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## How closely is the US stock market linked to Caribbean tax havens?

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## Abstract

This study is the first to examine the interconnectedness of the US equity market with eight Caribbean tax havens. It reveals significant, similar shock transmission between these markets during both bull and bear markets, with the exceptions of the Bahamas and Barbados. The Cayman Islands show substantial two-way shock transmission with the US, but only during normal market conditions. Post-COVID, significant shifts in network strength and direction are observed, likely due to the sensitivity of these tax havens to international capital flows. Macroeconomic uncertainty and investor sentiment explain these findings.

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# 1. Introduction

Nearly 75% of Fortune 500 companies have been maintaining subsidiaries in offshore tax havens, according to an annual study of offshore tax avoidance released by the US Public Interest Research Group Education Fund and the Institute on Taxation and Economic Policy in 2016[1]. The report further reveals a $2.5 trillion offshore cash hoarding on which these companies avoid up to $750 billion in US taxes. The US, including other higher-tax countries, frequently express concerns over how tax havens can affect their economies. With burgeoning interests, researchers over time studied whether tax havens generally bring value to a firm or affect the cost of bank loans (Hines, 2010). By contrast, this study merits a special issue: connectedness. To the best of our knowledge, this is the first study to explore the connectedness of the US equity market with their tax haven Caribbean islands. This is mainly a result of data scarcity primarily related to the secrecy of financial activities. Though plausible but not empirically evidenced, the lack of research undermines the jurisdiction's connections with the international capital market. This makes our study timelier and more relevant in the context of connectivity.

We focus on the Caribbean region, particularly the Bahamas, Barbados, Bermuda, Cayman Islands, Guyana, Jamaica, Trinidad & Tobago, and Eastern Caribbean Islands. The Caribbean is a region of the Americas that comprises the Caribbean Sea surrounding coasts and islands. Notably, this region has the highest concentration of offshore tax havens globally.

The study's selection of eight Caribbean tax havens is based solely on data availability. These jurisdictions were chosen because of the comprehensive data available in the source used to compile Table i, not because of any judgement about their status relative to other potential Caribbean tax havens with less accessible or consistently reported data.

**Table i. List of jurisdictions with underlying index**

| Jurisdiction | Equity index |
|---|---|
| Bahamas | Authors' estimation (based on 18 listed firms) |
| Barbados | Barbados Stock Exchange |
| Bermuda | Bermuda Stock Exchange |
| Cayman Islands | Authors' estimate (based on 25 listed firms) |
| Eastern Caribbean | Authors' estimate (based on 13 listed firms) |
| Guyana | Authors' estimate (based on 08 listed firms) |
| Jamaica | Jamaica Stock Exchange |
| Trinidad & Tobago | Trinidad & Tobago Stock Exchange |

*Notes*: Index and firm-level price data are acquired from Bloomberg from 4 January 2010 to 24 December 2021.

[1] Read more: https://uspirg.org/news/usf/study-73-fortune-500-companies-used-offshore-tax havens-2016.

Given the highly integrated international financial market, we utilize the contemporary quantile connectedness approach, which yields a considerably nuanced examination of the strength and direction of connectedness. Importantly, we also explore the underlying antecedents of connectedness in various market conditions.

The rest of this article proceeds as follows. Section 2 describes the data and empirical approach. Section 3 presents the findings and insights. Lastly, Section 4 concludes.

# 2. Data and method

We extract daily prices and compute returns as: $r_{(i,t)} = \ln\left(\left(p_{(i,t)}\right)/p_{(i,t-1)}\right)$. Eastern Caribbean has the largest dispersion (0.106%) while Trinidad & Tobago has the least dispersion (0.003%), as shown in Table A i. Half of the series is skewed to the left, and half of them have right-tailed distributions, but all the series are leptokurtic. The JB test statistics confirm normal distributions, and the ADF alongside PP tests imply that all the series are stationary at their levels.

