Is Financial Innovation Bestowed or a Curse for Economic Sustainably: The Mediating Role of Economic Policy Uncertainty

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Abstract: The study’s motivation is to gauge the impact of financial innovation on economic growth from 2004M1 to 2018M12 in India and Pakistan’s economy with the mediating role of economic policy uncertainty. For instituting the possible association between financial innovations, economic policy uncertainty, and economic growth study considered both symmetric and asymmetric frameworks following autoregressive distributed lagged (ARDL) and nonlinear ARDL (NARDL). Furthermore, asymmetric causal relationships were evaluated by performing non-granger causality tests with asymmetric shocks of financial innovation and economic policy uncertainty (EPU). The results of Fpss, Wpss, and tBDM under symmetry framework established the long-run link between EPU, financial innovation, and economic growth in both countries. The results of standard Wald tests demonstrated the asymmetry effects furring from EPU to economic growth and financial innovation to economic growth both in the long-run and short-run. The asymmetry effects of positive and negative shocks in financial innovation revealed a positive linkage with economic growth and a negative tie between asymmetric shocks in EPU and economic growth in the long-run, but short-run magnitudes negligible. Refers to directional causality estimation, the study revealed evidence supporting the feedback hypothesis between EPU and financial innovation in all sample countries.

Keywords: financial innovation; economic policy uncertainty; economic growth; ARDL; NARDL; Toda–Yamamoto

1. Introduction

In the empirical literature, two lines of investigations are available considering financial innovation (FI, hereafter), economic policy uncertainty (EPU, hereafter), and economic growth that is nexus between FI and economic growth, see, for instance, Qamruzzaman, Jianguo [1]; Qamruzzaman and Wei [2]; Nazir, Tan [3]; Bara, Mugano [4] and nexus between EPU and economic growth, see for instance Bhagat, Ghosh et al. (2013) [5]. However, there is no such empirical study to investigate EPU and FI’s impact on economic growth in a single equation to my best knowledge. The study’s motivation is to unleash fresh evidence regarding EPU and FI’s potential impact on India and Pakistan’s economic growth by performing both symmetric and asymmetric effects of EPU and FI on economic growth. Furthermore, evaluating the combined effects of EPU and FI, the study adds one additional variable known as the interactive term, measured by EPU*FI where FI proxied by the indexed of FI constructs by performing principal component analyses (PCA). Literature suggests that EPU influences financial innovation, and their consolidated impact is significant and critical for the financial sector and, eventually, for economic growth. Finance scholars, including Miller [6] and Merton [7], advocated the importance of innovative financial products and services to achieve an efficient financial sector in the economy.
posit that financial innovativeness is critical not only for financial institutions’ sustainability but also for economic progress. Financial innovation expands the existing financing opportunities by lowering the cost of funds and efficient financial intermediation.

Financial innovation in the empirical literature is one of the discussant facts since Schumpeter [8]. Over the past few decades, researchers and academicians invest considerable efforts in gauging the effects of financial innovation. They produce substantial evidence such as financial innovation accelerate economic growth ([9–13], financial sector development [14–16], foreign direct investment (Qamruzzaman [17], financial inclusion [2]. Another line of findings are also available in the empirical literature, i.e., harmful or advise effects based on firm-specific and country-specific investigation see, for instance, Smith and Smithson [18] pointed to increasing volatility; however, the positive impact from financial innovation is more prominent than a negative one. Tufano [19] established that financial innovations are crucial for global financial integration and diversification and allow financial institutions in the home country to mitigate perceived risk in the financial system by utilizing innovative financial produce ad services. Financial innovation is a tool for investment risk mitigation through diversification.

In recent times, a vast number of studies appeared in literature dealing with the impacts of economic policy uncertainty, hereafter EPU, on a financial system such as credit expansion [20–23], financial stability [24,25], banking activities [23,26,27]. It suggests that the financial system’s key players are vulnerable to the changes in the present state of EPU in the economy. Hence, the powerful effects of EPU can hinder the average speed of financial development. Furthermore, empirical literature also revealed diverse outcome dealing with EPU impact on stock market volatility [28], the stock price [29,30], financial market [31–34], 2017), exchange rate volatility [35], firm-level investment [36]; Wang [37], unemployment [38], stock return [39] capital structure [40] and so no.

The novelty of the study relies on the following aspects. First, with our best knowledge, for the first time, the nexus between financial innovation, economic policy uncertainty, and economic have been investigated by using monthly data over the period 2004 M1–2018 M12. Second, empirical findings with a single proxy measuring financial innovation may not produce enthralling results as such, and this study considers three widely used proxies for measuring the presence of financial innovation in the empirical equation and construct a FI index by performing principal component analysis. Third, to gauge the possible association between EPU, FI, and economic growth, the study applied advanced econometrical methodology such as other than the conventional unit root test. We also applied the nonlinear unit root test proposed by Kapetanios, Shin [41] and Kruse [42]. The study performed autoregressive distributed lagged (ARDL) initiated by Pesaran, Shin [43], and nonlinear-ARDL proposed by Shin, Yu [44]. Moreover, their possible directional causality was investigated by performing the non-granger causality test proposed by Toda and Yamamoto [45].

Conventional unit root test revealed mixed order of integration that is few variables are statutory at a level and few after first difference. Furthermore, the unit root test with nonlinearity established that nonlinear stationary processes follow variables. The cointegration test with ARDL confirmed long-run cointegration between EPU, FI, and economic growth since the null hypothesis of “no-cointegration” is rejected in Fpss, Wpss, and tBDM tests. This verdict is suitable for all model estimations. Referring to long-run elasticity from EPU to economic growth, it is palpable that adverse force running to economic growth in both countries; moreover, FI positively accelerates economic growth both in the long-run and short-run. Asymmetry effects are established with empirical model excitation following a nonlinear framework by Shin, Yu [44]. Furthermore, the standard Wald test ascertains the long-run and short-run asymmetry impact running from EPU to economic growth and FI to economic growth in both countries. Finally, the directional causality test unveils bidirectional causal effects running between EPU and financial innovation.
The remaining sections apart from the introduction are Section 1, dealing with the literature survey. The motivation of the study is explained in Section 2. Brittle definitions and econometrical methodology are described in detail in Section 3. Empirical model estimation and interpretation are inserted in Section 4. Finally, study findings and conclusion reports in Section 5.

