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Examining structural stability and time-varying causality between economic policy uncertainty and Asia-Pacific Islamic stock price

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Abstract

This study examines the existence of structural stability and time-varying causality between economic policy uncertainty (EPU) and Asia-Pacific Islamic Stock Price (APISP) using the structural stability test and time-varying causality methods developed by Dizten, et al. (2021) and Shi, et al (2018) respectively. Our findings show the existence of five structural breaks between EPU and APISP which fall between several waves of the COVID-19 pandemic and the commencement of the Russia-Ukraine war. The finding further shows that the effect of EPU on APISP is negative and statistically significant in the first breakpoint, however, the effect turns to insignificant positive and negative in the second and third break points respectively. In the fourth and fifth breakpoints, an increase in EPU leads to a significant negative on APISP. We also find evidence of time-varying bidirectional causality between EPU and APISP which shows that both variables have predictive power on each other.

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1. Introduction

The financial market, especially the stock market, cannot be dissociated from the economic environment where it is located and operating. While positive events within and outside the location of the financial market can be good for investment and returns, adverse events could be detrimental to investment and returns. The world in recent times is characterised by adverse events that exacerbate the global economic environment, which has a negative effect on several sectors of the economy including financial sectors across the globe. From the Global Financial Crisis of 2007-2009 to the global COVID-19 pandemic and the ongoing Russia-Ukraine that has led to the crises in Europe and other advanced economies, the uncertainty about the prospects of two important economic agents- households and investors has increased greatly (Raifu, Kumeka and Aminu, 2021; Raifu, 2021, 2022a). Such an increase in global uncertainty often creates policy dilemmas for the policymakers leading to haste policymaking or delay in policymaking that can further fuel global uncertainty or create what is known as economic policy uncertainty (EPU hereafter).

Financial experts, economists and others have been interested in how EPU influences the financial sector, especially the stock market (Li, et al. 2016; Chow, et al. 2018). Such a sudden increase in EPU has been said to have a negative effect on stock market prices and returns (Antonakakis, Chatziantoniou and Filis, 2013). Aydin, Pata and Inal (2021) identified channels through which delays in government policy action lead to an increase in EPU which in turn affects the financial market. By stiffening the macroeconomic economic environment (Bloom, 2009), EPU can lead to unpredictability and disruption of the financial market. The unpredictable financial market raises the risks faced by investors, which in turn, affects their investments. When this happens, the investors' cash flows decline, thereby negatively impacting future returns. Given this theoretical nexus between EPU and stock market returns, a considerable number of studies have been conducted. The direction of research can be broadly grouped into two. Some studies examine the effect of EPU on stock market returns (see recent studies Chiang, 2020; Liao, et al. 2021; Xu, et al. 2021; Kundu and Paul, 2022). The overwhelming evidence from these studies shows that an increase in EPU negatively influences stock returns, although there could be some instances where EPU positively affects stock returns, especially when the asymmetric effect is taken into consideration. (Chiang, 2020; Kundu and Paul, 2022). The second strand of studies focuses on the predictive power of EPU on stock market returns. In this regard, researchers examine first the causality between EPU and stock market returns (Li, et al. 2016; Wu, et al. 2016; Chow, et al, 2017; Amengual and Xiu, 2018; Aydin, Pata and Inal, 2021) and second forecasting, predictability or hedging ability of EPU (Xu, et al., 2021).

Most of the studies above, particularly those that examine the impact of EPU on stock price or returns assume that the estimated coefficients do not vary over time. However, it has been argued that such an assumption may not hold for some reasons. For instance, economic crises such as the 2007-2009 Global Financial Crisis, the COVID-19 pandemic and the current war between Russia and Ukraine do cause disruption in the economy, thus, leading to parameter instability. Such parameter instability has a detrimental effect on the estimation and inference that can be made, which can affect policy decision-making (Ditzen, Karavias and Westerlund, 2021). In light of this, this study has two objectives. The first objective is to test for the existence of multiple structural breaks in the relationship between EPU and Asia-Pacific Islamic stock price (APISP hereafter). To achieve the first objective, we employ a new multiple structural breaks method developed by Ditzen, et al. (2021). Their method, which is based on Bai and Perron's (1998) criteria, applies to both time series and panel data. After detecting the structural breaks, we estimate the effects of EPU on APISP across the detected breaks. In other words, we seek to determine whether the coefficients of EPU vary across the identified or detected structural breaks or regimes. The second objective is to examine the time-varying causality between EPU and APISP using a time-varying causality method developed by Shi, Phillips and Hurn (2018). The advantage of this method is that it can help in determining the changes in the causal relationship between variables (see Raifu, 2022b). The motivation for choosing APISP is that it has been argued that, unlike conventional stocks which are susceptible to socioeconomic and political crises, APISP is resilient to economic challenges, even during the COVID-19 pandemic shock (Salisu and Sikiru, 2020).

