Journal of Economic Cooperation and Development, 47, 2 (2026), 193-218

Exploring the Resource Curse Hypothesis: Empirical Insight from Turkmenistan*

Gökhan Akar[1], Bilal Coşkun[2] and Sinem Yapar Saçik[3]

ABSTRACT

This study analyzes the effects of natural resource rents on GDP growth in Turkmenistan using annual data for the period 1990-2019. The ARDL model and the bounds testing approach are employed to examine the short and long-run relationships among the variables. The results show a long-run positive effect of natural gas rents on growth: a 1% increase in gas revenues is associated with a 2.3% rise in GDP growth. In contrast, oil rents negatively affect growth, with a 1% increase linked to a 3.1% decline. In the short run, the lagged values of gas rents exhibit a statistically significant negative impact. Specifically, the one-period lag coefficient is –0.74, indicating a short-run contractionary effect. Conversely, the one-period lag of oil rents has a positive and significant influence on growth. The error correction term confirms that 55% of deviations from long-run equilibrium adjust within a year, validating the model's stability. These findings suggest that while natural gas may support growth in the long term, oil dependency could be detrimental. Effective resource revenue management, institutional reform, and economic diversification are essential to avoid the resource curse. Turkmenistan must reduce its reliance on oil and allocate gas revenues strategically to achieve sustainable development.

ملخص

تحلل هذه الدراسة آثار ريع الموارد الطبيعية على نمو الناتج المحلي الإجمالي في تركمانستان باستخدام بيانات سنوية تغطي الفترة من 1990 إلى 2019. وقد وظف في ذلك نموذج الانحدار الذاتي للإبطاءات الموزعة (ARDL) ومنهجية اختبار الحدود (Bounds Testing Approach) لفحص العلاقات قصيرة الأجل وطويلة الأجل بين المتغيرات. وتظهر النتائج وجود أثر إيجابي طويل الأجل لريع الغاز الطبيعي على النمو الاقتصادي، إذ إن زيادة إيرادات الغاز بنسبة 1% ترتبط بارتفاع نمو الناتج المحلي الإجمالي بنسبة

* This study was presented as an extended abstract at the International Social and Economic Research Student Congress held in Konya/Turkiye on May 15–17, 2025.

[1] Department of Economics, Karamanoglu Mehmetbey University, Karaman, Turkiye.
E-mail: gakar@kmu.edu.tr
[2] Rectorate, Karamanoglu Mehmetbey University, Karaman, Turkiye.
E-mail: bilalcoskun@kmu.edu.tr
[3] Department of Economics, Karamanoglu Mehmetbey University, Karaman, Turkiye.
E-mail: sysacik@kmu.edu.tr

2.3%. وعلى النقيض من ذلك، تؤثر عوائد النفط سلبا على النمو، حيث ترتبط زيادة الإيرادات النفطية بنسبة 1% بانخفاض نمو الناتج المحلي الإجمالي بنسبة 3.1%. أما على المدى القصير، فتبرز القيم المتأخرة (المبطأة) لريع الغاز الطبيعي أثرا سلبيا ذا دلالة إحصائية. فعلى وجه التحديد، يبلغ معامل الإبطاء لفترة واحدة 0.74-، مما يشير إلى أثر انكماشي قصير الأجل. وفي المقابل، فإن الإبطاء لفترة واحدة لريع النفط له تأثير إيجابي ومعنوي على النمو الاقتصادي. كما يؤكد حد تصحيح الخطأ (Error Correction Term) أن 55% من الانحرافات عن التوازن طويل الأجل يتم تصحيحها خلال عام واحد، وهو ما يدعم استقرار النموذج وصلاحيته. وتشير هذه النتائج إلى أنه في حين يمكن للغاز الطبيعي أن يدعم النمو الاقتصادي على المدى الطويل، فإن الاعتماد المفرط على النفط قد يكون ضارا. لذلك، فإن الإدارة الفعالة لإيرادات الموارد الطبيعية، والإصلاح المؤسسي، وتنويع الاقتصاد من العناصر الأساسية لتجنب لعنة الموارد. وعليه، ينبغي لتركمانستان تقليل اعتمادها على النفط وتخصيص إيرادات الغاز بصورة استراتيجية لتحقيق التنمية المستدامة.

RÉSUMÉ

Cette étude analyse les effets des rentes issues des ressources naturelles sur la croissance du PIB au Turkménistan à partir de données annuelles couvrant la période 1990-2019. Le modèle ARDL et la méthode des tests de limites sont utilisés pour examiner les relations à court et à long terme entre les variables. Les résultats montrent un effet positif à long terme des rentes du gaz naturel sur la croissance : une augmentation de 1 % des recettes gazières est associée à une hausse de 2,3 % de la croissance du PIB. En revanche, les rentes pétrolières ont un effet négatif sur la croissance, une augmentation de 1 % étant liée à une baisse de 3,1 %. À court terme, les valeurs décalées des rentes gazières présentent un impact négatif statistiquement significatif. Plus précisément, le coefficient de décalage d'une période est de –0,74, ce qui indique un effet contractif à court terme. À l'inverse, le décalage d'une période des rentes pétrolières a une influence positive et significative sur la croissance. Le terme de correction d'erreur confirme que 55 % des écarts par rapport à l'équilibre à long terme se corrigent en l'espace d'un an, ce qui valide la stabilité du modèle. Ces résultats suggèrent que si le gaz naturel peut soutenir la croissance à long terme, la dépendance au pétrole pourrait être préjudiciable. Une gestion efficace des recettes tirées des ressources, des réformes institutionnelles et la diversification économique sont essentielles pour éviter la malédiction des ressources. Le Turkménistan doit réduire sa dépendance au pétrole et allouer stratégiquement les recettes du gaz afin de parvenir à un développement durable.