2. Literature Review

After the financial crisis of 2008s, to recover from the financial distress world economy feels the importance of effective and stable economic policy. Stability in the economy eliminates adverse shocks in macro fundamentals and accelerates the movement towards economic sustainability. However, global economic integration and macro complexity produce economic uncertainty and adverse shocks in economic activities both in the long run and short-run. Krol [35] documented that economic uncertainty positively correlated with the market economy due to macro fundamentals behavior are intertwined and complex. Uncertainty in monetary policy, according to Baker and Martin [46], shake economic activities both at the macro and micro level and reduce confidence in the economy with the perspective of domestic and foreign investors. Moreover, from an investment viewpoint, firms avail benefits from uncertainty by delaying investment on the ground of higher cost and costly workforce to run the project [47].

2.1. Effects of Financial Innovation on Economic Growth

The empirical analysis in finance has suggested four distinct theories to understand the connection between financial progress and economic development. First, the supply leading hypothesis indicates that financial innovation may positively affect economic growth in a region [48]. This theory indicates that financial progress in the financial sector accelerates economic development by accelerating capital formation, improving financial markets’ productivity, improving financial services, and making financial intermediation more effective. Shittu [49] perceived that successful financial intermediation had a major impact on Nigeria’s economic development. Second, the demand-led theory indicates that economic development draws financial creativity to the market. This theory indicates that the globalization of economic operations, the real economy’s growth, and expanded domestic and foreign trade placed a strain on financial markets to strengthen payment processes, render financial institutions more productive and diversify financial assets to mitigate investment risks. Third, the input theory indicates a bidirectional causality between financial innovation and economic development., e.g., Bara, Mugano [4] and Bara and Mudzingiri [9] have verified the bidirectional causality between financial innovation and economic development. However, Lumpkin [50] and Sekhar [51] find no causality between financial innovation and economic development.

The well-functioning financial sector is essential to economic sustainability due to capital creation, reallocation, and domestic wealth utilization. Regulatory bodies also persistently aim to devise and enforce appropriate monetary and fiscal strategies to ensure financial performance. In particular, financial quality includes diversification of financial resources and goods such that a broader community can be represented with ease. Miller [6] postulated that create financial products has increased the financial sector’s growth, especially in financial markets. They clarified that diversified capital assets lead to the transfer of risk, higher yields on tax-deductible security, and equity accumulation of investors.

Financial literature, especially finance-growth, postulated that financial innovation contributes to macro and micro development, such as economic growth, efficient financial intermediation, financial diversification, economic resources reallocation, and financial inclusion. The role of financial innovation established in empirical literature in a diversified manner such as, increases the value of financial products and facilities [52], raising the capital growth and distribution practices [53], advances the practices of financial development [54] and upsurges the efficacy of financial institutions [55]. Over the past decades,
financial innovation has contributed to enormous evolvement in the hunt for financial inclusion. Possibly the most prominent example of this is the accomplishment of mobile money transfer and banking services. In this vein, a growing number of studies are found in the empirical literature. For instance, in the study of Qamruzzaman and Wei [2] advocated that the process of financial inclusion was augmented by the diffusion of innovative financial products and services in the economy. In the study of Arslanian and Fischer [56], they suggested that financial innovation, particularly technological advancement in providing financial services, results in easy access to the unbanked population’s formal financial system.

In terms of both the positive and negative impact of financial innovation, various research has investigated the positive relationship between financial innovation and economic development in the host nation [17,57,58]. Despite positive correlations, negative factors have also been established in the relationship between financial innovation and economic development. Adu-Asare Idun and QQ Aboagye [59] used ARDL to investigate the negative connection between financial innovation and Ghana’s economic development. They argued that creating financial products has had a detrimental effect on saving inclination in Ghana, promoting the removal of savings from banks and generating a bank liquidity crisis. Likewise, Ansong, Marfo-Yiadom [60] claimed that undue financial creativity adversely impacted banks with diversified financial goods.

Further evidence was observed in the study (Niankara and Muqattash [61]; Agoba, Sare [62]; Amoah, Korle [63]. Financial inclusion with financial innovation augments integrating the unbans population into the formal financial system by allowing the unbanked rural population to access financial services at their ease. Hence, it is potential to believe that financial innovation broke the Chain of demographic and social attribute issues dragging people to avail financial benefits.

In Dunne and Kasekende’s [64] study, findings revealed money demand in Sub-Saharan Africa adversely influenced financial innovation both in the long-run and short-run. They advocated that financial innovation induced people to move away from liquidating currency to electronic currency in their daily transactions. Further evidence available in the study of Dooley and Spinelli [65], Arrau, De Gregorio [66], Hafer and Kutan [67], Adil, Hatekar [68], Dlamini and Mabuza [69]. Literature advocated that financial innovation plays a critical role in money demand functions. It is also established that transactional efficiency is one of the financial sector results due to the adaption of innovative financial services, hence financial innovation. In a study, Malik [70] postulated that financial innovation brings changes in the financial sector and banking industry reform and substantially influences money demand.

**Hypothesis 1.** Financial innovation positively induces economic growth.

### 2.2. Effects of Economic Policy Uncertainty on Economic Growth

Over the past decades, economic policy uncertainty becomes one of the key issues in investigating its impact on the economy; with this note, a growing number of empirical studies have already been performed concentrating on macro fundamentals. For instance, EPU impact on stock market volatility [28], stock price [29], financial market [31,32,34], exchange rate volatility [35], firm-level investment [36,37], unemployment [38], stock return [39], capital structure [40] and economic growth [71]. Another line of findings was also available in the empirical literature: macro factor effects on EPU see, for instance, oil price shocks [72], gold and Bitcoin [73].

Concerning the anticipated impact of EPU on economic growth, the recent period has produced interest among academicians, researchers, and policymakers. Addressing the impact of EPU on growth, Baker, Bloom [74], and Bhagat, Ghosh [5] advocated that EPU dwindle economic growth speed though showing down the economic activities in the economy, especially increase in unemployment. Further evidence can be observed in the study of Bhagat and Obreja [75]. Study finding exposed that economic growth and
fixed investment is adversely associated with EPU in India. Furthermore, the measures of the stock market in India also established a negative linkage with EPU. These findings are suggesting that the impact of EPU on macro fundamentals of the Indian economy immensely responsive, indicating that the increase of EPU can cause drastically and dismantle the progress, eventually.

In another study, Nyawo and Van Wyk [76] investigated the impact of EPU on developed and developing countries’ economic activity for 2003–2015 by applying impulses response. Study findings established an unanticipated rise in volatility can contribute to a small downturn in the economy because of shock. Additionally, factory output, demand, efficiency, and spending plunged, while unemployment went up considerably. Moreover, Economic policy instability has been discovered to be a rather strong influence. Uncertainty disturbances such as technical disruptions, energy costs, and headlines also lead to market cycle phenomena. Future studies must recognize which forms of shocks are more disruptive to the economy and build models that specifically capture these shocks.

