates to stimulate economic activity. Additionally, the heightened risk of infectious diseases led to increased volatility in both the US stock and oil markets, resulting in a positive correlation between IDR and these volatility indices. Figure 2 further demonstrates these relationships. It shows that with the escalation of infectious disease risks during the COVID-19 pandemic in early 2020, volatility rates in the US oil and stock markets surged, while long-term interest rates in the US declined.

Table 3. Correlation of Variables

	IDJ	CPU	IDR	EMV	FSI	OVI	LINR	SINR	WEPU	WGPR
IDJ	1.000									
CPU	0.214	1.000								
IDR	0.347	0.428	1.000							
EMV	0.215	0.196	0.706	1.000						
FSI	-0.351	-0.308	-0.327	0.000	1.000					
OVI	0.066	0.298	0.747	0.636	0.170	1.000				
LINR	-0.293	-0.420	-0.755	-0.431	0.113	-0.551	1.000			
SINR	-0.136	-0.269	-0.528	-0.120	-0.010	-0.369	0.663	1.000		
WEPU	0.315	0.520	0.666	0.603	-0.256	0.511	-0.593	-0.172	1.000	
WGPR	-0.028	-0.079	-0.365	-0.180	-0.019	-0.333	0.361	0.579	0.011	1.000

Source: Research results

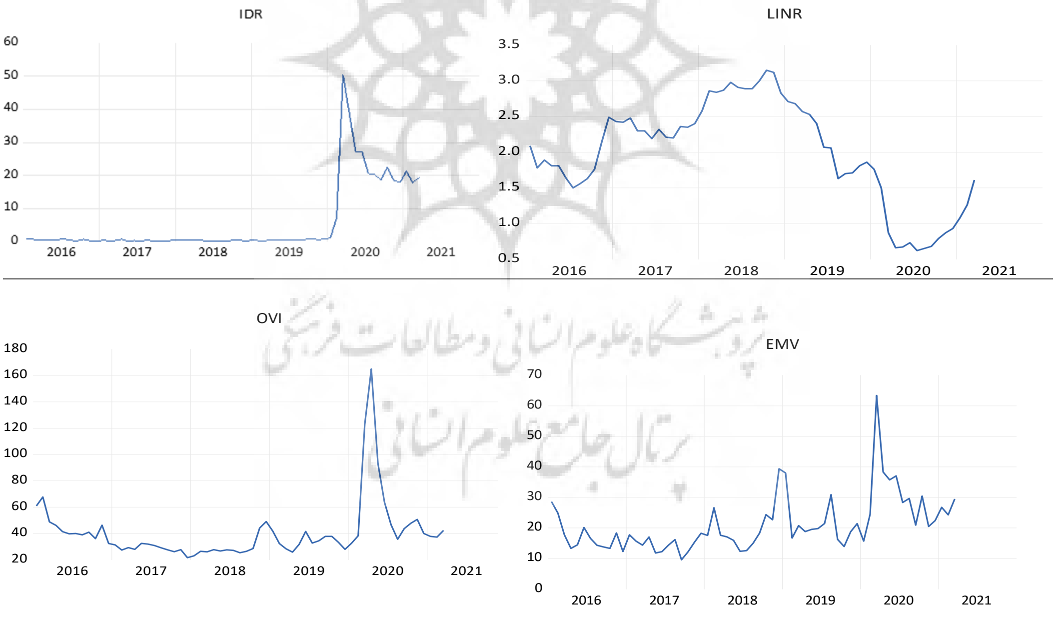


Figure 2. Time Series Trends of IDR, LINR, EMV, and OVI

Source: Research results

Methodology

SVAR model

The SVAR pattern starts from a VAR(p) standard reduced-form model as Equation 1:

$$y_t=A(L)y_{t-1}+u_t \quad (1)$$

Where yt is a Kx1 vector of time series variables, A(L) is a polynomial matrix as an intermittent operator L, and ut is a Kx1 vector of lag components with a variance-covariance matrix E[utu’t]=Σ and t=1, …, T. VAR Model may have an intercept and trend (Frasher et al., 2008).

The general relationship between reduced-form shocks and structural shocks in the SVAR model is as follows.

$$Au_t=Be_t \quad (2)$$

Where ut and et are reduced-form lag sentences vectors and structural lag sentences with Kx1 dimensions, respectively. A and B are invertible matrices with KxK dimensions, which express the simultaneous correlation between variables. The most common and practical types of constraints applied to the SVR model are as follows:

1) B=IK. IK is the square matrix of K order. In this case, Aut=et. For system identification, a set of constraints is applied to matrix A. Linear constraints on A can be written as vec(A)=RAɣA+rA, where ɣA contains all non-constrained elements of matrix A, RA is a suitable matrix with elements 0-1, and rA is a vector of normalized fixed elements.

2) A=IK. IK is a square matrix of K order. In this case, ut=Bet. For system identification, a set of constraints is applied to matrix B. Linear constraints on B can be written as vec(B)=RBɣB+rB, where ɣB contains all non-constrained elements of matrix B, RB is a suitable matrix with elements 0-1.