Keywords: Resource curse hypothesis, Natural resource revenues, Economic growth

JEL Classification: Q32, O47, C32

1. Introduction

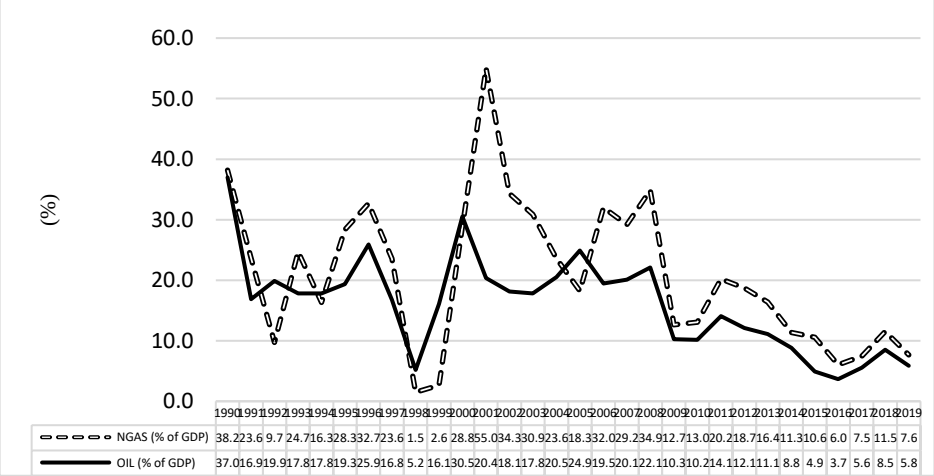
Possessing abundant natural resources is often associated with economic prosperity. However, empirical evidence in the literature suggests that resource wealth does not always lead to sustainable development. The concept of the "resource curse" defines the paradox in which countries rich in natural resources fail to achieve expected levels of economic growth. According to this hypothesis, the presence of strategic resources such as fossil fuels or minerals may not guarantee higher welfare; in fact, such countries may experience slower growth, weaker democratization, and limited institutional development compared to less resource-endowed nations (Smith & Waldner, 2021). This situation is linked to the concentration of production factors in a limited number of resource-based sectors, hindering the development of others and making the economy more vulnerable to fluctuations in commodity prices (Fernando, 2022). Another critical dimension of the resource curse is structural dependence. Directing productive resources disproportionately toward the extractive sectors often results in the neglect of investment in areas such as manufacturing, agriculture, and technology—ultimately weakening economic diversification and increasing macroeconomic fragility (Frankel, 2010).

Sachs and Warner (1995) conducted one of the first systematic empirical studies on the relationship between natural resource abundance and economic growth. Their findings suggested that natural resources may no longer be the main engine of growth and, under certain conditions, might even become a "curse of easy wealth," adversely affecting economic performance. Later literature also showed that factors such as lack of structural diversity, weak institutional quality, and increased external dependence reinforce this phenomenon. These findings have been tested in various regional contexts. For example, Saeed (2021) updated Sachs and Warner's model for the Gulf Cooperation Council countries and found that natural resource wealth negatively affects per capita growth, thus supporting the resource curse hypothesis with current data. However, the natural resource curse is not only an economic issue but also has institutional and political dimensions. Mehlum et al. (2006) emphasized that the effect of natural resources on economic performance depends on institutional quality. In countries with inclusive and accountable institutions, resources contribute to development, while in those with weak institutions, they tend to encourage rent-seeking behavior. Ross

(2001) argued that resource revenues could weaken tax-based fiscal systems and strengthen authoritarian tendencies.

In this context, Turkmenistan, the focus of this study, is one of the Central Asian republics that declared independence after the collapse of the Soviet Union in 1991. On October 27, 1991, the country officially declared its independence and began transitioning from a centrally planned socialist economic system to a market economy. According to official data, Turkmenistan had a population of approximately 7.4 million as of 2023 (World Bank, 2025). In the post-independence period, the country developed an economic structure heavily based on natural resources, especially natural gas and oil. According to World Bank data, in 1990, natural gas net rents accounted for 38.2% of GDP, while oil net rents accounted for 37.0%. Together, these two resources constituted 75.2% of GDP, indicating the dominant role of the energy sector in the economy. Natural resources became the backbone of both the public budget and foreign trade; the energy sector turned into the main pillar of the national economy. Thanks to rising energy prices and high export volumes, Turkmenistan, alongside Kazakhstan, has been among the countries in the region with the highest levels of oil and natural gas revenues (Isiksal, 2023).

Figure 1: Natural Gas and Oil Net Revenues of Turkmenistan (% of GDP)



Source: World Bank Indicators (WBI)

Figure 1 illustrates the percentage shares of Turkmenistan's natural gas and oil net revenues in gross domestic product (GDP) over the period 1990–2019. The graphical data clearly reveal that natural gas has played

a more dominant and decisive role in the national economy compared to oil revenues. In the early 1990s, the share of natural gas revenues in GDP stood at a notably high level of 38.2%. This ratio increased dramatically during the 1999–2000 period, peaking at 55% in the year 2000.

Compared to natural gas, oil revenues as a share of GDP fluctuated less dramatically and typically remained within the 10–25% range. In 1998, the oil revenue ratio exceeded 30%, marking a relative spike; however, this level was not sustained. Overall, the graph shows that natural gas revenues were more volatile and generally higher than oil revenues, although both sources followed a downward trend over time. After 2010, both revenue streams experienced a significant decline. Particularly after 2014, falling global energy prices, a contraction in Turkmenistan's export capacity, and limitations in infrastructure investments caused the share of both natural gas and oil revenues in GDP to drop to single digits. By 2019, the share of natural gas revenues had fallen to 5.8%, while oil revenues accounted for only 5.5%. This decline indicates that in the absence of economic diversification and sustainable resource management, the risk of experiencing a resource curse intensifies.

There is an ongoing debate in the existing literature regarding whether natural resources support economic growth. However, a significant part of this debate treats natural resources as a homogeneous whole and does not examine separately the short- and long-run effects of different types of resources (such as oil and natural gas) on economic growth. In this context, particularly in countries that are highly dependent on energy resources and have not completed their process of institutional transformation, whether the effects of natural resource revenues on economic growth differ according to resource type and temporal dimension emerges as an important research problem.

The case of Turkmenistan presents a distinctive example in this regard. The country's economy has long been highly dependent on both natural gas and oil revenues, while economic diversification and institutional reforms have remained limited. This situation suggests that the impact of natural resources on economic growth may not follow a unidirectional pattern. The main research problem of this study is to determine whether the effects of both natural gas and oil revenues on economic growth in Turkmenistan differ in the short and long run, and how this differentiation can be interpreted within the framework of the resource curse hypothesis.