Our empirical methodology comprises 2-steps. First, we follow the quantile connectedness method developed by Ando et al. (2018), built on Diebold and Yilmaz (2014). First, we estimate a Quantile Vector Autoregression ($QVAR_{(p)}$), specified as:

$$y_t = c(\tau) + \sum_{i=1}^{p} X_i(\tau)\, y_{t-i} + e_t(\tau),\ t = 1, \ldots, T \tag{1}$$

where $y_t$ refers to the n-vector of the dependent variable at a time t, $c(\tau)$ and $e\,t(\tau)$ are the n-vector of intercept and residual at quantile $\tau$, and $X_i(\tau)$ represents the matrix of lagged coefficients at quantile $\tau$ with $i = 1$, p lag length, and can be estimated assuming that residuals satisfy the quantile restrictions, $Q\tau\left(e_t(\tau)\middle|\, y_{t-i}, \ldots, y_{t-p}\text{¿}=0\right.$.

To transform the $QVAR_{(p)}$ to its $QVMA_{(\infty)}$ representation, we rely on Wold's theorem:

$$y_t = c(\tau) + \sum_{i=1}^{p} X_i(\tau)\, y_{t-i} + e_t(\tau),\ t = \mu(\tau) + \sum_{j=0}^{\infty} Y_j(\tau)\, e_{t-j}(\tau),\ t\,.$$

Accordingly, the H-step-ahead Generalised Forecast Error Variance Decomposition (GFEVD) of Koop *et al.* (1996) and Pesaran and Shin (1998) is employed to expose the impact a shock in the variable *i* yield on variable *j*, specified as:

$$\theta_{ij}^{g}(H) = \sigma_{jj}^{-1} \frac{\sum_{h=0}^{H-1} \left(\text{é¿¿}i\, A_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(\text{é¿¿}i\, A_h \Sigma \acute{A}_h e_i \text{¿}\right)\text{¿¿}} \text{¿}$$

, where *Σ* is the variance matrix of the error vector $\varepsilon_t$, $\sigma_{jj}$ is the standard deviation of the error for the $j^{th}$ term, $e_i$ is the opted vector (1 to the $i^{th}$ element, 0 otherwise), and $A_h$ is the moving average coefficient as of the forecast at time *t*. The unit of the decomposition matrix can be normalized by the row sum as:

$\theta_{ij}^{g}(H)=\frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{N}\theta_{ij}^{g}(H)}$. By construction, $\sum_{j=1}^{N}\theta_{ij}^{g}(H)=1$ and $\sum_{i,j=1}^{N}\theta_{ij}^{g}(H)=N$. Therefore, the average contribution of the return shocks across the markets is the total connectedness as:

$$QC^{g}(H)=\frac{\sum_{\substack{i,j=1\\ i\neq j}}^{N}\theta_{ij}^{g}(H)}{N}\cdot 100 \tag{2}$$

So, the direction of shock that is given by market *i* to all other markets *j* as:

$$QC_{\cdot i}^{g}(H)=\frac{\sum_{\substack{i,j=1\\ i\neq j}}^{N}\theta_{ji}^{g}(H)}{N}\cdot 100 \tag{3}$$

The direction of shock that is taken by market *i* from all other markets *j* as:

$$QCS_{i\cdot}^{g}(H)=\frac{\sum_{\substack{i,j=1\\ j\neq i}}^{N}\theta_{ij}^{g}(H)}{N}\cdot 100 \tag{4}$$

Second, to explore the underlying antecedents of connectedness, we suggest the following regression model:

$$QCi_{t}=\alpha_{0}+b_{1}X_{t}+\varepsilon_{¿} \tag{5}$$

where $X_t$ includes the US economic policy uncertainty (*epu*), US equity market volatility (*vix*), crude oil volatility (*ovx*), gold market volatility (*gvz*), global financial stress (*gfs*), and infectious disease instigated equity market volatility (*emv*) indices[2].

