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Do natural resources abundance and human capital development promote economic growth? A study on the resource curse hypothesis in Next Eleven countries

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ABSTRACT

This study aims to analyze the effects of natural resources, human capital, financial development, industrialization, technological progress, and international trade on the economic growth of the Next Eleven countries between 1990 and 2019. The novelty of this study lies in its approach to explore the indirect economic growth impacts of human capital development via the transmission channel of the natural resource utilization in these counties. The econometric methods involved are robust for accounting the cross-sectional dependence and slope heterogeneity concerns in the data. The results authenticate the resource curse hypothesis since higher natural resources rent are found to inhibit economic growth of the Next Eleven nations. In contrast, human capital development, financial development, industrialization, technological innovation and international trade participation are found to synthesize economic growth. Besides, another interesting finding in this study shows that human capital and natural resources jointly exert positive impacts on economic growth. Hence, it can be said that human capital development assists to mitigate the resource curse impacts in the case of the Next Eleven countries. Therefore, these findings necessitate the pertinence of boosting investments in human capital development, enhancing the strength of the financial sector, expediting industrialization, facilitating technological innovation, and amplifying international trade volumes for achieving higher economic growth in the Next Eleven countries. More importantly, human capital development should be prioritized for transforming the curse of the natural resources into blessing for these nations.

1. Introduction

Since the classical economists' era it has been acknowledged that a country having bountiful supply of natural resources is more likely to be developed and, therefore, have an advantage over the other countries. From this perspective, a country with abundant natural resources is believed to have the capacity to achieve more growth and development compared to a less natural resource-abundant economy. However, this preconceived notion was criticized by the theoreies of "Resource Curse" and "Dutch Disease". According these hypotheses, natural resources are said to be growth-inhibiting and are therefore considered to be a curse for the resource-abundant economies, in particular. Consequently, after the emergence of these theories, the research on natural resources and its impact on economic growth became an interesting area of research which led to equivocal findings concerning the natural resources-economic growth nexus across the globe.

Several existing studies have supported the resource curse hypothesis (Asif et al., 2020; Khan et al., 2020a,b; Dwumfour and Ntow-Gyamfi, 2018; Sachs and Warner, 1995). These studies demonstrated that the countries with plenty natural resources grow at a slower speed than those having limited natural resources, particularly due to their natural

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resource abundance either slowing down their economic growth rate (Ahmed et al., 2016) or even causing negative economic growth (Hussain et al., 2009). On the other hand, many studies have countered the resource curse hypothesis and supported that the utilization of natural resources contribute to enhance economic growth (Peach and Starbuck, 2011; Brunnschweiler, 2008). Also, few studies have aslo claimed natural resources to be neutral to synthesizing economic growth (Davis, 1995). So, it is probably impossible to make an universal statement regarding the natural resources and the associated economic growth impacts being positive, negative, or neutral.

Many factors are influence the economic growth of a country; among others, natural resources rent, human capital, financial development, industrialization, and technological innovation are acknowledged to play crucial roles in determining the growth of an economy. Besides, it is believed that low human capital development is one of the leading causes of resource curse in the natural resource-abundant developing countries (Butkiewicz and Yanikkaya, 2010). However, this resource curse can be expected to be transformed into a blessing by investing in human capital, since human capital development can stimulate economic growth (Hu and Xiao, 2007). But it could also be noted that the relative weight of mineral rents can negatively influence human capital development (Pérez and Claveria, 2020). On the other hand, studies have also identified the financial development impacts on economic development (Erdoğan et al., 2020; Tariq et al., 2020). Besides, industrialization is said to exert unconditional positive influences not only on economic growth, but also on other economic growth factors like capital stock, secondary school enrollment, and international trade (Dutta and Ahmed, 2004; Tsang et al., 2008). Similarly, technological innovation is asserted to amplify the positive impacts of these variables on economic growth and also helps to diminish the associated negative externalities to the environment, in particular (Shao, 2020).

The analysis of the resource curse hypothesis is particularly for the emerging economies since the growth-inhibiting impacts of the natural resources can be expected to compromise the sustainability of their growth performances; the Next Eleven (N-11) countries are no exception. In 2005, a group of researchers from Goldman-Sachs presented the N-11 countries and classified them as a set of countries that are fast-growing and having the potential of making good investments (O'Neill et al., 2005). The N-11 countries include Bangladesh, Egypt, Indonesia, Iran, Korea, Mexico, Nigeria, Pakistan, Philippines, Turkey, and Vietnam. These countries are expected to represent the majority of the world population by 2050. Keeping the demographic profile aside, this group is created by considering other macroeconomic variables, such as their international trade participations, political maturity, macroeconomic stability, inter alia. The remarkable economic growth trends, low inflation rates, and low macroeconomic volatility are some of the major attributes which make the N-11 countries favorable for investment which, in turn, is anticipated to boost the development of the respective countries in the next couple of decades. Consequently, the N-11 economies could compete for their place in the list of the leading global economies by virtue of their cumulative share in the international market by the year 2050 (Sachs, 2007:131,139; Erdoğan et al., 2020).