In this context, the primary objective of this study is to empirically assess, through the case of Turkmenistan, the question raised by Sachs and Warner (1995): *"Does natural wealth actually constitute a disadvantage?"* or *"Do natural resources support economic growth?"* The study seeks to address not only the question of whether natural resources support economic growth, but also which type of natural resource generates an effect, over which time horizon, and in which direction. These research questions move the problem beyond a one-dimensional framework. Accordingly, using annual data from the period 1990–2019, the study applies the ARDL bounds testing approach to empirically test the validity of the resource curse hypothesis. Focusing specifically on the Turkmenistan case, the research has the potential to fill a significant gap in both regional and country-specific empirical studies. Furthermore, it contributes to the literature by offering policy implications for other developing countries with similar natural resource profiles.

The remainder of this study is structured as follows: Section 2 presents a comprehensive review of the existing literature on the topic. Section 3 introduces the dataset and details the methodological approach employed. Section 4 analyzes the empirical findings and presents the results. The final section concludes with an evaluation of the results and provides various policy recommendations for decision-makers.

2. Literature Review

2.1. Theoretical Framework

The concept of the "resource curse" refers to a paradoxical situation in which resource-rich countries fail to achieve the expected level of long-term economic growth despite their high-income potential, and simultaneously experience political, institutional, and social vulnerabilities. This phenomenon was first systematically introduced by Richard Auty (1993) and later became the cornerstone of a broad literature following the empirical work of Sachs and Warner (1995). According to the theory, in countries that become heavily dependent on high-rent-generating resources such as energy, minerals, and oil, production factors tend to concentrate in these sectors, leading to a decline in productive sectors like manufacturing and agriculture (Frankel, 2010). Limited sectoral diversification weakens macroeconomic stability and

renders economies more vulnerable to global commodity price fluctuations. Additionally, when public revenues are largely derived from natural resources, governments' reliance on taxation decreases, thereby reinforcing authoritarian tendencies that undermine democratic accountability (Ross, 2001).

In this respect, resource wealth does not always serve as a tool for development; rather, in the absence of institutional quality, governance capacity, resource management strategies, and investment in human capital, it may become a destabilizing force for both economic and political structures. Hence, the resource curse encompasses not only economic growth but also dimensions such as democratization, income distribution, social welfare, and financial development. It is closely associated not only with sectoral imbalances in the economic structure but also with institutional quality, governance capacity, and the functioning of political institutions. The extent to which natural resources contribute to economic growth largely depends on the institutional framework in which they are managed.

In this context, Mehlum et al. (2006) argued that whether natural resource revenues promote development is directly related to the inclusiveness of institutions. According to the authors, in countries with inclusive and effective institutions, resources may serve as a "blessing"; however, in countries with weak and extractive institutions, the same resources may turn into a "curse." Robinson et al. (2006) further elaborated on this institutional perspective, emphasizing that weak governance, widespread corruption, lack of accountability, political instability, and non-transparent fiscal practices hinder the equitable distribution of resource revenues across society. In such countries, resource income is directed toward short-term political objectives, consumption spending, and patronage networks rather than productive investments. This not only undermines the sustainability of economic growth but also deepens social inequalities and threatens social cohesion and long-term development. Therefore, the resource curse must be addressed not merely as an economic issue but as a political and institutional one. To ensure that natural resource revenues contribute to long-term development, transparent, accountable, and inclusive institutions must be established.

One of the frequently referenced concepts in the resource curse literature is the "Dutch Disease." According to this theory, large foreign exchange

inflows from natural resource exports cause an overvaluation of the local currency in real terms, weakening the competitiveness of export-oriented sectors. The marginalization of productive sectors such as manufacturing and agriculture disrupts sectoral balance and impairs structural transformation in the long run. Sachs and Warner (2001) examined this issue in detail, arguing that resource-based income flows lead to a relative contraction in productive sectors, posing a serious threat to sustainable growth. Dutch Disease not only causes macroeconomic price imbalances but also leads to a misallocation of production factors like labor and capital toward inefficient sectors. These exchange rate distortions negatively affect investment decisions across sectors and restrict economic diversification over time. Within the framework of the resource curse debate, Dutch Disease is considered one of the core mechanisms that threaten the sustainability of energy-based growth models. Therefore, effective management of resource revenues without disrupting macroeconomic stability, achieving income diversification, and supporting productive sectors are of critical importance.

2.2. Review of the Empirical Literature

The impact of natural resources on economic growth has long been debated, particularly in the context of developing countries. Recent literature demonstrates that revenues derived from natural resources not only affect economic growth but also shape institutional capacity, governance quality, and the development of human capital. However, this relationship is not homogeneous and varies significantly from one country to another. Indeed, the fact that countries with similar resource structures display different growth performances reveals that not only the quantity of resources but also the manner in which they are managed plays a decisive role in the development process.

One of the pioneering studies in this field, Sachs and Warner (1995), covering the period between 1970 and 1990, found that countries heavily dependent on natural resources tended to have lower growth rates. Their study argued that revenues from natural resources put pressure on public administration, reduced democratic accountability, and hindered investments in strategic sectors such as education and industry. Accordingly, they suggested that poor management of resources may adversely affect economic growth.

Studies specific to Turkmenistan also reflect these global trends. For instance, Charyyev (2015), in his comparative study of Turkmenistan and Tajikistan, emphasized that natural resources entail both opportunities and threats. He noted that the management of energy revenues within a centralized and closed structure in Turkmenistan has constrained institutional capacity and economic diversification. Similarly, Seidimbek (2016), in comparing Turkmenistan with Kazakhstan, revealed that the two countries followed divergent development paths after the collapse of the Soviet Union. While Turkmenistan portrayed a classical "rentier state" profile with authoritarian governance and weak development indicators, Kazakhstan pursued a more market-oriented trajectory through institutional reforms, foreign investment, and privatization policies. These findings suggest that institutional frameworks and property rights arrangements play a critical role in directing natural resource revenues.