Economic slowdowns boost macro instability because macro uncertainty regarding potential development is counterproductive to short-run growth [77]. Some hypotheses prove to encourage creativity. Companies that operate in chaotic conditions are more likely to become creative. Furthermore, although the Internet created confusion, it was viewed as unprecedented and drew large investments in this revolutionary technology. A connection exists between economic instability and the stock market’s results. The financial sector is a victim of the instability of monetary policy [78]. Favero and Giavazzi [79] evaluate the spillover impact of the capital markets in other economic areas. The deficiency of loss is that such an indicator calculates the volatility shocks’ maximum effect on the wider economy.

**Hypothesis 2.** There is a negative association between economic policy uncertainty and economic growth.

### 2.3. Conceptual Development

The study’s prime motivation is not too comprehensive investigations of economic growth determinants rather unleash fresh evidence about the nexus between financial innovation, economic policy uncertainty, and economic growth in India and Pakistan. Existing literature does not establish inclusive evidence that is the mediating role of EPU in the growth equation with financial innovation. Thus, study findings will probably open an alternative avenue to gauge financial innovation’s impact by taking full consideration of risk ambiance in the economy.

### 3. Data and Methodology of the Study

The study utilizes monthly time series data for the period from 2004M1 to 2018M12 of BRIC countries. The selection of countries and study periods purely rely on data availability. All the variables were extracted from interfacial financial statistics (IFS) published IMF except the index of EPU.

#### 3.1. Financial Innovation

Lewis and Mizen (2000) posit innovation in the financial system appeared in product development and process development. Product innovation entails advancement in financial assets through modification or adaption of improved financial assets such as mutual funds, sweep accounts, and pension funds. Process innovation postulates development in fund accumulation and reallocation processes such as automated teller machines, point-of-sale terminals, and electronic funds transfer.

There is no consensus proxy available in empirical literature because measuring financial innovation in the empirical studies research used several proxy variables. Such variation was subject to data availability and the way of estimation along with countries’ socioeconomic status. However, bring into line with the prevailing literature, in this study,
we considered three proxy measures that are widely used in the various empirical study see, for instance, the first proxy is the broad-to-narrow money \((M2/M1)\) affects the demand for real cash balances, the income, and interest elasticity for money demand \([1,3,4,9,58,60,80]\). For the second measure of financial innovations (FI), we employed the ratio of \(M3\) to \(M1\) \([64,81,82]\) (Ref \([83]\)). Third, following empirical literature such as \([82,84,85]\), financial innovation is measured by financial sector R&D expenditures. The results of PCA displays in Table 1.

**Table 1.** Results of principal component analysis.

| Number | Value  | Difference | Proportion | Value  | Proportion |
|--------|--------|------------|------------|--------|------------|
|        |        |            |            |        |            |
| Panel A: PCA for India |        |            |            |        |            |
| 1      | 2.256  | 1.516102   | 0.7123     | 2.256757| 0.7123     |
| 2      | 0.740  | 0.738067   | 0.2169     | 2.997412| 0.9291     |
| 3      | 0.003  | —          | 0.0709     | 3.000000| 1.0000     |
| Panel B: PCA for Pakistan |        |            |            |        |            |
| 1      | 2.215  | 1.443      | 0.718      | 2.215  | 0.708      |
| 2      | 0.772  | 0.759      | 0.207      | 2.987  | 0.926      |
| 3      | 0.012  | —          | 0.075      | 3.000  | 1.000      |

Note: 1 indicates broad-to-narrow money \((M2/M1)\), 2 indicates the ratio of \(M3\) to \(M1\), and 3 indicates financial sector R&D expenditures, respectively.

3.2. Economic Policy Uncertainty

Baker et al. (2016) measured EPU for major countries and regions globally, and the data can be obtained from the Economic Policy Uncertainty database. It includes uncertainties regarding tax, spending, monetary and regulatory policy by the government that is calculated from 3 components: the frequency that economic policies appear in the newspaper, the number of expired codes, and the extent of forecaster disagreement over future inflation and government purchases. Policy uncertainty

3.3. Estimation Techniques

In empirical estimation, the order of the variables of integration plays a deterministic role in selecting appropriate techniques for further estimation. Thus, the study applies widely used unit root tests, namely ADF: Dickey and Fuller \([86]\), P-P: Phillips and Perron \([87]\), and KPSS: Kwiatkowski, Phillips \([88]\), for detecting variables order of integration (see Table 1).

The generalized ADRL model for assessing the financial innovation impact on economic growth with the mediating role of economic policy uncertainty is as follows:

\[
\Delta Y_t = \alpha_0 + \beta_1 Y_{t-1} + \beta_2 EPU_{t-1} + \beta_3 FI_{t-1} + \frac{1}{m1} \sum_{m=1}^{m1} \lambda_0 \Delta Y_{t-m} + \frac{1}{m2} \sum_{m=1}^{m2} \lambda_1 \Delta EPU_{t-m} + \sum_{m=0}^{m3} \lambda_2 \Delta FI_{t-m} + \sum_{m=0}^{m3} \lambda_3 \Delta FI^* EPU_{t-m} + \epsilon_t
\]

(1)

where, \(\alpha\) is a constant term, the coefficients of \(\beta_1 \ldots \beta_4\) explained the long-run elasticity of financial innovation, EPU, and their interaction term on economic growth; furthermore, the short-run coefficients exhibited by \(\lambda_0 \ldots \lambda_3\). The error correction term specified by \(\epsilon_t\) and are the optimal lag, i.e., \(m1\), \(m2\), and \(m3\), determined with AIC in empirical estimation.

ARDL model in empirical estimation pass through the following three steps;
First, using the F-test of Pesaran, Shin et al. (2001b) [43] with the null hypothesis of no-cointegration ($H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$) against the alternative of cointegration ($H_0: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$).

Second, a standard Wald-test (WPSS), which also tests the above joint null.

Third, the tBDM-test statistic of Banerjee and Dolado [89] with the null hypothesis of no-cointegration ($H_0: \beta_1 = 0$) against the alternative of cointegration ($H_0: \beta_1 < 0$).

Considering the test statistics and given critical value, the presence of a long-run association established if the test statistics from the above tests are higher than the critical value, then the long-run association confirmed.