3) Model AB consists of two sets of constraints on the matrix A and matrix B, similar to models 1 and 2, where Aut=Bet. In this case, two sets of constraints, vec(A)=RAɣA+rA and vec(B)=RBɣB+rB, are used for the system identification.

4) Sometimes, prior information on the long-term effects of some shocks may be available. In this case, a model called Model C is used. The general form of the SVAR model can be written as Equation 3:

$A(I_K-A_1L-A_2L^2-\dots-A_PL^P)y_t=Be_t$ (3)

For simplification, $\overline{A}=(I_K - A_1L - A_2L^2 - \dots - A_PL^P)$ then $\overline{A}^{-1}$ is the matrix of long-term effects of the reduced form of VAR shocks. Equation 3 can be rewritten as Equation 4:

$$y_t = \overline{A}^{-1}Be_t \quad (4)$$

Where $C = \overline{A}^{-1}B$ is the matrix of long-term response to orthogonal shocks and yt=Cet. In the long-run model, constraints are applied to the elements of matrix C (Lutkpel, 2004). Identification of VAR in Model 1 requires applying sufficient constraints to decompose ut and obtain economically significant structural shocks. If et is a Kx1 vector of independent structural shocks, then $E[e_te_t] = I_n$ a matrix-like A is required, where Aut=et. The jth column of the matrix (a_j) A is an impulse vector representing the simultaneous effect of the jth structural impulse as a standard deviation on the endogenous variable of the system; therefore:

$$\Sigma = E[u_tu_t'] = AE[e_te_t']A' = AA' \quad (5)$$

To identify the pattern, applying a minimum of K(K-1)/2 constraints on matrix A is necessary. The most common and traditional method most researchers use is the Cholesky Decomposition, in which matrix A has a conjunctive structure and becomes a lower triangular matrix (Frasher et al., 2008).

Results

Table 4 presents the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for unit root analysis. The results indicate that none of the variables are stationary at level I(0). However, they become stationary after applying the first difference.

Furthermore, the model's degrees of freedom decrease as the lag increases. Therefore, after confirming the stationarity of the variables, determining the optimal lag length for the vector autoregression (VAR) model is crucial. The Schwarz criterion is applied to achieve this, as it minimizes lag selection time while maintaining model efficiency (Wooldridge, 2013). The results for the optimal lag length determination are summarized in Table 5.

Table 4. ADF and PP unit root test

	ADF		PP	
Variables	Level	1st diff.	Level	1st diff.
IDJ	0.620	-5.070*	-0.496	-34.974*
CPU	-0.768	-8.956*	-1.209	-27.569*
IDR	-0.331	-10.444*	-0.255	-11.735*
EMV	-0.054	-5.951*	-1.443	-11.121*
FSI	-0.734	-9.027*	-1.181	-18.184*
OVI	-0.492	-8.997*	-0.290	-9.178*
LINR	-1.702	-8.173*	-1.704	-8.873*
SINR	-1.273	-7.089*	-1.371	-7.033*
WEPU	-0.631	-5.806*	-0.655	-5.862*
WGPR	-0.373	-5.083*	-0.657	-5.083*

Source: Research results
Note: * Significant at 1 % level.

Table 5 indicates that the lowest value of the Schwarz statistic corresponds to the first lag, identifying the optimal lag as pattern 1.

Additionally, the Johansen-Juselius multivariate cointegration technique was employed to detect and evaluate the cointegration relationships between the variables. This method uses both the trace and maximum eigenvalue tests, with the results summarized in Table 6.

Tabe 5. VAR Lag Order Selection Criteria

Lag Length Criteria	0	1	2	3
SC	74.895	71.290*	72.997	72.640

Source: Research results
SC: Schwarz information criterion

Given that the research model comprises 10 variables, there is potential for up to 9 interrelated relationships among them. However, based on the results presented, the statistical values of both the trace and maximum eigenvalue tests are below the critical values at the 95% confidence level. Consequently, no cointegration or long-term relationship exists among the research variables.

Table 6. Trace and Maximum Eigenvalue Test for Cointegration

	H_0	H_1	Trace Statistic	0.05 Critical Value
Trace Test	r = 0	r ≥ 1	273.188	469.929
	r ≤ 1	r ≥ 2	228.297	325.005
	r ≤ 2	r ≥ 3	187.470	216.600
	r ≤ 3	r ≥ 4	150.558	154.924
	r ≤ 4	r ≥ 5	101.915	117.708
	r ≤ 5	r ≥ 6	58.484	88.803
	r ≤ 6	r ≥ 7	22.324	63.876
	r ≤ 7	r ≥ 8	7.648	42.915
	r ≤ 8	r ≥ 9	2.459	25.872
Maximum Eigenvalue Test	H_0	H_1	Trace Statistic	0.05 Critical Value
	r = 0	r = 1	68.812	144.923
	r ≤ 1	r = 2	62.752	108.404
	r ≤ 2	r = 3	56.705	61.675
	r ≤ 3	r = 4	50.599	53.009
	r ≤ 4	r = 5	43.431	44.579
	r ≤ 5	r = 6	36.160	38.331
	r ≤ 6	r = 7	14.675	32.118
	r ≤ 7	r = 8	5.188	25.823
	r ≤ 8	r = 9	1.874	19.387

