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NATURAL RESOURCES AND ECONOMIC GROWTH IN CHINA: THE INTERACTING ROLE OF HUMAN CAPITAL AND INSTITUTIONS QUALITY

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Abstract

This study investigates the conditional effects of natural resources on economic growth in China via human capital and quality of institutions. Relative to earlier works, this study combines the interactive effects of i) natural resources and human capital, ii) natural resources and quality of institutions and iii) natural resources, human capital and quality of institutions (as one variable); in the same model. An error correction model was employed using appropriate World Bank data for china. The estimated regressions found a positive relationship between the rate of economic growth and natural resources. Concerning their signs and statistical significance, the outcomes of the control variables do not change even when the interaction terms are introduced (see models 2 – 9 in the Appendix). This means that this paper's findings rejected the resource curse hypothesis in China's situation relative to the data and method (time series analysis) employed. Considering the interaction between natural resources and human capital; natural resources and institutional quality; and natural resources, human capital and quality of institutions; this paper demonstrates that it is but prudent for resource-rich countries to simultaneously improve their human capital and quality of institutions in order to significantly benefit from natural resources, hence avoiding the resource curse.

Keywords: Natural resources, Economic growth, Resource Curse, Institutions, Human Capital

1. Introduction

Since Adam Smith and David Ricardo's time, there has been the belief that countries endowed with abundant natural resources can develop using these resources for sustained economic growth. Since the 1980s, much of the literature has challenged the opinion that natural resources are a blessing, especially for developing countries. Over time, this literature has significantly increased.

Ever since the ground-breaking works of Auty (1993), Sachs and Warner (1995), and Karl (1997) on the natural resources curse, there has been an increasing number of debates on the role of natural resources on economic growth hence development. These authors' findings suggest that countries with abundant natural resources had low economic growth relative to countries with scarce natural resources.

Ever since, the literature has been trying to give reasons for such a phenomenon. Therefore, numerous political, institutional, economic and environmental factors have been given to elucidate this perception (Robinson et al., 2006; John, 2011). The findings of the first set of studies suggest that countries that have high levels of human capital are the ones that have benefited immensely from the abundance of natural resources (Gylfason, 2001; Lederman, 2007). The second set of studies believes that the positive contribution of natural resources to any country's economic growth depends on the quality of institutions of that country (Mehlum et al., 2006a; Sala-i-Martin and Subramanian, 2008). Nevertheless, the third group of studies believes that there is no specific role of human capital or institutions on the resource curse ((Sachs and Warner 1995, 1995; Arezki and Van der Ploeg, 2007). There has been no agreement on the impact of natural resources' abundance on the country's economic growth performance and the mechanism underlying the effect. However, it is observed from a Meta-Analyses of 43 studies by Havranek et al. (2016). About 40 percent of empirical studies find no effect, 40% see a negative and 20% find a positive impact.

Given the previous conflicting results, there is a need to do further empirical investigations on the correlation between natural resources and economic growth.

The economic literature has recognized two types of natural resource effects that affect economic growth: direct and indirect. The indirect impact would mostly function via human capital and the quality of institutions. However, these two channels of indirect effects are only considered individually by several researchers. Therefore, from the viewpoint of the endogenous growth theory and institutional economics, it is fitting to analyze the influence of natural resources on economic growth performance by simultaneously looking at the effects of these two channels.

Therefore, this paper analyzes the conditional effects of natural resources on economic growth via human capital and institutions' quality in China. The objective of this is to investigate further whether natural resources can positively contribute to economic growth in the presence of institutions quality (Mehlum et al., 2006b; Mehlum et al., 2006a; Sala-i-Martin and Subramanian, 2008; etc.) and human capital (Bravo-Ortega and De Gregorio, 2005; Lederman and Maloney, 2007;Gylfason and Zoega, 2006; Gylfason, 2001; etc.). To achieve this objective, we employ an Error Correction model that makes it possible to simultaneously investigate the direct and indirect effects of natural resources on the economic growth performance of China.

In pursuit of finding empirical evidence on the influence of natural resources on China's economic growth, asking the following question is important: are human capital and institutions, simultaneously, the main channels through which natural resources improve economic development? The effort to answer this question forms the basis of the critical problem of this research work. **S**everal papers have focused on the nexus between natural resources and human capital on the one hand (see Badeeb et al., 2017 for a detailed survey) and natural resources and institutions on the other (Mehlum et al., 2006b; Mehlum et al., 2006a; Sala-i-Martin and Subramanian 2008; etc.). This paper's major contribution is primarily the simultaneous introduction of human capital and institutions into the analyses as the main channels through which natural resources influence China's economic growth. Considering most of the previous papers that only investigate these effects separately, this paper provides the first empirical analysis of resource rents' impact on China's economic growth through human capital and institutions in the same regression model using the mediation model. It specifically looks at the interaction between natural resources and human capital on one hand and natural resources and institutions' quality. It further investigates the interaction among natural resources, human capital, and institutions' quality (as a single variable) and its effects on China's economic growth in the same model.

As indicated by Horváth and Zeynalov (2016), most of the previous papers emphasize cross-sectional data. However, the use of time-series data is vital, especially to individual countries, because cross-sectional data suffer from omitted variable bias that emerges from the relationship between the omitted initial level of productivity and initial income. Time-series country studies, such as this, maybe helpful in solving this cross-sectional problem.

The other parts of the paper contain the following sections: Section 2 gives an overview of institutions, human capital, and economic growth in China. Section 3 provides the literature review. Section 4 deals with the methodology, including model specification, estimation techniques and data and sources. Section 5 talks about the analysis and discussion of empirical results, and section 6 focuses on the conclusion and policy recommendations.

2. Overview of Institutions, Human Capital and Economic Growth in China

This section summarizes the status of institutions, human capital, and growth performance in China to comprehend how these variables are intertwined.

During the 1990 to 2014 period, China's average growth rate was 9.8% per year, outperforming the growth rates of most, if not all, the countries in the emerging and developed worlds. Much of this performance has to do with the rapid economic growth of the cities in China. The economic growth rate of the larger cities in China, such as Beijing, Guangzhou, and Shanghai, has surpassed the country's average growth rate, making the large cities in China – as projected by most urban economics theories- the main reason for economic development. One of the significant reasons behind China's high economic growth has fundamentally been institutions' role in general and government institutions, particularly in creating and allowing economic activity in China, especially the country's urban areas. The focus of current Chinese policy thinking has been the improvement in government institutions' quality. Integrity initiatives and local capacity have become more conspicuous through diverse and numerous areas in China (Gong, 2015).

The Chinese cities' economic trajectory has directly been shaped by the fight against corruption and Government efficiency at the city level in recent years. There has been an immense increase in the returns of innovation, human capital, social conditions, and accumulation externalities in cities that have embarked on a robust fight against corruption. However, there has been less improvement in regions where there is a less or lax effort to fight against corruption.