3.4. Nonlinear ARDL

Since inception, the concept of asymmetry in empirical estimation for gauging the impact both long-run and short-run, a growing number of researchers see, for example [90–92] extensively applied in their study. To gauge the asymmetric effect of financial innovation, EPU on economic growth, we employed nonlinear ARDL proposed by Shin and considered the following asymmetric long-run regression.

\[ Y_t = (\beta^+ F_{1,t}^+ + \beta^- F_{1,t}^-) + (\gamma^+ E_{1,t}^+ + \gamma^- E_{1,t}^-) + \epsilon_t \]  

(2)

where $\beta^+$, $\beta^-$ and $\delta$, associated with long-run pavements. $\beta^+$; $\beta^-$ measure the effects of positive and negative shocks in EPU and $\gamma^+$; $\gamma^-$ for financial innovation on economic growth.

The positive and negative shocks in EPU, financial innovation, and the interactive term of $FI^*EPU$ represent in the equation by $EPU_{1,t}^*$; $EPU_{1,t}^*$, $FI_{1,t}^*$; $EPU_{1,t}^*$, $FI_{1,t}^*$ which is calculated by using the following equations.

\[
\begin{align*}
\text{POS}(FI)_{1,t} &= \sum_{k=1}^{T} \ln FI_k^+ = \sum_{k=1}^{T} \max(\Delta \ln FI_k, 0) \\
\text{NEG}(FI)_{1,t} &= \sum_{k=1}^{T} \ln FI_k^- = \sum_{k=1}^{T} \min(\Delta \ln FI_k, 0)
\end{align*}
\]  

(3)

\[
\begin{align*}
\text{POS}(EPU)_{1,t} &= \sum_{k=1}^{T} \ln EPU_k^+ = \sum_{k=1}^{T} \max(\Delta \ln EPU_k, 0) \\
\text{NEG}(EPU)_{1,t} &= \sum_{k=1}^{T} \ln EPU_k^- = \sum_{k=1}^{T} \min(\Delta \ln EPU_k, 0)
\end{align*}
\]  

(4)

\[
\begin{align*}
\text{POS}(EPU * FI)_{1,t} &= \sum_{k=1}^{T} \ln EPU * FI_k^+ = \sum_{k=1}^{T} \max(\Delta \ln EPU * FI_k, 0) \\
\text{NEG}(EPU * FI)_{1,t} &= \sum_{k=1}^{T} \ln EPU * FI_k^- = \sum_{k=1}^{T} \min(\Delta \ln EPU * FI_k, 0)
\end{align*}
\]  

(5)

Shin, Yu [44] show that the linear model (6) can be transformed into nonlinear ARDL by incorporating EPU variables’ decomposition in the following equation:

\[
\Delta Y_t = \partial U_{t-1} + (\beta^+ E_{1,t-1}^+ + \beta^- E_{1,t-1}^-) + (\gamma^+ F_{1,t-1}^+ + \gamma^- F_{1,t-1}^-) + (\pi^+ FI * E_{1,t-1}^+) \\
+ (\pi^- FI * E_{1,t-1}^-) + \sum_{j=1}^{m-1} \lambda_j \Delta Y_{t-j} + \sum_{j=1}^{n-1} (\pi^+ E_{1,j-1}^+ + \pi^- E_{1,j-1}^-) \\
+ \sum_{j=1}^{n-1} (\pi^+ F_{1,j-1}^+ + \pi^- F_{1,j-1}^-) + \sum_{j=1}^{n-1} (\pi^+ E_{1,j-1}^+ + \pi^- E_{1,j-1}^-) + \epsilon_t
\]  

(6)

Equation (6) can be rewritten in the following manner,

\[
\Delta Y_t = \partial e_{t-1} + \sum_{j=1}^{k-1} \lambda_j \Delta Y_{t-m} + \sum_{m=1}^{k-1} (\pi^+ E_{1,j-1}^+ + \pi^- E_{1,j-1}^-) + \sum_{m=1}^{k-1} (\pi^+ F_{1,j-1}^+ + \pi^- F_{1,j-1}^-) \\
+ \sum_{j=1}^{n-1} (\pi^+ E_{1,j-1}^+ + \pi^- E_{1,j-1}^-) + \epsilon_t
\]  

(7)
where \( e_{t-1} = Y_{t-1} - (\delta^+ EPU_{t-1}^+ - \delta^+ EPU_{t-1}^-) - (\delta^+ FI_{t-1}^+ - \delta^+ FI_{t-1}^-) + (\delta^+ FI_{t-1}^+ - \delta^+ FI_{t-1}^-) \theta \) is the nonlinear error correction term with \( \delta^+ = \frac{\delta^+}{\delta^-} ; \delta^- = \frac{\delta^-}{\delta^+} ; \gamma^- = -\frac{\gamma^-}{\gamma^+} \). \( \gamma^- \) are the long-run parameters. \( \theta = \sum_{j=0}^{m} \theta_j - 1 \), \( \lambda_j = \sum_{j=0}^{m} \theta_j \) for \( j = 1 \ldots m \). \( \delta^+ = \sum_{j=0}^{p} \delta_j^+; \delta^- = \sum_{j=0}^{q} \delta_j^- \). The short-run adjustments to positive and negative EPU and financial innovation changes are captured by \( \pi^+ \), \( \pi^- \), \( \mu^+ \), \( \mu^- \). To gauge the asymmetric relationship between Economic growth, EPU, and financial innovation, the following NARDL is considered:

\[
\Delta y_t = \alpha + \partial y_{t-1} + \beta^+ EPU_{t-1}^+ + \beta^- EPU_{t-1}^- + \gamma^+ FI_{t-1}^+ + \gamma^- FI_{t-1}^- + \mu^+ FI + EPU_{t-1}^+ + \mu^- FI + EPU_{t-1}^- + \sum_{j=1}^{m_1} \lambda_j \Delta y_{t-j} + \sum_{j=0}^{m_2} (n^+ EPU_{t-1}^+ + \sum_{j=0}^{m_3} n^- EPU_{t-1}^+ + \sum_{j=0}^{m_4} (\alpha^+ FI_{t-1}^+ + \sum_{j=0}^{m_5} \alpha^- FI_{t-1}^-) + \sum_{j=0}^{m_6} (\rho^+ FI_{t-1}^+ + \sum_{j=0}^{m_7} \rho^- FI_{t-1}^- + \epsilon_t \tag{8}
\]