Table 7 presents the results of the Structural Vector Autoregressive (SVAR) model. The matrix's last row shows the independent variables' effects on the Dow Jones Islamic Index (IDJ). Notably, the coefficients for CPU (Climate Policy Uncertainty) and IDR (Infectious Disease Risk) are 32.052 and -2.992, respectively, and both are highly significant. This indicates that the CPU positively impacts the IDJ, while IDR has a negative impact.

An increase in the CPU index reflects greater utilization of Earth's resources to produce goods and services by companies within the index, thereby boosting the IDJ. Conversely, an increase in the IDR index is associated with heightened economic recession, which leads to a decline in the IDJ.

Additionally, US EMV (Equity Market Volatility), FSI (Financial Stress Index), OVI (Oil Volatility Index), WGPR (World Geopolitical Risk), and GEPU (Global Economic Policy Uncertainty) all have negative impacts on the IDJ. Similarly, US LINR (Long-Term Interest Rate) and SINR (Short-Term Interest Rate) significantly negatively affect the IDJ. Rising interest rates discourage investment, ultimately reducing the value of the IDJ.

Table 7. SAVR Regression Result

Variables	CPU	IDR	EMV	FSI	OVI	SINR	LINR	WGPR	WEPU	IDJ
CPU	277.004 (0.000)	0	0	0	0	0	0	0	0	0
IDR	-48.476 (0.000)	74.292 (0.000)	0	0	0	0	0	0	0	0
EMV	-2.577 (0.000)	-0.803 (0.112)	3.349 (0.000)	0	0	0	0	0	0	0
FSI	-4.891 (0.000)	-1.469 (0.017)	1.909 (0.000)	3.530 (0.000)	0	0	0	0	0	0
OVI	-0.714 (0.000)	-0.397 (0.000)	-0.318 (0.000)	0.202 (0.003)	0.438 (0.000)	0	0	0	0	0
SINR	-11.927 (0.000)	-3.383 (0.000)	4.645 (0.000)	0.546 (0.311)	1.175 (0.024)	3.399 (0.000)	0	0	0	0
LINR	3.036 (0.000)	0.100 (0.007)	-0.082 (0.017)	-0.002 (0.339)	-0.150 (0.000)	-0.013 (0.579)	0.168 (0.000)	0	0	0
WGPR	0.120 (0.000)	0.065 (0.030)	0.031 (0.290)	-0.120 (0.000)	-0.090 (0.000)	-0.039 (0.030)	0.088 (0.000)	0.081 (0.000)	0	0
WEPU	-9.650 (0.136)	-7.890 (0.213)	-18.65 (0.001)	9.404 (0.090)	1.117 (0.377)	-7.756 (0.150)	18.074 (0.000)	-20.514 (0.000)	23.059 (0.000)	0
IDJ	32.052 (0.000)	-2.992 (0.002)	-4.502 (0.004)	-4.823 (0.003)	-2.271 (0.000)	-8.042 (0.000)	-7.710 (0.092)	-3.406 (0.052)	-17.833 (0.000)	24.523 (0.000)

Source: Research results
Note: shows the prob. value

Figure 3 illustrates the impulse response functions of the Dow Jones Islamic Index (IDJ) to standard deviation shocks in the independent variables over a 10-month duration. These responses exhibit various patterns, reflecting the dynamics of the relationships.

The IDJ’s response to CPU (Climate Policy Uncertainty) shocks initially decreases until the fourth period, then increases until the eighth period, after which it declines and approaches zero. Similarly, the IDJ’s response to IDR (Infectious Disease Risk) shocks decreases from the second to the fifth period, continues to decline until the seventh period, and then turns negative.

For GEPU (Global Economic Policy Uncertainty) shocks, the IDJ’s response decreases steadily until the sixth period, reaches zero by the eighth period, and then begins to rise. In contrast, the response to EMV (Equity Market Volatility) shocks increases until the second period, then decreases and turns negative between the second and fourth periods. It recovers to zero in the seventh period and continues to rise thereafter.

The IDJ’s response to FSI (Financial Stress Index) shocks follows a sinusoidal pattern. It decreases between the first and second periods, increases from the second to the fifth periods, declines again until the eighth period, and finally rises. For OVI (Oil Volatility Index) shocks, the response decreases until the second period, increases until the seventh period, and then declines again.

The IDJ’s response to SINR (Short-Term Interest Rate) shocks remains almost constant until the third period, decreases until the fifth period, rises until the ninth period, and stabilizes thereafter. Meanwhile, the response to LINR (Long-Term Interest Rate) shocks increases until the fourth period, decreases until the seventh period, remains constant from the seventh to the eighth period, and then resumes an upward trend.