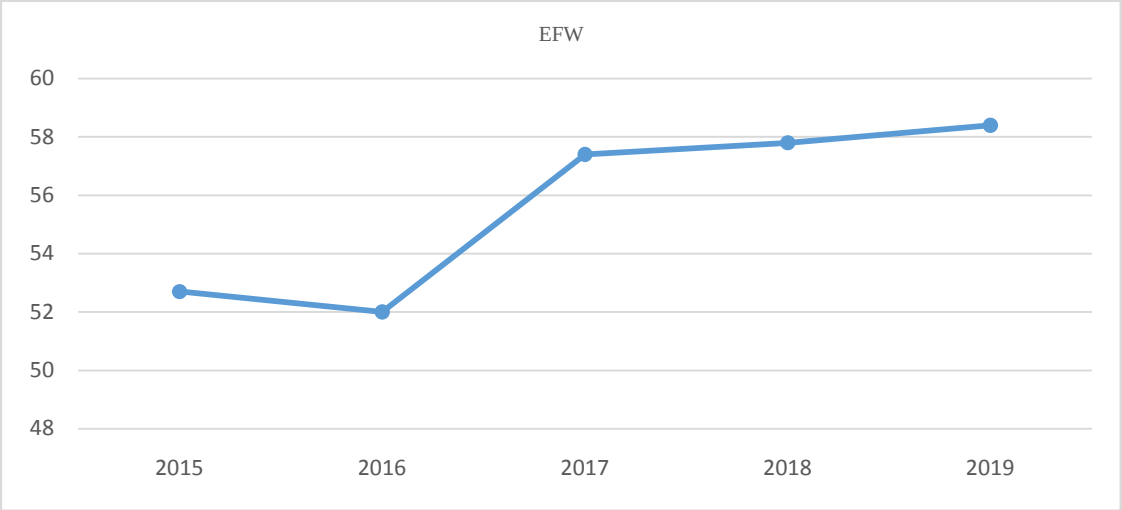
Choi et al. (2015) show a positive correlation between the quality of government and the firm's performance at the provincial level, while Reinecke and Schmerer (2017) confirm evidence to support the relationship between provincial government efficiency and firm-level exports. Cole et al. (2009) investigate the effect of government efficiency and anti-corruption measures on the location of FDI in China using data at the provincial-level from 1998 to 2003. These findings show that efforts to fight corruption and high government efficiency levels attract a substantial amount of Foreign Direct Investment to the provinces that made considerable efforts in such areas. "An essential factor in consolidating the regional economy is government efficiency" (Tang et al., 2014).

"Institutions are the rules of the game that shape human activity" (North 1990). The interaction of numerous economic factors in a country depends on government institutions' quality, which can lead to trust or distrust among economic agents, which can further lead to high transaction costs in the execution of business agreements. The fight against corruption and government efficiency can serve as incentives for robust economic activities (Ahrend et al., 2017). In contrast, governments with characteristics of corruption and low government efficiency can cause increase transaction costs and dampen interaction among economic agents. Consequently, government institutions are as much of a factor directly affecting economic growth as innovation skills or infrastructural development.

Considering the institutional quality, government efficiency or the fight against corruption differs across China's cities. In terms of the efficiency of government, there is a robust relationship between good governance and wealth. The majority of the top of the rankings in terms of government efficiency are well-off coastal cities. From Harbin, in the northeast, to Haikou, on the southern island of Hainan, most coast cities are above average concerning government index efficiency. Some big cities in the relatively wealthy interior, including Xi'an, Kunming, Changsha, Tongchuan, Taiyuan, Karamay, Baotou, or Ganzhou, have also done relatively well in the government efficiency ranking (Rodríguez-Pose and Zhang, 2018). These cities include but are not limited to Lvliang, Zhangjiajie, Baoding, Hebi, Luohe, Ezhou, Wuzhong, or Dazhou cities located in Anhui, Hebei, Hunan, Henan, Hubei, and Guangxi provinces. Rodríguez-Pose and Zhang (2018) carried out an empirical investigation between government efficiency and economic growth in China. They found out that the overall government efficiency index and the fight against corruption at the city level are positively correlated with high economic growth. They further indicated that Cities with more transparent, efficient, accountable, and capable governments perform relatively better. Also, the more robust the fight against corruption is at the local level, the more the cities realized economic growth benefits. The rapid improvement of cities in China has coincided with an increasing attention in government institutions role. Actions to increase local governments efficiency have been implemented across China (Tang et al., 2014). The central government has embarked on an ever more determined policy to reduce or eliminate corruption (Gong, 2015; Dong and Torgler, 2013).

To further expand on institutional quality status, China's economic freedom score (Miller et al., 2019) in the 2019 Index stood at 58.4. Its total score has improved by 0.6 points, with higher scores on the effectiveness of the judiciary (75.2), Tax Burden (70.4),Government Spending (70.1),Fiscal Health (76.0),Monetary Freedom (71.9), and Trade Freedom (73.0). See figure 1 below for the overall score.

Figure 1. Economic Freedom Score (EFW). This represents the quality of institutions



Source: 2019 INDEX OF ECONOMIC FREEDOM

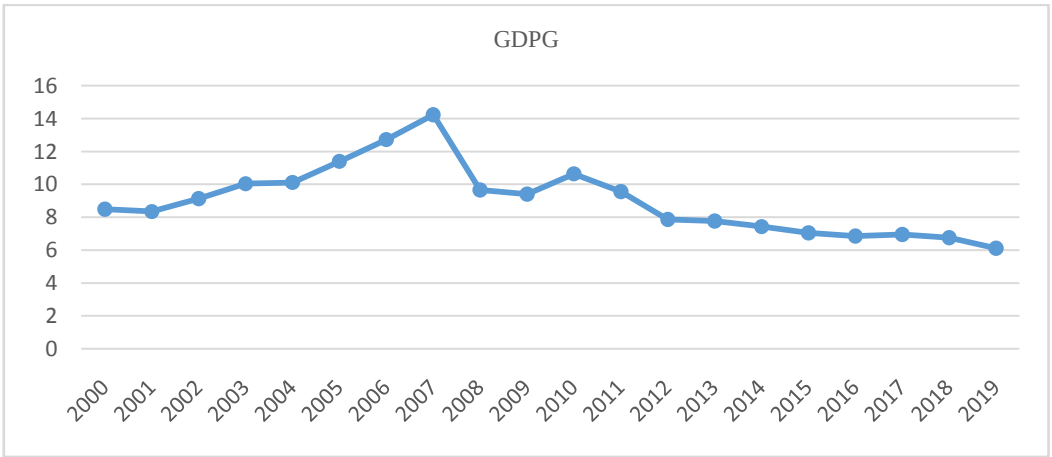
As stated, judicial effectiveness, especially for developing countries, maybe the area of economic freedom that is most important in laying the foundations for economic growth (Miller et al., 2019).

