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Investigating the Effect of Dependence on Natural Resources and Brain Drain on the Fragility of States and Good Governance in Developing Fuel-Exporting Countries

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Abstract:
Good governance is a system of values, policies, and institutions by which governments manage society. Stability and political stability in countries require the absence of management gaps and the achievement of governance improvement and lack of fragility, which weakened and fragile governments do not have the necessary conditions for such conditions. Usually, developing countries are exposed to the gap in natural resources and brain drain, which provide the basis for important effects on governance and fragility. In this study, to investigate the effect of dependence on natural resources and brain drain on the fragility of states and good governance, the statistical data of 26 developing countries that export fuel from 2007 to 2019 were used and with the approach of SUR Model estimation has been done. The results show that the effect of natural resource rent on the fragility of states is positive and statistically significant. Also, the effect of natural resource rent on good governance is negative and significant. In other words, the effect of natural resource rent on the fragility of states and good governance has an impact coefficient of 0.03 and -0.02, respectively. Therefore, the rent of natural resources can cause governments to weaken and become more fragile in good governance indicators. Also, the effect of brain drain on the fragility of states is positive and significant, and it is negative and significant on good governance. The effect coefficient of the brain drain variable on the fragility of states and good governance is 2.05 and -0.12, respectively.

1. Introduction

Today, the management of natural and human resources is one of the most critical challenges facing developing countries. The exploitation of valuable natural

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resources, including oil, gas, and minerals, is often cited as a key factor in the escalation or continuation of violent conflicts around the world. Also, the existence of a human resource crisis in developing countries in the form of migration of skilled and specialized labor to developed countries is another problem and challenge for governments. For this purpose, the issue of good governance and fragility in states has been taken into consideration in recent years (Hugon, 2010). The United Nations states that the decision-making process and the process by which policies and programs are implemented in countries can be considered a simple definition of governance. Now, when the mechanisms and institutions of the government are broken under the conditions for management and implementation and are not implemented properly, the governments become unstable and fragile. This instability and weakening is the result of various factors - factors that researchers have stated in their research and factors that will be investigated in this research - factors such as dependence on natural resources and brain drain affect governance. Elites and experts have a wide range of knowledge and science, and their departure and migration affect governance and stability (Gibson & McKenzie, 2010). One of the negative effects of dependence on natural resources and brain drain can be seen in countries that face instability, lack of institutional quality, and low levels of desirability. This temporary dependence and brain drain over time reduce the effectiveness of good governance of societies. On the other hand, at the same time, developing countries will also experience fragility due to dependence on resources and brain drain. The impact of brain drains and dependence on resources on the fragility of governments is expressed in such a way that these factors, in addition to not improving government governance indicators and exposure to risk and corruption, lead countries to economic fragility and weakening. According to the reports and data of the World Bank, the Institute of Good Governance Indicators, World Values (WVS), and Ivania et al. **(**2018), developing countries are in a low ranking of good governance indicators compared to developed countries. According to studies (Sachs and Warner, 2001), developing countries are rich in natural resources, and also (Okoye, 2015), the migration index of skilled labor in developing countries is increasing compared to other developed countries. By focusing on the two factors of natural resource rent and brain drain, the current research will continue its work according to studies and reports on developing countries.

Societies with fragile institutions and a lack of good governance can lead divisive social relations and systems to cycles of violent conflict. Preventing this negative spiral and ensuring the peaceful settlement of disputes is one of the main interests of the international community (Fricska et al, 2012). The exposure of communities to fragility, dangers, and lack of governance is the result of the influence of various factors. According to the studies of Kazantsev and Borishpoults (2013), as a result of elite migration and brain drain, the country is involved in the resulting consequences. In fact, with the lack of attractions necessary to attract and barriers

to the exit of specialists, the country of origin is affected and negatively affected by this factor in the field of organizational quality and governance (Kazantsev and Borish Poults, 2013). In fact, in countries, if society's access to sustainability and progress increases, under the optimization of effective factors, good governance and lack of fragility can be experienced. Societies that lack institutional arrangements may be drawn into unmanageable cycles, especially in areas where political systems are fragile and where differences between opposing parties are intense. First, policymakers and societies should consider good governance important, because the lack of good governance in developing countries may lead to instability and collapse. In simpler terms, when government structures lack the political will or capacity to provide the basic functions and governance needed to reduce poverty and develop and maintain their security and human rights, over time, countries move towards instability (Fricska et al., 2012). According to the definition of the World Bank, good governance is how power is exercised over the economic management of a country and its social interests to achieve economic development. Therefore, it is important to understand the relationship between the influencing factors on the indicators of failed/fragile states and good governance. The adoption of good governance principles by the governments in the country helps them to witness the improvement of their internal organizational processes along with the changes and developments of the external environment.

Now the important question is, what is the effect of dependence on natural resources and brain drain on the index of good governance? After examining this relationship, another important question is whether dependence on resources and brain drain in developing countries can affect the fragility index of governments? The present study was conducted to answer the mentioned questions. Regarding the communication channel between the brain drain or migration of experts along with the dependence on natural resources of developing countries, not many studies have been conducted on the government sector and the fragility of the government. Most of the studies have been done on one sector and one dimension, but the index of good governance and government fragility has rarely been studied. Therefore, in the current research, the impact of dependence on natural resources and brain drains on the fragility of governments and good governance in developing fuel-exporting countries during the years 2007-2019 is investigated.