Finally, the IDJ’s response to WGPR (World Geopolitical Risk) shocks decreases until the sixth period and then begins to rise steadily from the sixth period onwards

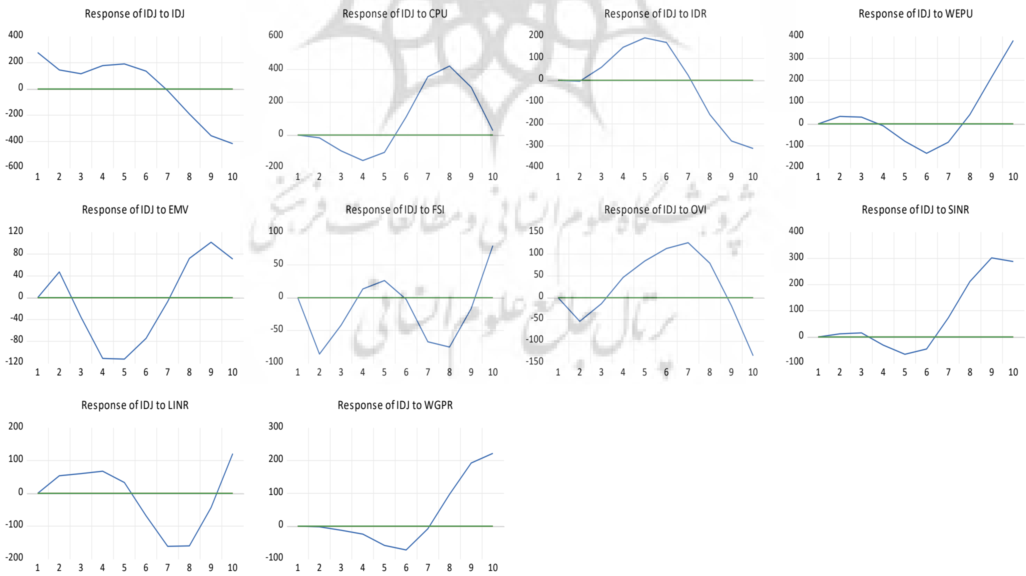


Fig 3. Impulse Response Function

Source: Research results

Table 8 and Figure 4 present the variance decomposition functions. Using the Forecast Error Variance Decomposition (FEVD) method, the contribution of each variable's volatility to external shocks affecting the system variables is determined. Over short-term and 10-month horizons, the contributions of CPU (Climate Policy Uncertainty), IDR (Infectious Disease Risk), and US LINR (Long-Term Interest Rate) and SINR (Short-Term Interest Rate) are 21.48%, 14.21%, 10.96%, and 11.22%, respectively, collectively accounting for 57.87% of the changes in the IDJ index after 10 months. This underscores the significant and influential role of climate policy and infectious diseases in shaping financial markets.

The IDJ index (dependent variable) initially explains 100% of its own variance at the start of the period. However, this proportion declines to 23.39% by the end of the seventh period. This trend reverses slightly from the eighth to the tenth period, with the IDJ's contribution increasing to 25.80%.

The contribution of the CPU variable starts at 0% in the first period and rises to a peak of 35.92% in the eighth period. This share then decreases during the ninth and tenth periods. Meanwhile, the IDR variable exhibits an increasing influence on IDJ changes until the sixth period, declines from the seventh to the ninth period, and increases again in the tenth period.

The trends for other variables are also evident in Figure 4 and Table 8, which provide further clarity on their individual contributions to the variance of the IDJ index over time.