The rest of the study is organised as follows. Section 2 focuses on the methodology while section 3 presents data sources and descriptions. Results are presented in section 4. Section 4 concludes.

2. Methodology

As previously mentioned, two estimation methods are used in this study. The first one is the multiple structural break detection method developed by Ditzen, et al. (2021) while the second one is the time-varying causality method of Shi, et al. (2018). Two methodological frameworks are briefly presented as follows:

Following Ditzen, et al (2021), we assume that we have a linear model with structural breaks, s specified as follows:

$$y_t = x_t \alpha_i + \varepsilon_t \qquad (1)$$

Where y denotes APISP, x denotes EPU. In this study, we use the US EPU. $i = T_{i-1},...,T_t$ and $i = i,...,s+1$ with $T = 0$ and $T_{s+1} = T$. It is possible to have s breaks or $s+1$ regimes with the regime i. The regime i covers the observations $T_{i-1},...,T_i$. The regime-wise structural break for equation 1 can be written as:

$$y_t = x_t \alpha_1 + \varepsilon_t \text{ for } t = T_0,...,T_1,$$
$$y_t = x_t \alpha_2 + \varepsilon_t \text{ for } t = T_1,...,T_2$$
$$\bullet$$
$$\bullet$$
$$\bullet$$
$$y_t = x_t \alpha_{s+1} + \varepsilon_t \text{ for } t = T_s,...,T_{s+1} \qquad (2)$$

In this study, we assume that the estimated coefficient in equation 1 is not affected by any economic crises during the period of investigation. Therefore, there are no structural breaks that cause the structural change in the relationship between EPU and APISP. This is the null hypothesis. The alternative hypothesis is that the coefficient is affected by economic crises within the period under consideration. After detecting the structural breaks, we apply the Ordinary Least Squares method (OLS) to estimate the effect of EPU on APISP along the identified structural breaks. However, the use of OLS may violate the basic assumptions for its usability, leading to spurious results. One of the classical assumptions that are likely to be violated is the serial correlation among the regressors (Phillips and Hansen, 1990). Given this, this study also employs the Fully Modified Ordinary Least Squares (FM-OLS) estimation method. The FM-OLS estimation method is a cointegration method which accounts for serial correlation effect as well as endogeneity in the regressors (Phillips, 1995).

To model the time-varying causality between EPU and APISP, we employ the time-varying causality developed by Shi, et al. (2018). We begin the specification of time-varying causality by specifying a lag-augmented VAR (LA-VAR) suggested by Toda and Yamamoto (1995). Assume a bivariate case of y_{1t} and y_{2t}, the LA-VAR model can be specified as:

$$\begin{aligned} y_{1t} &= \beta_{10} + \beta_{11t} + \sum_{i=1}^{k+d} \lambda_{1i} y_{1t-i} + \sum_{i=1}^{k+d} \phi_{1i} y_{2t-i} + \varepsilon_{1t} \\ y_{2t} &= \beta_{20} + \beta_{21t} + \sum_{i=1}^{k+d} \lambda_{1i} y_{2i1t-i} + \sum_{i=1}^{k+d} \phi_{2i} y_{2t-i} + \varepsilon_{2t} \end{aligned} \tag{3}$$

Where k is the lag length, d is the maximum order of integration and t is the time trend. The null hypothesis of no Granger causality between y_{1t} and y_{2t} is specified as:

$$H_0 : \phi_{11} = \bullet\bullet\bullet = \phi_{1k} = 0$$

The alternative hypothesis is specified as:

$$H_0 : \phi_{11} \neq \bullet\bullet\bullet \neq \phi_{1k} \neq 0$$

Given the LA-VAR framework above, Shi et al (2018) developed three supremum Wald statistic tests that can be used to test for time-varying causality between variables. These three supremum Wald tests include forward recursive, rolling window and recursive evolving algorithms. Following Shi, et al. (2018), the forward recursive algorithm Wald statistic $[f_1, f_2]$ with a small sample size fraction $f_w = f_2 - f_1 \geq f_0$ is given as $W_{f_2}(f_1)$ and the supremum Wald statistic version is given as:

$$sw_F(f_0) = \frac{\sup}{(f_1, f_2 \in \wedge_0, f_2 = f)} \left\{ W_{f_2}(f_1) \right\} \tag{4}$$