# 3. Empirical findings

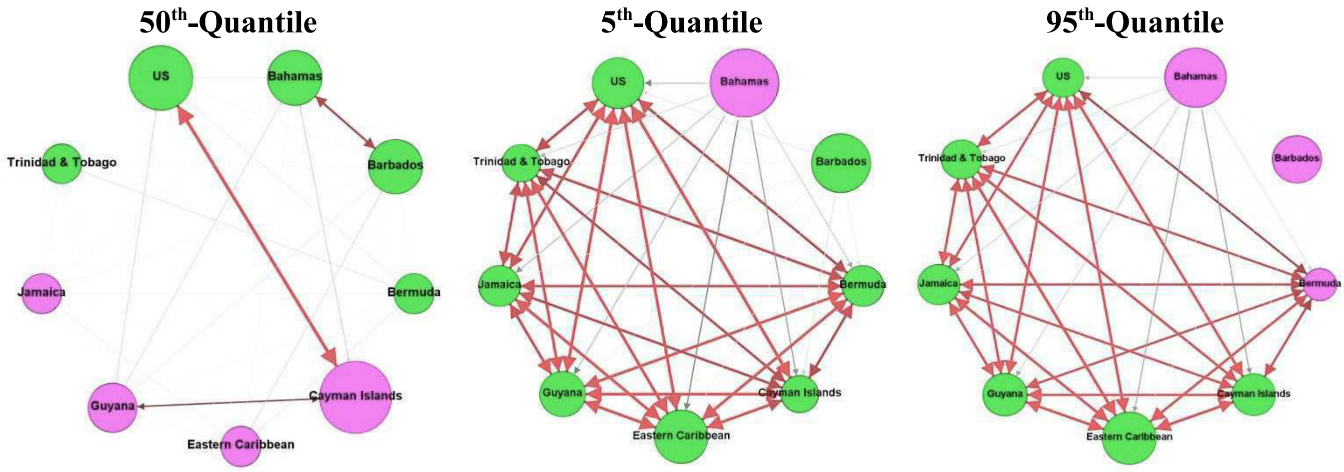
We start with the estimations of bilateral return shocks and use Gephi, open-source software to depict the strengths and directions in network diagram in normal markets (i.e.,

[2] Series are stationary, and we control heteroskedasticity and autocorrelations alongside the normality of error and misspecifications. Moreover, we have added the details of these explanatory variables in Appendix A ii.

50th-quantile, average returns), bearish market (i.e., 5th-quantile, extreme negative returns), and bullish (i.e., 95th-quantile, extreme positive returns) market, as shown in Figure 1.

We spot that the extent of connectedness in the normal market is not reflective of the level of significantly increased connectedness in bearish and bullish markets, consistent with past studies (Baumöhl, 2019). In the normal market, only the Cayman Islands depict substantial bi-directional shock transmission with the US[3]. Similar bi-directional shock transmission was exposed in the Bahamas and Barbados. However, in bearish and bullish markets, we find significant but analogous shock transmission between the US and the 6 Caribbean markets Bermuda, Cayman Islands, Eastern Caribbean, Guyana, Jamaica, and Trinidad & Tobago. Interestingly, Barbados and, to some extent, the Bahamas are isolated from the US and the rest of the Caribbean markets. During extreme conditions, the Bahamas and Barbados can provide opportunities for cross-border US investors to diversify a portfolio or hedge the risk of dramatic movements in the Caribbean markets.

**Figure 1. Network diagram of return shock transmission of the US and eight Caribbean markets**




*Notes*: This network diagram is based on the pair-wise return shocks. Node size signifies the extent, and colour specifies whether a market is a net transmitter (olive) or recipient (lilac) of shocks. The forced-directed layout algorithm sets node location where the sum of the vectors sets the node route. Arrow width signifies the strength of the pair-wise connectedness, and colour specifies the strongest (red) to weakest (black) directions of connectedness.