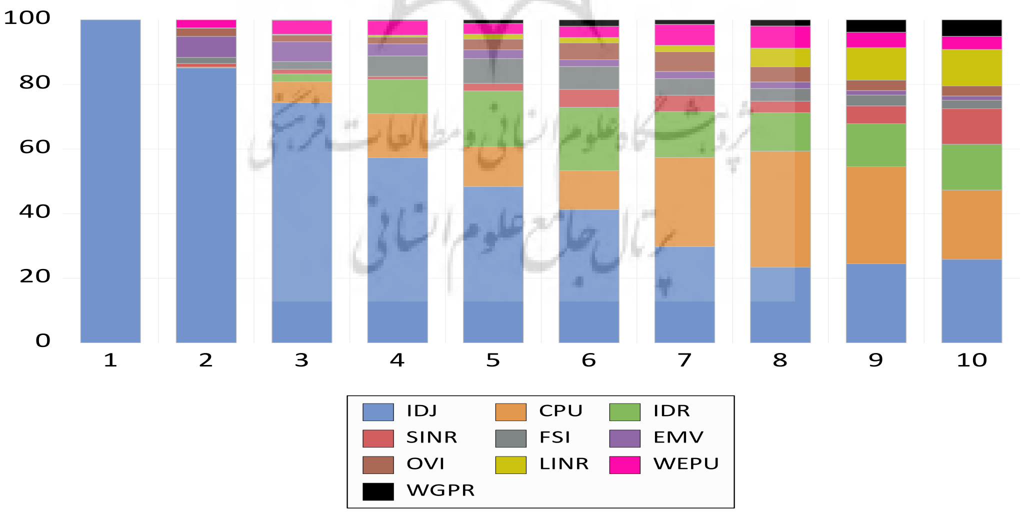


Fig 4. Variance Decomposition

Source: Research results

Table 8. Variance Decomposition

Period	IDJ	CPU	IDR	SINR	FSI	EMV	LINR	OVI	WEPU	WGPR
1	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	85.09	0.27	0.01	1.05	0.00	2.48	0.12	2.55	6.45	1.93
3	74.31	6.54	2.40	1.45	0.11	4.34	0.26	2.09	6.14	2.33
4	57.26	13.70	10.58	0.90	0.30	4.45	0.56	2.11	3.75	6.34
5	48.38	12.31	17.28	2.30	1.14	3.28	1.55	3.32	2.70	7.69
6	41.25	12.03	19.61	5.54	1.99	3.50	1.64	5.20	2.09	7.10
7	29.77	27.59	14.22	5.05	1.44	6.45	1.98	6.13	2.18	5.13
8	23.39	35.92	11.91	3.54	1.90	6.86	5.79	4.69	2.02	3.93
9	24.44	30.06	13.32	5.50	3.80	4.78	10.10	3.21	1.38	3.36
10	25.80	21.48	14.21	10.96	5.09	4.12	11.22	3.14	1.29	2.64

Source: Research results

In this section, the effects of the interrelationships between the two main independent variables—Climate Policy Uncertainty (CPU) and Infectious Disease Risk (IDR)—as well as other independent sub-variables on the dependent variable (IDJ), are analyzed using contour plot graphs. A contour graph provides a way to visualize three-dimensional data in a two-dimensional space. These graphs use three levels of intensity: Low (blue dots), Medium (green dots), and High (yellow dots). Figures 5 and 6 depict these relationships.

Table 9 presents the results of the contour analysis, examining how reciprocal relationships between the independent variables influence the dependent variable (IDJ).

- Figure 5a illustrates the interaction between CPU and EMV on the IDJ. At low and medium levels, the interplay between these variables decreases the IDJ (blue dots), but at high levels, the interaction positively affects IDJ (yellow dots).
- Figure 5b shows the interaction between CPU and FSI on the IDJ. At high levels, the combined effect of these variables on the IDJ is negative.

- Figure 5c depicts the interaction between IDR and CPU on the IDJ. At low levels, their combined effect is negative. At medium levels, the effect becomes mildly positive, and at high levels, it is strongly positive. This result suggests that high levels of climate policy uncertainty and infectious disease risk positively impact the Dow Jones Islamic Stock Index. This could be attributed to increased utilization of land resources by manufacturing plants, leading to higher production. Additionally, the rising risk of infectious diseases may drive inflation, which in turn stimulates IDJ growth.

The analysis of other figures follows a similar pattern, demonstrating the varying effects of these interrelationships across different levels of the variables.

Table 9. Interaction of CPU, IDR, and Other Variables on IDJ

Variables	EMV			FSI			IDR			OVI			LINR			SINR			WEPU			WGPR		
Level	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H
CPU	-	-	+	-	-	-	-	-	+	-	+	-	-	+	-	-	+	+	-	-	+	-	-	+
IDR	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	+	-	-	+	+

