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Natural resources and sustainable financial development: Evidence from South Asian economies

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ABSTRACT

In contemporary times, the existing literature provides a blurred image regarding the connection between natural resources and financial market development. Some studies validate the financial resource curse, while others reveal financial resource blessings. To reach a true conclusion, this study analyzes the impact of natural resources on financial market development in the presence of financial risk and technological innovation. Exploring the nexus in four South Asian economies, this study covers the period from 1990 to 2020. Due to the data's asymmetric distribution, this study uses the novel non-parametric (bootstrap quantile regression) technique. The empirical results revealed that natural resources are a curse in the development of financial markets. That is, natural resources are negatively associated with financial market development. On the other hand, financial risk and technological innovation are the substantial factors of financial market development, which positively affect financial markets throughout quantiles. The robustness of the model is also tested via parametric (robust regression) and non-parametric (panel quantile regression) approaches. Unidirectional causal impact is observed from natural resources, financial risk, technological innovation, and financial market development. Based on the empirical findings, this study directed the channelization of natural resources, reducing financial risk and enhancing investment in research, development, and human capital.

1. Introduction

As the world globalizes, economic, financial, and environmental sustainability requirements intensify. Financial development is significant in promoting economic progression and a sustainable environment, and it is important lifeblood of a developed economy (Cao et al., 2022; Ielasi et al., 2018; Su et al., 2022b). It not only alleviates poverty but also signifies promoting environmental quality. Further, improving the financial sector aids in refining growth for market progression (Chen et al., 2022; Umar et al., 2022b; Wang et al., 2022). Financial market development is a valuable source for the evolution of cumulative businesses, economic production, and attracting investment opportunities through the efficient allocation of resources (Ferrat et al., 2021; Gao et al., 2021; Hmaittane et al., 2019). Overall, it is imperative to generate economic wealth that leads to sustainable development (Ji et al., 2021a; Yang et al., 2022). Alongside this, the role of technology and revenues from natural resources play a prominent part in supporting financial sector development.

The exploitation of resource revenues can be significantly utilized through the improved financial sector and technological innovation for sustainability (Abbasi et al., 2022; Atil et al., 2020; Han et al., 2022; Khan et al., 2021; Su et al., 2022a, 2022c; B. Yang et al., 2021; Yuhui and Zhang, 2022). After the financial crisis (2008), the importance of financial development increased. However, the academic literature is infrequent in analyzing certain factors that influence financial market development. Hence, financial risk, natural resource rents, and innovation have become interesting areas for obtaining sustainability. Grounded on the research need, the present study is motivated by scrutinizing the determinants of financial market expansion in the sample of South Asian economies. The present literature has attempted to explore the association between resource rents, technological innovation, and financial development (Han et al., 2022; Lv et al., 2021; Yuhui and Zhang, 2022). Due to the diversity of research outcomes and scarcity of empirical evidence on financial market development in South Asian countries, the research intends to analyze these determinants.

In the context of South Asian economies, the study aims to have the

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following objectives. The study's primary objective is to analyze the role of natural resource rents on financial market development in South Asian Economies. The study's second aim is to inspect that technological innovation on financial market development, while the third objective is to investigate the impact of financial risk on financial market development in South Asia. To accomplish these, the study utilizes bootstrap Quantile regression analysis and causality analysis to obtain significant and reliable results. The innovative variables are obtained from the PRS group and World bank, respectively, as described in methodology section 3.

The study is significant in the following ways. The study is substantial in analyzing imperative factors for the South Asian economies. South Asia is now known as the hub of technological innovation, with many educated laborers and their connection to new technological innovation. However, the majority still lag in terms of advancement. But then again, it would be significant in estimating the influence of technological advancement on financial market development in South Asia. The findings might aid in encouraging technological innovation besides supporting policy regulations. Further, the study is significant in determining the factors for financial market development in South Asian economies. Increasing financial market development is imperative in alleviating poverty and increasing risk management. Therefore, inspecting the factors that positively or negatively impact financial market development will help strategize policies for improving financial development for sustainability and progression in the economy.