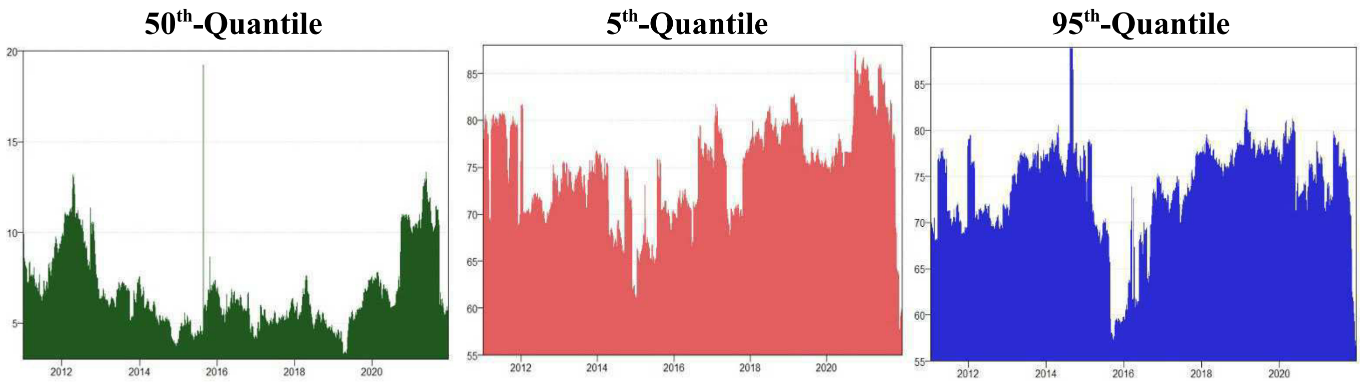
Next, we look at the unique impact of COVID-19 by highlighting the variances before and during the pandemic, as shown in Figure A1 and Figure A2, respectively. The overall results remain almost identical in the pre-COVID period. However, substantial deviations in network strengths and directions are exposed in the post-COVID period with visibly higher magnitude in extreme conditions. For instance, the US market came out as the largest net recipient of return shocks in the normal market. Bahamas is now ominously tied with the US, particularly in the normal and bearish markets. It is also highly linked with the rest of the

[3] This is not entirely surprising as the Cayman Islands has the sixth-largest portfolio capital inflow in the world (Hines, 2010).

Caribbean markets in extreme markets. The rest of the movements are intuitive with the antecedent conditions of the pandemic.

At this point, we examine the total return connectedness over time as stock market movements are highly dynamic, as shown in Figure 2. The magnitude of total connectedness[4] remains significantly higher in bearish and bullish markets throughout, implying investors react more strongly in extreme markets. This also signals higher interdependence at the extremely positive and negative return phases, insights a material challenge pricing efficiency of these markets (Baumöhl, 2019). Notably, there is an upward trend in the extreme negative return connectedness after 2015, which further intensified with the eruption of the pandemic, consistent with the increasingly integrated nature of international equity markets.

**Figure 2. Time-varying total connectedness**




*Notes*: Time-varying total connectedness is based on a 250-day rolling window. Black, Blue, and Pink trajectories refer to 0.50th, 0.5th, and 0.95th quantiles.

It would be helpful for investors to have some level of awareness in what manner return shocks are augmented by prevalent macroeconomic variables. Accordingly, we venture into the fundamental antecedents in a regression setup for extreme conditions. The model retains important variables, including local and global stress, volatility, uncertainty, and investor sentiments in alternative markets. Table ii reports the results.

The impact of US economic policy uncertainty is coherently contrasting in market conditions. Specifically, it curtails linkages in the bearish market while inflating linkages in the bullish market. Real sector and pandemic-instigated equity market volatility exert a similar impact. However, the US stock market implied volatility entails analogous impact intensifying linkages in the extreme markets, intuitive as a reaction of market players with varying expectations (Ji et al. 2019) while investor sentiments in the gold market juxtapose negative impacts. This is also consequential to the heterogeneous expectations and hedging aspects of the equity market. For instance, investors rely on gold in times of volatility in the stock market; thus, an increase in gold value is expected to decrease the demand in the stock market, shrinking the return linkages. However, in the case of the coefficient magnitude, the

[4] Total connectedness values are 01.78—18.58 in a normal market, whereas ~61.45—87.67 in a bearish market and ~57.34—88.78 in a bullish market.

global financial stress is the most dominant variable, intensifying associations in the extreme negative return phase.