Source: Research results

Note: L, M, and H mean Low, Medium, and high levels

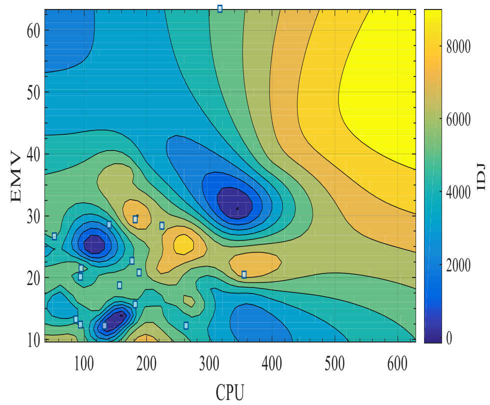


Fig. 5a

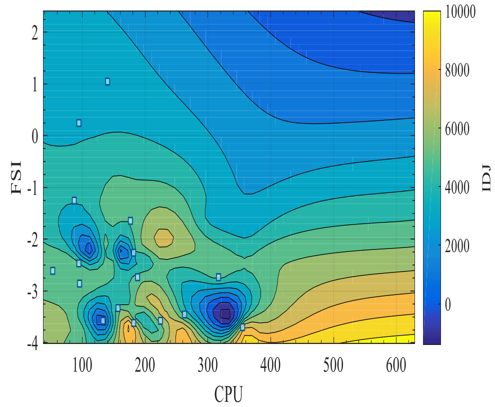


Fig. 5b

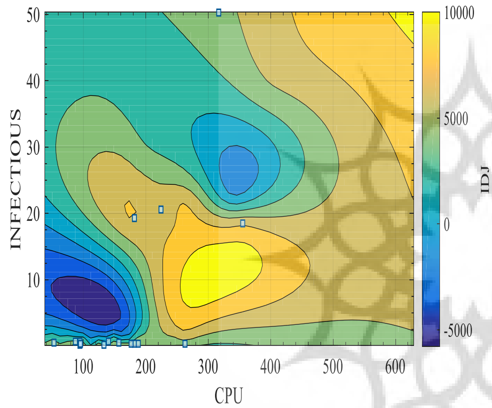


Fig. 5c

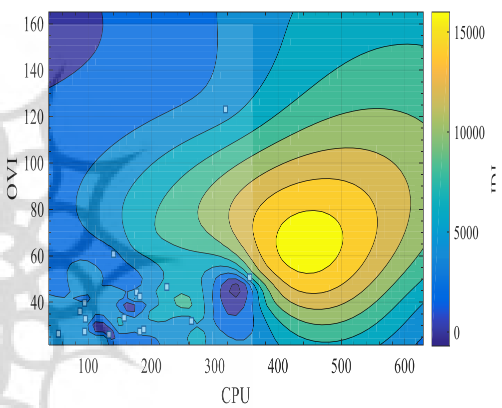


Fig. 5d

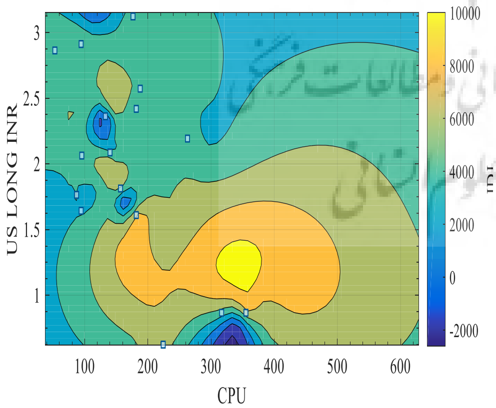


Fig. 5e

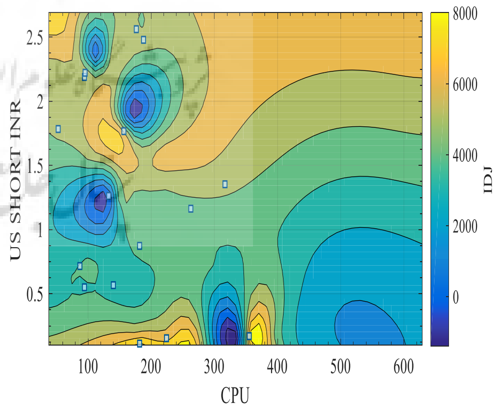


Fig. 5f

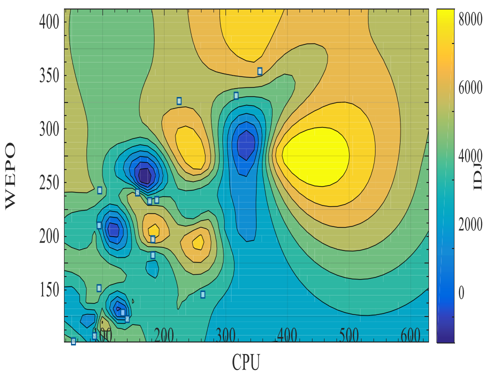


Fig. 5g

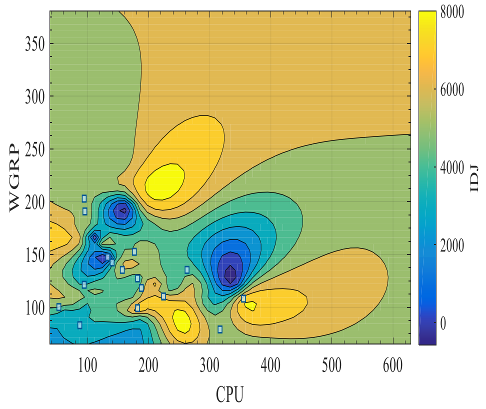


Fig. 5h

Fig 5. Interaction of CPU and Other Variables on IDJ

Source: Research results

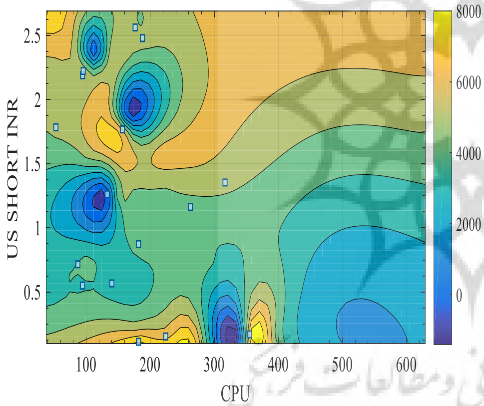


Fig. 6a

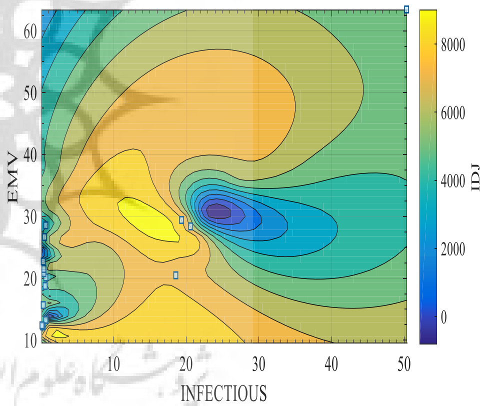
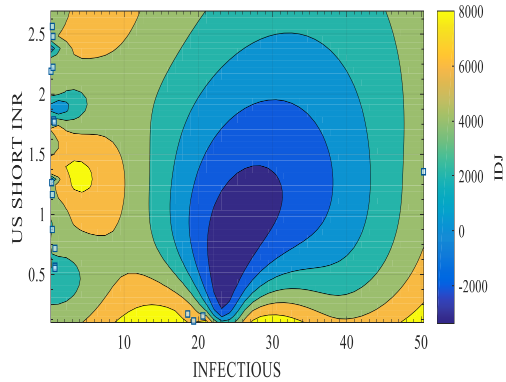


Fig. 6b



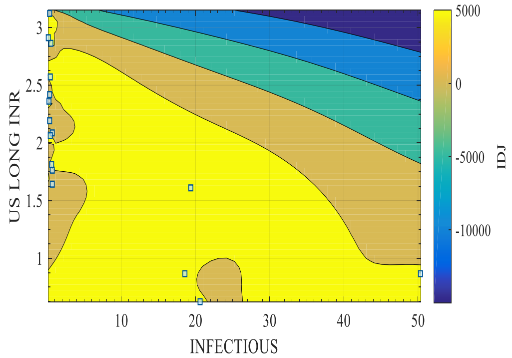
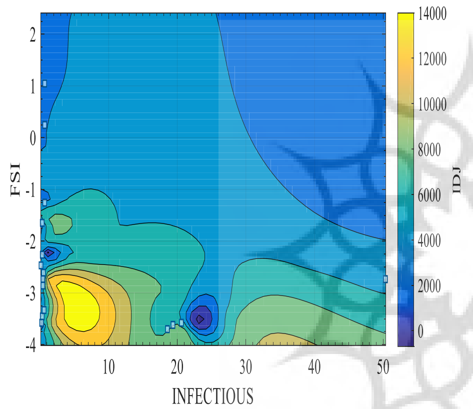


Fig. 6c **Fig. 6d**



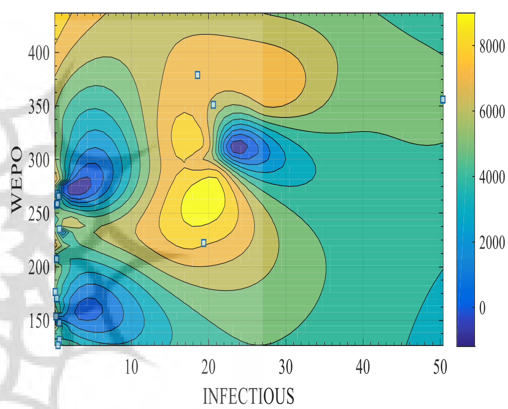