The study is noteworthy in contributing to the literature in the following ways. First, the study provides additional empirical literature on the relationship between total natural resource rents and financial market development. previous studies have scrutinized the connection with asymmetric outcomes (Ali and Ramakrishnan, 2022; Han et al., 2022; Z. Khan et al., 2020b; Nawaz et al., 2019). The present study aims to investigate the nexus in South Asian economies. Second, the study is novel in inspecting the influence of financial risk on financial market development. The extant literature on this area is scarce. Therefore, the present study contributes to the academic literature by providing empirical evidence. Third, the study contributes to the literature analyzing the influence of technological innovation, natural resources, and financial risk on financial market development simultaneously in South Asian countries from the year 1990–2020. In this way, the current research aims to determine the factors that influence financial development, which is a novel contribution to the large body of pragmatic knowledge of financial development.

The rest of the manuscript is organized as follows. The upcoming section is about the review of the relevant literature. Then Section 3 documents the data and methodology of the study. Section 4 is about results and their interpretations. Section 5 deals with conclusions and policy implications.

2. Literature review

Financial development helps achieve financial and economic substantially. Therefore, this segment elaborates on the relationships and aspects of the variables under consideration to examine determining factors for financial market development in three sub-sections.

2.1. Resource and development nexus

The economic progression is based on the heightening of financial development (Yıldırım et al., 2020). examined the nexus of natural resources and financial market development in developing economies from 1994 to 2017. The panel estimates demonstrate that natural resource rents have a positive long-run association with financial market development. Whereas in the short term, no specific influence was observed. Similarly, in the case of Pakistan (Nawaz et al., 2019), validated the resource blessing hypothesis. The promotion of natural resources has a positive impact on the finance and growth nexus. Also, the development of financial markets increases domestic production in the country. In another research on the economy of Pakistan (Atil et al., 2020), scrutinized the positive association between natural resources and financial market development, indicating the validation of the resource blessing hypothesis. In China (Guan et al., 2020a), analyzed the relationship between natural resources and financial market development through cointegration and ARDL analysis. The results depicted long-run associations with confirmation of the resource curse hypothesis. Likewise, in another study in China (Z. Khan et al., 2020c; Umar et al., 2021; J. Yang et al., 2021), inspected the negative relationship between natural resources on financial market development. A negative association is observed in the case of emerging and developing economies. However, the negative resource finance connection is overcome with the inclusion of institutional quality, trade openness, and human capital (Khan et al., 2019; Sun et al., 2020). (Moradbeigi and Law, 2017; Rahim et al., 2021) investigated the inverse impact of oil resource abundance on economic growth in oil abundance economies. However, the negative influence of natural resources is dampened by the economic promotion of financial market development (Dogan et al., 2020a; Z. Khan et al., 2020b). analyzed the nexus between natural resources and financial development. The empirical findings validated the resource curse hypothesis, and the abundance of natural resources negatively influences the financial market development in resource-rich economies and China, respectively. In contrast (Hussain et al., 2021), observed that abundant natural resources are a blessing in resource-rich economies. The empirical findings demonstrated that abundant natural resources support financial development in resource-rich countries. In another novel contribution to resource abundance economies (Han et al., 2022), examined that increasing natural resources in the country negatively affects financial development. In the case of ASEAN economies (Nathaniel, 2021), investigated the negative relationship between natural resources on financial market development using panel econometric analysis. The results emphasize that resource abundance decreases financial development. In another novel research on ASEAN nations (Tang et al., 2022), examined the negative association between resource rents and financial market development. However, encouraging business regulations balances the inverse finance resource nexus (Ali and Ramakrishnan, 2022). observed a financial resource curse in the case of the Malaysian Banking sector, meaning that the abundance of natural resources deteriorates the financial market development. However, a positive association is observed between natural resource abundance and stock (finance) market development. Apart from the adverse impact of natural resources on financial development, it also enhances the level of carbon emissions (Ji et al., 2021b; Umar et al., 2022a). However, the literature suggested an enhancement in human capital, fiscal decentralization, renewable energy consumption, technological innovation; financial inclusion, exports, financial development, technological innovation; environmental regulations, research and development, energy efficiency, and pollution prevention investment (Cai et al., 2022; Jiang et al., 2022; Khan et al., 2021, 2019; Z. Khan et al., 2020a, 2020c; L. Qin et al., 2021a, 2021b; Shahzad et al., 2021; Tufail et al., 2021; Zhao et al., 2022).