As far as the natural resource profiles of the N-11 countries are concerned, there is a great deal of heterogeneity in respect of the availability of natural resources. For instance, Pakistan, Iran and Nigeria are some of the highly resource-rich N-11 countries while Bangladesh has limited natural resource endowments. However, surprisingly, apart from Bangladesh, the rest of the N-11 countries have been acknowledged to be vulnerable to the natural resource curse syndrome; the resources of these countries, off late, have not been able to substantially contribute to the growth of their respective economies (Li et al., 2020). According to the World Bank (2020) estimates of 2019, Nigeria leads among the N-11 countries in respect of the nation's share of total natural resources rent in the GDP while South Korea registered the lowest share. The diversity in the natural resources of the N-11 countries can also be understood from the understanding that these nations can also be classified into net oil-importing and net oil-exporting economies (Ferdaus et al., 2020).

Table 1
The trends in the natural resource rents and human capital indices in N-11 countries. *Source:* World Development Indicators (World Bank, 2020) and Penn World Table V9.1.

Country	Total natural resource rent (% of GDP)				Human capital index			
	1990	2000	2010	2019	1990	2000	2010	2019
Bangladesh	0.53	0.59	1.19	0.66	1.46	1.64	1.87	2.05
Egypt	18.32	7.03	9.38	6.91	1.69	1.97	2.36	2.62
Indonesia	12.26	10.30	7.34	4.78	1.90	2.19	2.42	2.32
Iran	21.93	32.79	23.30	4.13	1.41	1.71	2.12	2.42
Mexico	7.98	3.53	5.14	3.47	2.18	2.42	2.60	2.74
Nigeria	24.87	23.65	14.83	11.48	1.22	1.46	1.76	1.92
Pakistan	1.68	1.35	1.97	1.31	1.36	1.55	1.79	1.77
Philippines	1.93	0.50	2.85	1.47	2.22	2.44	2.59	2.69
South Korea	0.07	0.01	0.03	0.02	2.85	3.19	3.47	3.69
Turkey	0.59	0.24	0.54	0.48	1.80	2.00	2.21	2.44
Vietnam	11.95	9.16	9.40	4.32	1.70	1.97	2.42	2.76

On the other hand, the level of human capital of the N-11 nations is poor compared to that of the developed countries. This is understandable from the understanding that all the N-11 nations are classified as developing nations that are poised to exhibit robust economic growth performance in the future. Although the human capital indices of the N-11 nations are more or less similar, South Korea currently leads this list courtesy of the nation's human capital index in 2019 being relatively higher than the corresponding indices of the other 10 N-11 countries. An understanding of the trends in the natural resources and human capita scenarios of the N-11 nations can be perceived from the nations' total natural resource rents and human capital indices reported in Table 1.

Against this background, this study aims to scrutinize the effects of natural resources, human capital development, financial development, industrialization, technological innovation, and international trade on the growth of the N-11 economies. In particular, this study specifically focuses to evaluate the authenticity of the resource curse hypothesis in the N-11 context and also to assess the impacts of human capital development in this regard. Annual frequency data spanning from 1990 to 2019 is used to ascertain these impacts in the long-run. Among the major contributions to the corresponding literature, this study considers both the direct and indirect channels through which human capital can affect the growth of the N-11 nations, especially through its impact via the natural resources channel. To the best of the authors' knowledge, this is the only study which emphasizes on the indirect economic growth impacts of human capital development in the N-11 context. Additionally, as opposed to the conventionally use econometric methods which primarily account for only the cross-sectional dependency concerns in the data, this study uses the Augmented Mean Group (AMG) estimator of Eberhardt (2012) to predict the long-run impacts of the explanatory variables on the economic growth of the N-11 nations by simultaneously accounting for the cross-sectional dependency and slope heterogeneity concerns in the data. Not many studies have simultaneously addressed these issues to model economic growth in the N-11 countries controlling for abovementioned the macroeconomic variables considered in this study.

2. Literature review

This section is classified into two smaller sub-sections. First, the theoretical underpinnings concerning the transmission channels through which natural resources and human capital can affect the growth of an economy are discussed. Second, the corresponding empirical evidences documented in the literature are summarized.

2.1. Theoretical framework

In the neoclassical era, economic growth was postulated to be driven by a nation's capital stock and labor supply. However, with time, the neoclassical growth conjecture received criticism whereby other macroeconomic aggregates were claimed to be equally important in determining growth of an economy. Among these, natural resources were also acknowledged to have the capacity to generate the national output to synthesize economic growth. Although, as per the preconceived notion, natural resources were said to exert positive economic growth impacts, this presumption did not seem to hold. This led way to the emergence of the resource curse theory which states that natural resources could turn out to be curse for the resource-rich countries due to the associated growth-inhibiting impacts (Su et al., 2020). The resource curse hypothesis was first introduced by Ross (1999) who attempted to explain how the resources of low and middle-income nations failed to boost the growths of their respective economies.