**Table ii. Underlying antecedents of connectedness**

| | Variable | i | ii | Iii | Iv | v | vi | vii[5] |
|---|---|---|---|---|---|---|---|---|
| Bearish market condition | EPU | -0.009*** | | | | | | -0.008*** |
| | | (0.001) | | | | | | (0.001) |
| | VIX | | 0.022** | | | | | 0.057*** |
| | | | (0.130) | | | | | (0.012) |
| | OVX | | | -0.021*** | | | | -0.014*** |
| | | | | (0.005) | | | | (0.005) |
| | GVZ | | | | -0.307*** | | | -0.406*** |
| | | | | | (0.017) | | | (0.021) |
| | GFS | | | | | -0.224 | | 1.447*** |
| | | | | | | (0.147) | | (0.168) |
| | EMV | | | | | | 0.010 | -0.052*** |
| | | | | | | | (0.009) | (0.009) |
| | $R^2$ | 5.34 | 8.20 | 9.00 | 8.3 | 5.07 | 7.80 | 20.80 |
| | *N* | 2717 | 2717 | 2717 | 2717 | 2717 | 2717 | 2717 |
| Bullish market condition | EPU | 0.067 | | | | | | 0.003*** |
| | | (0.174) | | | | | | (0.001) |
| | VIX | | 0.049*** | | | | | 0.149*** |
| | | | (0.014) | | | | | (0.004) |
| | OVX | | | -0.008 | | | | 0.035*** |
| | | | | (0.005) | | | | (0.002) |
| | GVZ | | | | -0.176*** | | | -0.015** |
| | | | | | (0.020) | | | (0.008) |
| | GFS | | | | | -1.832*** | | 0.064 |
| | | | | | | (0.159) | | (0.059) |
| | EMV | | | | | | 0.084*** | 0.015*** |
| | | | | | | | (0.010) | (0.003) |
| | $R^2$ | 9.34 | 14.20 | 21.00 | 23.3 | 26.07 | 27.00 | 48.80 |
| | *N* | 2717 | 2717 | 2717 | 2717 | 2717 | 2717 | 2717 |

*Notes*: See equation 5 for model derivation. The HAC standard errors are in parenthesis, superscripts are symbolizing *** $p < 0.01$, ** $p < 0.05$.

# 4. Conclusion

[5] The correlation coefficients (available on request) of the variables suggest the model is free from multicollinearity issues.

This is the first study that examines the connectedness of the US equity market with eight tax havens Caribbean islands - Caribbean islands, the Bahamas, Barbados, Bermuda, Cayman Islands, Guyana, Jamaica, Trinidad & Tobago, and Eastern Caribbean Islands- utilizing the contemporary quantile connectedness approach. Interestingly, only the Cayman Islands depict substantial bi-directional shock transmission with the US in the normal market. We, however, find significant but analogous shock transmission between the US and the Caribbean markets in extreme markets, except for Barbados and Bahamas. Barbados and, to some extent, the Bahamas are isolated from the US and the rest of the Caribbean markets. Substantial drifting in network strengths and directions is exposed in the post-COVID period. Macroeconomic stress, volatility, uncertainty, and sentiments in alternative markets collectively rationalize our findings.

Though we provide compact evidence of how tail dependencies were altered in Caribbean markets by the pandemic, our results should be interpreted cautiously. Their movements are probably instigated by the acute sensitivity of offshore tax havens with unhindered access to international capital. This is because capital flow through tax havens is not subject to local capital gain taxes. Tax havens are typically reluctant to impose capital restrictions, including the currency aspect.

# References


Ando, T., Greenwood-Nimmo, M., & Shin, Y. (2018). Quantile Connectedness: Modelling tail behaviour in the topology of financial networks. *Available at SSRN 3164772*.

Baumöhl, E., & Shahzad, S. J. H. (2019). Quantile coherency networks of international stock markets. *Finance Research Letters*, 31, 119-129.

Baker, R. J. (2019). *CMOS: circuit design, layout, and simulation*. John Wiley & Sons.

Billah, M., Amar, A. B., & Balli, F. (2023). The extreme return connectedness between Sukuk and green bonds and their determinants and consequences for investors. *Pacific-Basin Finance Journal*, *77*, 101936.

Billah, M., Hoque, M. E., Balli, F., Kaur, J., & Kumar, S. (2024). Downside risk connectedness between Islamic sectors and green bond markets: implications for hedging and investment strategies. *Applied Economics*, 1-34.

Diebold, F. X., & Yılmaz, K. (2014). On the network topology of variance decompositions: Measuring the connectedness of financial firms. *Journal of Econometrics*, 182(1), 119-134.