2.2. Technological advancement and financial development

Technological innovation is recognized to have an imperative role in affecting environmental quality (Abbasi et al., 2022; Chishti and Sinha, 2022; Khan et al., 2021; B. Yang et al., 2021). However, in some economies, it positively impacts the development of the financial market. In China (Khan et al., 2021), analyzed technological innovation's constructive and significant influence on financial market development (Hussain et al., 2021). analyzed the development of financial markets upsurges in high-income economies in the presence of technological innovation. The empirical results demonstrated that increasing technological advancement raises financial market development (Zeng et al., 2022a). inspected the moderating role of technological innovation in

promoting financial market development in China, which is significant in improving environmental quality (Pan et al., 2019). also discovered that technological advancement has a substantial role in improving energy efficiency, which is significantly impacted by trade and financial market development. In the case of China (Yao et al., 2018), scrutinized that technological innovation is significant in promoting financial market development (Xie et al., 2019). analyzed the positive role of technological innovation in promoting financial market development. The empirical results depict that innovation significantly enhances green finance and the firm's financial performance, which is imperative for sustainable financial market development. In a novel analysis (Lv et al., 2021), examined that the innovation output substantially plays a vital role as a mediator between financial development and technological innovation (Hsu et al., 2021). investigated that financial market development is significant in promoting technological innovation, which simultaneously aids in limiting carbon dioxide emissions.

2.3. Financial risk and financial market development

The scrutiny of financial risk concerning economic and financial development is limited. In addition, the impact of financial risk on financial market development is quite scarce in the extant literature. But then again, the following body of knowledge substantially particularizes on the nexus between financial market development on financial risk. Such as (Abdul Hamid et al., 2020), emphasized that financial risk is associated with the banking (financial) sector. The empirical findings demonstrate that financial development heterogeneous impacts bank risks depending on their types. However, the financial risk upsurges in virtuous times. In the case of China, the improvement in financial development positively impacts controlling financial risk in the financial sector. The increasing progression in the finance market depletes corporate financial risk through governance and resource effect (Yuhui and Zhang, 2022). In a novel analysis (Ozili, 2021), discovered that increasing financial market development increases the efficiency of the financial sector, which ultimately reduces financial risks. Similarly (Vithessonthi, 2014), observed a significant association between financial market development and financial risk.

After details review of the literature on financial market development factors, it is evident that several amounts of studies have analyzed the resource and finance nexus with asymmetrical findings (Han et al., 2022; Hussain et al., 2021; Z. Khan et al., 2020a, 2020b; Nathaniel, 2021; Sun et al., 2020). For the influence of technological innovation and financial risk, quite a few have inspected the impact on financial market development in diverse economies (Lv et al., 2021; Zeng et al., 2022a; Yuhui and Zhang, 2022). Hence, the present study analyzes the simultaneous impact of financial risk, technological innovation, and natural resource rents on financial market development.

3. Data and methodology

3.1. Data and model specifications

Following the study objectives and the contradictory literature discussed above, this research tends to re-examine the influence of natural resources [TNR: percent of gross domestic product (GDP)] on the financial market development (FMD: Domestic credit to private sectors by banks, % of GDP). In addition, this research also analyzes the important role played by the financial risk index (FRI) and technological innovation (TI: patents applications registered by residents and non-residents) on FMD. Data for these variables are obtained from authentic sources, i.e., the World Bank[1] and PRS group.[2] Data for the study variable is extracted for the last three decades, i.e., 1990–2020, which covers four South Asian economies, including India, Bangladesh, Sri Lanka, and Pakistan. Other economies are not included in the analysis due to data unavailability for the prescribed period.

Following the study of (Ibrahim et al., 2022), this study constructed the following model:

$$FMD_{it} = \alpha_0 + \varphi_1 TNR_{it} + \varphi_2 FRI_{it} + \varphi_3 TI_{it} + \varepsilon_{it} \quad (1)$$

From the above model, it must be noted that α_0 is the intercept of the model, whereas φ reports the coefficients for each explanatory variable. In addition, ε is the error term of the model, whereas "i" and "t" in the subscript represent cross-sections and time series, respectively.