Here $\wedge_0 = \left\{ (f_1, f_1); 0 \prec f_0 + f_1 \leq f_2 \leq 1, and 0 \leq f_1 \leq 1 - f_0 \right\}$ for the small sample size $f_0 \in (0,1)$ in the regression. Shi, et al. (2018) state that the forward expanding and rolling window are special cases of recursive evolving procedures which have $f_1 = 0$ and sets $f = f_1$. The rolling window itself has a fixed window width $f_w = f_2 = f_1 = f_0$ and window initialisation $f_1 = f_2 - f_1$. The dating rules, especially in a simple switch case, are given for the three causality tests procedures as follows:

Forward: $\hat{f}_e = \frac{\inf}{f \in [f_0, 1]} \left\{ f : W_f(0) > cv \right\}$ and $\hat{f}_f = \frac{\inf}{f \in [f_e, 1]} \left\{ f : W_f(0) > cv \right\}$ (5)

Rolling: $\hat{f}_e = \frac{\inf}{f \in [f_0, 1]} \left\{ f : W_f(f - f_0) > cv \right\}$ and $\hat{f}_f = \frac{\inf}{f \in [f_e, 1]} \left\{ f : W_f(f - f_0) > cv \right\}$ (6)

Recursive: $\hat{f}_e = \frac{\inf}{f \in [f_0, 1]} \left\{ f : SW_f(f_0) > scv \right\}$ and $\hat{f}_f = \frac{\inf}{f \in [f_e, 1]} \left\{ f : SW_f(f_0) > scv \right\}$ (7)

Where CV and SCV are critical values of W_f and SW_f statistics respectively. $\hat{f}_e$ and $\hat{f}_f$ are estimated chronologically and their test statistics can exceed or fall below the critical values for the beginning and endpoints in the causal nexus.

3. Data Sources

We use the daily data of the US EPU and APISP. The US EPU is obtained from the Federal Reserve Bank of St Louis. The APISP is proxied by the Dow Jones Islamic Market Asia-Pacific Index which measures the performance of equity stock traded in 15 countries in the Asia/Pacific region. It is obtained from investing.com. The data covers the period from 2nd January 2020 to 31st May 2022. The descriptive statistics and the trend of the variables are presented in Table 1 and figure 1 respectively. From Table 1, the mean value of APISP during the period under consideration stood at 1542.36 which is characterised by high standard deviation which stood at 342.42. This signifies the existence of high volatile APISP during the period under consideration, especially during the COVID-19 pandemic. In the case of EPU, the mean value stood at 198.91 with the standard deviation of about 128.86.

Table 2 reports the results of the unit root tests. Three unit root test methods are used and they include Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Zivot-Andrew (ZA) unit root tests. While both ADF and PP unit root methods are employed to test the stationarity properties of the series without considering the structural break, the ZA unit root is employed when the structural break is considered in the series. The null hypothesis of the ADF and PP unit root tests is that the series contains a unit root without a structural break while the ZA unit root hypothesis is that the series contains a unit root with a structural break. The null hypotheses are tested against their respective alternative hypotheses. For the ADF and PP unit root tests, the alternative hypothesis stipulates that the series is stationary. In the case of the ZA unit root test, the alternative hypothesis states that the series is stationary with a break. In both cases, the null hypothesis is not rejected when the computed t-value statistic is lower than the tabulated critical value. In other words, when the probability values are greater than 5 per cent, then the null hypothesis is not rejected, otherwise, it is rejected. As shown in Table 2, ADF and ZA unit root test results show that both APISP and EPU contain a unit root, that is, they are not stationary and they become stationary after they are first difference. However, the PP unit root test results show that EPU is stationary at the level. In the ZA, the structural break occurs in the APISP and EPU series around 25th and 26th May, 2020, the period when the first wave of the COVID-19 pandemic is receding (Iftimie et al., 2021).

Figure 1 reports the trend of APISP and EPU over the period under consideration. As shown in the figure, it is evident that due to a significant spike in EPU that characterised the period of the COVID-pandemic, APISP declined significantly, especially during March and April of 2020. However, as the EPU declined, it can be observed that APISP rose significantly, subjected to occasional fluctuations in EPU. A little spike in EPU during the ongoing Russia-Ukraine war also leads to a moderate decline in APISP as observed in the figure during the months of March, April and May.