In this research, two models and two dependent variables have been used, so in the literature, we first examine the factors and variables influencing the good governance index from a theoretical point of view, and in the second part, the effects of these factors on the endogenous variable, The fragility of governments will be examined. In the following, after reviewing the research literature, the appropriate model will be introduced to answer the above questions. Finally, based

on the estimation of these models, the obtained results will be analyzed and policy and practical suggestions will be presented.

2. Literature Review

Since the dependence on natural resources is related to fluctuations of instability and stability in developing countries, and the creation of a fluctuating environment caused by dependence on natural resources is a risk for the goods obtained to stabilize and improve the progress of the country (Haiying et al., 2022). Countries with natural resources are both growth losers and growth winners, and the main difference between success and failure cases is the quality of institutions. The abundance of resources often becomes a curse instead of a blessing. On average, resource-rich economies have lower growth, instability, and conflict than economies with fewer natural resources. There is a causal relationship between the abundance and dependence of resources on governance and economic performance (Mehlom et al., 2006; Ross, 2001). Developing countries have experienced a continuous increase in population growth and a growing gap in the supply and demand of natural resources. This growing resource gap will expose countries to an unstable environment by affecting management and governance. According to studies and discussions of natural resources, they claim the effect of dependence on natural resources is a curse or a blessing! It depends on the optimal use of resources and their impact (Sachs and Warner, 2001; Atil et al., 2020; Badeeb et al., 2020; Cheng et al., 2020; Mahmoodi and Dahmardeh, 2022). Emphasizing the importance of natural resources, the International Energy Agency (IEA) expects oil demand to grow by more than 50% between 2002 and 2030, while gas demand will double over the same period (IEA, 2021). However, resource allocation and supply decisions within and between economies cannot be separated from sound governance and sound and practical policies. This is especially important in times of scarcity and overconsumption of resources (Haiying et al., 2022). This study focuses on natural resources and dependence on these resources, which are essential inputs for physical capital and the service sector. The role and importance of these resources determine the amount of world trade and determine the economic relationship between exporting and receiving countries. The correct management of natural and human resources helps the economy to reach the path of sustainable growth. The term governance is a common concept in the literature of economic, administrative, and financial planning and is used for all levels of government, public institutions, private institutions, associations, assemblies, and individuals because it allows the rational delegation of authority and action. Under good procedures that can appear at the level of all institutions or companies and administrative-government units by exercising control and responsibilities and duties. In today's world, it has become an urgent need and is one of the strategic goals. Many developed countries seek prosperity and development in the

governance and sustainability sector by observing and correcting the path for the following reasons (Alhayani and Abdullah, 2021).

• Good governance is a key factor in creating a suitable environment for business because it helps to attract investment and improve the efficiency of investment processes and maximize profits, as well as in the direction of increasing the value of the country or institution and supporting it. takes a step

• Determines the strategic direction of the government or organizations by making the correct strategic decisions to preserve resources.

• Reducing conflict situations in the institution and increasing the cases of integration and interaction between stakeholders, by increasing the effectiveness of disclosure, accountability, and control and helping to invest the best available intellectual capital, and increasing innovation and creativity that leads to success and excellence.

According to the report of the World Bank and the United Nations Development Program (2021) (UN), good governance indicators for countries have adopted accountability, transparency, political stability/non-violence, government effectiveness, regulatory quality, rule of law (rule of law) and corruption control (Anwar Sharif and dhiaa aldeen, 2021; Gani and Duncan, 2007; Langbein and Knack, 2010; Kaufmann et al., 2008). Governance indicators in countries are influenced by various factors over time. It may lead to the improvement of governments or, on the contrary, they may experience poor governance. According to the studies and interpretations, one of the factors affecting governance is the abundance of natural resources in developing countries. Abundance undermines institutional quality and governance by creating dependence/rent on natural resources (Damania and Bulte, 2008; Murshed and Mansoob, 2004; Olsson, 2007; Mehlom et al., 2005; Borzel et al., 2008; Bilgin and Morton, 2004; Nuruzzaman, 2009; van der Ploeg, 2011). Countries with natural resources are facing Dutch disease and lack of development, and abundance and dependence on resources as a blessing or a curse affect the quality of institutions and governance (Steinberg, 2017). The weakening of governance and institutional quality is more widespread in countries with natural resource rents or resource dependence, especially in corrupt and ineffective governments (Van der Ploeg, 2011).

Also, the issue of migration and flight of specialists to developed countries is one of the critical issues of developing countries (Gibson and McKenzie, 2010; Docquier and Rapoport, 2012; Okoye, 2015). Elite and expert forces themselves play a prominent role directly as a knowledge-based production factor in the production of high-tech products (Belderbos et al., 2010). Based on this, experts with practical knowledge, ideas, and creativity can contribute to the governance and management of countries and prevent the economy from becoming unstable and unstable. Therefore, with brain drain and emigration of economic elites, the country of origin will face a lack of skills, proper management, and the lack of

necessary platforms for development and governance (Bain et al., 2008; Kazantsev and BurishPolets, 2013; Agbola and Acupan, 2010). According to studies and research, the results of the studies show that the effects of dependence on natural resources in developing countries that have an abundance of natural resources, as well as brain drain and migration of experts, are unfavorable on the governance index. Developing countries affected by these factors suffer from low institutional quality, lack of sustainability, and weak governance. This issue will be analyzed in the present study.