3.2. Estimation strategy

This study investigates summary analysis for examined variables to offer an exhaustive assessment of panel data. Specifically, descriptive information includes the mean, median, and range statistics, with the latter including the least and greatest data attributes. This study also examines the standard deviation for each research variable, revealing the time variable's volatility via the data's dispersion from the mean. In addition, two normality measures are used to assess the distributional features of the data. Specifically, skewness and Kurtosis are used in the data to determine if the dispersion of a variable fulfills the normalizing requirements. Even though Skewness and Kurtosis give reliable information on the spread of the variable. However, this strategy addresses the topic of normalcy in more depth. This research employs the normalcy assumption of (Jarque and Bera, 1987a), which evaluates skewness and excess Kurtosis and supposes their values as zero, hence validating the null hypothesis that the normal distribution. Below is the statistical formulation for normalcy statistics developed by Jarque-Bera:

$$JB = \frac{N}{6}\left(S^2 + \frac{(K-3)^2}{4}\right), \quad (2)$$

This research analyzes the stationarity of each variable under discussion after analyzing descriptive and normality statistics. This research used a collection of five-unit root estimators, including (Breitung, 2001; Levin et al., 2002; Pesaran et al., 1997), ADF-Fisher (Maddala and Wu, 1999; Phillips and Perron, 1988) estimators, to examine the long-run estimations. Each of these tests is applied on both leveled and first-differenced data to provide a complete image of the variables' stationarity. As the null hypothesis, the aforementioned tests demonstrate the existence of a unit root in the time series of the panel data. However, such a hypothesis may be rejected if statistical values at the 1%, 5%, and 10% levels are greater than their corresponding critical values.

Since the analyzed variables indicated stationarity, one of the fundamental prerequisites for long-run computing elasticities, it is possible to compute long-run elasticities. Consequently, the continuing investigation accounts for the non-symmetric distribution of data, necessitating the use of a unique Bootstrap Quantile Regression (BSQR) technique. Despite the existence of a number of econometric strategies that can recognize the long run coefficients, including panel fully modified ordinary least square, dynamic ordinary least square, and the generalized method of moment, among others. Yet, these approaches are restricted in their ability to account for non-linearity, which may result

[1] Data for financial market development, natural resources, and technological innovation is obtained from the World Development Index of World Bank, available at: https://databank.worldbank.org/source/world-development-indicators#.

[2] Data for Financial Risk Index is extracted from the PRS Group, available at: https://www.prsgroup.com/.

in inaccurate estimates. The BSQR method is an interstitial method for assessing confidence intervals and statistical significance. The advantage of these requirements is that they resample the data to get measurable data while eliminating the asymptotically regular sample distribution constraint (Efron and Tibshirani, 1994). The BSQR leverages algorithmic skills to more precisely estimate the sample distribution of the evaluated model. In addition, this approach offers more accurate estimation techniques and empirical outcomes (Efron and Tibshirani, 1994). The stated connection between the variables is tested in four quantiles: Q_{25th}, Q_{50th}, Q_{75th}, and Q_{90th}.

Using the non-parametric panel quantile regression approach proposed by (Koenker and Bassett Jr, 1978), this study aims to evaluate the model's stability. To eliminate the overvaluation and underestimation biases of the estimated coefficients in the mentioned approach, this research used the quantile regression strategy, which offers the predicted coefficient at each specified quantile. The quantile regression approach is preferable to the traditional least square method since it considers both distributional and individualized heterogeneity, hence providing comprehensive information regarding the connection between the study components (Cheng et al., 2019). Quantile regression is also more robust than traditional regression, which offers just the average contribution of regressors (M. Qin et al., 2021). As indicated by the following equation, the originally given regression equation, Eq. (1), can be transformed into the quantile regression template:

$$Q_{FMD_{it}}(\theta \mid \alpha_i, \varphi_t, X_{it}) = \alpha_i + \varphi_t + \varphi_{1,\theta} TNR_{it} + \varphi_{2,\theta} FRI_{it} + \varphi_{3,\theta} TI_{it} + \varepsilon_{it}, \quad (3)$$

This study used four quantiles, namely Q_{25th}, Q_{50th}, Q_{75th}, and Q_{90th}, to statistically analyze the impacts of TNR, FRI, and TI on the financial market development of South Asian countries, whereby the subscripts of the preceding equation represent the quantile of each study variable.

Using quantile regression to obtain empirical data, this study utilizes a parametric technique to measure the model's robustness. The robust predictor used in this study is robust least squares. Unlike quantile regression, this approach produces robust average coefficients for each study variable.

In addition to the long-term estimator and its robustness, this paper aims to examine the causative linkage between FMD and regressors, as earlier estimation approaches failed to demonstrate a causal link between these variables. In this regard, the current study employs the pairwise panel Granger causality approximation suggested by (Dumitrescu and Hurlin, 2012), which is more successful at addressing the issues with panel data, such as cross-section dependence and slope variability.