Table 1: Descriptive Statistics

Variables	Obs	Mean	Std.Dev.	Min	Max	p1	p99	Skew.	Kurt.	Jarque-Bera
APISP	627	2542.36	342.41	1626.66	3173.38	1712.52	3137.95	-0.46	2.24	37.59***
EPU	627	198.81	128.86	22.25	807.66	56.89	618.66	1.53	5.27	378.2***

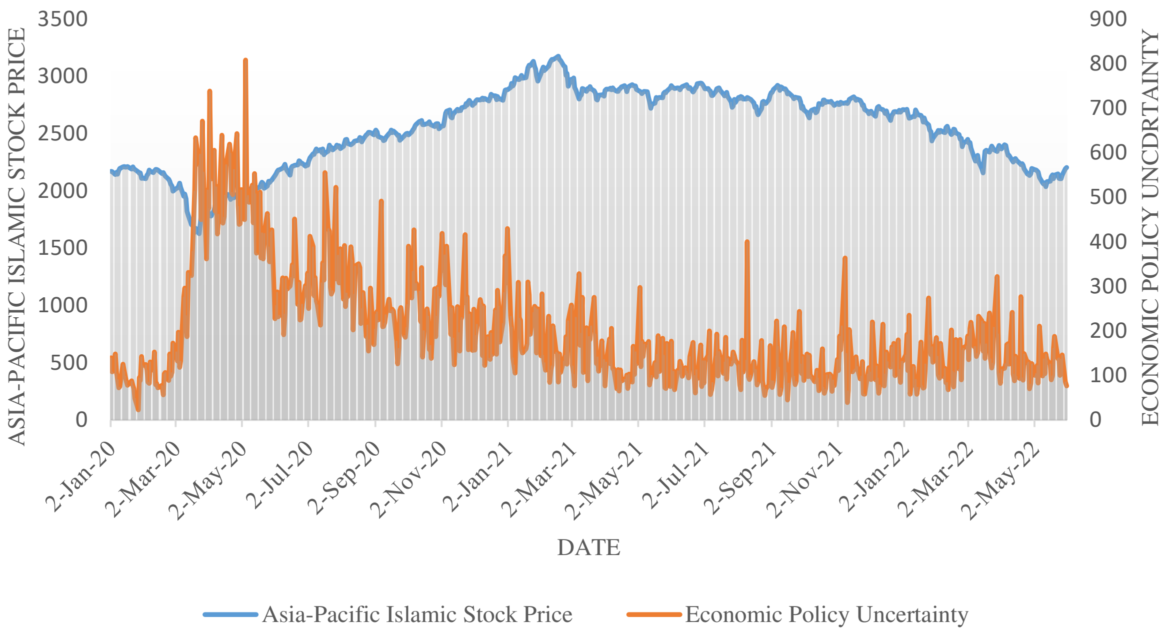
*Note: Compiled by the author, ***, ** and * denote 1%, 5% and 10% significant level respectively.*

Table 2: Unit Root Tests

	Augmented Dickey-Fuller		Phillips-Perron		Zivot=Andrew	
	Level	**First Diff.**	**Level**	**First Diff.**	**Level**	**First Diff.**
APISP	-1.197	-14.168***	-1.211	-21.900***	-2.510 (May 25th, 2020)	-22.093*** (May 25th, 2020)
EPU	-2.055	-9.786***	-12.808***	-60.492***	-4.523 (January 4, 2021)	-18.266*** (May 26th, 2020)

*Note: APISP and EPU are Asian-Pacific Islamic stock price and economic policy uncertainty respectively. ***, ** and * denote 1%, 5% and 10% significant level respectively. First Diff. denotes first difference.*

Figure 1: Trend of Asia-Pacific Islamic Stock Price and Economic Policy Uncertainty