One of the basic indicators of social liberties is civil liberties. Governments and institutions have different responsibilities for maintaining civil rights and civil liberties in society. In the concept of the social systems model, civil society is usually the provider of governance and administrative values and parameters. Good governance is the product of three institutions: the government, civil society, and the private sector. The government creates the political and legal sectors, the private sector creates employment and income, and the civil society facilitates the political and social interaction of active groups (Isham et al., 1997; Anwar and Coory, 2012). According to the studies conducted, society will seek to formulate appropriate decision models in organizations and companies in line with its civil liberties. The improvement of political institutions and civil liberties causes the development and growth of the institutional quality and governance of governments, specifically, it affects the quality of civil liberties of governance, and its improvement will have a significant impact on the country. Another goal of countries is the development of the human sector. Developing countries are facing the problems of lack of economic and human development. Although they have experienced progress in recent years, many of them suffer from poverty, political violence, low civil liberties, low human development index, and non-participation, and have not faced good governance performance (Haroon Khan, 2015). One of the important criteria of development in the country and governments is human development. The ultimate goal of improving human development in governments is to have good governance. Thus, the analysis of human development in the developing countries of the world and its relationship with good governance requires special attention.

In an ideal world, risks are answered with appropriate and automatic reactions, but in the real world, many countries are not prepared to face risks, and due to the increasing dependence of countries on each other, the failure of a country and when the region faces a risk, it not only causes damage to the country but also causes the effects of that risk to be transferred to other countries and regions (Manning and Trzeciak-Duval, 2010). so there is an impact of the security index for countries on institutional quality and governance. The economic structure of countries, especially developing countries, is vulnerable to adverse factors, and the impact of risk factors and creating security in the areas of proper management and growth is significant (Nay, 2013). security threats distort the space and situation of countries

and prevent providing a favorable social and political environment for proper planning and economic activities - in line with good governance until the exploitation stage.

In this section, as mentioned earlier, the government's fragility index has also been used as a factor affecting dependence on resources, brain drain, and other factors. Countries may experience fragility when government structures lack the political will or capacity to provide the basic functions needed to reduce poverty, develop, and maintain the security and human rights of their populations. The issue of state fragility was raised precisely after the Cold War and it referred to those new security threats that are mostly the result of conflicts, economic collapses, and failed government policies in the social strata of Asian, African, and Latin American countries. were created (Solarz and O'Hanlon, 1997). In the government and different states, a wide range of terms are used to describe fragile states, such as; Failed, weak, crisis, unruly governments, and difficult environments. Also, a wide range of factors leads to the fragility of states. (Feeny et al., 2015). According to Huntington's point of view, the most important factors that lead to the fragility of the government are the lack of adaptability of the government to the developments, needs, and complexities of the society, the specialization and non-functionality of the institutions, the lack of independence of the government from groupings and social divisions, the serious weakness of the government In exercising power, neglecting the interests of the society, corruption, failure to establish justice, the inability of elites to resolve conflicts and unfortunate consequences caused by the gap between traditions and modernization, cultural poverty, lack of institutionalization of civil cultures and beliefs, the spread of mistrust, There is a severe class gap and the failure to meet expectations and the ineffectiveness of the government (Huntington, 2006). According to the studies, many researchers are worried that developing countries will become failed countries.

Karin Christiansen argues that fragility and its challenges surround mixed external intervention and may have tensions, for example, between trade, aid, development, and security policies. He states that foreign actors and commercial policies can weaken a country, it is necessary to know the context of the country and take necessary measures to stabilize and embody fragile states. This recognition requires a single process at the country level that moves towards identifying common problems, goals, strategies, policies, programs, resources, and implementation mechanisms. Therefore, the fragility of the government is dangerous for the national security of countries (Christiansen, 2005). Manning and Trzeciak-Duval, (2010) state in a part of their article that the provision of services and attractiveness in developed countries affects the desire to leave and migrate brains, and this migration causes instability and fragility in developing states. to be Brain drain in developing countries is more than in developed countries (Docquier

et al., 2007). The ability of developing countries to create a space and field for growth and prosperity for specialized forces is less than that of developed countries, this factor leads to the creation of an immigration incentive for highly skilled people to be attracted to advanced countries and it leaves traces of fragility and instability for the countries of origin.

It was stated earlier, the development of the human and social sector - civil liberties - is considered one of the undeniable factors in the growth and development of countries and is one of the prerequisites for development. Due to the importance of human development and civil liberties, many developing countries are trying to promote this sector in their country with different methods (Haroon Khan, 2015). improving human development in developing countries to some extent improves fragility in governments, in fact, according to studies, improving and protecting human development indicators, risk recognition, and security index to some extent improve fragility. It leads to stability, stability, and preventive reactions.