Besides, the resource curse hypothesis tries to unearth the factors, other than the natural resources, responsible for countries with relatively higher resources having comparatively lower economic growth rates than countries with lower resource availability. Among these, technological redundancy (Fleming et al., 2015), inefficient political governance (Robinson et al., 2006), and poor institutional quality (Mehlum et al., 2006a,b) are referred to as some of the key factors which explain the resource curse hypothesis. Moreover, the adverse growth impacts associated with natural resource extraction are also explained through the Dutch Disease theory. This theory emerged from the detrimental economic growth impacts which emerged from the appreciation of the Dutch currency following the discovery of natural gas fields in the Netherlands (Corden, 1984; Geurts et al., 2000). As the natural gas sector of the Netherlands started to boom, the nation's decision to proactively export natural gas led to appreciation of the local currency which, in turn, deteriorated its export competitiveness in general. Consequently, the overall exports declined to shrink the Dutch economy (Geurts et al., 2000). The resource curse hypothesis via the channel of the domestic currency appreciation-induced Dutch Disease phenomenon was also verified in the context of Venezuela, the Democratic Republic of Congo, and Angola which are countries rich in oils and diamonds.

On the other hand, it is also believed that the disparities in human capital across countries could be an additional factor that can explain the authenticity of the resource curse hypothesis. In general, human capital accumulation is hypothesized to be necessary for attaining high rates of economic growth, especially in the resource-rich countries (Ogunleye et al., 2017). As per the existing theory on human capital, expanding human capacities generate economic values which get translated into higher labor productivity and, therefore, ensure higher growth rates (Voskoboynikov, 2017; Ogundari and Awokuse, 2018). Now referring to the role of human capital development on the resource curse phenomenon, it can be expected that skill development can assist in effective extraction and utilization of the natural resource which, in turn, can mitigate the adverse growth impacts accompanying natural resource consumption (Li et al., 2020). Besides, human capital development can also exert a technological impact to enhance the contribution of the natural resources to the growth of the economy. For instance, in Bangladesh, technological constraint has limited the rate of natural gas extraction; consequently, unreliable energy supplies have been acknowledged to depress the growth of the Bangladesh economy (Murshed, 2021; Murshed et al., 2021). In this regard, human capital development-induced technological advancement can be expected to amplify the contribution of the nation's natural resource supplies to its economic growth. Therefore, apart from directly contributing to economic growth, human capital development can also be expected to exert a joint indirect economic growth impact via the natural resource utilization channel. Hence, it is also important to investigate these indirect growth transmission channels for policy-making purposes.

2.2. Empirical evidence

Until the late 1980s, natural resources were considered as a blessing, but after the arrival of resource curse and Dutch disease theories, a contradictory room is generated. Many studies are available indicating that the abundance of natural resources in a country grows slower than those countries having lower natural resources.[1] For the case of China, Khan et al. (2020a,b) also support the stance of these studies by confirming the resource curse, which hurts economic growth and also financial development. The abundant natural resources frustrate economic growth, which is not a favorable factor for the economic development of the country (Kangning and Jian, 2006).

However, the decision about the resource curse is still not cleared and contradictory because Davis (1995) found no reason to claim that the countries having abundant natural resources are striving for development. There are many studies available such as Mehrara (2009), Philippot (2010) that described natural resources as blessings, promoting economic growth. The recent study of Redmond and Nasir (2020) empirically showed that natural resources have a significant positive impact on economic growth. Similarly, Shahbaz et al. (2018) bring evidence that natural resources contribute to a country's economic growth. Brunnschweiler (2008) re-examined the natural resource abundance effect on economic growth using the OLS and the 2SLS approaches and found that natural resources have a positive and direct relationship to economic growth of a country. Using the time-series panel data over the period 1984–2016 for (OIC), Erum and Hussain (2019) investigated natural resources and corruption, and economic growth using the CS-ARDL techniques. They found that natural resources have a significant positive impact on economic growth. However, corruption slow-down that process. The study of Zallé (2019) examined the natural resources and economic growth nexus over the period 2000–2015. The ARDL model was introduced, and it is found that natural resources enhance economic growth in the presence of human capital. In contrast, corruption or inefficient institutions impede the contribution of natural resources towards economic growth. In support of the earlier studies, Herb (2005) and Boyce and Emery (2005) also suggested that natural resources increase the per capita GDP and other economic growth factors.

For the period of 1995–2013, Raheem et al. (2018) used the financing gap model and simulation methodology to investigate the impact of human capital supported by government expenditure via natural resources rent investments, over the economic growth. The study targeted 18 Sub-Sahara African countries to achieve the objectives. The findings of the study reveal that the health care expenditures with the natural resources are significant for inclusive economic growth process. Additionally, the increase in government expenditures on health increase per capita GDP by more than 3.1%. Shao and Yang (2014) explained the resource curse and resource blessings phenomenon while considering natural resources, human capital, and economic growth. The study carried out the normative research and recommend that human capital guaranteed the evasion of resource curse.