4. Empirical Findings and Discussion

Table 3 presents the results of the first objective. The first objective aims at testing the existence of structural breaks in the relationship between EPU and APISP and to ascertain the effect of EPU on APISP along the identified structural breaks. As shown in the table, five structural breaking points are detected, including June 15th, 2020, November 4th, 2020, April 30th, 2021, September 9th, 2021and January 19th, 2022. All these dates fall into the period of the several waves of the COVID-19 pandemic and the commencement of the Russia-Ukraine war. For instance, the identified break date point (June 15th, 2020) almost coincides with the end of the first wave of the COVID-19 pandemic and the commencement of the second wave of the COVID-19 pandemic (see Iftimie, et al., 2021). The final breaking date detected is very close to the commencement of the Russia and Ukraine war (see Raifu, 2022). Our finding, therefore, suggests that the relationship between EPU and APISP is characterised by multiple structural breaks. The next question answered in this section is whether the effect of EPU on APISP varies or is unchanged across the identified structural breaks. The answer to this question is also presented in Table 3. As shown in the Table, our results reveal that, although the estimated coefficients of EPU on APISP vary across the identified structural breaks, the effects of EPU on APISP are mostly negative. To be breakdown the effects of EPU on APISP along the identified or detected breaks, the finding shows that the effect of EPU on APISP is negative and statistically significant in the first breakpoint, however, the effect turns to insignificant positive and negative in the second and third break points respectively. This suggests that as the COVID-19 pandemic recedes in many countries, EPU also declines, leading to its insignificant effect on APISP. However, as another wave of the COVID-19 pandemic rages and the Russia-Ukraine war commences, EPU increases, thereby leading to its negative and significant effect on APISP in the fourth and fifth identified structural breaks. This mainly suggests that a significant spike in EPU is detrimental to financial sector growth and development. This confirms the extant findings from the relevant studies (Chiang, 2020; Kundu and Paul, 2022).[1]

The results above are robust to the use of FM-OLS estimation method even though there is a slight difference. The FM-OLS results show that EPU affects APISP negatively and significantly along the identified structural breaks. However, it can be observed that the estimated coefficients along the structural breaks decline up till to the third breaking point which is coincided with April 30th, 2021. This means that as the wave of the COVID-19 pandemic recedes, the effect of EPU on APISP declines. Karavias, et al. (2021) provides an explanation for a decline in the effect of EPU on stocks. According to Karavias, et al. (2021), the government policy interventions across the world, particularly in the US restored the confidence of investors, leading to a rise in the prices of stocks and thus reducing the effect of uncertainty on stock prices and returns. It is, however, observed that at the fourth break, the negative effect of EPU on APISP increases, increasing from 0.007% at the third break to 0.016% at the fourth break. The fourth break point coincides with the third wave of the COVID-19 pandemic as identified by Tandon, et al. (2022). The fifth break which occurs on January 19th, 2022 is close to the commencement of the Russia-Ukraine war (February 24th, 2022). The rumour of war between the two countries might have generated uncertainty leading to an increase in investors' sentiments that could affect the stock prices negatively. Hence, at the fifth break, the negative effect of EPU on APISP increases to 0.046%, suggesting that the rumour of the Russia-Ukraine war severely affects asset prices including stock prices.

Table 3: Identified Structural Breaks and the effect of EPU on APISP

Date Breaks	95% Confidence Interval	
June 15th, 2020	-669497-669729	
November 4th, 2020	-1.1e+06-1.1e+06	
April 30th, 2021	-5.7e+09-5.7e+09	
September 9th, 2021	-2.1e+08-2.1e+08	
January 19th, 2022	-765216-766282	
Dependent Variable	Asia-Pacific Islamic Stock Price	
Estimation Methods	Ordinary Least Squares	Fully Modified Ordinary Least Squares
EPU	-0.065*** (0.004)	-0.068*** (0.000)
Δ EPU1	-0.030*** (0.004)	-0.033*** (0.000)
Δ EPU2	0.001 (0.004)	-0.004*** (0.000)
Δ EPU3	-0.003 (0.004)	-0.007*** (0.000)
Δ EPU4	-0.011*** (0.004)	-0.016*** (0.000)
Δ EPU5	-0.045*** (0.004)	-0.046*** (0.000)
Constant	7.967***(0.019)	7.961*** (0.001)
Observation	627	626
R-squared	0.890	0.021
Adjusted R-Squared	0.889	0.011
F-Statistics (p-value)	839.60 (0.000)	

[1] *See the appendix (Table A) for some post estimation results of the OLS. The results show that the assumptions of OLS are violated which cast a doubt on the reliability of OLS results. Hence, the FM-OLS is employed to obtain reliable results.*

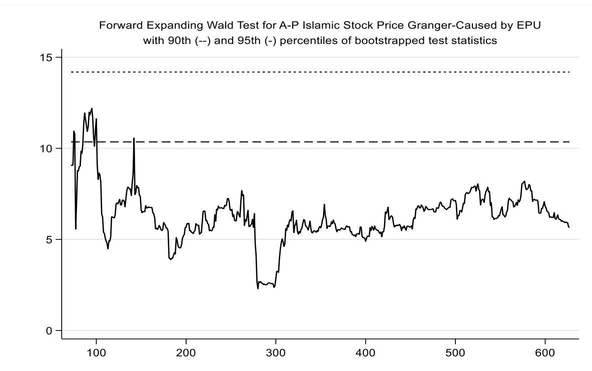
*Note: Standard errors are in parenthesis *** p<0.01, ** p<0.05, * p<0.1. The estimated coefficient of EPU shows the effect of EPU on APSIP without structural break. The rest EPUs with sign Δ (Δ EPUs) show the effects of EPU on APISP along the identified structural breaks.*