On the other hand, the contribution of human capital to economic growth performance cannot be overemphasized. According to Li et al. (2008), higher education in China has undergone tremendous changes since 1999.

The main reason for increasing higher education in China is to stimulate the economy and accrue talents for China's future prosperity. Wu et al. (2020) opine that higher education development could lead to an upsurge in educational opportunities. In 1999, China's government included further development of higher education as part of its revival plan. The majority of the higher educational institutions in China are dominated by public institutions (Roy et al., 2012).

Since 1999, the effect of the significant reforms of education in China, which sharply increased both student enrollments and tertiary educational expenditures (see Li et al., 2008), correspond with the average growth rate of GDP during 1978-2008, reached 9.82%. The average growth rates of GDP during the two periods between 1978 -1999 and 1999 - 2008 were 9.7% and 10.1%, respectively. It can be observed that the GDP growth rates remain at high levels after 1999 till the 2008 Financial Crisis, when they dropped back to 9.6% (see figure 2 below). The growth rate ofGDP again rises from 2009 till 2010 before it fell to around 6.1% in 2019. Even though there has been a steady decline in the growth rates since 2010, these rates are still high relative to the world's most developed and emerging markets. The drop in growth is sometimes understandable because China is the second-largest economy globally, and it is difficult for any country with such income to grow at these rates.

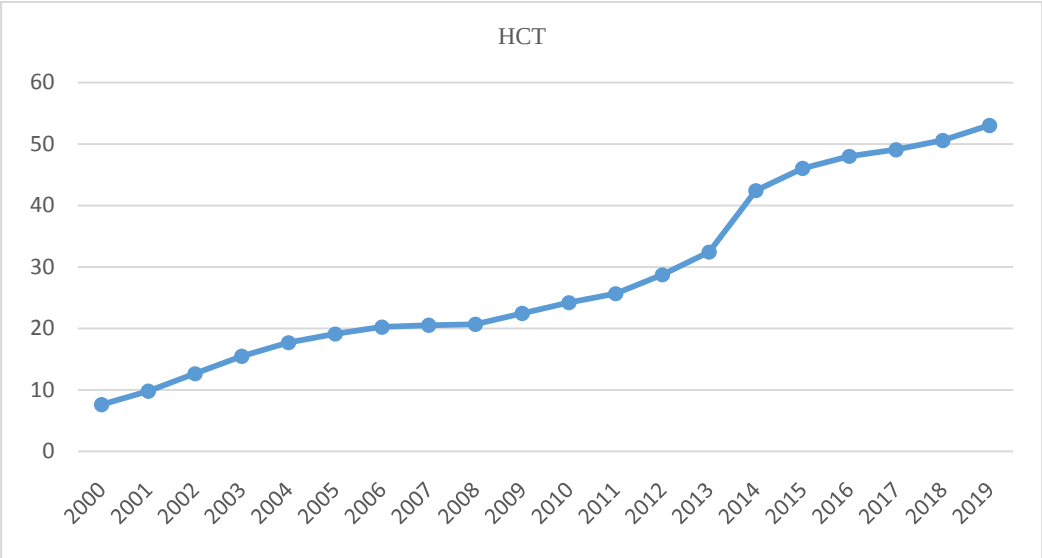
Figure 2. GDP Growth (GDPG of China)



Source: World Bank Data

According to Whalley and Zhao (2010), the stock of human capital was 1.1 trillion yuan in 1978 and got to the 9.8 trillion yuan mark in 2008, growing by 7.6% yearly and contributed 33.2% to the growth of GDP. The upsurge of the stock of human capital for education at the tertiary level is even more significant, ranging from 27 billion yuan in 1978 to 1.7 trillion yuan in 2008; this led to an annual increase of 14.8%. After 2000, the formation of human capital at the tertiary education level experienced a tremendous increase rate (see figure 3 below), which is vital for the growth of the Chinese economy, and this is consistent with the expansion of higher education in China since 1999 (see Li et al., 2008).

Figure 3. Human Capital (HCT) represented by the Gross Enrollment Ratio of tertiary education in China



Source: World Bank Data

Furthermore, following the adoption of the Private Education Promotion Act of 2003, the number of institutions of higher education that are privately owned and offered formal courses has quickly increased to 278 in 2008. In 2019, higher education's gross enrollment ratio was 53 (as indicated in figure 3 above); it has grown by 243.4 percent since 2003. China's gross domestic product (GDP) increased by 723.5 percent from $US1.7 trillion in 2002 to around $US 14 trillion in 2019.

Human capital plays a significant role in China's economic growth and makes enormous contributions of 20%-40% to GDP growth (Whalley and Zhao 2010). China's economic growth rate would have been lower had it not been for the tremendous improvement in labor quality and human capital accumulation.

The pivot of research in China has been due to the tremendous improvements in education and, by extension, innovation. Groups of highly skilled labor with a blend of vast concentrations of firms facilitate the circulation of knowledge and enhance innovation.

As China becomes one of the world's major economic centers, higher education has also become an essential part of national development. Several studies (as indicated above) reveal that higher education expansion is closely related to its growth rate.

3. Literature Review

There is no consensus in the contemporary economic literature about whether abundant natural resources are a curse to resource-rich countries. A good number of studies are gradually acknowledging the natural resource curse. Nevertheless, the different forms of development paths of countries rich in natural resources indicate that some countries have been negatively affected far more than others.

3.1 Natural resources and economic growth: the role of human capital

The literature shows the interaction of human capital with natural resources that positively affects countries' economic growth. There is the belief that resources can negatively influence economic growth only in countries with deficient levels of human capital qualities.

Theoretical models assume that an increase in natural resources can encourage the reallocation of human capital from the industrial sector to the natural-resource sector. Bravo-ortega and De Gregorio (2005) demonstrate that the marginal effect of the abundance of natural resources is positive for economic growth in countries with plenty of human capital. From this standpoint, Lederman and Maloney (2007) observe that rich countries, such as Australia and Norway, have effectively exploited their natural resources for development purposes because they both have high and quality human capital levels. Consequently, the abundance of natural resources can only reduce economic growth when there is low human capital value. Conversely, Gylfason (2001) says that natural resource richness tends to crowd out other forms of capital, specifically physical capital, human capital, and social capital. Consequently, countries that do not adequately invest in their human capital will encounter severe challenges in liberating themselves from primary product dependence. Therefore, these countries will face minute diversification in the growth of their economies.

Furthermore, South Korea's and Finland's development of their industries demonstrate a strong relationship between the prospective of having high levels and quality of human capital and the capability of a country to change from an economy that depends on commodities to an economy that depends on manufactures. And two of the systems of education that are most regularly cited for being successful among the world's countries are South Korea and Finland's educational systems. Furthermore, Gylfason and Zoega (2006) establish that natural resource abundance has a positive and indirect influence on the economy's growth via human capital.