It is worth noting to discuss the role of human capital in natural resources, as the educational and skills institutions are increases. Pérez and Claveria (2020) investigated the natural resources and human development for African mineral dependent countries throughout 2007–2016 and found that the relationship between mineral dependence and development is weak and negative. Using a panel data set for 100 developed and developing countries, Butkiewicz and Yanikkaya (2010) illustrate that the resource curse in developing countries exists because of low-quality institutions and low human capital. An investment in human capital can overcome the resource curse (Hu and Xiao, 2007). Although many ways are determining human capital; however, education is one of them. In this regard, Rickman et al.

[1] See for instance, Sachs and Warner (1995, 2001) and Dwumfour and Ntow-Gyamfi (2018).

(2017) suggested that higher education in the presence of abundant natural resources may lead to better economic growth. Moreover, abundant natural resources contribute more to economic development than human development (Redmond and Nasir, 2020).

However, the human capital is not only important to regulate or better utilization of the natural resource rents. The human capital is also playing a crucial role in economic growth. Studies have been done (see for instance, Han and Lee, 2020; Ahmed et al., 2020; Xu and Li, 2020; Hassan et al., 2019; Zallé, 2019) that indicates the positive role of human capital in economic growth. Also, these studies recommend investment in human capital for efficient utilization of the natural resource rents, and to eradicate corruption for transforming resource curse into blessings, that may return higher economic growth. Conversely, these studies, specifically Ahmed et al. (2020) unveil that economic growth leads to the degradation of environmental quality in the long run, but human capital plays a mitigation role of environmental quality.

Among other variables, financial development is also a variable of concern that is considered to have influence over economic growth. In this regard, Čižo et al. (2020) investigated the financial development (FD) and economic growth nexus for European union economies over the period 1995–2017. The study developed three hypotheses, i.e., directed impact of the financial development level on economic growth, financial development follows economic growth and bidirectional causal relationship between them. Different periods satisfy these three hypotheses; hence, it can be concluded that financial development plays a significant role in economic growth. Erdoğan et al. (2020) investigated abundant natural resources, financial development, and economic growth for the case of N-11 countries throughout 1996–2016. The findings of the study reveal that financial development plays a significant role in synthesizing economic growth. Specifically, when the financial deepening exceeds from 45%, a unit increase in the oil exports causes 7% of the economic growth increase. For the case of Pakistan, Tariq et al. (2020) used quantile regression over the period 1980–2017 and confirm the U-shaped relationship between financial development and economic growth. Furthermore, when the financial development is below the threshold level (0.151), it exerts negative impact on economic growth, while higher than the threshold level, financial development contributes more toward economic growth. Kumar and Paramanik (2020) investigated the same for India throughout 1996Q1-2018Q3 while employing non-linear ARDL approach. The results reveal positive impact of financial development over economic growth in the long run.

Ali et al. (2016) investigated the trade openness and industrial value added influence over economic growth for the case of Bangladesh throughout 1981–2015. Employing the OLS and Granger causality techniques, the study found a positive impact of industry value added on economic growth. The higher industry value added leads to higher economic growth. The discussion and importance of the modern-day development is not complete without considering technology or innovation (i.e., technological innovation). Considering the technological innovation, Zhou et al. (2020) examined China's economic development under industry 4.0 and circular economy for 30 provinces over the period 2000–2016. The findings of the study claim that technological progress for pollution abatement, backstop technological progress and the autogenous structural conservation are the major components of sustainable economic growth. Technological innovation not only benefiting economic growth in one way, but also channelizing better natural resources rents. Cao et al. (2020) examined the linkage of environmental regulations and economic growth via technological innovation for China throughout 2000–2002. The study used spatial panel data model and conclude that technological innovation and resources consumption are vital mechanisms for regulation of the environment that influences economic growth. Besides the traditional neoclassical economic growth model, Law et al. (2020) studied the innovation impact over economic growth for the case of Malaysia. The study concludes that technological innovation significantly contributes to economic growth.

The Next-11 countries are thought to be emerging developed economies soon, so the role of natural resources must be noticed. For the case of Iran, Ahmed et al. (2016) studied the dynamic concerning economic growth, natural resources, and capital from 1965 to 2011. The empirical results indicate that the natural resources slow-down the economic growth in the long run. The study also found that an increase of one percent in natural resources production leads to a decline in the GDP by 0.47%, proving the resource curse hypothesis in Iran. Similarly, for the case of Pakistan, Hussain et al. (2009) examined a time series data from 1975 to 2006. They concluded that the effect of natural resources on economic growth is negative, and that is because of paying no adequate attention to human resource development. Sala-i-Martin and Subramanian (2013) highlight the resource curse presence in Nigeria. For New Mexico, Peach and Starbuck (2011) analyzed the energy production and economic growth nexus for New Mexico. The empirical findings oppose the resource curse hypothesis and conclude that the extraction of oil and gas had a small but positive impact on different economic activities, such as income and employment.