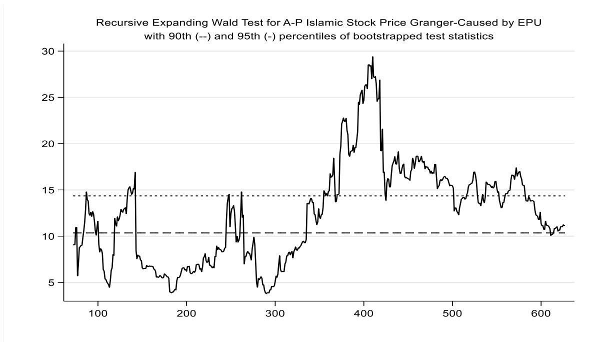
The results of the second objective to test the time-varying causality between EPU and APISP are presented in Table 4. However, before testing for the existence of time-varying causality between the two variables, we first performed linear causality between them using Toda-Yamamoto Granger non-causality test. The results of the linear causality test, however, show the existence of unidirectional causality that runs from APISP to EPU suggesting that it is the APISP that has predictive power on EPU. However, this does not reflect the true nature of causality between EPU and APISP as evident in the results of the time-varying causality test. Three types of time-varying causality tests are reported in Table 4. They include forward expanding window causality, rolling window causality and recursive expanding causality. According to Shi, et al., (2018), the three methods are used for comparison sake and robustness. Our findings show that all three methods support a bidirectional causality between EPU and APISP. This suggests that while EPU can Granger cause APISP, the APISP can also Granger-cause EPU. In other words, while EPU has the potential to affect the financial sector or market, negative effects in the financial sector or market can generate EPU faced by policymakers. The ready examples of how a negative event in the financial market can lead to EPU are the Asian Financial Crisis of 1997 and the Global Financial Crisis of 2007-2009. The graph of time-varying causality between EPU and APISP is shown in figure 2 after Table 4. The graph shows that the causality between EPU and APISP varies over time.

Table 4: Linear and Time-varying Causality Results

Null Hypothesis	Test Results	Decision
	Linear Causality –Toda-Yamamoto Granger Non-Causality Test	
EPU → APISP	3.826 (0.700)	Unidirectional Causality from
APISP → EPU	18.947 (0.004)	APISP stock price to EPU
	Time-Varying Causality Test	
EPU → APISP	Forward Expanding	Granger-caused
APISP → EPU		Granger-caused
EPU → APISP	Rolling Window	Granger-caused
APISP → EPU		Granger-caused
EPU → APISP	Recursive Expanding	Granger-caused
APISP → EPU		Granger-caused

Table 3 reports the results of linear and time-varying causality between APISP and EPU. Note: → indicates the null hypothesis that the first variable does not Granger-cause the second one. *** denotes 1% level of significance