3.5. Toda–Yamamoto Causality Test

To establish directional causality between financial innovation, money supply, interest rate, remittance, and stock price, we applied the non-causality test proposed by Toda and Yamamoto [45]. Because traditional causality tests are based on F-statistics in a regression context for determining whether some parameters in the model jointly zero (a stable VAR model) is not valid with variables are integrated. To overcome existing limitations in the traditional causality test, Toda and Yamamoto [45] proposed a causality test utilizing the modified Wald test to restrict a VAR(k). The Toda and Yamamoto (1995) causality test is based on the idea of vector autoregressive at level (P = K + Dmax) with correct VAR order K and d extra lag, where d represents the maximum order of integration of time-series.

\[
Y_t = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} Y_{t-i} + \sum_{j=k+1}^{d_{\text{max}}} \beta_{2j} Y_{t-j} + \sum_{i=1}^{k} \gamma_{1i} EPU_{t-i}^+ + \sum_{j=k+1}^{d_{\text{max}}} \gamma_{1j} EPU_{t-j}^- + \sum_{i=1}^{k} \varphi_{1i} F1_{t-i}^+ + \sum_{j=k+1}^{d_{\text{max}}} \varphi_{1j} F1_{t-j}^- + \epsilon_t \tag{9}
\]

4. Model Estimation and Interpretation

**Unit Root Test**

The results of the conventional unit root test, i.e., ADF and P-P with the null hypothesis of data is no stationary and KPSS with the null hypothesis of data is stationary, exhibit in Table 2. Results established mixed order of integration, suggesting that few variables are stationary at a level I(0) and few become stationary after the first difference I(1). This verdict is pertinent to all three unit root tests.

| Table 2. Results of unit root test. |
|------------------------------------|
| **India**                          |
| ADF                                |
| Y                                  | -1.525 |
| F1                                 | -1.941 |
| EPU                                | -5.340 * |
| ΔY                                 | -12.383 *** |
| ΔF1                                | -2.645 * |
| ΔPE                                | -12.714 *** |
| **Pakistan**                       |
| ADF                                |
| Y                                  | -1.589 |
| F1                                 | -2.756 |
| EPU                                | -8.679 *** |
| ΔY                                 | -12.473 *** |
| ΔF1                                | -21.348 *** |
| ΔPE                                | -49.777 |

Panel A: with constant

**Panel A:**

| **India** | **Pakistan** |
|-----------|--------------|
| ADF       | KPSS         | ADF | KPSS |
| Y         | -1.092       | -1.0927 | 1.400 *** |
| F1        | -0.778       | -1.8064 | 1.116 *** |
| EPU       | -0.778       | -1.8064 | 1.116 *** |
| ΔY        | -13.375 ***  | -13.375 *** | 0.094 |
| ΔF1       | -16.738 ***  | -16.342 *** | 0.265 |
| ΔPE       | -16.650 ***  | -17.320 *** | 0.268 |
Table 2. Cont.

|          | India          | Pakistan          |
|----------|----------------|-------------------|
|          | Panel B: with constant and trend |                   |
| $Y$      | −1.1931        | −1.446            |
|          | 0.265 ***      | −1.789            |
|          | −1.8108 ***    | 0.1944 **         |
| $FI$     | −1.867         | −2.636            |
|          | 0.089          | −3.514            |
|          | −3.1007        | 0.1729 **         |
| $EPU$    | −10.537 ***    | −10.633 ***       |
|          | 1.093 ***      | −3.514            |
|          | −3.1007        | 0.1729 **         |
| $\Delta Y$ | −12.393 ***   | −12.460 ***       |
|          | 0.067          | −13.34 ***        |
|          | −13.341 ***    | 0.0885            |
| $\Delta FI$ | −2.939        | −23.154 ***       |
|          | 0.048          | −16.696 ***       |
|          | −16.3092 ***   | 0.0846            |
| $\Delta EPU$ | −12.680 ***  | −49.603           |
|          | 0.041          | −16.721 ***       |
|          | −17.5537 ***   | 0.0846            |

Note: ***/**/* indicate the level of significance at a 1%, 5%, and 10%, respectively.

In the following, the study investigates both long-run and short-run relationships between financial innovation, EPU, and economic growth in India and Pakistan by performing equation-1. Table 3 displays the results, including long-run cointegration test in panel A; long-run coefficients in panel B; short-run coefficients report in panel C and residual diagnostic tests result in panel D.

Panel A of Table 3 reports the results of the long-run cointegration test performing three statistics. First, the modified F-test (FPSS), advanced by Pesaran, Shin [43]. Second, a standard Wald-test (WPSS), which is the above joint null hypothesis, and Third, a $t$-test (tBDM) proposed by Banerjee, Dolado [89]. We observed that the null hypothesis of no cointegration is rejected by a significant 1% level, suggesting that test statistics of $F_{pss}$, $W_{pss}$, and $t_{BDM}$ are higher than the critical value at a 1% level significance. Once the long-run association documented, we move to assess both long-run and short-run magnitudes running from economic policy uncertainty and financial innovation on the economic growth of India and Pakistan.

Table 3 of panel B reports long-run coefficients. It is palpable for EPU and economic growth that a negative impact is running from EUP to economic growth. Study findings in line with the existing literature; see, for instance, [5, 71, 75, 76]. More specifically, the increase of 10% EPU in the coming year can produce an adverse outcome in terms of aggregate output by reducing GDP at a rate from 4.21% to 7.94% in India and Pakistan. Thus, aggregate output has reduced a rate from 2.9% to 7.4%. These findings suggest that economic policymakers must focus on observing the trend of EPU and the reaction of macro fundaments. Otherwise, instability and discomfort situation can halt the growth speed for a longer period. Results of FI impacts on economic growth exhibit positive linkage in India (a coefficient of 0.067) and in Pakistan (a coefficient of 0.029). Study findings suggest that innovativeness in the financial system can cause overall macro performance with a positive note. The possible interpretation is that efficient financial intermediation and economic resources channelization increase the possibility of growing further and ensuring optimization, especially for resources. The coefficient of interactive term measuring EPU and FI’s combined impact on economic growth is negative and statistically significant for India (a coefficient of −0.044) and Pakistan (a coefficient of −0.115). Study findings established that even though FI positively induces economic growth and EPU exposes adverse impact on economic growth, the combined impact also reveals a negative association. It indicates the elasticity of EPU is more obvious than FI in the economy; thus, the overall impact appears on a negative note. To avail the full potential benefits from adaptation and diffusion of financial innovation in the economy, it is imperative to control whether the state of EPU should be lower.
Table 3. Linear autoregressive distributed lagged (ARDL) estimation results.