From the various works above, it is observed that the interaction of the high quality of human capital with natural resources can boost economic growth, hence development. Therefore, the lack of a high and quality level of human capital causes the resource curse.

3.2 Natural resources and economic growth: the role of institutions

According to the literature, institutions' role and natural resources can be put into three groups. The first group of works states that institutions' quality has been negatively affected by an abundance of natural resources, thereby triggering the economy's poor performance. This situation is termed as the institutional resource curse that mirrors the fact that natural resources would prevent reforms for institutions favorable to economic growth. These types of work demonstrate that natural resources lower institutions' quality by degrading the level of civil liberties, reducing the quality of the rule of law, and postponing the process of democracy (Leite and Weidmann, 1999; Isham et al., 2005; Sala-i-Martin and Subramanian, 2008). Furthermore, countries that generally score high in the corruption index tend to have an abundance of resources (Leite and Weidmann, 1999), especially developing countries. Also, countries usually endowed with many resources such as diamonds, gold, etc., and cash crops, namely cocoa, coffee, etc., typically exhibit a lesser quality of institutions (Isham et al., 2005).

Natural resources can also undermine institutions' improvement because governments usually use revenues from resources to change public accountability, calm down opposition to their rule, and counter pressures for institutions' quality (Isham et al. 2005; Sala-i-Martin and Subramanian, 2008). Moreover, Sachs and Warner (1995) demonstrate that countries with lower institutional quality usually are rich in natural resources. The reason is that natural resource abundance tends to be a determinant in the creation of actions that can lead to corruption, hence institutions' ineptitude. Coller and Hoeffler (2005a) have also demonstrated that the high risk of civil wars occurring in countries best endowed with natural resources is one reason for the institutional curse. Therefore, civil wars can destroy the quality of institutions, which can lead to a weaker state. Also, political volatility and the risk of war can be exacerbated by the tussles to capture and share rent (Carbonnier, 2013). Carbonnier (2013) believes that leaders have a habit of reallocating rents to groups of people that are more influential in society rather than to activities that can boost economic growth to remain in power. As a result of this, and according to the rentier state theory, Ross (2001) states that rents from oil negatively affects democratization. Jensen and Wantchekon (2004) support the argument about a negative association between democratic regimes in Africa and natural resource abundance. They argue that resource abundance is a significant factor for a transition to democracy; it also, to some extent, decides the attainment of democracy in Africa. Besides, since citizens do generally not contribute to the mobilization of public funds, leaders tend to be unwilling to be accountable to them on how they share the rents, paving the way for the rise of institutions that are not democratic and transparent (Leite and Weidmann, 1999; Ross, 1999).

Karl (1997) states that rent is negatively associated with institutions' quality. For instance, countries that mainly exhibit lower signs of quality of institutions usually depend on high exports of crops, minerals, and fuels. In addition to this, there is a negative correlation between democracy and resource wealth (Auty, 2000 and Collier and Hoeffler, 2005b). Indeed, the mixture of rent from natural resources and democracy has significantly affected countries' economic growth. Resource types and the simplicity to which their rents can be appropriated encourage institutions established in the colonies (Acemoglu et al., 2012).

The second groupof works emphasizes that natural resources and institutions' quality interact. The quality of institutions decides how the revenues obtained from natural resources will be used, leading to whether resources are a curse or a blessing (Mehlum et al. 2006b). Meaning it is the quality of institutions that decides whether revenues received from resources can be used appropriately to boost its economy.

Sala-i-Martin and Subramanian (2008) demonstrate that natural resources no longer directly influence economic growth when the quality of institutions is controlled. Also, it has been established by Mehlum et al. (2006a) that if the quality of institutions is high, revenues from resources will promote economic growth. Conversely, it is the existence of weak institutions that encourage activities of wealth plundering that cause the transformation of resources into a curse. Owing to the quality of institutions, the negative consequence of natural resources can be defused.

The connection between economic growth and the quality of institutions brings enlightenment into the resource curse phenomenon. In this case, the resource curse can only be experienced when you have weak institutions.

The third group of works demonstrates that institutions do not affect the association between economic growth and natural resources; they are neutral (Mehlum et al., 2006a). Therefore, Sachs and Warner (1995) claim that institutions show no particular role in the resource curse. These researchers believe that the impact of natural resource wealth on institutions is not the main channel for expressing the natural resource curse. Furthermore, Arezki and van der Ploeg (2007) concluded that resources had no impact on the growth of the economy.

Numerous theoretical and empirical findings on this topic point to the view that the negative impact of natural resources dependence on economic growth emanates from the low quality of human capital and weak institutions. Nevertheless, the current findings do not employ the different transmission mechanisms of the curse for countries with a high quality of human capital and high institutional quality in the same model. China has high levels of human capital and strong institutions quality. This paper aims to fill this gap by carrying out such research on China at the country level.

4. Methodology

4.1 Model Specification

The study gives an empirical analysis of natural resources' effect on China's economic growth via human capital and institutions, employing an econometric approach. The approach includes regressing GDP per capita growth on total natural resources rent, foreign direct investment, physical capital, inflation, the interaction between total natural resources rent and human capital, and the interaction between total natural resources rent and institutions. The following technique is employed: Applying stationarity test for the variables using the Augmented Dickey-Fuller test for unit roots; Johansen co-integration to observe for the existence of long-run relationships. Furthermore, the Error Correction Model (ECM) is applied to estimate the models together with the error correction term. Finally, diagnostic tests were employed to observe the strength of the assumed model. Relative to several works of literature, the functional form below was adopted as the model:

$$GDPPCG = F(TNRR, FDI, PK, INF) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4-1)$$

The econometric form of the model is expressed in equation 4-2 below:

$$GDPPCG_t = \beta_0 + \beta_1 TNRR_t + \beta_2 FDI_t + \beta_3 PK_t + \beta_4 INF_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots (4-2)$$

To estimate the level of responsiveness (elasticity) of GDPPCG in connection to TNRR, FDI, PK and INF, the Log-Log model (eq. 4-3) was applied:

$$LNGDPPCG_t = \beta_0 + \beta_1 LNTNRR_t + \beta_2 LNFDI_t + \beta_3 LNPK_t + \beta_4 LNINF_t + \varepsilon_t \dots (4-3)$$

Subsequently, we added the interaction term between natural resources and human capital into (Eq. 4-3). This allows us to test if natural resources' effect on GDP per capita growth is conditional on human capital. The significance and sign of the coefficient of this interaction variable will tell us whether the impact of natural resources on growth is contingent on the Size of human capital. Including this variable, we modify (Eq. 4-3) as stated below:

$$LNGDPPCG_t = \beta_0 + \beta_1 LNTNRR_t + \beta_2 LNFDI_t + \beta_3 LNPK_t + \beta_4 LNINF_t + \beta_5 LN(HCT_t * TNRR_t) + \varepsilon_t \dots\dots\dots (4-4)$$