On the other hand, Marques and Pires (2019), in their study of 25 natural gas-producing countries, investigated the effects of natural gas on economic growth using production-, reserve-, and rent-based approaches. Their analysis, utilizing ARDL and Driscoll-Kraay methods, found that natural gas consumption supports growth both in the short and long term; however, the resource curse effect was only marginally observed under the production-based approach. This implies that natural gas may diverge from the classical "resource curse" paradigm and act as a transitional energy source. Similarly, Doğan et al. (2020) analyzed the impact of natural resource rents on financial development in developed countries using a panel quantile regression approach. Their findings revealed that rents from oil, coal, natural gas, and forests positively influenced financial development, thus supporting the "resource blessing" hypothesis rather than the curse. In another study, Aktaş Şenkardeşler (2021) analyzed 12 oil-rich countries and found that a 1% increase in oil prices raised per capita real income by 0.16% and export volume by 0.27%. These results indicate that natural resources may contribute positively to economic growth. Siraj and Javaid (2021) examined the impact of hydrocarbon wealth on political and economic transformation in Central Asia and argued that despite their natural wealth, countries in the region failed to achieve democratization and market transition. Centralized political systems, fiscal regulations serving interest groups, and revenue models based on resource exports hindered the development of democratic institutions. In this context, while natural resource wealth may support economic growth, it may also generate negative effects in terms of

democratization and equitable distribution of prosperity. In the case of Ghana, Adabor et al. (2022) analyzed the relationship between oil revenues and economic growth using the Cobb–Douglas production function framework. The ARDL, Toda–Yamamoto, and nonlinear causality tests revealed that a 1% increase in oil revenues raised economic growth by 0.84% in the long term, though the short-term effect was statistically insignificant. Additionally, a one-way causality from oil revenues to growth was detected. Another study by Adebayo et al. (2022) investigated the impact of natural resources on economic growth in the MINT countries (Mexico, Indonesia, Nigeria, and Turkey) using a quantile-on-quantile regression approach. Analyzing data from 1970–2019, they found that the effects of natural resources on growth varied across countries—positive in Nigeria and Mexico, but mostly negative in Indonesia and Turkey. These findings emphasize that the contribution of natural resources to economic performance is context-dependent, shaped by institutional structure, energy policies, and resource management strategies.

Dell'Anno and Maddah (2022), in their study on the Iranian economy, approached the resource curse within the framework of institutional structure and rent-seeking behavior. Using the PLS-SEM method, they concluded that natural resource dependence negatively impacts growth only when rent-seeking exceeds a certain threshold. In Iran, this threshold was surpassed after 2012, revealing that the resource curse became prominent in tandem with institutional weaknesses. Isiksal (2023) found an inverted U-shaped relationship between natural resource rents and financial development in his analysis of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. This suggests that while natural resources initially create positive effects, they may eventually constrain financial development. Moreover, institutional quality and human capital were found to support financial development, with bidirectional causality observed between these variables. Likewise, in a panel data study of MENA countries covering the 1990–2020 period, Yağış (2024) examined the impact of natural resource dependence on economic growth. The findings indicated that resource revenues positively influenced growth, supporting the validity of the resource blessing hypothesis. Additionally, population growth, fixed capital investments, and financial development were found to bolster growth, whereas labor force expansion had a negative effect.

Overall, the literature suggests that while natural resource wealth has the potential to foster economic growth, this potential is frequently underutilized due to weak institutional structures and flawed policies. Accordingly, the extent to which natural resources contribute to sustainable economic gains largely depends on the strength of institutional infrastructure, investment in human capital, and strategic planning for revenue diversification.

3. Data and Methodology

All variables used in this study were obtained from the World Development Indicators (WDI) database published by the World Bank, which is widely used in empirical growth and resource economics literature due to its consistency and international comparability. Owing to data availability constraints -particularly with respect to natural gas and oil rent variables- the analysis is conducted using annual data covering the period from 1990 to 2019. This time span ensures the consistent reporting of energy rent data and allows the analysis to capture both short-run fluctuations and long-run dynamics in economic growth.

Moreover, Turkmenistan gained its independence from the former Soviet Union in 1991, which substantially limits the availability and reliability of macroeconomic and energy-related data for earlier years. As a result, internationally comparable and systematically reported data prior to the early 1990s are largely unavailable, necessitating the use of data beginning in 1990.

Table 1: Descriptive Information of the Variables

Variables	Definition	Source
Y_t	GDP growth (annual, %)	WDI
$NGAS_t$	Natural gas rents (% of GDP)	WDI
OIL_t	Oil rents (% of GDP)	WDI
CPI_t	Consumer Price Index (annual, %)	WDI

The dependent variable representing economic growth is the annual GDP growth rate (%), denoted as Y_t which is commonly employed in growth-related empirical studies to reflect macroeconomic performance. Natural gas and oil net revenues are represented by the percentage of GDP derived from natural gas revenues ($NGAS_t$) and oil revenues (OIL_t), respectively,

as these indicators directly capture the economic significance of natural resource dependence. In addition, the Consumer Price Index (CPI_t) is included to control for price level movements and macroeconomic stability, which are known to influence growth performance. All variables are employed at an annual frequency and expressed in real terms to ensure consistency with time-series analysis and to avoid distortions arising from nominal effects.

When examining the descriptive statistics of the variables used in the study, the average value of the GDP growth variable is 57.706, with a minimum of –172.999 and a maximum of 353.846 (Table 2). This indicates that the Turkmen economy has experienced significant fluctuations in growth during the analysis period.

Table 2: Descriptive Statistics of the Variables

	Y	***NGAS***	***OIL***	***CPI***
Mean	57.706	207.938	160.566	2.442.224
Median	64.000	194.765	173.371	152.371
Maximum	353.846	550.088	369.959	30.891.525
Minimum	-172.999	14.992	36.553	-208.604
Standard Deviation	100.597	121.835	78.745	6.296.287
Skewness	-0.0050	0.5825	0.4517	34.196
Kurtosis	48.677	32.394	31.531	151.741
Jarque-Bera (JB)	43.604	17.684	10.495	2.437.300
JB p-value	0.1130	0.4130	0.5917	0.0000
No. of Obs.	30	30	30	30

The variables representing natural gas revenues and oil revenues have average values of 207.938 and 160.566, respectively. When expressed as a percentage of GDP, these figures demonstrate that energy revenues occupy a significant share of the national economy. Both variables exhibit positive skewness (0.58 and 0.45) and high kurtosis (32.39 and 31.53), indicating that their distributions are right-skewed and leptokurtic (i.e., with sharp peaks). The results of the Jarque-Bera test show that the assumption of normal distribution is rejected only for the Consumer Price

Index variable ($p < 0.01$), whereas for the other variables, the normality assumption is generally considered acceptable.