From a theoretical perspective, an increase in the natural resources of a country increases the reallocation of human capital to the natural resources sector from others (such as industrial) sectors (Zallé, 2019). A country having human capital in abundance, its abundant natural resources has a positive marginal effect (Bravo-Ortega and De Gregorio, 2005). It must be noted from this viewpoint, that many wealthy countries, like Australia and Norway, have exploited their natural resources for economic growth and development (Lederman and Maloney, 2007). Hence, it is concluded that, when human development is low, the natural resources downgrade economic growth. Sun et al. (2018) investigated the dependence on natural resources, education, human capital accumulation and investment for the case of China. The study addresses the reason for converting the natural resources blessings into a curse by empirically finding that the dependence on natural resources and investment in public education increases the chances for the public to lower the crowding-out effect the natural resources on human capital. Additionally, Law et al. (2020) recommended that the association between technological innovation and economic growth could be complemented by enhancing institutional quality and developing skilled human capital that ensure economic growth promotion.

3. Methodology, model specification and data sources

This study attempts to trace the effect of natural resources rent and human capital on economic growth. This study also considered an endogenous growth model and controlled for the effects of natural resources, human capital, financial development, industry value added, technological innovation, and international trade. Following the above-mentioned variables, this study developed the following model specifications:

Model − 1

$$GDP_{it} = f\left(TNR_{it}, HC_{it}, FD_{it}, IVA_{it}, TI_{it}\right) \quad (1)$$

Model − 2

$$GDP_{it} = f\left(TNR_{it}, HC_{it}, FD_{it}, IVA_{it}, TI_{it}, TNR * HC_{it}\right) \quad (2)$$

Model − 3

$$GDP_{it} = f\left(TNR_{it}, HC_{it}, FD_{it}, IVA_{it}, TI_{it}, TO_{it}\right) \quad (3)$$

In model-1, 2 and 3, "t" is for the time period of the data, i.e., from 1990–2019 and "i" is for the cross-sections, i.e., Bangladesh, Egypt, Indonesia, Iran, Mexico, Nigeria, Pakistan, the Philippines, Turkey, South Korea, and Vietnam. Moreover, GDP is for gross domestic product (proxy for economic growth), TNR is for total natural resources (proxy for natural resource abundance), HC is for human capital index (proxy for human capital development), IVA is for industry value added (proxy for industrialization and capital accumulation), FD is for financial development index (proxy for financial development), TI is

Table 2
Variables measurement and sources of data.

Variables	Measurement	Sources
GDP	Constant 2010 US dollars.	World Development Indicators, World Bank https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions
TNR	Percentage of GDP	World Development Indicators, World Bank https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions
HC	Index	Penn World Table (PWT) 9.1 https://www.rug.nl/ggdc/productivity/pwt/?lang=en
FD	Index	International Monetary Fund (IMF) https://data.imf.org/?sk=F8032E80-B36C-43B1-AC26-493C5B1CD33B
IVA	Percentage of GDP	World Development Indicators, World Bank https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions
TI	Number of patents both by residents and non-residents	World Development Indicators, World Bank https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions
TO	Sum of exports and imports as a percentage of GDP	World Development Indicators, World Bank https://databank.worldbank.org/source/world-development-indicators#advancedDownloadOptions

for technological innovation (proxy for technological change) and TO is for trade openness index (proxy for international trade). In model 2, an integration term between total natural resource and the human capital index (TNR∗HC) is included to ascertain the joint impacts of these two key macroeconomic variables on the growth of the N-11 countries. The econometric models are given below as:

$$GDP_{i,t} = \beta_0 + \beta_1 TNR_{i,t} + \beta_2 HC_{i,t} + \beta_3 FD_{i,t} + \beta_4 IVA_{i,t} + \beta_5 TI_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$GDP_{i,t} = \beta_0 + \beta_1 TNR_{i,t} + \beta_2 HC_{i,t} + \beta_3 FD_{i,t} + \beta_4 IVA_{i,t} + \beta_5 TI_{i,t} + \beta_3 HC * TNR_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$GDP_{i,t} = \beta_0 + \beta_1 TNR_{i,t} + \beta_2 HC_{i,t} + \beta_3 FD_{i,t} + \beta_4 IVA_{i,t} + \beta_5 TI_{i,t} + \beta_6 TO_{i,t} + \varepsilon_{i,t} \quad (6)$$

Table 2 reports the description, unit of measurement and the corresponding data source of the variables considered in this study. For empirical results estimations, this study first tested whether the slope coefficients are homogeneous or heterogeneous through (Pesaran and Yamagata, 2008) test and dependence of cross-sections using (Pesaran, 2004a,b) test. For unit root, Pesaran (2007) test is used and for cointegration (Westerlund, 2007) test is used. Moreover, for long-run results estimations, augmented mean group analysis (AMG) by Eberhardt (2012) is employed. The AMG estimator controls for the possible concerns arising from endogenous covariates in the model (Eberhardt, 2012; Murshed and Tanha, 2020). The pertinence of controlling for the endogeneity issues in the context of this current study is driven by the possibility of an association between human capital and natural resource; whereby, the regression model controls for a joint impact of these variable on economic growth in the N-11 countries. For causality, Dumitrescu and Hurlin (2012) method is used. The next section provides empirical results obtained by using the aforementioned techniques.