Similarly, another interaction term, natural resources and quality of institutions, was included in the equation. Incorporating this interaction term into equation (4-4) gives rise to equation (4-5) below:

$$LNGDPPCG_t = \beta_0 + \beta_1 LNTNRR_t + \beta_2 LNFDI_t + \beta_3 LNPK_t + \beta_4 LNINF_t + \beta_5 LN(HCT_t * TNRR_t) + \beta_6 LN(EFWH_t * TNRR_t) + \varepsilon_t \dots\dots\dots (4-5)$$

Furthermore, to examine how these variables (institutions quality and human capital) interact with natural resources simultaneously, we introduce another interaction term, natural resources with institutions quality and human capital, into equation (4-5). This leads to equation (4-6):

$$LNGDPPCG_t = \beta_0 + \beta_1 LNTNRR_t + \beta_2 LNFDI_t + \beta_3 LNPK_t + \beta_4 LNINF_t + \beta_5 LN(HCT_t * TNRR_t) + \beta_6 LN(EFWH_t * TNRR_t) + \beta_7 LN(HCT_t * EFWH_t * TNRR_t) + \varepsilon_t \dots\dots\dots (4-6)$$

Where,

$GDPPCG_t$ = gross domestic product per capita growth in time t
$TNRR_t$ = total natural resources rent (a proxy for natural resources measured as total natural resources rents as a % of GDP) in time t
FDI_t = foreign direct investment in time t
PK_t = physical capital in time t
INF_t = inflation in time t

HCT_t = human capital represented bytertiary school enrollment (Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, usually requires, as a minimum condition of admission, the successful completion of education at the secondary level) in time t
$EFWH_t$ = quality of institutions (represented by economic freedom of the worldtaken from the Economic Freedom of the World annual report by James Gwartney and Robert Lawson) in time t
β_i = set of parameters indicating the relative effects of the independent variables.
ε_t = Error term
t = Time
Below are the specific institutions:
SOG_t = Size of government in time t
$LSPR_t$ = legal systems and property rights in time t
SM_t = sound money in time t
FTI_t = freedom to trade internationally in time t
R_t = regulation in time t

4.2 Estimation techniques

The Error Correction Model (ECM)

The ECM comprises of the short-run and long-run effects of variations in GDPPCG. And in general, the ECM is written as:

$$\Delta G_t = \delta_0 e_{t-1} \sum_{j=1}^{T} \delta_j \Delta P_{t-j} + \sum_{j=1}^{T} \theta_j \Delta Q_{t-j} + \varepsilon_t \dots\dots\dots\dots\dots (4-7)$$

If $\delta_0 e_{t-1}$ is significantly not equal to zero; this means P and Q are co-integrated, thus having a long-run relationship. The needed quantity of lags to get white noise is represented by T and ε_t represent the stochastic disturbance term, Δ denotes the difference operator.

The error correction term defined by e_{t-1} shows the degree of disequilibrium between P and Q. δ_0 is the coefficient of e_{t-1} predicted to be significant and shows a negative sign, referred to as the speed of adjustment.

The ECM further tells us that the variation in P_t does not only hinge on lagged variations in Q_t but also on the lagged variations of itself. This is interesting because it can encourage flexibility by linking the short-run and long-run changes in a combined structure. Therefore, the approximations of the ECM parameters are generally efficient and consistent (Hendry and Richard, 1983).

4.3 Data and its Sources

This part of the paper looks at the secondary data used to investigate the association between growth and natural resources. We compiled data on total natural resources rents, foreign direct investment, physical capital, inflation, and human capital from the World Bank online data bank for China and used them as independent variables. We used yearly data for the period 2000 - 2019. We further collected institution variables from the "INDEX OF ECONOMIC FREEDOM" published every year. Economic freedom of the world is an index that measures how different countries in the world use policies and institutions to enhance economic freedom for economic growth. Economic freedom fundamentals are based on personal choice, voluntary exchange, security of privately owned property, and freedom to compete. Economic freedom is divided into five broad areas (size of government; legal systems and property rights; sound money; freedom to trade internationally and regulation).

5. Analysis and discussion of empirical results

We investigate the empirical results of the model in this part of the chapter. The variables under investigation were tested for time series properties, employing the Augmented Dickey-Fuller (ADF) test. Stationarity is attained by differencing each variable. A Co-integration test was also performed to ascertain for long-run relationship. Furthermore, we estimate the model by using ECM. Lastly, we carried out diagnostic tests for the robustness of the model.

5.1 Results of Unit Root Test

Table 5-1. Unit Root Test

Variables		Augmented Dickey-Fuller (ADF) Unit Root Test		
		Constant	Constant and Trend	Order of integration
LNGDPPCG	level	-0.725083	-2.527338	I(1)
	Δ level	-3.542544**	-4.105881**	I(1)
LNTNRR	level	-0.927133	-1.457116	I(1)
	Δ level	-4.272655***	-4.581870***	I(1)
LNFDI	level	0.069154	-1.708637	I(1)
	Δ level	-4.791300***	-4.281539**	I(1)
LNPK	level	-1.941443	-0.109599	I(1)
	Δ level	-5.813056***	-3.952290**	I(1)
LNINF	level	-1.005682	1.001943	I(1)
	Δ level	-4.224545**	-5.080807***	I(1)
LNHCT	level	-2.970591	-3.345204	I(1)
	Δ level	-3.540908**	-4.175619**	I(1)
LNEFWH	level	-1.498466	-2.018110	I(1)
	Δ level	-5.467767***	-5.980353***	I(1)
LNSOG	level	1.764121	-1.021248	I(1)
	Δ level	-4.459634***	-5.123989***	I(1)
LNLSPR	level	-1.787448	-1.790159	I(1)
	Δ level	-3.907725***	-3.793987**	I(1)
LNSM	level	-0.624797	-3.098272	I(1)
	Δ level	-3.677656**	-3.593742**	I(1)
LNFTI	level	-2.733697	-2.486183	I(1)
	Δ level	-5.462902***	-5.357003***	I(1)

LNR	level	-1.444954	-3.677745	I(1)
	Δ level	-6.320249***	-6.97638***	I(1)

Δ = first difference, *** and ** means 1% and 5% respectively; and I (1) = integrated of order one

The ADF unit root test estimates (table 5-1) show that all the variables are not stationary in level butstationary at first difference. Therefore, the variables are integrated of order one, as denoted by I (1).

5.2 Co-integration Test Results

The co-integration test of Johansen was employed to look for a long-run association among the variables. Also, the maximum Eigen statistics (λ_{max}) and trace statistics (λ_{trace}) were both used and the estimates are presented in tables 5-2 and 5-3.