Another index investigated in the research is the index of public services. Establishing good governance and non-fragility in countries is an absolute necessity for a government system in which the interests of the public sector also participate. This means that the index of public services should also be included in this requirement and its effect should be checked. Improving the performance of public services is considered important by stakeholders such as governments, citizens, and the private sector. The reform of public services is on the main agenda of the central government, and the renewal of public services can promote the sustainability of good governance (Pratiwi and Puspita Sari, 2017). guaranteeing security and reducing economic and structural risks, as well as strong political associations, improving good governance and lack of fragility for countries is mandatory. This provides a platform for growth and stability and can reduce the volatility and vulnerability of the region.

In relation to the issue of dependence on natural resources and brain drain, there have been few studies on good governance and the fragility of states. Since the empirical studies conducted in connection with fragility and governance have not achieved a clear and effective result, and limited studies have been conducted on the subject of dependence on resources and parabrains on fragility and governance. Also, there is no study that directly expresses the effect of effective and efficient factors on fragility, and most of the studies have been conducted through the governance channel in order to improve fragility. Therefore, in this research, it has been tried to investigate more seriously and by using the influence of other factors on the endogenous variables of good governance and fragility in fuel exporting developing countries. Each of the civil liberties index, human development index, security threat index, economic risk index, and ... are defined as two models whose

purpose is to investigate the effects of each of the variables on the dependent variables of the good governance index and the fragility states index.

3. Data and method

This section consisted of two subsections: the first subsection introduces the data/variables, and the second subsection presents the methodologies used in this research.

3.1. Data

The variables used in this study include the Fragile state index (FSI), Good governance index, Human Development Index, Economic Risk Rating, Civil liberties index, Security threats index, Total natural resources rents (% of GDP), Human flight and brain drain index and Public services index. The data for these variables are taken from the Worldwide Governance Indicators (WGI), The International Country Risk Guide (ICRG), The global economy, Freedom House, Fragil Estates Index, Human Development Data Center, and World Bank Data (WBD) websites. In this research, 26 developing countries exporting fuel during the period 2007-2019 have been examined. According to the United Nations (2020) report, developing countries that export fuel, including Bolivia, Colombia, Ecuador, Trinidad and Tobago, Venezuela, Algeria, Angola, Cameroon, Congo, Rep., Gabon, Libya, Mozambique, Nigeria, Brunei Darussalam, Indonesia, Mongolia, Papua New Guinea, Iran, Bahrain, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates and, Yemen have been studied in this research. The reason for choosing this period was the availability of data until 2019. Table (1) shows the data/variables and sources.

Table 1. Variable acronyms, descriptions, and sources

Variable acronyms	Variable description	Sources
Dependent variables		
FSI	Fragile state index	Fragile States Index (FFP)
GG	Good governance index	The Worldwide Governance Indicators (WGI)
Independent variables		
HDI	Human Development Index	Human Development Data Center
CLI	Civil liberties index	Freedom House
RR	Total natural resources rents (%GDP)	World Bank Data (WBD)
ST	Security threats index	The global economy
BD	Human flight and brain drain index	The global economy
ERR	Economic Risk Rating	The International Country Risk Guide (ICRG)
PSI	Public services index	The global economy

In this research, the variables **FSI**, **GG**, **HDI**, **CLI**, **RR**, **ST**, **BD**, **ERR**, and **PSI**, have been used. Where FSI and GG are the dependent variables and the rest are independent variables. In this study, the Principal Component Analysis method (PCA) was used to calculate **GG**. After introducing the variables, the next section describes the methodologies. In this research, based on the subject literature and previous studies, the following two models are evaluated:

$$FSI_{it} = Cons_{it} + HDI_{it} + CLI_{it} + RR_{it} + ST_{it} + BD_{it} + ERR_{it} + PSI_{it} + \varepsilon_{it} \qquad Model\ I$$
$$GG_{it} = Cons_{it} + HDI_{it} + CLI_{it} + RR_{it} + ST_{it} + BD_{it} + ERR_{it} + PSI_{it} + \varepsilon_{it} \qquad Model\ II$$

Here cons indicate the constant, *i* indicates the Cross-sections, *t* indicates the time and ε_{it} indicates the regression error sentences. Other template variables are interpreted in Table (1).

3.2. Method

In this section, the seemingly unrelated regression method is first introduced, then the Cross-sections dependence and unit root tests are discussed.

3.2.1. Seemingly unrelated regression method

This research utilized the seemingly unrelated regression (SUR) method, well-known as Zellner's method for estimating the parameters of the model. The SUR system includes different regression equations that are related through their error terms or residuals that are supposed to be connected. Thus, SUR models are employed when there are several equations that seem to be irrelevant, but they may be related for the following reasons: (1) some coefficients are supposed to be the same or zero; (2) the errors terms or residuals are linked throughout the equations; (3) independent variables are common (Zellner, 1962).

Consider a set of separate regressions expressed as follows:

$$y_{ir} = x_{ir}^{T}\beta_i + \varepsilon_{ir}\,, \qquad i = 1, \dots, m \tag{1}$$

where y_{ir} is the *i*th observation on the *r*th dependent variable which is to be explained by the *r*th regression equation, *x* is *r*th explanatory variable appearing in the ith equation, β_i is the coefficient associated with x_{ir}^{T} at each observation, and ε_{ir} is the ith value of the random error component associated with *r*th equation of the model.