4. Results and discussion

This section provides the estimated results via employing various panel techniques. The results for slope coefficient heterogeneity (SCH) and cross-sectional dependence (CD) tests for the two models are provided in Table 3. The SCH estimates via (Pesaran and Yamagata, 2008)

Table 3
Heterogeneity and dependence test results.

Pesaran and Yamagata (2008)		
Models	$\tilde{\Delta}$	$\widehat{\Delta^{Adjusted}}$
Model-1	15.989***	18.261***
Model-2	15.601***	18.218***
Model-3	13.706***	16.006***
Pesaran (2004a,b)		
GDP	HC	TNR
39.855***	39.132***	20.813***
FD	IVA	TI
21.043***	38.183***	21.176***
TO		
35.971***		

Note : $p < 0.01^{***}$, $< 0.05^{**}$ and 0.1^{*}, respectively.

Table 4
Unit root test.

Variables	I(0)	I(1)
	Intercept and trend	
GDP	−1.801	−4.570***
HC	−0.438	−2.836***
TNR	−1.569	−5.933***
TI	−1.809	−5.391***
IVA	−1.795	−4.785***
FD	−2.358	−5.013***
TO	−2.178	−5.341***

Note : $p < 0.01^{***}$, $< 0.05^{**}$ and 0.1^{*}, respectively.

for Model-1, Model-2 and Model-3 are highly statistically significant at P < 0.01. Therefore, the null hypothesis of the cross-sections being homogeneous are rejected and concluded that the cross-sections in all the three models stands heterogeneous in nature. Though, the coefficients are heterogeneous in nature, but may still one variable exert a spillover effect over other variables. That lead us to utilize (Pesaran, 2004a,b) test for identifying the cross-section dependence. The results for all the variables under study report statistically significant results at P < 0.01. So, the variables such as GDP, HC, TNR, FD, IVA, TI, and TO reject the null hypothesis of being cross-sectionally independent. In contrary, they are found cross-sectionally dependent, holding a spillover effect over the same variables of the cross-sections. The prime reason behind cross-sections dependency is that majority of the countries are interconnected in this globalized world. Hence, a positive or negative shock in one of the variables in a specific country significantly affect the other country(s). the increasing economic integration and common shocks both at local and global level further fuel the problem of cross-section dependency. Such shocks include oil price shocks, Asian financial crises, global financial crises, inter alia.

In the panel data, if the problems of heterogeneous slope coefficient and dependency of the cross-sections are ignored, this may lead to biased and inconsistent results (Khan et al., 2020a). Also, for a time series in specific, it is mandatory to investigate for stationarity or unit root, because the discontinuity creates problems for further econometric estimations. Therefore, Pesaran (2007) test has been utilized on both "at level" I(0) and "first difference" I(1) data for all variables. The estimated outcomes are presented in Table 4. All the seven variables showed insignificant results at leveled data, that lead to the acceptance of null hypothesis of the presence of a unit root. However, the Pesaran (2007) estimates for the data at I(1) show highly statistically significant results at P < 0.01. Hence, we conclude that all the variables are found stationary while rejecting the null hypothesis unit root presence at I(1).

Based on the variables unit root estimations, the results for long-term cointegration relationship of the panel by employing the Westerlund (2007) test, are provided in Table 5. The earlier mentioned test examined the test hypothesis illustrating if the error correction

Table 5
Cointegration test.

Models	G^t	G^a	P^t	P^a
Model-1	−8.967***	−17.627***	−26.158***	−18.034***
Model-2	−9.909***	−16.079***	−29.672***	−21.847***
Model-3	−13.143***	−16.601***	−32.661***	−20.413***

Note : $p < 0.01^{***}$, $< 0.05^{**}$ and 0.1^{*}, respectively.

term is zero in a conditional panel error correction model (ECM). Both Model-1 and Model-2 reported the error correction values for mean group (G^t and G^a) and for panel (P^t and P^a), which are highly statistically significant at $P < 0.01$. Hence, the criteria for rejecting the null hypothesis of no cointegration among the variables has been satisfied. Therefore, it is concluded that there is a long run cointegration association among human capital, total natural resource rents, financial development, industry value added and technological innovation, which are the variables for Model-1. Also, all these aforementioned variables of Model-1, along with the interaction term of human capital and total natural resource rents, are found to have a long term cointegration among them, representing Model-2 of the study. In Model-3, all the discussed variables along with the trade openness, except for the excluded interactive term of human capital and total natural resource rents are cointegrated.