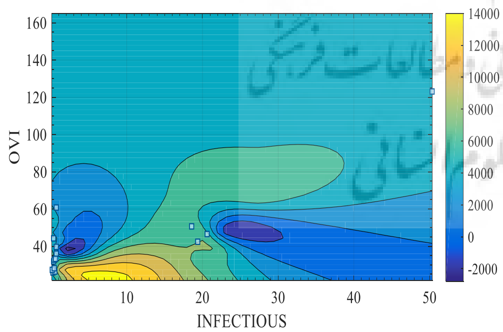


Fig. 6e **Fig. 6f**



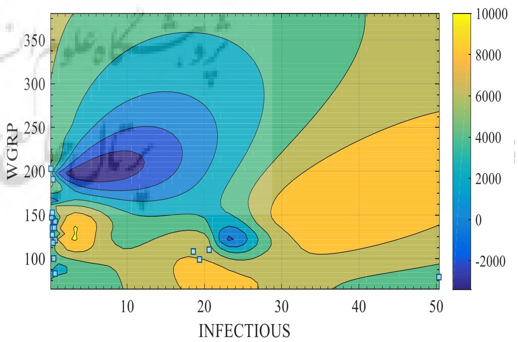


Fig. 6g **Fig. 6h**

Fig 6. Interaction of IDR and Other Variables on IDJ

Source: Research results

Discussion and Conclusion

This paper examines the impact of Climate Policy Uncertainty (CPU) and Infectious Disease Risk (IDR) on the Islamic Dow Jones Index (IDJ). The analysis utilizes monthly data spanning from January 2016 to March 2021, employing a Structural Vector Autoregressive (SVAR) model. Additionally, Contour Plot graphs are used to estimate the effects of interaction on the IDJ. Other variables considered in the study include World Geopolitical Risk (WGPR), Global Economic Policy Uncertainty (GEPU), US Equity Market Volatility (EMV), Financial Stress Index (FSI), Oil Volatility Index (OVI), and US Long-Term (LINR) and Short-Term Interest Rates (SINR).