Hines Jr, J. R. (2010). Treasure islands. *Journal of Economic Perspectives*, 24(4), 103-26.

Ji, Q., Bouri, E., Lau, C. K. M., & Roubaud, D. (2019). Dynamic connectedness and integration in cryptocurrency markets. *International Review of Financial Analysis*, 63, 257-272.

Koop, G., Pesaran, M. H., & Potter, S. M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, 74(1), 119-147.

Pesaran, H. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, 58(1), 17-29.

# Appendix

**Table A i. Descriptive statistics**

| Equity index | Mean | Std. Dev. | Skew. | Kurt. | JB | ADF | PP |
|---|---|---|---|---|---|---|---|
| Bahamas | 0.018 | 0.010 | 39.41 | 1937.15 | 4.6E+08 | 1.2E+03 | -54.20 |
| Barbados | 0.001 | 0.059 | -0.28 | 81.42 | 7.6E+05 | 1.2E+03 | -129.51 |
| Bermuda | 0.007 | 0.016 | -0.67 | 37.84 | 1.5E+05 | 3.7E+03 | -58.63 |
| Cayman Islands | 0.025 | 0.011 | 0.48 | 26.81 | 7.0E+04 | 2.6E+04 | -47.25 |
| Eastern Caribbean | -0.015 | 0.106 | -0.16 | 5.70 | 9.2E+02 | 2.2E+06 | -246.55 |
| Guyana | -0.086 | 0.023 | -0.74 | 13.48 | 1.4E+04 | 9.0E+04 | -52.22 |
| Jamaica | 0.052 | 0.008 | 0.22 | 12.25 | 1.1E+04 | 3.0E+05 | -57.81 |
| Trinidad & Tobago | 0.018 | 0.003 | 0.60 | 19.84 | 3.5E+04 | 1.3E+04 | -60.06 |
| US[6] | 0.090 | 0.019 | -1.50 | 36.90 | 1.4E+05 | 1.3E+02 | -62.95 |

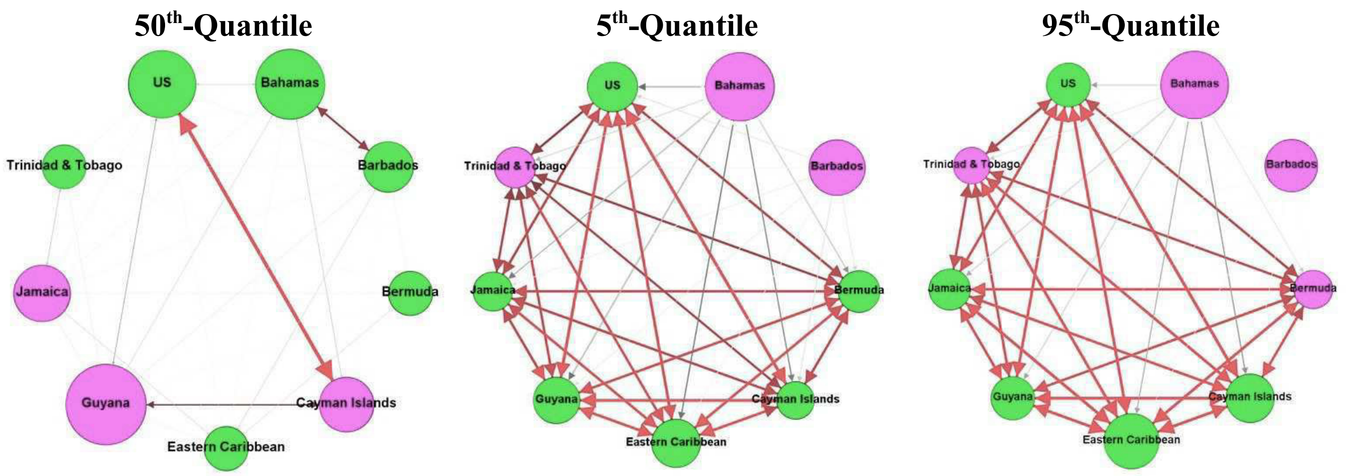
*Notes*: Std. Dev. refers to standard deviation. JB is Jarque-Bera test statistics for normality, while ADF (i.e., Augmented Dickey & Fuller) and PP (i.e., Phillips & Perron) are stationarity tests. They are entirely significant at 1% (* $p < 0.01$).