In order to determine the stationarity levels of the variables included in the model, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied. According to the results, GDP growth (Y) was found to be stationary at level [I(0)], while natural gas revenues (NGAS), oil revenues (OIL), and the consumer price index (CPI) were determined to be stationary at first difference [I(1)]. The fact that none of the variables are integrated of order two [I(2)] confirms the suitability of applying the ARDL model for econometric analysis.

In this context, the ARDL (Autoregressive Distributed Lag) approach was preferred to examine the short- and long-term relationships among the variables. Developed by Pesaran et al. (2001), this method enables the testing of long-run cointegration relationships even when the explanatory variables have different levels of integration. Additionally, the ARDL approach aligns with the objectives of the study as it is well-suited for small sample sizes and allows for the simultaneous analysis of both short- and long-run effects.

To analyze the effects of natural resource revenues on economic growth, a theoretical model is constructed by drawing upon established empirical frameworks in the literature. In particular, the model builds on the approaches proposed by Alkhathlan (2013), Bal et al. (2014), Demiral, Bal, and Akça (2016), and Marques and Pires (2019), which examine the growth implications of oil and natural gas–related revenues using macroeconomic control variables.

Alkhathlan (2013) models economic growth using real GDP per capita as the dependent variable and includes oil revenues, industrial oil consumption, inflation, terms of trade, and workers' remittance outflows as explanatory variables. Similarly, Bal et al. (2014) proxy economic growth with GDP per capita and capture oil-related effects through oil export revenues and industrial oil consumption, while controlling for macroeconomic stability using the consumer price index and the real exchange rate. Demiral, Bal, and Akça (2016) extend this framework to a panel of oil-rich developing countries by incorporating crude oil prices and export quantities as proxies for oil-related revenues, alongside standard macroeconomic controls. In line with this literature, Marques

and Pires (2019) model economic growth as a function of natural gas production, reserves, and rents per capita, controlling for structural factors such as energy consumption, capital formation, globalization, employment, and population.

Following these studies, economic growth in the present analysis is specified as a function of natural resource revenues and a set of macroeconomic control variables that potentially influence growth performance. In particular, natural gas and oil rents are included to capture the direct impact of resource dependence on economic growth, as resource rents represent the share of national income derived from extractive activities (Sachs & Warner, 1995; Mehlum et al., 2006). Additionally, the Consumer Price Index (CPI) is incorporated to account for macroeconomic stability and inflationary pressures, which are widely recognized as key determinants of growth dynamics in resource-dependent economies (Frankel, 2010; Demiral et al., 2016).

Accordingly, the baseline economic model is specified as follows: $$Y_t = \alpha_0 + \alpha_1 NGAS_t + \alpha_2 OIL_t + \alpha_3 CPI_t + \varepsilon_t \quad (1)$$

In this model, Y_t represents the real gross domestic product (GDP) growth in terms of annual percentage change. The variable $NGAS_t$ denotes the share of natural gas revenues as a percentage of GDP, while OIL_t similarly indicates the share of oil revenues in GDP. CPI_t reflects the annual change in the consumer price index (inflation). The term ε_t is defined as the error term that captures the effects of all other factors not explicitly included in the model.

The ARDL (Autoregressive Distributed Lag) form of this linear regression model is expressed as follows:

$$\Delta Y_t = \beta_0 + \Sigma\beta_{1i}\Delta Y_{t-i} + \Sigma\beta_{2j}\Delta NGAS_{t-j} + \Sigma\beta_{3k}\Delta OIL_{t-k} + \Sigma\beta_{4l}\Delta CPI_{t-l} + \lambda_1 Y_{t-1} + \lambda_2 NGAS_{t-1} + \lambda_3 OIL_{t-1} + \lambda_4 CPI_{t-1} + \varepsilon_t \quad (2)$$

The Δ operator captures the short-term effects by taking the first difference of the respective variables. The β coefficients represent the short-run parameters of the variables included in the model, while the λ coefficients denote the long-run equilibrium relationships (cointegration parameters). The term ε_t is considered classical white noise and

represents the error component of the model. This structure enables the model to analyze both the effects of transitory shocks and the long-term structural relationships.

The optimal lag length of the model was determined based on the Akaike Information Criterion (AIC), and both short-run and long-run coefficients were estimated. The existence of a long-run relationship was tested using the Bounds Test developed by Pesaran et al. (2001). Additionally, the Error Correction Model (ECM) was employed to assess the capacity of the model to revert to long-term equilibrium in the face of short-run deviations. The error correction term was found to be negative and statistically significant, confirming the presence of a long-run cointegration relationship.

4. Empirical Results

In this study, the stationarity levels of the variables were examined using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests under models with constant and with constant plus trend. The tests were evaluated at the 5% significance level. According to both ADF and PP test results, the GDP growth variable (Y) was found to be stationary at level. In the ADF test, the test statistic was calculated as –5.105 for the model with constant and –6.784 for the model with constant and trend; in both cases, the results were statistically significant ($p < 0.01$). The PP tests similarly produced significant results at level, indicating that the GDP growth variable is level stationary, i.e., integrated of order zero I(0).

Regarding the natural gas rents variable (NGAS), the ADF test results indicate marginal significance at level under the model with constant ($p = 0.020$), but this significance disappears in the model including both constant and trend. However, statistically significant results were obtained at the first-difference level under both models. Similarly, the PP test results show significance at level under the model with constant ($p = 0.031$), but not under the trend-included model. At the first-difference level, the PP test produced robust results. Based on these findings, the NGAS variable is stationary at first difference, suggesting it is integrated of order one, I(1).