The results reveal that CPU and IDR have contrasting impacts on the IDJ. CPU positively influences the IDJ, as increased climate policy uncertainty often drives companies to utilize more of Earth's resources to boost production and economic activity, thereby enhancing stock market performance. However, this economic prosperity comes at an environmental cost, such as rising global temperatures, sea level increases, and declining agricultural yields, which pose significant risks to long-term sustainability.

In contrast, IDR negatively impacts the IDJ. As infectious disease risk rises, economic recessions become more prevalent, reducing consumer demand and dampening economic activity, ultimately leading to declines in stock market indices.

A key finding of this study is that, over a 10-month horizon, CPU and IDR exert the most significant influence on the IDJ. Following these two variables, US short-term and long-term interest rates also significantly affect the index.

Based on these findings, the study recommends that policymakers take proactive measures to mitigate these risks. For instance, administering booster doses of COVID-19 vaccines can help reduce the risk of infectious diseases. Furthermore, adhering to the Paris Climate Agreement can help alleviate climate policy uncertainty, promoting a more stable and sustainable economy. Based on the findings of this study, policymakers are encouraged to adopt a multifaceted approach to address the dual challenges of climate policy uncertainty and infectious disease risk, both of which significantly impact the Islamic Dow Jones Index (IDJ) and broader financial markets.

1. Mitigating Infectious Disease Risks

- **Accelerating Vaccine Distribution:** Policymakers should ensure widespread availability of COVID-19 booster vaccines and other immunizations to minimize the spread of infectious diseases. Governments can partner with pharmaceutical companies and international health organizations to ensure equitable vaccine access globally, especially in low-income countries.
- **Enhancing Healthcare Infrastructure:** Increased investment in healthcare systems is essential to improve preparedness for future pandemics. This includes building more hospitals, training healthcare professionals, and strengthening supply chains for critical medical equipment.
- **Establishing Pandemic Early Warning Systems:** A global disease monitoring network should be developed to rapidly detect and respond to infectious disease outbreaks. Leveraging artificial intelligence and big data analytics can help identify and mitigate risks before they escalate.
- **Public Awareness Campaigns:** Governments should invest in public health education to encourage preventive measures, such as hygiene practices and vaccination uptake, reducing pandemics' societal and economic impacts.

2. Addressing Climate Policy Uncertainty

- **Commitment to International Agreements:** Policymakers should reaffirm and strengthen commitments to the Paris Climate Agreement and other global initiatives to reduce greenhouse gas emissions. Setting clear, actionable goals and timelines will reduce policy uncertainty, giving businesses the confidence to make long-term investments.
- **Promoting Renewable Energy Adoption:** To reduce dependency on fossil fuels, governments should incentivize the adoption of renewable energy technologies. Subsidies, tax credits, and grants for solar, wind, and other sustainable energy sources can facilitate the transition to a greener economy.
- **Implementing Carbon Pricing Mechanisms:** Introducing carbon taxes or cap-and-trade systems can encourage industries to reduce emissions while generating revenue that can be reinvested in sustainable projects.

- **Encouraging Green Financial Instruments:** Governments and financial institutions should promote green bonds, sustainable investments, and socially responsible investment (SRI) funds to direct capital toward environmentally friendly projects and technologies.

3. Strengthening Financial Market Resilience

- **Developing Financial Stress Mitigation Policies:** Regulators should create contingency plans to address market volatilities caused by external shocks, such as infectious disease outbreaks and climate crises. Policies to stabilize financial systems, such as targeted stimulus packages, can help mitigate recessionary effects.
- **Diversifying Financial Portfolios:** Policymakers should encourage investors to diversify portfolios by including Shariah-compliant and sustainable financial products. Diversification can reduce exposure to specific market risks associated with global crises.
- **Fostering Regional Cooperation:** Economic collaboration among countries can mitigate the adverse effects of global uncertainties. Sharing best practices, financial resources, and technological innovations can enhance resilience to both climate and health-related risks.

4. Encouraging Corporate Responsibility

- **Mandating ESG Reporting:** Governments should require companies to disclose environmental, social, and governance (ESG) metrics, ensuring transparency in their sustainability practices. Such disclosures can attract socially responsible investors and enhance public trust.
- **Incentivizing Sustainable Business Practices:** Providing tax benefits, grants, or public recognition to companies adopting sustainable production methods and adhering to strict environmental standards can promote eco-friendly industrial growth.
- **Promoting Innovation in Green Technologies:** Encouraging research and development (R&D) in sustainable technologies can lead to breakthroughs that reduce environmental impact and improve economic performance.

By adopting these policies, governments can mitigate the negative impacts of infectious disease risks and climate policy uncertainty, fostering a more stable and sustainable economic environment. These measures support financial markets like the IDJ and contribute to broader societal and environmental well-being.

Declaration of Conflicting Interests

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