Table 5-2. Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.976623	111.0240	69.81889	0.0000
At most 1	0.825449	47.17223	47.85613	0.0579
At most 2	0.526120	17.49804	29.79707	0.6032
At most 3	0.203490	4.802419	15.49471	0.8294
At most 4	0.053495	0.934651	3.841466	0.3337
Trace test indicates 1 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: E-views output

Table 5-3. Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.976623	63.85180	33.87687	0.0000
At most 1	0.825449	29.67419	27.58434	0.0266
At most 2	0.526120	12.69562	21.13162	0.4806
At most 3	0.203490	3.867768	14.26460	0.8730
At most 4	0.053495	0.934651	3.841466	0.3337
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: E-views Output

The co-integration test results for the trace statistic confirm one co-integrating equation at the 5% significance level. In contrast, the maximum Eigen statistic demonstrate two co-integrating equations at the 5% level of significance. As a result of this outcome, the Error Correction Model (ECM) was estimated because the variables under consideration are co-integrated, meaning there are long-run associations among the variables.

5.3 Results of the Error Correction Model

We estimate the Error Correction Model (ECM) since the co-integration test results establish a long-run association among the variables. The results of this function are presented in the Appendix. The long-run relationship running from the independent variables to economic growth was established by thesignificance and presence of the negative signs of the coefficients of the error correction terms of the various models. The speed of adjusting the error terms correspond to their respective coefficients (see Appendix). The adjusted R-squared (R^2) value in each model is greater than 50%, implying that approximately more than 50% of the GDP per capita growth variations are determined by the independent variables, which means a good fit.

Similarly, the values of the Durbin-Watson statistic imply no auto-correlation of the first order. The F-statistic values were also very high with significant corresponding probability values that led us to deduce that the general equations are statistically significant.

We commence our main examination by investigating the evidence established on the standard model's estimates (model 1), capturing the independent variables' relative effect on GDP per capita growth. The estimates are presented in the Appendix. Model 1 denotes the base specification of the ECM devoid of human capital and quality of institutions variables. The calculations demonstrate that the variable representing natural resources is correlated with positive growth in per capita GDP. The coefficient of natural resources is 0.0019, suggesting that when shares of total natural resources rents rise by 10%, the growth rate of GDP per capita increases by 0.019% (see Appendix, model 1). Undoubtedly, our result does not support the hypothesis that natural resources tend to reduce economic growth. The results contradict previous findings obtained by Sachs and Warner (1995, 1997ab, 1999, 2001); Humphreys et al. (2007); Boschini et al. (2007); Jalloh (2013). However, several studies have also established that abundance of natural resources does not hinder economic growth instead, it improves it (Bah, 2016;Adu, 2012; Van der Ploeg and Poelhekke, 2010; Nunn, 2008; Sala-i-Martin et al., 2004; Manzano and Rigobon, 2001) as the outcomes of this study have also shown it. Models 2 to 9 present the estimates when human capital and quality of institutions variables were successively included in the base model as interaction terms. The effect of natural resources in all the models is mostly the same. This shows an overwhelming indication of a positive and significant correlation between natural resources and GDP per capita growth. This implies that a 1% increase in the natural resources variable (TNRR) can increase growth by their respective corresponding coefficients (models 1 to 9 in the Appendix) on average. This result may not be unconnected because institutions' quality and human capital have improved drastically in china since the opening-up policy in 1978.

The estimates in the appendix indicate that the control variables are mostly satisfactory in their coefficients. Specifically, the estimates show that FDI is positive and statistically significant in influencing growth as anticipated. This is consistent with the findings of Omri and kahouli (2014); Anwar and Nguyen (2011); Borenzstein et al. (1998), etc.. The results also indicate that investment in physical capital is positive and statistically significant in influencing growth as predicted. This confirms the theory of traditional growth, which states that investing in physical capital is essential for higher and improved growth. The findings of Ghazanchyan and Stotsky (2013) also confirm such outcomes. The coefficient of physical capital is 1.3480, implying that when investment in physical capital in China increases by 10%, the growth rate of GDP per capita increases by 13.5% (see model 1 in the Appendix).

Concerning inflation, there is a negative correlation with the growth of GDP per capita. Its coefficient sign is negative as expected from the theory but not significant.

Concerning their signs and statistical significance, the outcomes of the control variables do not change even when the interaction terms are introduced (see models 2 – 9 in the Appendix). Similar to the result of model 1 inthe Appendix, the effects of natural resources on GDP per capita growth (models 2-9) remain positive and statistically significant. Interestingly, the interaction of natural resources (TNRR) with human capital (HCT) and the overall quality of institutions variable (EFW), including specific variables of quality of institutions (SOG, LSPR, SM, FTI, and R), generates robust and positive effects on growth.

Regarding the variable of the interaction term of human capital and natural resources, the ECM regression result reveals that the coefficient sign is positive and statistically significant at the 1% level (see model 2 in the Appendix). This indicates that improving the qualityof human capital and increasing the human capital level has a strong and positive effect on growth.The effect of this variable is even bigger than the effet of TNRR in model 1 This is because human capital contributes more significantly to China's economic growth, 38.1% of economic growth over 1978-2008, and even higher for 1999-2008 (Whalley and Zhao, 2010). This outcome is similar to the results of several studies on the role of human capital in augmenting the performance of natural resources on growth (Bravo-ortega and De Gregorio 2005; O Zallé, 2019). These researchers believe that natural resources could be beneficial in countries with a high level and quality of human capital.

Similarly, considering the variable of the interaction term of the overall quality of institutions (EFW) and natural resources, the ECM regression result reveals that the sign of the coefficient is positive and statistically significant at the 5% level (see Appendix, model 3). It indicates that an improvement in the overall quality of institutions enhances natural resources' performance to have a healthy and positive effect on growth. This outcome is similar to the results of numerous studies on the role of institutions in improving the performance of natural resources on growth (see (O Zallé, 2019; Sala-i-Martin and Subramanian, 2008; Mehlum et al., 2006b, 2006a; etc.).

Also, with regards to the variable of the interaction term of human capital, the overall quality of institutions and natural resources (LNHCT*EFWH*TNRR), the ECM regression result reveals that the sign of the coefficient is positive and statistically significant at the 5% level (see model 4 in the Appendix). This shows that improving the country's human capital and the overall quality of institutions simultaneously can positively and strongly affect growth. This lends credence to the idea that both human capital and the quality of institutions are complementary to natural resources in improving growth. This highlights the point that both are very important as growth enhancement mechanisms. Developing one without the other might not work as an excellent strategy to improve growth.