Table 3: Unit Root Test Results

Variables	Augmented Dickey-Fuller Test Statistic (ADF Test)			
	With Intercept		Trend and Intercept	
	Level	***1st diff.***	***Level***	***1st diff.***
Y	-5.105 (0.000)*	-9.500 (0.000)*	-6.784 (0.000)*	-5.511 (0.000)*
NGAS	-3.397 (0.020)	-5.241 (0.000)*	-3.897 (0.026)	-5.381 (0.001)*
OIL	-1.340 (0.596)	-6.531 (0.000)*	-2.292 (0.427)	-4.412 (0.009)*
CPI	-3.423 (0.018)	-7.693 (0.001)*	-4.469 (0.007)*	-7.563 (0.000)*
Variables	**Phillips-Perron Test Statistic (PP Test)**			
	With Intercept		**Trend and Intercept**	
	Level	***1st diff.***	***Level***	***1st diff.***
Y	-5.157 (0.000)*	-11.969 (0.000)*	-6.284 (0.000)*	-11.598 (0.000)*
NGAS	-3.189 (0.031)**	-7.498 (0.000)*	-3.119 (0.121)	-7.952 (0.000)*
OIL	-3.540 (0.014)	-11.396 (0.000)*	-4.438 (0.007)*	-13.203 (0.009)*
CPI	-3.456 (0.017)**	-10.266 (0.000)*	-4.485 (0.007)*	-9.264 (0.000)*

Note: * indicates 1% and ** indicates 5% levels of statistical significance.

For the oil rents variable (OIL), the ADF test results did not indicate stationarity at level, as the variable was found to be statistically insignificant under both model specifications ($p > 0.05$). However, at the first-difference level, the variable was observed to be stationary under both the model with constant and the model with constant plus trend. According to the PP test, marginal significance was observed at level under the constant model, and statistical significance was achieved under the model with trend. Nonetheless, the PP test also confirmed that the OIL variable is clearly stationary at the first-difference level. These findings indicate that the OIL variable is integrated of order one, I(1).

As a result of the unit root tests, the dependent variable is found to be level stationary (I(0)), whereas the independent variables are stationary at the first difference (I(1)). These different orders of integration make the ARDL approach methodologically suitable for model specification.

According to the diagnostic tests presented in Table 4, the model is statistically valid. The F-statistic value ($p = 0.6$) indicates that the null

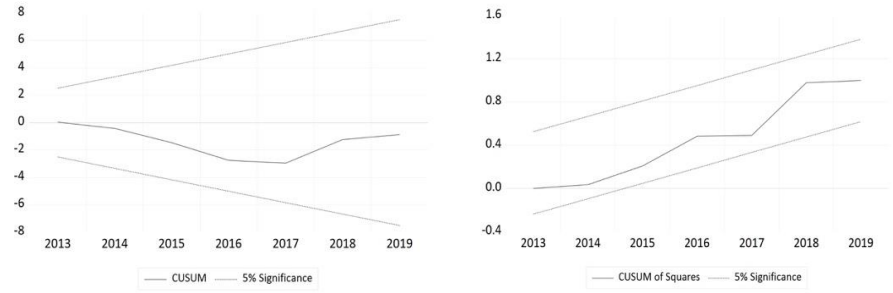
hypothesis of no serial correlation cannot be rejected, suggesting that there is no autocorrelation issue in the model. The Jarque-Bera statistic testing for the normal distribution of residuals ($p = 0.51$) is not significant, implying that the error terms are normally distributed. The F-statistic from the heteroskedasticity test ($p = 0.81$) also fails to reject the null hypothesis of homoskedasticity, suggesting the assumption of constant variance is valid. Finally, the Ramsey RESET test result ($p = 0.64$), which evaluates the correctness of the model's functional form, indicates no specification error. Based on these findings, it can be concluded that the model satisfies the core assumptions, and the results obtained are statistically reliable.

Table 4: Diagnostic Test Results of the ARDL (4,4,4,3) Model

Test Type	**Test Statistic**	**p-value**	**Interpretation**
Serial Correlation	F (2,5) = 0.5628	0.60	No autocorrelation
Normality (Jarque-Bera)	JB = 1.3464	0.51	Residuals are normally distributed
Heteroskedasticity (Breusch-Pagan)	F (18,7) = 0.6108	0.81	No heteroskedasticity
Ramsey RESET	F (1,6) = 0.2390	0.64	No evidence of model misspecification

Furthermore, the CUSUM and CUSUMQ tests were employed to assess whether the short- and long-run parameters of the model remained stable over time. These tests are graphical diagnostic tools used to examine the presence of structural breaks or parameter instability within the model. In the analysis, the test statistics remained within the 5% critical bounds, indicating that the parameters were stable over time and that the model maintained its reliability.

A review of the graphs reveals that both the CUSUM and CUSUMQ test lines stayed within the 95% confidence interval, suggesting that the estimated parameters did not exhibit significant deviations. This confirms the structural stability of the model over time and supports the conclusion that the model's predictive performance is consistent and reliable.



Before estimating the long-run coefficients, the Bounds Test was applied to determine whether a stable and meaningful long-term relationship exists among the variables included in the model. The calculated F-statistic was found to be 8.669, which exceeds the upper-bound critical values at both the 5% and 1% significance levels. This clearly indicates the presence of a statistically significant long-run cointegration relationship among the variables used in the model. Therefore, the selected ARDL model is methodologically appropriate for analyzing long-term relationships, and the interactions among the variables are not random but based on a statistically coherent and integrated structure.

Table 5: Upper and Lower Critical Values

k	**F Stat.**	**5% Critical Values**		**1% Critical Values**	
		Lower Bound I(0)	Upper Bound I(1)	Lower Bound I(0)	Upper Bound I(1)
3	8.669	3.272	4.306	4.614	5.966

Following the confirmation of a long-run cointegration relationship among the variables based on the ARDL bounds testing approach, the estimation of long-run coefficients was conducted. Accordingly, using the ARDL (4,4,4,3) model structure, coefficients representing the long-term effects of independent variables on economic growth were derived. In these estimations, the long-run impact of each variable was assessed individually, and the results are presented in Equation 3. The p-values shown in parentheses indicate the statistical significance levels of the respective coefficients. These values are used to evaluate the reliability of the estimated parameters and their explanatory power within the model.

$$Y = 5.674443 + 2.270557NGAS - 3.13535OIL + 0.010187CPI \quad (3)$$

(0.024) (0.059) (0.068) (0.254)