[6] We use the MSCI USA Index that covers nearly 85% of the free float-adjusted market capitalization in the US.

**Table A ii. Variables of interest**

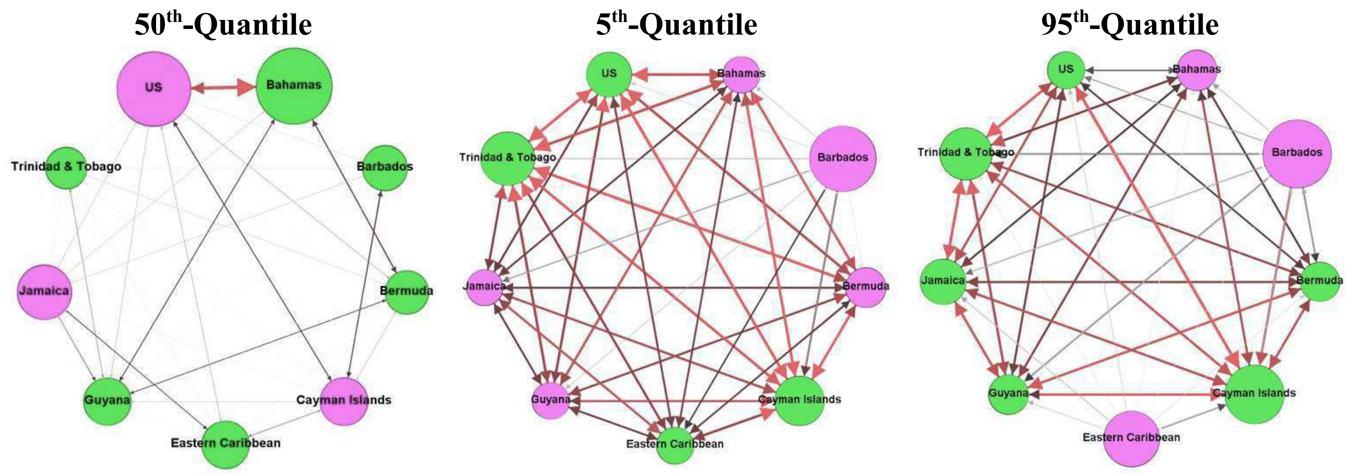
| Variable | Description |
|---|---|
| EPU | The EPU index determines how consistently newspapers in one's home country report economic news made up of EPU criteria combining Economic elements with Policy statements and Uncertainties. The literature review demonstrates that EPU shows an upside-down relationship with changes in green markets (Billah et al., 2023; Billah et al., 2024). According to expectations EPU will yield a negative signal. |
| VIX | The real-time VIX assesses market expectations about volatility throughout the next 30 days. Research conducted the US and eight Caribbean markets that increased VIX volatility levels diminish green market performance thus lowering the TSI. Our analysis indicates that the VIX will bear a negative reaction. |
| OVX | The expected 30-day crude oil volatility estimate known as OVX derives its value from the US Oil Fund (USO) settings. According to Hoque et al. (2021) higher premiums of the OVX lead to negative market impacts on US stock market prices resulting in reduced TSI levels. The anticipated sign for OVX becomes negative. |
| GVZ | GVZ provides a forecast of the upcoming 30-day return volatility for the SPDR Gold Shares ETF (GLD). |
| GFS | The Global Financial Stress Index (GFSI) is a tool used to assess the level of stress in the global financial system. It compiles various financial indicators to create a composite score that reflects conditions in the financial markets, banking sector, and overall economic stability. |
| EMV | According to Baker et al. (2019) the Equity Market Volatility (EMV) tracker index uses the content from eleven major U.S. newspapers for estimation. The VIX volatility movement shows close parallelism with this index which tracks S&P 500 realized market volatility. |

**Figure A 1. Total connectedness before COVID period**




*Notes*: See Figure 1 notes.

**Figure A 2. Total connectedness during COVID period**




*Notes*: See Figure 1 notes.