4. Results and discussion

4.1. Results

This section begins the presentation of the empirical results by calculating the summary statistics, which further consist of the mean, median, minimum, and maximum observations value. The computed values are provided in Table-1, where the mean, median, and range (maximum-minimum) values for FMD, FRI, and TI are positive from 1990 to 2020. This indicates that financial markets rapidly evolve along with financial risk and technological innovation. On the other hand, the TNR is reported with negative mean and minimum observation values while having positive median and maximum values. Since this study observed a substantial difference between the range values, this study evaluates each variable's standard deviation. Generally, the standard deviation is used to indicate the volatility of the time variable. This study observed that FRI is the most volatile variable across the selected factors, followed by TI, TNR, and FMD. Apart from the standard deviation, this study uses two metrics to determine normality, i.e., skewness and Kurtosis. From the results, it is noted that the skewness, as well as Kurtosis, deviates from their statistical values, indicating the variables' non-normal distribution. To comprehensively analyze the issue of data normality, this study uses a suitable measure, i.e., the (Jarque and Bera, 1987b) test of normality. From the examined results, this study noted that the TNR, FRI, and TI statistical values are significant at 1% and 5% levels. Thus, this null proposition of normally distributed data could be rejected, and it is concluded that these variables follow an asymmetrical distribution path.

Table-1
Summary statistics and normality results.

	FMD	TNR	FRI	TI
Mean	1.441952	−0.085710	36.03800	3.016500
Median	1.426830	0.003581	36.60417	2.769236
Maximum	1.737604	0.851489	44.83333	4.754127
Minimum	0.945528	−1.157171	21.33333	1.968483
Std. Dev.	0.177469	0.468834	6.061168	0.780199
Skewness	−0.331429	−0.434891	−0.548920	0.967586
Kurtosis	2.752687	2.317741	2.388469	2.829615
Jarque-Bera	2.836423	6.924668	8.948934	21.38556
Probability	0.242147	0.031356	0.011396	0.000023
Observations	136	136	136	136

After the descriptive summary of the data under consideration, this research tends to investigate the stationarity of each variable, which is one of the basic requirements of long-run coefficients analysis. In this sense, the present research summarizes the panel unit root tests in Table-2. The examined results asserted that FMD, TI, and TNR are insignificant at the level, whereas FRI provides statistically significant estimates for Levin, Lin, and Chu and ADF-Fisher Chi-square tests. The latter variable rejects the null hypothesis of the unit root presence. Since the stationarity of all variables is one of the essential conditions for the long-run analysis. Therefore, this study also tested the stationarity of variables at I (0). In the latter scenario, the statistical values of all the tests, including Levin, Lin and Chu, Breitung t-stat, Im, Pesaran, Shin W-stat, ADF-Fisher Chi-square, and PP-Fisher Chi-square, are found statistically significant for all the variable at 1% level. Therefore, these statistical values reject the null hypothesis and conclude that FMD, FRI, TI, and TNR are stationary. This allows the current study to use appropriate econometric approaches for the long-run analysis.

Nonetheless, the panel data under consideration validates the stationarity of the variables under consideration, which allows the estimation of the long-run coefficients estimations. Additionally, the

Table-2
Stationarity testing.

Panel Unit Root Summary [I(0)]				
Method	FMD	FRI	TI	TNR
Levin, Lin & Chu t*	1.15915	−2.44182***	0.14787	−0.16436
Breitung t-stat	−0.26925	0.70984	−1.13773	−1.23612
Im, Pesaran and Shin W-stat	0.70302	−0.94016	1.17964	0.16457
ADF - Fisher Chi-square	6.08342	13.8235*	2.65245	7.70318
PP - Fisher Chi-square	5.00441	5.96182	6.89696	5.19906
I(1)				
Levin, Lin & Chu t*	−0.70613	−6.50765***	−3.98789***	−6.78000***
Breitung t-stat	−4.54321***	−7.37579***	−6.00151***	−4.21420***
Im, Pesaran and Shin W-stat	−2.38164***	−6.72037***	−6.78768***	−7.65927***
ADF - Fisher Chi-square	19.1754**	51.8744***	55.1489***	60.6788***
PP - Fisher Chi-square	55.9498***	71.2101***	157.382***	69.5150***