With all observations stacked the model for the *r*th equation can be written as Eq. 2:

$$y_i = X_i\beta_i + \varepsilon_i\,, \qquad i = 1, \dots, M \tag{2}$$

Finally, we can stack the m equations into a SUR model:

$$[y_1\ y_2\ \vdots\ y_m] = [X_1\ \cdots\ 0\ \vdots \ddots \vdots\ 0\ \cdots\ X_m][\beta_1\ \beta_2\ \vdots\ \beta_m] + [\varepsilon_1\ \varepsilon_2\ \vdots\ \varepsilon_m] = X\beta + \varepsilon \tag{3}$$

where for the *M*th equation y_i is $R \times 1$, X_i is $R \times k_i$ of rank k_i and fixed, β_i is a $k_i \times 1$ and unknown, and ε_i is $R \times 1$ and vector of random error terms, each with a mean zero.

The assumption of the model is that error terms ε_i are independent across time but may have cross-equation contemporaneous correlations. Thus, we assume that $E[\varepsilon_{ir}\varepsilon_{jr}|\,X] = 0$ whenever $r \neq s$, whereas $E[\varepsilon_{ir}\varepsilon_{jr}|\,X] = \sigma_{ij}$.

Denoting $\sum = [\sigma_{ij}]$ the $m \times m$ skedasticity matrix of each observation, the covariance matrix of the stacked error terms ε will be equal to Eq. 4:

$$\Omega = E[\varepsilon\varepsilon^T | X] = \sum \otimes I_R \quad (4)$$

where I_R is the R-dimensional identity matrix and $\otimes$ denotes the matrix Kronecker product (Zellner, 1962).

The reason for using data panel models in this study is that these models have many advantages that include panel data that assists us in managing heterogeneity of cross-section, endogeneity, and serial correlation (Baltagi et al., 2005).

Before performing any estimation econometric for panel data, in the beginning, we check the cross-sectional dependence, which is an important test to determine whether sections are dependent or independent. To test for cross-sectional dependency in the model residuals, we can utilize the Pesaran cross-sectional dependency (CD) test.

Consider the standard panel-data model

$$y_{it} = \alpha_i + \beta_i x_{it} + u_{it} \ , \ i = 1,2, \dots, N; t = 1,2, \dots, T \quad (5)$$

where x_{it} is a $K \times 1$ vector of regressors, α_i represents time-invariant individual nuisance parameters, and β is a $K \times 1$ vector of parameters to be estimated. Under the null hypothesis, u_{it} is assumed to be independent and identically distributed over periods and across cross-sectional units. Under the alternative, u_{it} maybe correlated across cross-sections, but the assumption of no serial correlation remains.

Thus, the null hypothesis is

$$\{H_0: \rho_{ij} = \rho_{ji} = cor(u_{it}, u_{jt}) = 0 \quad for\ i \neq j \ H_1: \rho_{ij} = \rho_{ji} \quad (6)$$
$$\neq 0 \qquad for\ some\ i \neq j$$

where ρ_{ij} is the product-moment correlation coefficient of the disturbances and is given by

$$\rho_{ij} = \rho_{ji} = \frac{\sum_{t=1}^{T} u_{it} u_{jt}}{(\sqrt[2]{\sum_{t=1}^{T} u_{it}^2})(\sqrt[2]{\sum_{t=1}^{T} u_{jt}^2})} \quad (7)$$

The number of possible pairings ($u_{it} u_{jt}$) rises with N.

According to this, Pesaran CD is presented to examine the existence of interdependence or cross-sectional independence in balanced panel data as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)} (\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \rho_{ij})} \quad (8)$$

and showed that under the null hypothesis of no cross-sectional dependence *CD d* $\rightarrow$ *N(0, 1)* for $N \rightarrow \infty$ and T is sufficiently large.

If the absolute value of the CD statistic is greater than 1.96, the null hypothesis of the test is rejected and the existence of cross-sectional dependence is confirmed (De Hoyos and Sarafidis, 2006).

In this study, since has been identified cross-section dependency between the countries in the panel for all variables used, the stationary of the series has been analyzed with one of the second-generation unit root tests which is the CADF test developed by Peseran (2007). Through CADF, a unit root test can be performed in each cross-section unit in the series forming the panel. So the stationary of the series can also be estimated one by one for the panel's overall and each cross-section. CADF test hypothesizes that every country is affected differently by time effects and considers the spatial autocorrelation is used in *T*>*N* and *N*>*T* situations. The Stationary for each country is tested by comparing the statistics values of this test with Peseran's CADF critical table values. If CADF critical table value is greater than the CADF statistics value, the null hypothesis is rejected and it is found that the series of only that country is stationary. CADF test statistic is estimated as the following:

$$Y_{it} = (1-\phi_i)\mu_i + \phi_i y_{i,t-1} + u_{it} \ , \ \ i = 1,2,\dots,N \ \ and \ t = 1,2,\dots,T \tag{9}$$