Interestingly, the interaction of natural resources with specific institution's quality such as the Size of government (SOG), legal systems and property rights (LSPR), sound money (SM), free to trade internationally (FTI), and Regulation (R) generates robust and positive effects on growth. The ECM regression results reveal that the coefficients of these specific measures of institutions quality have positive signs and statistically significant at the 5% and 10% levels (see Appendix, models 5 to 9). However, it is essential to note that the effect of the variable (legal systems and property rights) on growth (4.6945) is comparatively more extensive than the other measures. This outcome is consistent because China has recently got higher scores (75.2) on judicial effectiveness in the economic freedom index (see Miller et al. 2019). This could be attributed to the idea that the effectiveness of the judiciary, particularly for underdeveloping nations, maybe the area of economic freedom that is most important in laying the foundations for economic growth (Miller et al., 2019). Judicial effectiveness is a vital and robust tool for fighting corruption. This finding buttresses the traditional understanding that confronting the existence of corruption is significant for realizing strong economic growth, particularly in developing countries. But this could only be achieved through an effective and efficient judicial system. This implies that these specific institutional factors are associated with natural resources to improve China's economic growth. The result confirms that natural resources could play a significant and positive effect on economic growth in the presence of good institutions. In essence, enhancing the quality of institutions, particularly as it connects to judicial effectiveness over and above the quality of contract execution and safeguarding property rights, fighting corruption, quality of formulating and implementing trade policy, and the trustworthiness of government commitment policies of trade is vital. For example, corruption discourages investment in the private sector because of increasing costs and encouraging uncertainty on the side of the investor. Through these findings, it could be observed that the quality of institutions and natural resources are complementary, as stated earlier, in the growth process of China.

5.4 Diagnostics tests results

Diagnostic tests were carried out to check for the strength of the model employed. The results of the tests are presented in Table 5-4 below.

Table 5-4. Diagnostic Test Results

Test Type	Null Hypothesis	Statistic	Probability	Inference
Normality Test (Jarque-Bera Statistics)	Residuals are normally distributed	Jarque-Bera Statistic = 0.7943	Probability = 0.6722	Fail to reject Ho
Serial Correlation (Breush-Godfrey Serial Correlation LM Test)	No serially correlated errors	F-statistic = 0.2497	Prob. Chi-Square = 0.0517	Fail to reject Ho
Heteroskedasticity Test: Breusch-Pagan-Godfrey	Variance of the Model is Homoschidastic	F-statistic = 0.1370	Prob. Chi-Square = 0.1551	Fail to reject Ho
ARCH Test (Autoregressive Heteroskedasticity Test)	ARCH effect does not characterize model's errors	F-statistic = 0.4206	Prob. Chi-Square = 0.3840	Fail to reject Ho

Source: E-views output

The diagnostic test that was employed ascertain the model's good fit. The model has no serial correlation. The model has a Homoschidastic variance. The model's residuals are normally distributed, and there is no ARCH effect as ascertained by the probability values greater than 5%.

6. Conclusion and Policy Recommendation

6.1. Summary of the results of the study

This study's main objective is to investigate the nexus between natural resources and economic growth in China. Specifically, the paper examines two significant issues. Firstly the empirical chapter analyses the influence of natural resources on the growth of the economy in China. Secondly, to further enrich the debate, the empirical chapter investigates human capital's interacting role with natural resources and institutions' quality with natural resources on China's economic growth. To circumvent the omitted variable bias issue, we include control variables such as foreign direct investment, physical capital, and inflation that influence growth. Each of these points has been explained in the literature review with a detailed contextual understanding of natural resources, human capital, institution quality, and economic growth.

The ECM estimates show that foreign direct investment and investment in physical capital are significant determinants for China's good growth performance. Most significantly, we established that natural resources have a positive effect on growth in China. The Economic theory suggests that the abundance of natural resources improves an economy's growth through abundant "natural capital". Although numerous research such as Papyrakis and Gerlagh(2007) and Sachs and Warner (1995, 1999, 2001) establish a negative correlation between economic growth rate and the dependence of natural resource at the global stage, this research indicate opposing results to their outcomes and substantiate the economic theory. This implies that this research results do not support the resource curse assumption in China's perspective. This concludes that a rise in total natural resources rents (% of GDP), employed as a proxy of natural resources, enhances China's economy. This supports the International Council's findings on Mining and Metals' (ICMM) Resource Endowment Initiative established in 2004 in collaboration with the United Nations Conference on Trade and Development and the World Bank. They state that mining can substantially support a country's economy and alleviate poverty in resource-rich countries. But this could be achieved by improving the country's human capital and the quality of its institutions, as evidenced by the results of this study's estimates. More estimates endorse that for natural resources to have a more robust and positive effect on economic growth, human capital and institutions' qualities are essential. Specifically, we found that a positive impact of natural resources on economic growth is conditional on improving human capital and institutions' quality. This is especially true for legal systems and property rights that enhance enforcement of contracts and property rights protection; help fight against corruption; promote regulatory quality; improve quality of formulating and implementing trade policy; and the government's commitment to financial policies.

Since the simultaneous interaction of human capital, natural resources and institutions' quality has positive effects on China's growth, we conclude that the complementary role of human capital and institutions quality is good for growth. The policy direction is that improving human capital and having a good quality of institutions may be necessary for accelerating growth in resource-rich countries, especially those with difficulties in improving their economies.

6.2. Policy Recommendations

One implication of the findings is that governments in resource-rich countries have to reduce their dependence on natural resources because international commodity prices are unstable in the global market. To prevent and ease this problem, governments in resource-rich countries must expand their economies by enhancing other growth sectors, such as the manufacturing industry, as evidenced in China's case. Moreover, in the end, these countries' governments must embrace innovations and advancements in technology to enhance the impact of natural resources on these economies.

Designing and the implementation of policies relating to natural resources must be undertaken with caution. As mentioned inter-alia, formulating, and implementing natural resources policies could be self-defeating since there could be severe consequences on society. This is because reform policies for natural resources can be defeated when there are low human capital and poor quality of institutions, such as ineffective and inefficient judicial system, high rate of corruption, government ineffectiveness, and inadequate regulatory quality in an economy.

Another major policy implication of our findings is that resource-rich countries must first improve their human capital quality and strengthen their quality of domestic institutions. One of the most significant input factors, Human capital, has been thought to be an essential growth factor.

By employing the Gross enrollment ratio of tertiary education in China as a human capital proxy, human capital and economic growth are established to be significantly and positively related. This suggests that an enhancement of human capital will complement natural resources in improving the growth of the economies of resource-rich countries, therefore, probably the living standards and economic development of the citizens of those countries. From the policy standpoint, the governments of such countries must improve and device policies that will improve primary, secondary and tertiary education enrollment through more educational institutions, and continue to give financial support to students. The focus must be put to enhance the quality of tertiary education. Aghion and Howitt (1998) stated that education at the Tertiary level is more significant for innovation and technology diffusion.