Note: Asterisks *, **, and *** report a significance level of 10%. 5%. And 1% level.

normality tests such as skewness, (Jarque and Bera, 1987b) asserted that all the variables follow a non-linear path of distribution. Based on the asymmetric data distribution, this study adopts the non-parametric estimation approach, i.e., the BSQR, which is more effective than the traditional regression approaches. The estimated results of the study are provided in Table-3. The results show that the TNR is adversely affecting the financial market development, which is statistically significant at 1% throughout the quantiles. More specifically, a one percent increase in the TNR leads to reducing the FMD by 0.345–0.113%. The magnitude of the negative influence decreases over time from the lower (Q0.25) quantile to the upper (Q0.90) quantile. Such adverse association between TNR and FMD is consistent with the empirical results of (Ali and Ramakrishnan, 2022; Dogan et al., 2020b; Guan et al., 2020b; M. K. Khan et al., 2020) in various countries and regions. On the other hand, FRI and TI are positively associated with FMD. Specifically, a percentage increase in each of these variables enhances the FMD level by 0.597–1.181% (FRI) and 0.274–0.069% (TI). Both these variables are statistically significant at 1%, 5%, and 10% levels throughout the selected quantiles, where the magnitude of FRI increases from lower to higher quantile while reducing for that of TI. Concerning the positive influence of both variables, the estimated results are in line with the empirical evidence provided by (Abdul Hamid et al., 2020; Ozili, 2021) for FRI and (Abbasi et al., 2022; M. A. Khan et al., 2020; Pan et al., 2019; Zeng et al., 2022b) for TI in different countries and regions. From the estimation results, it could be concluded that even though natural resources could have an adverse impact on the development of financial markets, technological innovation and financial risk index helps in the development of financial markets. Apart from the empirical coefficient values, this study also provided the coefficient estimates graphically for brevity, reported in Figure-1.

After the empirical analysis of the long-run impact of TNR, FRI, and TI on FMD, this research tends to test the robustness of the model under consideration. In this regard, the current study uses both non-parametric and parametric measures. Specifically, the panel quantile regression (non-parametric method) is used, the results of which are reported in Table-4, while the robust least square (parametric method) results are provided in Table-5. The key difference between these measures is that the former substantially consider data non-normality. However, the latter considers the data as a normal distribution. From the empirical estimates, this study found a similar influence of TNR, FRI, and TI on FMD. Specifically, the TNR is negatively related to FMD, while FRI and TI are progressively encouraging the development of financial markets in South Asian countries. The empirical results are consistent with the earlier findings of the BSQR, which are consistent with the existing literature. Hence, the natural resources lead to a financial resource curse in the study region.

After the empirical examination of the long-run coefficient values and their robustness, this study analyzes the causal association between FMD and regressors, including TNR, FRI, and TI. The estimated outcomes are reported in Table-6. The table presents the results estimated via the pairwise Dumitrescu and Hurlin panel causality test. The results show that there exists only an uni-directional causality, which runs from the TNR, FRI, and TI to FMD. This shows that all these three indicators played a substantial role in the development of financial markets. That is, any policy-level change in one variable could lead to changes in the policies regarding the development of financial markets. In this context, appropriate and relevant policies are required to tackle the financial resource curse and transform it into financial resource blessings.

Table-3
Quantile estimates – BSQR.

Bootstrap Quantile Regression				
Variable	Q0.25	Q0.50	Q0.75	Q0.90
TNR	−0.345***	−0.188***	−0.132***	−0.113***
	[0.043]	[0.057]	[0.047]	[0.020]
FRI	0.019	0.597*	0.967***	1.181***
	[0.310]	[0.302]	[0.125]	[0.146]
TI	0.274***	0.162***	0.101***	0.069***
	[0.036]	[0.038]	[0.020]	[0.022]
Constant	0.470	0.025	−0.285	−0.464***
	[0.385]	[0.353]	[0.183]	[0.168]

Note: FMD is dependent variable. Asterisks *, **, and *** reports the significance level of 10%. 5%. And 1% level.