According to the estimated long-run equation, the constant term is approximately 5.67, representing the model's baseline level. The long-run coefficient of NGAS is estimated at 2.27 and is marginally significant at the 10% level with a p-value of 0.059. This indicates that a 1% increase in natural gas net revenues leads to an approximate 2.3% increase in economic growth. This finding is consistent with Marques and Pires (2019), who report that the resource curse hypothesis is not verified for natural gas and that natural gas production and consumption are positively associated with economic growth. This result also aligns with studies emphasizing that the growth effects of natural resources are resource-specific rather than uniform, and that certain energy sources may support growth under appropriate institutional conditions (Yağış, 2024). The coefficient of OIL is –3.13, suggesting a negative relationship, and it is also marginally significant at the 10% level with a p-value of 0.068. Accordingly, a 1% increase in oil-related revenues results in an estimated 3.1% decline in long-run economic growth. This negative effect is in line with the classical resource curse literature, particularly Sachs and Warner (1995, 2001), which documents that economies heavily dependent on oil revenues tend to experience weaker long-term growth performance. Similar results are reported by Siraj and Javaid (2021) and Dell'Anno and Maddah (2022), who argue that oil-based revenues tend to constrain long-run growth in the presence of weak institutional structures and rent-seeking behavior. Although the CPI variable shows a positive coefficient of 0.010, it is not statistically significant, as its p-value is 0.254. Overall, the findings suggest that while natural gas revenues provide limited support for long-run growth, oil revenues may exert a constraining effect on economic performance over time. In this respect, the results diverge from studies such as Aktaş Şenkardeşler (2021) and Adabor et al. (2022), which report positive growth effects of oil revenues, highlighting the importance of country-specific institutional settings and methodological differences. These results are also compatible with institutional-based explanations in the literature, which emphasize that in the presence of weak governance structures, oil revenues are more likely to generate rent-seeking behavior and inefficient resource allocation rather than sustainable growth (Mehlum et al., 2006; Robinson et al., 2006).

Following the establishment of a long-run cointegration relationship, the short-run dynamics of the model are examined through short-run coefficients and the Error Correction Term (ECT). The relevant estimation results are presented in detail in Table 6.

Table 6: Short-Run Coefficients and Error Correction Term (ECT)

Variables	Coefficient	Standard Error	T-Statistic	Probability
COINTEQ*	-0.5495	0.0666	-82.532	0.0000
D(Y(-1))	0.4144	0.1186	34.934	0.0050
D(Y(-2))	0.5746	0.1067	53.856	0.0002
D(Y(-3))	0.6396	0.0541	118.213	0.0000
D(NGAS)	0.1453	0.0688	21.127	0.0583
D(NGAS(-1))	-0.7408	0.0668	-110.864	0.0000
D(NGAS(-2))	-0.4717	0.0610	-77.332	0.0000
D(NGAS(-3))	-0.3789	0.0476	-79.627	0.0000
D(OIL)	-0.3077	0.1330	-23.130	0.0411
D(OIL(-1))	0.8530	0.1052	81.056	0.0000
D(OIL(-2))	0.0450	0.0971	0.4636	0.6519
D(OIL(-3))	0.4874	0.0909	53.640	0.0002
D(CPI)	0.0190	0.0032	60.214	0.0001
D(CPI(-1))	-0.0091	0.0011	-81.810	0.0000
D(CPI(-2))	-0.0018	0.0008	-23.098	0.0413
R-squared	0.9894	Adjusted R-squared		0.9759

According to the findings, most of the short-run relationships are statistically significant, indicating that the model has strong explanatory power for the dependent variable, economic growth. In particular, the lagged values of natural gas revenues have a negative and significant impact on growth. For example, the coefficient of D(NGAS(-1)) is –0.7408, and it is statistically significant at the 1% level. This suggests that sudden and sharp increases in natural gas revenues may disrupt short-term economic balance and negatively affect growth. The oil net revenue variable also shows statistically significant effects on growth in both its current and lagged values. Especially, the coefficient of D(OIL(-1)) is estimated at 0.8530 ($p < 0.01$), indicating that past increases in oil revenues may have a supportive effect on short-term growth. However, this effect is not consistent across all lag levels. On the other hand, the Consumer Price Index (CPI) exhibits a complex and bidirectional effect

on short-term growth. The current-period CPI coefficient is positive and significant (0.0190; $p < 0.01$), whereas its lagged values have negative and significant effects. These findings suggest that, in the short term, increases in price levels may stimulate demand-driven expansion and support growth, but over time, this effect may reverse and distort real sector balances.

The estimated error correction term (COINTEQ) in the model is –0.5495, with a p-value of 0.0000, indicating a highly significant result. The negative and statistically significant coefficient implies that approximately 55% of the short-run disequilibria are corrected within one period (i.e., one year), allowing the system to return to its long-run equilibrium level. This outcome confirms the existence of a long-term cointegration relationship within the model and also demonstrates that the dynamic adjustment process is stable and economically meaningful.

5. Conclusion and Policy Suggestions

This study aims to analyze the impact of natural resource revenues (natural gas and oil) on economic growth in Turkmenistan using annual data for the period 1990–2019 within the framework of the ARDL model. According to the results of the bounds testing procedure, a long-run cointegration relationship was found among the variables in the model. The estimated long-run coefficients indicate that natural gas revenues have a positive and marginally significant effect on economic growth, while oil revenues have a negative and marginally significant effect. These findings suggest that natural gas may serve as a supportive factor for long-term economic growth, whereas oil revenues could exert downward pressure on growth, aligning with the natural resource curse hypothesis.

These findings are consistent with some empirical studies in the literature. For instance, Adabor et al. (2022) found that resource revenues support long-run growth in Ghana, while Isiksal (2023) noted that in Central Asian countries, natural resources initially promote growth but eventually create fiscal pressures. Similarly, Yagış (2024) emphasizes that resource revenues contribute to growth if they are utilized in a planned and efficient manner. However, other studies such as Dell'Anno and Maddah (2022) argue that institutional weaknesses and high levels of rent-seeking behavior can undermine the positive effects of resource revenues on

growth. These contrasting findings demonstrate that the relationship between natural resources and growth is not solely determined by economic variables, but also by institutional structures, governance quality, and revenue management strategies.