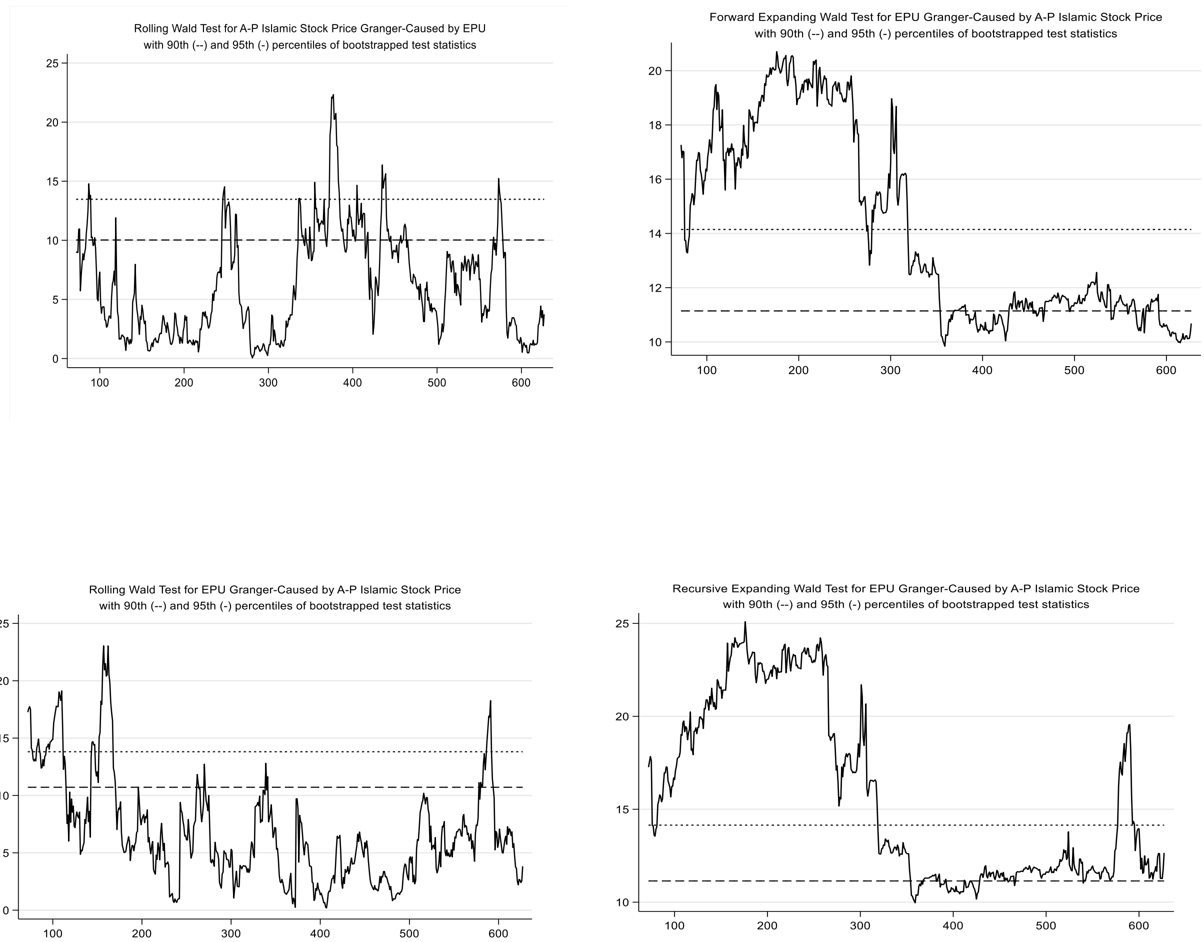


Figure 2: The graphs of time-varying causality between EPU and APISP

5. Conclusion

This study has achieved two objectives. The first objective achieved is the validation of the existence of multiple structural breaks in the nexus between EPU and APISP and the effects of EPU on APISP along the identified structural breaks. The second objective achieved is the validation of the existence of time-varying causality between the two variables. The first objective is achieved using the structural break method developed by Ditzen, et al. (2021) and the OLS and FM-OLS estimation methods. The second objective is achieved using the time-varying causality method developed by Shi, et al (2018).

Our results show the existence of multiple structural breaks between EPU and APISP. Also, along the structural breaks, the effects of UPU on APISP are mostly negative, though varied. We also document the existence of time-varying causality between EPU and APISP which runs in both directions, that is, EPU and APISP Granger-cause each other. Thus, a financial policy that would stem the negative effect of EPU on APISP is greatly required. In other words, it is important for policymakers to adopt macroprudential tools or regulations (macroprudential policies) that would make financial markets resilient to adverse economic uncertainty. This could entail building up buffers through loan loss provision and raising minimum capital requirements which could be released during an economic crisis to mitigate the adverse effect of such any crisis on the financial system. Above all, the study focuses on the test of structural stability and time-varying causality between EPU and APISP, the future studies should be extended to test the structural stability and time-varying causality between EPU and conventional stock prices in different countries, particularly from the Asia-Pacific countries India, China, Japan, Singapore or Hong Kong.

Appendix

Table A: OLS Post Estimation Diagnostic Results

Diagnostic Tests	Results
Breusch–Pagan/Cook–Weisberg test for heteroskedasticity	75.81 (0.000)
Breusch–Godfrey LM test for autocorrelation	265.113 (0.000)
Durbin's alternative test for autocorrelation	1692.998 (0.0000)
Ramsey RESET test	2.40 (0.001)
Mean VIF	35.35

Note: Compiled by the Author

References

Amengual, D., and Xiu, D. (2018) "Resolution of policy uncertainty and sudden declines in volatility" *Journal of Econometrics*, *203*(2), 297-315.