4.2. Discussion

From the estimated results, this study noted that the financial resource curse is valid in South Asian economies. The abundance of natural resources may influence the development of financial markets in four ways: First, the extraction of TNR transfers industrial (tradable) sector production elements. This demonstrates that excess TNR tends to reduce the tradable industry and that trade liberalization is an important factor in developing financial markets. In this manner, the over-abundance of TNR hinders FMD by reducing the country's trading sector (Baltagi et al., 2009). Second, the extraction of TNR may also contribute to rent-seeking and corruption. Both corruption and rent-seeking seem to reduce the number of businesses essential to FMD. This indicates that an excess TNR is detrimental to a nation's financial system development if rent-seeking and corruption are encouraged (Baland and Francois, 2000). Third, the availability of TNR not only discourages the building of human capital in both the public and private sectors yet also crowds out social capital, a crucial driver of FMD. The confidence level influences social capital, and social capital influences FMD if financial transactions are founded on trust. This demonstrates that social and human capitals depend on TNR's availability, which may have a substantial effect on FMD (Guiso et al., 2004). Lastly, private, public, and foreign direct investments are impacted by social capital, human capital, corruption, and rent-seeking. The prevalence of Dutch disease impedes investments in the tradable (manufacturing) sector, while corruption and rent-seeking further reduce investment, leading to a reduction in financial services and a consequent impediment to FMD (Gylfason and Zoega, 2006). This study noted technological innovation's progressive role in the development of financial markets. The innovation process refers to innovative methods of conducting commercial operations and adopting digital technologies, such as internet banking, mobile banking, and Automated Teller Machines (ATM), among others (Abor, 2005). Generally, technological innovation leads to product innovation, including new financial services, weather derivatives, securitized assets, hedge funds, foreign currency mortgages, private equity, and exchange-traded funds, among others.[3] Institutions innovation is the introduction of new forms of financial enterprises, such as cheap brokerage firms, online banking, specialized credit card companies, etc. All of these innovations enhance the payment methods employed in lending and borrowing cash, facilitating a fast method of interacting with clients. Additionally, they encompass technological advancements, the creation of equity, and the transfer of risk, all of which enhance the amount of credit accessible to borrowers and offer banking firms a modern and inexpensive option to acquire money.

5. Conclusion and policy recommendations

5.1. Conclusion

One of the most debated issues in the last few decades is exploring the true influence of natural resources on economic growth. However, the nexus of financial market development remained relatively ignored, which tends this study provide empirical evidence in the presence of financial risk and technological innovation. Comparatively, the stated

[3] See https://www.cairn.info/revue-journal-of-innovation-economics-2018-3-page-195.htm#no1.

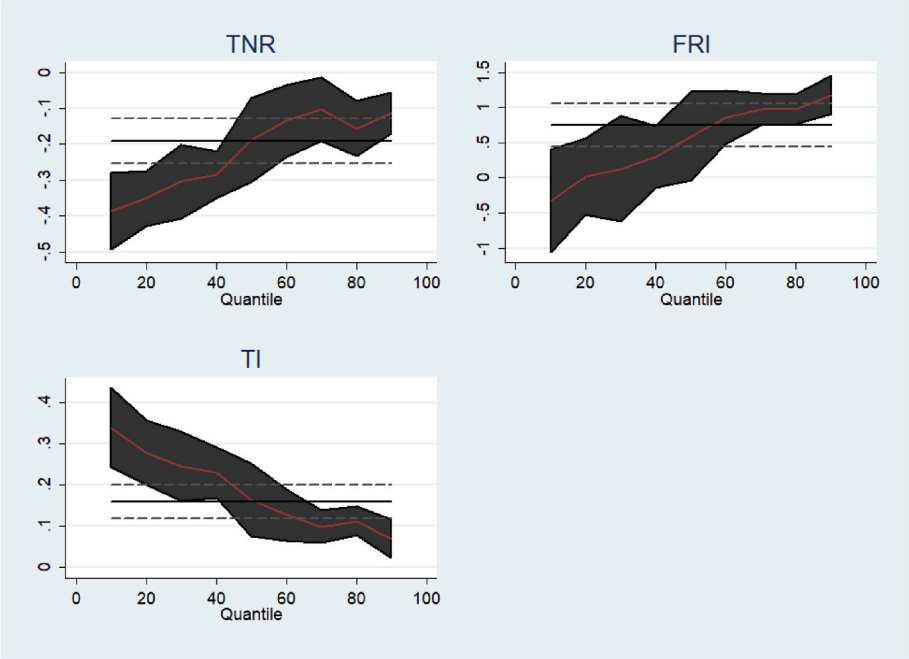

Figure-1. Coefficient values of quantiles – BSQR

Table-4
Non-parametric robustness estimates – quantile regression.