The aforementioned cointegration test already reports the existence of long-run association among these variables. So, the long-run effects of the explanatory variables on economic growth of the N-11 countries are predicted using the AMG estimator. The long-run coefficients are reported in Table 6. Firstly, in the case of Model-1, the coefficient estimates showed a positive and statistically significant, at 10% level, effect of human capital development on economic growth. It is found that if the human capital index increases by one unit, it will significantly increase the GDP level of the N-11 countries by 0.0834 units. Hence, it can be said that accumulation of human capital, in line with the human capital theorem, contributes to the value addition of the N-11 nations. On the other hand, financial development, industrialization, and industrialization are also found to exert positive impacts on economic growth. The positive signs of the corresponding slope coefficients, at 1% significance level, affirm this claim. It can be seen that a one unit change in the financial development index, industry valued added share in the GDP, and technological innovation increase the GDP by 0.318, 0.547 and 0.028 units, respectively. Hence, it can be claimed that along with human capital development, it is also necessary for the N-11 countries to develop the respective financial sectors, enhance the volume of capital investment for expediting the rate if industrialization, and invest in technological development projects to synthesize growth of their economies. However, in the context of the impacts of natural resources, the predicted slope coefficient highlights a negative economic growth effect. This can be perceived from the negative sign of the statistically significant, at 1% significance level, slope coefficient. A 1% rise in the share of total natural resources rent in the GDP is seen to decreases the GDP level of the N-11 countries by 0.0014 units. Thus, this particular finding validates the authenticity of the resource curse hypothesis in the context of the N-11 countries. Therefore, it can be said that the natural resources of these nations are not being utilized in an appropriate manner to be translated into economic benefits.

Similarly, in the case of Model-2, which in addition to the explanatory variables considered in Model-1 includes the interaction term between human capital index and total natural resources rent share in the GDP, reveals identical impacts of human capital development, natural resource abundance financial development, industrialization, and technological innovation on the growth of the N-11 economies. However, the major finding from this model is that there is a joint favorable economic growth impact stemming from human capital development and natural resource abundance. The positive sign of the statistically significant, at 1% significance level, slope coefficient attached to the interaction term affirms this claim. Therefore, it can be said that human capital development not only exerts a direct positive impact on the growth of the N-11 nations, it also plays a key role in mitigating the growth inhibiting impacts associated with the extraction and utilization of the natural resources in the N-11 countries. This is a critically important finding in respect of policy making purposes to convert the natural resources from being a curse to a blessing for the N-11 nations.

Lastly, in the context of Model-3 which also controls for the impacts of international trade, similar results are evidenced. Additionally, international trade is found to contribute to the growth of the N-11 nations. The positive sign and statistical significance, at 1% significance level, of the corresponding slope coefficient supports this claim. It can be seen that if the trade openness index increases by 1% increase in the trade openness index increases the GDP level by 0.220 units. Therefore, enhancing imports and exports are equally important for value addition within the N-11 countries.

The main reason of the positive impact of human capital development on the growth of the N-11 economies could be that more educated and skilled humans are more productive and innovative which, enhances the overall levels of factor productivity to synthesize economic growth. This finding is parallel to the findings by Hassan et al. (2019), Zallé (2019), Han and Lee (2020), Ahmed et al. (2020) and Xu and Li (2020). In contrast, the validity of the resource curse hypothesis indicates that the strategies involved in the extraction and utilization of natural resources are inefficient in contributing to the growth of the N-11 countries. This could be due to several other factors (political rent seeking, institutional quality, lack of diversification, and commodity price volatility, etc.) which have been acknowledged in the literature to reduce the efficacy of the endowed resources in respect of economic development. Thus, it is important for the N-11 nations to unearth the transmission channels responsible for the validation of the resource curse hypothesis. This finding shows consistency with the empirical findings documented by Khan et al. (2020a,b), Ahmed et al. (2016), Sala-i-Martin and Subramanian (2013) and Hussain et al. (2009). However, the joint favorable growth impact of human capital development and natural resource abundance indicates that developing human capital can ensure efficient extraction and utilization of the resources available to the N-11 countries. This finding is identical to the findings by Rickman et al. (2017), Hu and Xiao (2007), and Bravo-Ortega and De Gregorio (2005).

On the other hand, the positive impact of financial development on economic growth is in line with the theory of capital accumulation which requires a strong financial system for borrowers to borrow money and invest in the economy. Similar findings were reported in the studies by Čižo et al. (2020), Erdoğan et al. (2020), and Kumar and Paramanik (2020). Besides, the finding of the positive correlation between industrialization supports the Lewis two-sector economic growth conjecture which postulates structural transformation from an agrarian to an industrialized economy results in higher economic growth. The positive impact of industrialization on economic growth was also reported in the study by Ali et al. (2016). Similarly, technological innovation is believed to enhance the productivity across all sectors of the economy, which, in turn can justifiably be expected to contribute to the overall growth of the N-11 nations. This fining corroborates the results put forward in the existing studies by Cao et al. (2020), and Law et al. (2020). Lastly, the positive growth impact of international trade can be explained from the perspective that globalization, especially though involvement in international trade of goods and services, plays a vital role in stimulating knowledge and technological spillover effects which, in turn, can also be anticipated to boost the growth of the N-11 nations.