Antonakakis, N., Chatziantoniou, I., and Filis, G. (2013) "Dynamic co-movements of stock market returns, implied volatility and policy uncertainty" *Economics Letters*, *120*(1), 87-92.

Aydin, M., Pata, U. K., and Inal, V. (2020) "Economic policy uncertainty and stock prices in BRIC countries: evidence from asymmetric frequency domain causality approach" https://www.emerald.com/insight/content/doi/10.1108/AEA-12- 2020-0172/full/html

Bai, J., and Perron, P. (1998) "Estimating and Testing Linear Models with Multiple Structural Changes" *Econometrica*, *66*(1), 47-78.

Bloom, N. (2009) "The impact of uncertainty shocks" *Econometrica*, *77*(3), 623-685.

Chiang, T. C. (2020) "Economic policy uncertainty and stock returns—evidence from the Japanese market" *Quantitative Finance and Economics*, *4*(3), 430-458.

Chow, S. C., Cunado, J., Gupta, R., and Wong, W. K. (2018) "Causal relationships between economic policy uncertainty and housing market returns in China and India: Evidence from linear and nonlinear panel and time series models" *Studies in Nonlinear Dynamics and Econometrics*, *22*(2), 1-15.

Ditzen, J., Karavias, Y., and Westerlund, J. (2021) "Testing and estimating structural breaks in time series and panel data in stata" *arXiv preprint arXiv:2110.14550.*

Iftimie, S., López-Azcona, A. F., Vallverdú, I., Hernández-Flix, S., De Febrer, G., Parra, S., ... and Castro, A. (2021) "First and second waves of coronavirus disease-19: A comparative study in hospitalized patients in Reus, Spain" *PloS one*, *16*(3), e0248029.

Karavias, Y., Narayan, P. K., and Westerlund, J. (2022) "Structural breaks in interactive effects panels and the stock market reaction to COVID-19" *Journal of Business & Economic Statistics*, 1-14.

Kundu, S., and Paul, A. (2022) "Effect of economic policy uncertainty on stock market return and volatility under heterogeneous market characteristics" *International Review of Economics and Finance*, *80*, 597-612.

Li, X. L., Balcilar, M., Gupta, R., and Chang, T. (2016) "The causal relationship between economic policy uncertainty and stock returns in China and India: Evidence from a bootstrap rolling window approach" *Emerging Markets Finance and Trade*, *52*(3), 674-689.

Liao, G., Hou, P., Shen, X., and Albitar, K. (2021) "The impact of economic policy uncertainty on stock returns: The role of corporate environmental responsibility engagement" *International Journal of Finance and Economics*, *26*(3), 4386-4392.

Phillips, P. C. (1995) "Fully modified least squares and vector autoregression" *Econometrica: Journal of the Econometric Society*, 1023-1078.

Phillips, P. C., and Hansen, B. E. (1990) "Statistical inference in instrumental variables regression with I (1) processes" *The Review of Economic Studies*, *57*(1), 99-125.

Raifu, I. A. (2021) "The Effects of COVID-19 Pandemic on Stock Market Performance in Africa" *Available at SSRN*.

Raifu, I. A. (2022b) "Examining time-varying causality between oil returns and stock returns in Norway" *Energy Research Letter*. https://doi.org/10.46557/001c.37693

Raifu, I. A., (2022a) "COVID-19 Pandemic, government policy responses and stock market performance in some selected African countries", *DBN Journal of Economics and Sustainable Growth*, Vol. 4. Issue 3, pp. 24-65.

Raifu, I. A., Kumeka, T. T., and Aminu, A. (2021) "Reaction of stock market returns to COVID-19 pandemic and lockdown policy: Evidence from Nigerian firms stock returns" *Future Business Journal*, *7*(1), 1-16.

Salisu, A. A., and Sikiru, A. A. (2020) "Pandemics and the Asia-Pacific Islamic stocks" *Asian Economics Letters*, *1*(1), 17413.

Shi, S., Phillips, P. C., and Hurn, S. (2018) "Change detection and the causal impact of the yield curve" *Journal of Time Series Analysis*, *39*(6), 966-987.

Tandon, P., Leibner, E. S., Hackett, A., Maguire, K., Mashriqi, N., and Kohli-Seth, R. (2022) "The third wave: Comparing seasonal trends in COVID-19 patient data at a large hospital system in New York City" *Critical Care Explorations*, *4*(3), e0653.

Xu, Y., Wang, J., Chen, Z., and Liang, C. (2021) "Economic policy uncertainty and stock market returns: New evidence" *The North American Journal of Economics and Finance*, *58*, 101525.