|                      | India (1)       | Pakistan (2)    | Pakistan (3)    | Pakistan (4)    | Pakistan (5)    | Pakistan (6)    |
|----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Panel A: long-run cointegration test** |                 |                 |                 |                 |                 |                 |
| $F_{pss}$            | 8.44 ***        | 12.102 ***      | 12.518 ***      | 11.919 ***      | 16.761 ***      | 9.511 ***       |
| $W_{pss}$            | 19.8 ***        | 19.774 ***      | 5.101 ***       | 11.109 ***      | 12.857 ***      | 18.106 ***      |
| $b_{BDM}$            | −9.077 ***      | −5.233 ***      | −4.712 **       | −8.698 ***      | −7.402 ***      | −9.061 ***      |
| **Panel B: Long-run coefficient** |                 |                 |                 |                 |                 |                 |
| $\beta$              | −0.079 ***      | −0.064 ***      | −0.042 **       | −0.074 ***      | −0.053 ***      | −0.029 **       |
|                      | (−25.314)       | (−11.475)       | (−5.762)        | (−13.411)       | (−11.457)       | (−5.745)        |
| $\gamma$             | 0.067 **        | −0.054 ***      | 0.019 ***       | −                | 0.045 ***       | (24.513)        |
|                      | (11.254)        | (10.512)        | (8.744)         | −                | (24.513)        |                 |
| $FI*EPU$             | −0.044 **       | −0.029 **       | −                | −0.115 ***      | −0.027 ***      | (−15.754)       |
|                      | (−24.551)       | (−10.442)       | −                | (−54.712)       | −                |                 |
| **Panel C: short-run coefficients** |                 |                 |                 |                 |                 |                 |
| Constant             | −0.495 ***      | −1.037 ***      | −0.015 **       | 0.604 ***       | 0.201 ***       | −0.042 ***      |
|                      | (−75.845)       | (−88.754)       | (−97.215)       | (25.762)        | (67.451)        | (−37.142)       |
| Trend                | 0.034 ***       | 0.019           | −0.016 ***      | 0.061 ***       | 0.016 ***       | 0.242 ***       |
|                      | (10.514)        | (5.755)         | (9.114)         | (12.745)        | (10.241)        | (44.751)        |
| $\zeta$              | −0.317 ***      | −0.314 ***      | −0.091 ***      | −0.143 ***      | −0.378 ***      | −0.053 ***      |
|                      | (−23.154)       | (−75.014)       | (−24.514)       | (−25.146)       | (−75.412)       | (−14.215)       |
| $\lambda_1$          | −0.005 ***      | −0.091 ***      | −0.015 ***      | −0.025 ***      | −0.028 **       | −0.073 **       |
|                      | (−17.241)       | (−10.712)       | (−5.771)        | (−10.614)       | (−24.014)       | (−1.142)        |
| $\lambda_2$          | 0.211 **        | 0.016           | 0.215 ***       | 0.015 **        | −                | −0.006 *        |
|                      | (10.512)        | (10.421)        | (15.251)        | (10.412)        | −                | −10.142         |
| $EPU*FI$             | −0.005 **       | 0.003 ***       | 0.002           | −0.006 *        | −                | −0.006 *        |
|                      | (−0.021)        | (3.021)         | (0.004)         | (−5.124)        | −                | −10.142         |
| **Panel D: residual diagnostic test** |                 |                 |                 |                 |                 |                 |
| $R^2$                | 0.789           | 0.792           | 0.329           | 0.287           | 0.132           | 0.747           |
| $F$–test             | 10.384 ***      | 10.667 ***      | 45.054 ***      | 12.587 ***      | 15.294 ***      | 14.035 ***      |
| $x^2_{AR,corr}$      | 0.011           | 0.557           | 0.271           | 0.31            | 0.785           | 0.237           |
| $x^2_{Nor}$          | 0.368           | 0.424           | 0.894           | 0.942           | 0.409           | 0.174           |
| $x^2_{het}$          | 0.235           | 0.078           | 0.473           | 0.891           | 0.714           | 0.445           |
| RESET                | 0.584           | 0.877           | 0.285           | 0.152           | 0.135           | 0.123           |

Note: ***/*/ Indicates the level of significance at a 1%, 5%, and 10%, respectively.

Panel C of Table 2 reports the Short-run coefficients of the empirical model. The study documented that the error correction term is negative and statistically significant at a 1% level. The coefficients specify the speed of adjustment toward long-run equilibrium due to prior period shocks. Regarding EPU’s effects on economic growth, the study revealed similar associations like the long-run, i.e., adverse impact. On the other hand, the magnitudes of financial innovation on economic growth expose positive ties, but the coefficients’ impact is minimal. Moreover, finally, the impact of interactive term, that is, EPU*FI, also shows negative and statistical significance, but considering their elasticity, palpable that similar to financial innovation.

Panel D of Table 2 presents the result of diagnostic tests. The associated $p$-value of test statistics is statistically insignificant, implying that empirical models are free from serial correlation, residuals are normally distributed, and internal consistency is also established.
Next, the asymmetric effects of EPU and financial innovation on economic growth were investigated by executing nonlinear ARDL (see Equation (8)) and result in reports in Table 4.

Table 4. Results of asymmetric model estimation.