The AMG estimations as discussed earlier, showed specific influence of each explanatory variable over the dependent variable. However, for identification of the causality, we utilized (Dumitrescu and Hurlin,

Table 6
Augmented Mean Group (AMG).

Variables	Model-1 Coefficients [Std.Error]	Model-2 Coefficients [Std.Error]	Model-3 Coefficients [Std.Error]
HC	0.0837* [0.0481]	0.0505*** [0.0087]	0.0577*** [0.01024]
TNR	−0.0137*** [0.00467]	−0.0188*** [0.00251]	−0.01644*** [0.00452]
FD	0.318*** [0.1023]	0.3844*** [0.1204]	0.3621*** [0.0672]
IVA	0.547*** [0.05412]	0.5380*** [0.0526]	0.5322*** [0.05874]
TI	0.0281*** [0.00526]	0.00827* [0.00467]	0.0120*** [0.00231]
TO	– –	– –	0.220*** [0.03451]
HC*TNR	– –	0.0227*** [0.00351]	– –
Constant	5.0853*** [0.5516]	5.2472*** [0.54108]	5.0397*** [0.52816]

Note : $p < 0.01^{***}$, $< 0.05^{**}$ and 0.1^{*}, respectively.

Table 7
Causality test.

Null hypothesis	Wald–Stats	$\bar{Z}$–stats	Prob.
HC-GDP	3.633***	5.179	0.000
GDP-HC	3.929***	5.779	0.000
TNR-GDP	1.893*	1.645	0.099
GDP-TNR	1.953*	1.766	0.077
TI-GDP	4.646***	3.144	0.000
GDP-TI	6.654***	11.31	0.000
IVA-GDP	2.207**	2.283	0.022
GDP-IVA	2.830***	3.548	0.000
FD-GDP	4.303***	6.539	0.000
GDP-FD	3.183***	4.264	0.000
TO-GDP	5.314***	4.299	0.000
GDP-TO	6.9254***	6.516	0.000

Note : $p < 0.01^{***}$, $< 0.05^{**}$ and 0.1^{*}, respectively.

2012) Granger causality test, for which the estimated results are presented in Table 7. The causality of each explanatory variable has been tested with the dependent variable and vice versa. Explanatory variables such as, human capital, technological innovation, industry value added, financial development and trade openness significantly causes economic growth at $P < 0.01$ significance level. At the same level of significance, the economic growth Granger causes human capital, technological innovation, industry value added, financial development and trade openness.

This means that these variables are favorable for economic growth in the under-study group of countries i.e., N-11. Similarly, economic growth is also as much important as these variables itself for economic growth. If all these variables showed positive trend, the economic growth, human capital, technological innovation, industry value added, financial development and trade openness will move along side. However, the TNR also significantly causes economic growth, but weakly at $P < 0.1$, and in response, the economic growth Granger causes TNR at the same level of significance. Moreover, all the explanatory variables positively contribute to economic growth and vice versa.

5. Conclusion

This empirical study aims to investigate the impacts of natural resources, human capital, financial development, industrialization, technological innovation, and international trade on economic growth in the N-11 countries over the 1990–2019 period. From the econometric exercises, we found that the natural resource rents have negative and significant impact on the economic growth of N-11 countries. This leads to the conclusion that the resource curse hypothesis exists for these nations. However, the human capital was found to both directly and indirectly, through a joint impact with natural resources, to positively influence the growth of the N-11 nations. Hence, in line with these findings, it can be concluded that human capital development is critically important for efficient extraction and utilization on natural resources in order to boost the growth of the N-11 economies of concern. Consequently, curse of the natural resources can be eventually be converted into blessing for these nations provided appropriate policies are adopted to enhance human capital development. Besides, financial development, industrialization, technological advancement, and international trade participation were also found to synthesize long-run economic growth in the N-11 countries.

As per these study findings, it is recommended that natural resources could become blessings for a nation if it is used efficiently, so policies are needed that are useful in the efficient management of the natural resources. Additionally, human capital is playing a vital role in transforming that resource curse into blessings, so the policies regarding investment in human capital are needed to raise its level and overcome the inefficient use of natural resources for economic betterment and real economic growth. Moreover, it is also necessary for the associated governments of the N-11 countries to enhance the strength of their respective financial sectors, expedite the rate of industrialization, and boost international trade volumes to secure higher levels of economic growth. Furthermore, investment in research and development for facilitating technological innovation is also needed which not only would synthesize economic growth but could also be a means of sustaining it in the future.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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