$$u_{it} = \gamma_i f_t + \varepsilon_{it} \tag{10}$$

$$Y_{it} = (1-\phi_i)\mu_i + \phi_i y_{i,t-1} + u_{it} \ , \ \ i = 1,2,\dots,N \ \ and \ t = 1,2,\dots,T$$

$$u_{it} = \gamma_i f_t + \varepsilon_{it}$$

Here f_t shows unobservable common effects of each country, ε_{it} shows individual-specific error. Equations (9), (10) and unit root hypotheses can be written as the following:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i f_t + \varepsilon_{it} \quad i = 1,2,\dots,N \ \ and \ \ t = 1,2,\dots,T \tag{11}$$

$$\{H_0: \beta_i = 0 \ \ for\ all\ i \qquad (Series\ is\ non-stationary)\ H_1: \beta_i < 0 \ , \ \ i = 1,2,\dots,N_1 \ , \ \ \beta_i = 0 \ , \ \ i = N_1+1, \ \ N_1+2,\dots,N \ \ (Series\ is\ stationary) \tag{12}$$

Test statistics and critical values have been computed for each country and panel (overall).

Then, we use the panel cointegration test by Westerlund and Edgerton (2008). Westerlund and Edgerton (2008) test the null hypothesis which is defined as follows:

$$\{H_0: \phi_i = 0 \quad for\ all\ i\ against\ H_1: \phi_i < 0 \qquad for\ some\ i \tag{13}$$

The zero hypothesis of this test is the absence of cointegration; therefore, consider the following pooled log-likelihood function

$$log\ (L)\ constant - \frac{1}{2}\sum_{i=1}^{N}(Tlog(\sigma_i^2) - \frac{1}{\sigma_i^2}\sum_{t=1}^{T} e_{it}^2) \tag{14}$$

The following statistics are defined for the study of H_0 and H_1 hypotheses:

$$\{Z_j(N) = N^{\frac{1}{2}}(LM_j(N) - E(B_j))\ Z_j(N) \to N(0, Var(B_i)) \tag{15}$$

then, compare *Z* statistics with critical values. If the statistic of *Z* is greater than its critical value, the null hypothesis is rejected, and the variables will have cointegration (Dobnik, 2011) Finally, after estimating the Lagrange coefficient test, the SUR test in the panel will be undertaken.

4. Results and discussion

Table (2) presents the results of the statistical summary such as the mean, maximum, minimum, standard deviation, and skewness of all the variables in our study. The results reveal that the mean values of all data are positive, and the values for each variable (**FSI**, **GG**, **HDI**, **CLI**, **RR**, **ST**, **BD**, **ERR**, **PSI**) are 76.85, 4.70, 0.69, 24.70, 22.48, 6.46, 5.68, 36.43 and 6.45, respectively. Other descriptive statistics are reported in Table (2).

Table 2. Descriptive statistics

Variables	Descriptive statistics				
	Obs.	Mean	Std.-Dev.	Min.	Max.
FSI	338	76.85	16.61	40.10	113.50
GG	338	4.70	1.64	1.21	8.06
HDI	338	0.69	0.12	0.37	0.89
CLI	338	24.70	11.49	6.00	50.00
RR	332	22.48	15.08	0.79	64.50
ST	338	6.46	1.85	1.90	10.00
BD	338	5.68	1.93	1.10	9.50
ERR	338	36.43	7.22	11.87	50.00
PSI	338	6.45	2.27	1.3	10

Notes: Obs. is the number of observations in the model, Std.-Dev. is the standard deviation, Min and Max are the minimum and maximum, respectively.

Findings in Table (3), show that the CD test rejects the null hypothesis of "no cross-sectional dependence" at 1% significance level, accepts the alternative hypothesis, and takes into account the cross-sectional dependence for **FSI**, **HDI**, **CLI**, **RR**, **BD**, **ERR**, **PSI** variables.

Table 3. Cross-sectional dependence

Variables	CD test	P-value	Corr.	Abs (corr.)
FSI	3.91^{***}	0.00	0.06	0.61
GG	-0.60	0.54	-0.009	0.50
HDI	36.71^{***}	0.00	0.56	0.82
CLI	18.19^{***}	0.00	0.28	0.54
RR	45.08^{***}	0.00	0.70	0.79
ST	1.07	0.28	0.01	0.49
BD	5.03^{***}	0.00	0.07	0.50
ERR	28.54^{***}	0.00	0.43	0.51
PSI	5.44^{***}	0.00	0.08	0.57

Notes: *** denotes statistically significant at 1% level.
Source: Research Findings

In this study, to evaluate the unit root in variables that have cross-sectional dependence, the **Levin, Lin & Chu** and **Im, Pesaran and Shin** tests have been used, the results of which are reported in Table (5). Also, to measure the unit root for variables that do not have cross-sectional dependence, the **Covariate-augmented Dickey-Fuller** unit root test has been used, the results of which are reported in Table (4).