|          | India      | Pakistan   |
|----------|------------|------------|
|          | (7)        | (8)        | (9)        | (10)       | (11)       | (12)       |
| Panel A: long-run asymmetry cointegration |            |            |            |            |
| $F_{pss}$ | 18.748     | 5.525      | 8.606      | 10.873     | 12.676     | 17.409     |
| $W_{pss}$ | 16.338     | 8.303      | 17.592     | 10.283     | 18.387     | 5.98       |
| $b_{BDM}$ | −7.896     | −9.861     | −7.583     | −10.861    | −8.378     | −12.277    |
| Panel B: Long-run coefficients |            |            |            |            |
| $\gamma^+$ | −0.195 **  | −0.004 *** | −0.106 *** | −0.013 *** | −0.101 *** | −0.041 *** |
| $\gamma^-$ | −0.356 *** | −0.015 *** | −0.045 *** | −0.052 *** | −0.107 *** | −0.028 *** |
| $\lambda$ | 0.069 **   | 0.195 ***  | −0.106 *   | 0.014 *    |            |            |
| $\lambda$ | −0.127 *** | 1.807 **   | 0.135 **   | −0.013 *   |            |            |
| $\mu$    | 0.002 **   | −0.17 **   | −0.031 *** | −0.021 **  |            |            |
| $\mu$    | 0.089 **   | −0.481     | 0.048 ***  | −0.028 **  |            |            |
| Panel C: Short-run coefficients |            |            |            |            |
| $\zeta$  | −0.262 *** | −0.094 *** | −0.328 *** | −0.128 *** | −0.091 *** | −0.083 *** |
| Constant | 0.969      | 0.037      | 0.943      | −0.358     | 0.204      | 0.13       |
| Trend    | −0.081     | 0.005      | −0.024     | 0.032      | 0.048      | 0          |
| $\delta^+$ | −0.012 **  | −0.292 *   | −0.033 *** | −0.023 *** | −0.024 *** | −0.209 *** |
| $\delta^-$ | −0.098 **  | −0.024 *   | −0.082 *** | −0.035     | −0.011 *** | −0.014 **  |
| $\lambda$ | 0.067      | −0.864     | 0.149      | −0.015     |            |            |
| $\beta$  | −0.098     | 0.072      | −0.119     | 0.005      |            |            |
|          | −0.041     |            |            |            |
|          | −0.003     |            |            | −0.015     |            |            |
| Long-run and short-run symmetry |            |            |            |            |
| $W_{FI}^{LR}$ | 18.961   | 8.664      | 8.978      | 14.461     | 11.557     | 19.809     |
| $W_{EPU}^{LR}$ | 18.961   | 8.664      | 8.978      | 14.461     | 11.557     | 19.809     |
| $W_{EPU+FI}^{LR}$ | 18.961 | 8.664      | 8.978      | 14.461     | 11.557     | 19.809     |
| $W_{EPU}^{SR}$ | 9.77     | 4.377      | 3.502      | 12.241     | 8.216      | 10.728     |
| $W_{EPU+EPU}^{SR}$ |         |            |            |            |            |            |
| Residual diagnostic test |            |            |            |            |
| $x^2_{Auto}$ | 0.699    | 0.215      | 0.589      | 0.494      | 0.906      | 0.059      |
| $x^2_{Het}$ | 0.401    | 0.347      | 0.907      | 0.023      | 0.718      | 0.535      |
| $x^2_{Nor}$ | 0.914    | 0.525      | 0.212      | 0.764      | 0.072      | 0.859      |
| $x^2_{RESET}$ | 0.316   | 0.658      | 0.427      | 0.285      | 0.177      | 0.177      |
| CUSUM    | S          | S          | S          | S          | S          | S          |
| CUSUM of square | S         | S          | S          | S          | S          | S          |

Note: ***/**/* indicate the level of significance at a 1%, 5%, and 10%, respectively. S indicates stability.
Panel A of Table 4 shows the results of Fpss, Wpss, and tBDM for the cointegration test and rejected their respective null hypothesis at a 1% level of significance. Next, the long-run and short-run Wald test results rejected the null hypothesis of symmetry at a 1% level of significance. These findings suggest that positive and negative shocks of EPU and financial innovation do not have a conventional association with economics. It suggests that both in the long-run and short-run, the impact of financial innovation and EPU can erratically err in the economy. Therefore, applying NARDL in assessing the long-run and short-run effects of EPU on financial innovation allows a better fit model in empirical estimation.

Move to assess nonlinear effects of EPU, i.e., positive and negative shocks of EPU, on economic growth, and the results exhibit in panel B of Table 3 for the long run. The study established a negative linkage between positive and negative shocks in EPU and economic growth. These findings suggest that the increase of EPU in the economy adversely caused the development and evolution of financial innovation in the financial system; on the other hand, financial stability through reducing EPU acts as a catalyst role and encourages aggregated movement output Indian and Pakistan economy. Furthermore, reducing EPU induces domestic investment through the contribution from both local investors and foreign investors [93]) The lower level of EPU attracts foreign capital flows with higher profitability, and investors are enabled to tradeoff between risk and return. In contrast, the high degree of EPU investors seeks investment protection rights and privileges. Thus, discourage capital inflows from the economy, eventually lessen the possibility of economic progress.

The asymmetric effects of FI on economic growth established positive linkage, these findings in the like with Qamruzzaman, Jianguo [1], Qamruzzaman and Wei [94]. Financial institutions adapt and offer innovative financial products and services in the economy, which efficiently allows economic resource allocation. Thus, maximization enhances productivity growth; moreover, innovativeness in the financial system entices institutional growth and diversification. Offering financial products and services to society ensures financial inclusion and offers greater income generation opportunities with productive output.

The short-run nonlinear effects are displayed in panel C of Table 3. The study revealed several statistically significant coefficients. More specifically, statistically significant positive and negative shocks established a positive linkage with financial innovation and economic growth and a negative tie between EPU and economic growth, but the asymmetry impact of the interactive term established a statistically insignificant linkage with economic growth. In terms of asymmetric magnitudes, both EPU and FI are very much minimal, implying that EPU can halt economic progress and FI adaptation can cause a positive move, but their magnitudes are tiny in comparison with long-run estimation.

The results of the long-run and short-run symmetry are shown in panel D of Table 5. Both long-run and short-run asymmetry are investigated through the standard Wald test with the null hypothesis of “long-run and short-run symmetry.” The test statistics reject the null hypothesis at a 1% level of significance and confirmed asymmetry running from EPU to financial innovation. These findings suggested that positive and negative shocks in EPU do not cause in the same direction with the same magnitudes. Furthermore, residual diagnostic tests confirm model stability and efficiency for empirical estimation.

The residual diagnostic test confirm the model is free form serial correlation (χ²_{Autocorrelation}), no problem for heteroscedasticity, and residuals are normally distributed (χ²_{Normality}) for each country-tested model. Moreover, the Ramsay RSET test confirms model functional form is well established.