Similarly, this research suggests that the institutions' quality is vital for a country's economic growth. The effect is that an enhancement in institutions quality (as proxied by EFW) of a country improves its economic growth performance. Economic freedom is subdivided into five major areas, including Size of government (Area 1); legal systems and property rights (Area 2); sound money (Area 3); Freedom to trade internationally (Area 4); and Regulation (Area 5). The most significant of the subdivided groups is the legal systems and property rights, which has to do with area 2. The rule of law— enforcement of contracts and property rights protection, a court system that is not partial, and an independent judicial system — is vital for protecting property and safeguarding contracts, which are the basics of a market economy. Without the presence and trust of the rule of law, economic growth and prosperity will be challenging to achieve. Based on those mentioned above, resource-rich countries' governments should develop policies that would considerably enhance economic freedom, hence benefiting from exporting natural resources. Nevertheless, the main significant areas that governments must focus on to considerably improve these countries' economic performance are discussed below: (1) The rule of law must be enhanced to protect properties' rights, increase investment, and alleviate corruption. This submission can be buttressed by the improvement of the legal system, especially judicial effectiveness (Miller et al., 2019), in China. Without this, many voluntary exchanges beneficial and fundamental to the market system are discouraged, hence detrimental to the market-exchange system. (2) Policies that serve as barriers to trade must be removed. Countries should make fair use of opening up their markets to global trade to access new and bigger markets at the international level. The benefits of trade openness could be realized by enhancing the manufacturing and service industries for export to the international stage. This argument can also be supported by the fact that China's manufacturing sector is one of the most effective in the world. (3) Policies that encourage draconian business regulations must be eliminated to promote and improve investment, especially foreign direct investment, alleviating corruption and decreasing the administration cost on businesses. More importantly, the contribution of FDI to economic growth could be manifested in China's rapid economic growth since the opening up of the country in 1978.

Our control variables' policy implications are explicit. In short, it is essential to encourage a favorable atmosphere and develop the necessary infrastructure for national investment and FDI to boom. This could be achieved through investment in physical capital, as can be recognized by the impact of physical capital on China's economy. It was established by Chow and Li (2002) that the major influence on the growth of the economy of China after the reform period of 1978-1998 was the accumulation of capital instead of increases of TFP in productivity. Based on their findings, the accumulation of capital contributed 54 percent of economic growth. According to Li et al. (2005), capital accumulation even accounted for more extensive growth, 63 percent, during the post-reform period of 1978-2003.

In summary, it is essential to note that the endowment of natural resources in countries is simply a chance for governments to secure natural capital gains. It is not an assurance that these countries will automatically realize their benefits. Natural resources could be a means, not an end (economic growth), hence economic development. While natural resources may help accelerate countries' growth, our findings indicate that it does not guarantee an automatic growth strategy for resource-rich countries. Additional factors that could augment economic growth performance are also desired, including investments in human capital, enhancements of institutions' quality, investments in infrastructural development, and physical capital. Furthermore, having an effective and efficient judicial system could help fight against corruption in resource-rich countries, enhancing economic growth.

This study's findings indicate that resource-rich countries' natural resources can positively impact growth if human capital and institutions quality are also developed simultaneously. This is evidenced by the positive and statistically significant effect on growth with interaction terms of natural resources, human capital, and institutions' quality. To this end, resource-rich countries should simultaneously pursue policies toward improving institutions' quality and human capital.

Since natural capital could be a significant variable to boost economic growth, it would be more important for further studies to be carried out on this topic using other natural resources measures other than those employed in this research. Specifically, it would be wise to look at proxies such as natural resources export as a percentage of total exports to further determine the effect of natural resources on economic growth using human capital and institutions as mediation terms at the country level. Such studies could help guide policymakers of resource-rich countries to improve economic growth and development, hence alleviating poverty.

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Appendix

Error Correction Model Estimation Results: D(LNGDPPCG) as the Dependent Variable

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
C	-0.0756 (-1.29)	-0.0723 (-1.11)	1.7577 (18.36)***	1.8099 (16.66)***	1.8762 (17.54)***	1.7716 (15.84)***	1.7987 (19.15)***	1.7810 (16.26)***	1.7556 (17.93)***
D(LNTNRR)	0.0019 (1.87)*	0.0061 (2.06)*	0.0059 (1.94)*	0.0089 (2.06)*	0.0058 (1.86)*	0.0394 (2.28)**	0.0054 (2.10)*	0.0052 (1.97)*	0.0051 (1.89)*
D(LNFDI)	0.5457 (4.73)***	0.5461 (4.43)***	0.4192 (1.97)*	0.3942 (1.84)*	0.6339 (2.85)**	0.5399 (2.61)**	0.6093 (2.81)**	0.4473 (1.92)*	0.4157 (1.89)*
D(LNPK)	1.3480 (2.71)**	1.3620 (2.54)**	3.4438 (4.40)***	3.4499 (4.41)***	2.7562 3.41)***	3.3518 (3.77)***	3.3089 (4.43)***	3.2439 (3.65)***	3.0505 (3.79)***
D(LNINF)	-0.0185 (-0.97)	-0.0185 (-0.91)	-0.0090 (-0.19)	-0.0082 (-0.20)	-0.0373 (-1.07)	-0.0147 (-0.37)	-0.0353 (-1.03)	-0.0258 (-0.60)	-0.0006 (-0.020

D(LNHCT*TNRR)		3.7326 (4.83)***							
D(LNEFWH*TNRR)			3.3597 (2.71)**						
D(LNHCT*EFWH*TNRR)				3.9062 (2.37)**					
D(LNSOG*TNRR)					0.7507 (1.99)*				
D(LNLSPR*TNRR)						4.6945 (3.35)**			
D(LNSM*TNRR)							3.3858 (2.01)*		
D(LNFTI*TNRR)								2.9914 (2.23)*	
D(LNR*TNRR)									2.7709 (2.61)**
ECM(-1)	-0.2702 (-2.06)*	-0.0666 (-3.90)***	-0.4180 (-3.88)***	-0.3168 (-1.88)*	-0.8161 (-2.73)**	-0.4180 (-3.88)***	-0.3342 (-2.32)**	-0.3763 (-3.36)***	-0.4639 (-4.90)***
R-SQUARED	0.8539	0.8545	0.7126	0.7371	0.7972	0.7165	0.7980	0.7261	0.7776
ADJUSTED R-SQUARED	0.7261	0.6883	0.6168	0.6176	0.6756	0.5465	0.6768	0.5617	0.6442
F-STATISTIC	6.681427	5.140651	7.437783	6.169214	6.552615	4.212943	6.584563	4.417553	5.827267
DURBIN-WATSON STAT	2.173084	2.205695	0.900988	1.022282	1.509633	0.911024	1.384219	0.860407	1.794357

Note: The variables are expressed in log form and t –values are reported in parenthesis;(*) (**) and (***) signify significance at the
10%, 5% and 1% levels respectively. The variables entering the ECM model are in first difference; ECM (Error Correction Model).