Panel Quantile Regression				
Variable	Q0.25	Q0.50	Q0.75	Q0.90
TNR	−0.345***	−0.188***	−0.132***	−0.113***
FRI	0.019	0.597***	0.967***	1.181***
TI	0.274***	0.162***	0.101***	0.069***
Constant	0.470	0.024	−0.285	−0.464**

Note: FMD is the dependent variable. Asterisks *, **, and *** report a significance level of 10%. 5%. And 1% level.

Table 5
Parametric robustness estimates – robust least square.

Panel Quantile Regression				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
TNR	−0.193***	0.029	−6.460	0.0000
FRI	0.157***	0.019	8.140	0.0000
TI	0.621***	0.039	15.822	0.0000

Note: FMD is the dependent variable. Asterisks *, **, and *** report a significance level of 10%. 5%. And 1% level.

Table-6
Causality results.

Pairwise Dumitrescu Hurlin Panel Causality Tests			
H_o	W-Stat.	Zbar-Stat.	Prob.
TNR ≠ FMD	2.531*	1.82423	0.0681
FMD ≠ TNR	0.951	−0.15000	0.8808
FRI ≠ FMD	8.430***	9.19729	0.0000
FMD ≠ FRI	1.387	0.39534	0.6926
TI ≠ FMD	6.755***	4.85449	0.0000
FMD ≠ TI	1.916	1.05644	0.2908

Note: Asterisks *, **, and *** report a significance level of 10%. 5%. And 1% level.

nexus remained scant in developing economies. Therefore, this study investigated the South Asian economies during the last three decades (1990–2020). Various panel data techniques are used to determine the impact of natural resources, financial risk, and technological innovation on financial market development, including the stationarity analysis of all the variables and the long-run estimators. Due to the data non-linear distribution, this study uses the novel bootstrap quantile regression. The estimated results asserted that natural resources significantly diminish financial market development in the South Asian economies. This validates the phenomenon of the financial resource curse in the study region. On the other hand, the empirical evidence asserted that financial risk and technological innovation significantly enhance the financial market development. In an econometric investigation, it is pertinent to test the reliability of the results. In this context, the present study tested the robustness of the model by applying the non-parametric (panel quantile regression) approach and the parametric (robust least square) approach, which validates the negative impact of natural resources, while the positive impact of financial risk and technological innovation on financial market development. Apart from the long-run influence, this study also explored the causality analysis between the variables, confirming only the unidirectional causal association from natural resources, financial risk, and technological innovation towards financial market development.

5.2. Policy recommendations

Based on the empirical results, this study suggests that the progressive role of natural resources, financial risk, and technological innovation in the development of financial markets could be encouraged. Specifically, the natural resources shall be managed more effectively. In the South Asian economies, the natural resources shall be regulated by authorities via checks and balances, with increased accountability, mismanagement, and corruption. However, channeling natural resources could encourage financial activities, which ultimately helps promote the development of financial markets. In addition, financial risk affects the financial markets positively: still, this study suggests reducing financial risk to encourage investors and industrialists to utilize financial services, which consequently leads the South Asian economies to develop in financial markets. Lastly, this study suggests that investment

in technological innovation could be increased. These economies must promote a culture of research and development, education, human capital, etc., which could help efficiently utilize technologies. Technological advancement will not only enhance the productivity level but also boost financial activities and lead to the development of financial markets.

5.3. Limitations and future research directions

Nevertheless, this study contributed to the existing literature in several directions: still, this study is limited in a few dimensions, which this study recommended to future researchers. Specifically, this study only analyzes four South Asian economies (Bangladesh, India, Pakistan, and Sri Lanka), while the other four economies (i.e., Afghanistan, Bhutan, Maldives, and Nepal) remained ignored due to data unavailability. Therefore, this study recommends that future researchers empirically examine the nexus of natural resources and financial market development. Further, this study utilizes non-parametric methods to explore the nexus between variables. Future researchers could use other parametric methods, such as ARDL or the GMM, to provide empirical evidence. Further, future researchers could extend the present study to other developed economies, such as the G7, G8, or G20 economies, or the developing economies, such as the BRICS economies.

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Author statement

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Data availability

The data that has been used is confidential.

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