Moreover, the findings obtained in this study indicate that fluctuations in energy revenues may complicate macroeconomic adjustment processes in the short run. In this context, it is assessed that prudent fiscal practices aimed at smoothing natural gas revenues over time—such as mechanisms prioritizing revenue stability—may contribute to limiting short-term volatility. The results regarding oil revenues, on the other hand, suggest that economic growth becoming highly dependent on this type of revenue in the long run may increase structural vulnerabilities. Therefore, it can be stated that policies aimed at developing non-oil sectors and strategies supporting economic diversification are potentially important for long-term growth performance. Nevertheless, since the effects of natural resource revenues on economic performance are closely related to institutional structure and governance capacity, it is anticipated that strengthening transparency and accountability in public financial management, increasing efficiency in public expenditures, and implementing reforms aimed at channeling resource revenues into productive areas may support long-term growth.

Based on the findings, the following policy recommendations are proposed:

• To effectively harness the long-term growth potential of natural gas revenues, it is essential to manage these resources within a development-oriented and institutionally reformed framework. Revenues should be allocated to productive and sustainable sectors such as infrastructure, education, and healthcare.

• Given the risk that oil revenues may negatively affect growth, reducing economic dependence on oil, ensuring income diversification, and developing non-oil sectors should be prioritized.

• Economic diversification is a critical factor for sustaining resource-based growth strategies. Productive sectors such as agriculture, manufacturing, and services should be promoted.

• Institutional capacity and governance quality play a key role in the efficient utilization of resource revenues. Therefore, reforms that improve accountability, transparency, and the efficiency of public expenditures should be implemented.

In conclusion, Turkmenistan's ability to transform its natural resource wealth into sustainable economic growth depends not only on the presence of these resources but also on institutional development, resource management, and diversification strategies. The extent to which resources become a blessing or a curse will be determined by the country's ability to implement policies that address this multidimensional challenge.

References

Adabor, O., Buabeng, E., & Dunyo, J. F. (2022). "The causative relationship between natural resource rent and economic growth: evidence from Ghana's crude oil resource extraction", *International Journal of Energy Sector Management*, 16(5), 899-923.

Adebayo, T. S., Akadiri, S. S., Radmehr, M., & Awosusi, A. A. (2022). "Re-visiting the resource curse hypothesis in the MINT economies", *Environmental Science and Pollution Research*, 30, 9793-9807.

Aktaş Şenkardeşler, R. (2021). "Ekonomik Büyüme İçin Doğal Kaynaklar Bir Şans Mı Yoksa Kaynak Talihsizliği Mi?", *International Social Sciences Studies Journal*, 7(76), 270-278.

Alkhathlan, K. A. (2013). "Contribution of oil in economic growth of Saudi Arabia", *Applied Economics Letters*, 20, 343-348.

Auty, R. (1993). Sustaining Development in Mineral Economies: The Resource Curse Thesis. London.

Bal, H., Algan, N., & Akça, E. E. (2014). "Petrol Üretiminin İran Ekonomisi Üzerine Etkileri", İ.Ü. *Siyasal Bilgiler Fakültesi Dergisi*, 50, 17-38.

Charyyev, R. (2015). "The Curse and Blessing Effects of Natural Resources in Central Asia: Turkmenistan and Tajikistan", Yüksek lisans tezi, Central European University, Budapest, Hungary: CEU Electronic Theses and Dissertations.

Dell'Anno, R. (2022). "Natural resources, rent seeking and economic development. An analysis of the resource curse hypothesis for Iran", *Macroeconomics And Finance In Emerging Market Economies*, 15(1), 47-65.

Demiral, M., Bal, H., & Akça, E. E. (2016). "Petrol Gelirleri ve Ekonomik Büyüme: Seçilmiş Petrol Zengini Gelişmekte Olan Ülkeler Üzerine Bir Panel Veri Analizi", *Sosyoekonomi*, 24(27), 85-102.

Dogan, E., Altinoz, B., & Tzeremes, P. (2020). "The analysis of 'Financial Resource Curse' hypothesis for developed countries: Evidence from asymmetric effects with quantile regression", *Resources Policy*, 68, 101773.

Fernando, J. (2022). Resource Curse: Definition, Overview and Examples, Investopedia: https://www.investopedia.com/terms/r/resource-curse.asp

Frankel, J. A. (2010). "The natural resource curse: A survey." *National Bureau of Economic Research,* NBER Working Paper No. 15836.

Isiksal, A. Z. (2023). "The Role of Natural Resources in Financial Expansion: Evidence from Central Asia", *Financial Innovation,* 9(78).

Marques, A. C., & Pires, P. S. (2019). "Is there a resource curse phenomenon for natural gas? Evidence from countries with abundant natural gas", *Resources Policy*, 63, 101466.

Mehlum, H., Moene, K., & Torvik, R. (2006). "Institutions and the Resource Curse", *The Economic Journal*, 116(508), 1-20.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics*, 16(3), 289-326.

Robinson, J. A., Torvik, R., & Verdier, T. (2006). "Political foundations of the resource curse", *Journal of Development Economics*, 79, 447-468.

Ross, M. L. (2001). "Does Oil Hinder Democracy?", *World Politics*, 53(3), 325-361.

Sachs, J. D., & Warner, A. M. (1995). "Natural resource abundance and economic growth", *National Bureau of Economic Research,* NBER Working Paper No. 5398.

Sachs, J. D., & Warner, A. M. (2001). "The curse of natural resources", *European Economic Review,* 45(4-6), 827-838.

Saeed, K. A. (2021). "Revisiting the natural resource curse: A cross-country growth study", *Cogent Economics & Finance*, 9(1), 2000555.

Seidimbek, A. (2016). "Petroleum Politics, the Management and Curse of Resources in Central Asia: Kazakhstan and Turkmenistan in Comparative Perspective", Master's thesis, Budapest, Hungary: Central European University, Department of Political Science.

Siraj, U., & Javaid, F. (2021). "Resource Curse and Political & Economic Transition in Central Asia", *Pakistan Journal of International Affairs*, 4(2), 29-47.

Smith, B., & Waldner, D. (2021). Rethinking the Resource Curse. Cambridge University Press.

World Bank, (2025). World Bank Data, https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TM

Yağış, O. (2024). "Doğal Kaynak Bağımlılığı ve Makroekonomik Göstergelerin Ekonomik Büyüme Üzerindeki Etkisi: MENA Ülkeleri İçin Panel Veri Analizi", *Ekonomik ve Sosyal Araştırmalar Dergisi*, 20(1), 112-131.