Table 4. Covariate-augmented Dickey-Fuller unit root test

	CADF statistic			
Variables	**t-bar**	**Z (t-bar)**	**P-value**	**Decision**
FSI	-0.88	3.86	1.00	Non-stationary at level, i.e., I(1)
HDI	-1.89	-0.81	0.20	Non-stationary at level, i.e., I(1)
CLI	-1.63	0.38	0.65	Non-stationary at level, i.e., I(1)
RR	-	-0.30	0.38	Non-stationary at level, i.e., I(1)
BD	-1.36	1.63	0.94	Non-stationary at level, i.e., I(1)
ERR	-2.18	-2.14	0.01	stationary at level, i.e., I(0)
PSI	-0.96	3.51	1.00	Non-stationary at level, i.e., I(1)

Source: Research Findings

Table 5. Panel unit root test

	Levin, Lin & Chu				Im, Pesaran and Shin				
	Individual intercept		Individual intercept and trend		Individual intercept		Individual intercept and trend		
Variables	**Statistic**	**Prob.**	**Statistic**	**Prob.**	**Statistic**	**Prob.**	**Statistic**	**Prob.**	**Decision**
GG	0.42	0.66	-5.20	0.00	1.80	0.96	-1.27	0.10	Non-stationary at level, i.e., I(1)
ST	-0.80	0.20	-2.90	0.00	1.71	0.95	2.00	0.97	Non-stationary at level, i.e., I(1)

Source: Research Findings

According to the results of table (4) and table (5), all variables are Non-stationary at level, except the **ERR**. Therefore, it is necessary to examine the long-run relationships between the variables. For this purpose, Westerlund and Edgerton panel cointegration test has been used. The results of the Westerlund and Edgerton panel cointegration test are reported in Table (6).

Table 6. Westerlund and Edgerton panel cointegration test (model I)

Model	Statistic	P-value
Model I	4.86 ***	0.00
Model II	7.41 ***	0.00

Notes: *** denotes statistically significant at 1% level.
Source: Research Findings

According to the results of Table (6), in **Model I** and **Model II**, there are long-term relationships between variables. Therefore, there is no need for stationary variables and the relationship between dependent and independent variables can be estimated at the level.

Table 7. The Lagrange coefficient test (correlation matrix of residuals)

Prob.	0.00
Breusch–Pagan test of independence: chi2 (1)	63.79

Source: Research Findings

The results in Table (7) show that the concurrent correlation between residuals in regression equations is accepted; Also, the results of Table (8) show the test of difference in equations. Given that the probability value is less than five percent. therefore, the SUR model can be applied to estimation equations.

Table 8. Test the difference in equations

chi2 (8)	93918.40
Prob.	0.00

Source: Research Findings

Table 9. SUR method in selected Developing countries exporting fuel

Dependent variables	Independent variables	Coefficient	Std. err.	z	Prob.
FSI	**HDI**	-33.91***	2.43	-13.94	0.00
	CLI	-0.19***	0.02	-8.07	0.00
	RR	0.03*	0.01	1.82	0.06
	ST	4.96***	0.20	23.87	0.00
	BD	2.05***	0.23	8.67	0.00
	ERR	-0.11***	0.04	-2.74	0.00
	PSI	0.51***	0.11	4.29	0.00
	_cons	61.54***	2.98	20.63	0.00
GG					
	HDI	2.36***	0.46	5.15	0.00
	CLI	0.00	0.00	1.54	0.12
	RR	-0.02***	0.00	-8.04	0.00
	ST	-0.39***	0.03	-10.03	0.00
	BD	-0.12***	0.04	-2.70	0.00
	ERR	0.07***	0.00	8.81	0.00
	PSI	-0.05**	0.02	-2.43	0.01
	_cons	4.47***	0.56	7.94	0.00

Notes: ***, **, * denote statistically significant at the 1%, 5%, and 10% levels, respectively.
Source: Research Findings.

According to the results reported in Table (9), the effect of the Human Development Index on the fragility of governments is negative and statistically

significant at the level of 1%. The value of this coefficient is equal to -33.91. In other words, assuming other conditions are constant, if the human development index 1 unit increases, then the fragility of governments in the countries under study will decrease by -33.91 units. It is noteworthy that the effect of the human development index on the good governance index is positive and statistically significant at the level of 1%. The value of this coefficient indicates that if human development by 1 unit increases, then the good governance index will directly be increased by 2.36 units.

Similarly, the effect of the Civil Liberties Index on the fragility of governments is negative and significant. The coefficient of this variable indicates that if one unit of civil liberties increases, then the fragility of governments will decrease by -0.19 units. Also, the value of the coefficient impact of the Civil Liberties Index on good governance is positive and non-significant.

Among the main variables of our research are natural resource rent variables and brain drain. According to the results of our research, the effect of natural resource rents on the fragility of governments is positive and statistically significant at the level of 10%. Also, the effect of natural resource rents on good governance is negative and statistically significant at the level of 1%. The results show well that assuming other conditions are stable if a unit of natural resource rent increases, then the fragility of governments will increase by 0.03 units and good governance will decrease by 0.02 units. These results could be significant for policymakers in developing fuel-exporting countries. It is noteworthy that the effect of brain drain on the fragility of governments is positive and significant and good governance is negative and significant. In other words, assuming other conditions are stable, if one unit of the brain drain index increases, then the fragility of governments will increase by 2.05 units and good governance will decrease by -0.12 units. According to our research, the effect of brain drain on the fragility of governments in developing fuel-exporting countries is much greater than the effect of natural resource rents. This is also true for good governance.