Next, the directional relationship assesses by performing a causal Equation (9), and the results are shown in Table 5. The study established several directional causalities; however, the study focuses on causal effects running from asymmetries of EPU and financial innovation on economic growth.
Table 5. Results of causality test: financial innovation measured by $M_3/M_1$.

|       | Y   | EPU+ | EPU− | FI+ | FI− | Causal Relationship                     |
|-------|-----|------|------|-----|-----|-----------------------------------------|
| Panel A: India |     |      |      |     |     | **EPU+ → Y; EPU− ↔ Y; FI+ → Y; Y ↔ FI−** |
| Y    | 12.142 *** | 15.594 *** | 7.249 * | 8.072 ** |     |                                         |
| EPU+ | 5.799 | 7.094 * | 2.026 | 13.381 *** |     |                                         |
| EPU− | 6.119 * | 0.591 | 1.08 | 6.114 * |     |                                         |
| FI+  | 0.839 | 6.733 * | 3.46 | 9.963 ** |     |                                         |
| FI−  | 20.626 *** | 6.737 * | 5.689 | 11.822 *** |     |                                         |
| Panel B: Pakistan |     |      |      |     |     | **EPU+ ↔ Y; EPU− → Y; Y ↔ FI+**         |
| FI   | 14.279 *** | 10.95 *** | 10.225 *** | 4.996 |     |                                         |
| EPU+ | 6.562 * | 7.427 * | 1.446 | 1.234 |     |                                         |
| EPU− | 1.422 | 1.058 | 0.067 | 1.486 |     |                                         |
| FI+  | 11.519 *** | 6.392 * | 0.459 | 0.632 |     |                                         |
| FI−  | 0.537 | 1.33 | 11.852 *** | 0.693 |     |                                         |

Note: */**/*** indicate the level of significance at a 10%/5%/1% level, respectively.

The study revealed supportive evidence favoring the existence of a feedback hypothesis that is bidirectional causality between negative shocks in EPU and economic growth ($EPU− → Y$) and negative shocks in FI and economic growth ($FI− → Y$) in India. These findings suggest that any adverse shock in EPU and financial innovation can case the present trend of economic growth. On the other hand, continual growth in the economy helps mitigate the impact of EPU and the destructive impact of financial innovation. Furthermore, unidirectional causality runs from positive shocks in EPU and financial innovation, implying that innovativeness in the financial system helps augment the present state of economic growth, and the potential impact can be observed in the economy due to instability as well.

Whereas for Pakistan, the feedback hypothesis holds in explaining the causality between positive shocks in EPU and economic growth ($EPU+ ↔ Y$) and positive shocks in FI and economic growth ($FI+ ↔ Y$). These findings suggest that Pakistan’s economic growth immensely inclined the movements’ internal stability and the financial system’s capacity in terms of adaptation and diffusion innovation in products and services. Additionally, unidirectional causality running from EUP+ to economic growth ($EPU− → Y$) and positive shocks in FI and economic growth ($FI− → Y$) in India. Furthermore, unidirectional causality running from Negative shocks in EPU and economic growth ($EPU− → Y$).

5. Findings and Conclusions

The paper has examined the nexus between economic policy uncertainty, financial innovation, and economic growth in India and Pakistan for 2004M1–2018M12. The key finding of the study are as follows:

First, detecting variables order of integration, we performed both conventional and nonlinear unit root tests. Conventional unit root test established a mixed order of integration, i.e., few variables are stationary at a level, and few become stationary after the first difference. The result of nonlinear unit root tests disclosed variables become stationary by following a nonlinear process. Such a variable order of integration induces further estimation following a nonlinear framework in the empirical study.

Second, empirical model estimation with ARDL established a long-run association between economic policy uncertainty, financial innovation, and economic growth in selected countries. The long-run coefficient exhibits a negative association with EPU and economic growth in both countries. Study findings in line with Bhagat, Ghosh [5]; Sahinoz and Erdogan Cosar [71]. EPU shrinks aggregate output by discouraging the overall consumption
and investment in the economy; furthermore, overall import performance in the economy is also adversely affected by EPU (Sharma and Paramati [95]. The study of MAWUSI [96] argued that EPU adversely influences the relationship between bilateral trade; moreover, a higher degree of EPU in the economy hampered countries’ exports.

Furthermore, the effects of financial innovation on economic growth establish a positive linkage supported by empirical findings such as Bara and Mudxingiri [9]. Qamruzzaman, Jianguo [1]; Law, Sarmidi [97]. In a study, Forgor and Julie [98] advocate that financial innovation accelerates economic growth through financial development, it is because the offering of diversified products and services establishes a bridge and brings the unbanked population into the formal financial system. Society integration into formal financial system assists in forming a knowledge-based economy, thus promotes aggregate economic activities.

Third, the standard Wald test’s test statistics confirmed that the asymmetric effects are running from EPU and FI to economic growth in India and Pakistan both in the long-run and short-run. In the long-run, both positive and negative variations in EPU display negative linkage with economic growth in all empirical models. Considering the elasticity of their economic growth, it appears that negative shocks of EPU are nevertheless more vibrant than positive shocks in EPU. In the short run, positive and negative shocks in EPU established a statistically significant economic growth impact; however, statistically significant coefficients are negatively associated with financial innovation. With regard to asymmetric effects of financial innovation on economic growth. It is observable that positive ties available with asymmetric shocks of FI and economic growth in India and Pakistan. These findings suggest that financial progress with adaption and diffusion of products and services diversification can assist in thriving economic growth. Financial innovation strengthens the financial system with the implementation of new rules and regulations in the economy. A conducive environment is a sine qua non for private investments that will contribute meaningfully to economic growth [99].

Finally, the directional causality test holds the feedback hypothesis of explaining the causal effects between EPU and financial innovation. These findings suggesting that in the long-run, anything happened in either variable, i.e., financial innovation and EPU, the obvious effects will have appeared, respectively.

The present study does not free from certain limitations. The measurement of financial innovation can be considered in diversified ways. Several measurements have been used in literature, and diversifications in proxy selection may result in a new avenue of thinking. Regarding, selection of control variables with global proxy measures can cause in producing diverse outcome in the future estimation.

Author Contributions: Conceptualization, S.X., M.Q. and A.H.A.; data curation, M.Q.; formal analysis, S.X. and A.H.A.; methodology, S.X., M.Q. and A.H.A.; writing—original draft, S.X., M.Q. and A.H.A.; writing—review and editing, M.Q. and A.H.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research dose received no external funding.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available in the form of readily used for research rather need to collect different sources and managed accordingly.

Acknowledgments: We would like to express our heartfelt thanks and gratitude’s to the associate editor and Academic editor for their valuable consideration in revising the manuscript. Furthermore, extend our sincere respect to three anonymous reviewers for their constructive comments, which help us revise the manuscript’s present form and developed it with standard acceptance.

Conflicts of Interest: The authors confirm no conflict of interest.
Abbreviations

ARDL  Autoregressive distributed lagged
NARDL  Nonlinear autoregressive distributed lagged
EPU  Economic policy uncertainty
FI  Financial innovation
ADF  Augmented Dickey–Fuller
P-P  Phillips–Perron
KPSS  Kwiatkowski–Phillips–Schmidt–Shin

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