According to the results reported in Table (9), the effect of security threats on the fragility of governments and good governance is positive and negative, respectively, and is statistically significant at the level of 1%. In other words, if a unit of security threats increases, then the fragility of governments will increase by 4.96 units, and good governance will decrease by -0.39 units.

Another variable that affects the fragility of governments and good governance is the economic risk index. In this index, higher values indicate less risk. Following the results of Table (9), the effect of economic risk on the fragility of governments is negative and statistically significant at the level of 1%. Also, the effect of economic risk on good governance is positive and significant. In other words, if an economic risk index unit increases (risk decreases) then the fragility of the studied governments will decrease by -0.11 unit. The effect of economic risk on good

governance is positive and significant. This means that if an economic risk index unit increases (risk decreases) then good governance will increase by 0.07 units. Finally, the last variable that is examined is the public service index. In this index, higher values indicate fewer public services and lower values indicate more public services. According to the results of our research, the effect of the public service index on the fragility of governments is positive and significant. In other words, assuming the stability of other conditions, if a unit of the public services index increases (public services decrease) then the fragility of governments will increase by 0.51 units. Also, the coefficient effect of the public service index on good governance is negative and statistically significant at the level of 5%. In other words, if a public service index unit increases (public service decreases) then good governance decreases by -0.05 units.

5. Conclusion and policy implications

In this research, we investigated the effect of natural resource rent and good governance on the fragility of states on the one hand and good governance on the other. To investigate this effect, a system of seemingly unrelated simultaneous equations was used. Since the developing countries that export fuel have a lot of resource rents and on the other hand, dependence on natural resources leads to mismanagement in the mentioned countries, therefore, investigating the effect of natural resource rents on institutional variables such as governance quality index and state fragility index It is necessary at the same time. In addition, the elite immigration rate is very high in the studied countries. The migration of elites leads to the loss of human capital in the mentioned countries, which will ultimately weaken the index of good governance and continue to make the state fragile. According to the results of our research, the effect of natural resource rent on the fragility of states in the studied countries is positive and significant. In other words, the rent of natural resources will make the states more fragile. Also, the effect of natural resource rent on institutional quality indicators is negative, which indicates that natural resource rent in the mentioned countries has weakened the institutions. The results of our research showed that brain drain leads to more fragile states and weakens the good governance index. The results of this research are very important for the policymakers of developing fuel-exporting countries. Based on the results of our research, it is suggested that policy makers apply laws for the optimal use of natural resources. It is also suggested to prevent brain drain by creating the necessary platform to maintain human capital.

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بررسی تأثیر وابستگی به منابع طبیعی و فرار مغزها بر شکنندگی دولت‌ها و حکمرانی خوب در کشورهای درحال‌توسعه صادرکننده سوخت

چکیده

حکمرانی خوب نظامی از ارزش‌ها، سیاست‌ها و نهادها است که دولت‌ها جامعه را به‌وسیله آن مدیریت می‌کنند. پایداری و ثبات سیاسی در کشورها نیازمند عدم وجود شکاف‌های مدیریتی و دستیابی به بهبود حکمرانی و عدم شکنندگی هست که دولت‌های تضعیف شده و شکننده بستر لازم چنین شرایطی را ندارند. کشورهای درحال‌توسعه در معرض شکاف منابع طبیعی و فرار مغزها قرار دارند که این دو عامل بستر تأثیرات مهمی بر روی حکمرانی و شکنندگی را فراهم می‌کنند. در این مطالعه با هدف بررسی تأثیر وابستگی به منابع طبیعی و فرار مغزها بر شکنندگی دولت‌ها و حکمرانی خوب، از داده‌های آماری ۲۶ کشور جهان در دوره زمانی ۲۰۱۹-۲۰۰۷ استفاده شده و با رویکرد معادلات به‌ظاهر نامرتبط به برآورد مدل اقدام شده است. نتایج نشان می‌دهد که تأثیر رانت منابع طبیعی بر شکنندگی دولت‌ها مثبت و از نظر آماری معنادار است. همچنین تأثیر رانت منابع طبیعی بر حکمرانی خوب منفی و معنادار است. به‌عبارت‌دیگر، با فرض ثبات سایر شرایط، تأثیر رانت منابع طبیعی بر شکنندگی دولت‌ها و حکمرانی خوب به ترتیب دارای ضریب تأثیر ۰/۰۳ و ۰/۰۲- است؛ بنابراین، رانت منابع طبیعی می‌تواند باعث شکننده‌تر شدن دولت‌ها و تضعیف شاخص‌های حکمرانی خوب شود. همچنین تأثیر فرار مغزها بر شکنندگی دولت‌ها مثبت و معنادار و بر حکمرانی خوب منفی و معنادار است. به‌عبارت‌دیگر، با فرض ثبات سایر شرایط، ضریب تأثیر متغیر فرار مغزها بر شکنندگی دولت‌ها و حکمرانی خوب به ترتیب ۲/۰۵ و ۰/۱۲- است.

کلیدواژه: حکمرانی خوب، شکنندگی دولت‌ها، فرار مغزها، منابع طبیعی.