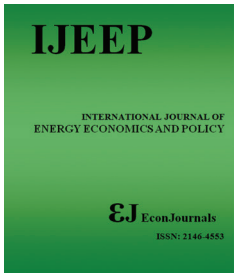

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Oil- and Gas-Rich Azerbaijan's Economic Diversification: Analysis of Global Experiences and Prospects for Application

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ABSTRACT

This paper examines the current state and future prospects of economic diversification policy in Azerbaijan's economy, which remains highly dependent on oil and gas resources. Based on time-series data covering the period 2014-2024, trend analysis was conducted to visualize structural changes and identify intersectoral dynamics. Using ARDL (Autoregressive Distributed Lag) and VAR (Vector Autoregression) models, the short- and long-term interactions between the share of oil in GDP, non-oil exports, innovation and research expenditures, and fiscal revenues were empirically assessed. The findings indicate that the share of the oil sector in GDP decreased from 41% to 27.5%, while non-oil exports and R&D expenditures demonstrated upward trends. However, the high share of oil revenues in the state budget persists, confirming that sustainable diversification within the fiscal structure has yet to be fully achieved. Strategic investments by SOCAR and other energy enterprises in non-oil sectors play a crucial role in this transition process, providing additional impetus to industrial transformation. A comparative analysis with Norway, the United Arab Emirates, and Kazakhstan, based on panel data, revealed the potential for local adaptation of international experiences in this area. Applying SWOT and GAP analysis approaches, Azerbaijan's economic strengths and weaknesses were systematized, leading to the conclusion that institutional reform is necessary within the framework of strategic planning. The main conclusion of the paper is that Azerbaijan, in the course of its transition to the post-oil stage, must strengthen its innovation policy and improve institutional mechanisms aimed at developing non-oil sectors.

Keywords: Economic Diversification, SOCAR, ARDL Model, Oil Dependence
JEL Classifications: O1, O4, F1, Q4, H5, L7

1. INTRODUCTION

The development trajectory of resource-rich countries has long been at the center of scholarly and policy debates. Particularly noteworthy is the paradox referred to as the "resource curse," which posits that countries endowed with abundant natural resources may, at times, experience weaker economic growth, institutional fragility, and deepening social inequality compared to resource-scarce nations (Arezki and Brückner, 2015; https://president.az/articles/50474). Azerbaijan, endowed with substantial oil and gas reserves, has achieved rapid economic growth since the early 2000s, largely fueled by hydrocarbon exports. However, this growth has also been accompanied by a high degree of vulnerability to external shocks, such as fluctuations in global oil prices (Barma and Viñuela, 2020; Bhattacharyya and Collier, 2016). In the current phase—marked by increased volatility in energy markets and accelerated global initiatives toward a transition to renewable energy—the issue of economic diversification in Azerbaijan has become even more pressing (Cust and Mihalyi, 2017; Farzanegan and Krieger, 2019).

Dependence on oil revenues has revealed a number of structural challenges within Azerbaijan's economy. These include the underdevelopment of non-oil sectors, a low level of innovation capacity, and excessive reliance on government spending (Frankel, 2021). Research shows that overreliance on natural

resources often leads to reduced investment in human capital, rent-seeking behavior, and governance deficiencies (Gylfason, 2020; Hausmann and Hidalgo, 2021). Such patterns have been observed in many oil-exporting countries and are largely explained through institutional, fiscal, and macroeconomic perspectives (IMF, 2016; IMF, 2022).

International organizations—including the International Monetary Fund (IMF), the World Bank, and the Organisation for Economic Co-operation and Development (OECD)—emphasize the necessity of structural transformation in oil-dependent economies, noting that a shift toward knowledge-based and export-oriented sectors is a key instrument for achieving sustainable development (Kaldor et al., 2020; Kuralbayeva and Stefanski, 2018; OECD, 2018). Azerbaijan has undertaken several initiatives in this direction, including the adoption of Strategic Roadmaps for economic diversification and the establishment of mechanisms for intergenerational financial stability through the Oil Fund (Ross, 2017; Sachs and Warner, 2016). Nevertheless, challenges persist in implementation mechanisms, institutional capacity, and long-term planning (Satti et al., 2019).

Conversely, a number of resource-rich countries have managed to overcome these issues with relative success and achieve economic diversification. For example, Norway has channeled oil revenues through its globally renowned Government Pension Fund, implemented strict fiscal rules, and invested heavily in human capital (Smith and Watts, 2018). The United Arab Emirates—particularly the Emirate of Dubai—has developed its non-oil economy based on tourism, logistics, and financial services (Sousa et al., 2019; Svaleryd and Vlachos, 2021). Kazakhstan, meanwhile, has pursued a state-led diversification model through industrialization policies and digital transformation, although the results remain mixed (UNCTAD, 2020).

The literature indicates that the success of diversification strategies depends not only on economic instruments but also on political will, institutional quality, and regional integration (van der Ploeg and Poelhekke, 2017; Vieira and Bresciani, 2021). Recent quantitative studies show that effective macroeconomic governance and inclusive policies play a critical role in transforming resource abundance into sustainable development (World Bank, 2020; World Bank, 2022; Yegorov and Wijnbergen, 2019).

The aim of this paper is to assess Azerbaijan's current position in economic diversification and to explore approaches that could be adapted from the global experiences of countries such as Norway, the UAE, and Kazakhstan. In this context, the study proposes institutional and policy frameworks that could support Azerbaijan's transition toward a more sustainable and diversified economic model.

2. PROBLEM STATEMENT

2.1. Literature Review

Economic development and diversification in countries dependent on oil and gas resources have generated extensive scholarly debate. Much of this research is built on the concept of the resource curse, which suggests that resource abundance often conflicts with long-term economic sustainability and inclusive growth (Frankel, 2021; Ross, 2017; Sachs and Warner, 2016). Frankel (2021) and Ross (2017) confirm this approach, highlighting the link between oil revenues, macroeconomic instability, and weakened political institutions.

Empirical studies on advanced oil exporters have revealed significant relationships between oil prices, fiscal policy, and government spending (Arezki and Brückner, 2015; Smith and Watts, 2018). Smith and Watts (2018), for example, note that government expenditures in Gulf countries rose sharply during periods of oil booms.

Empirical works employing ARDL and VAR models have analyzed the long- and short-term linkages between the share of oil in GDP and exports and indicators of non-oil sector development (Barma and Viñuela, 2020; Bhattacharyya and Collier,2016; Farzanegan and Krieger, 2019). Bhattacharyya and Collier (2016) argue that failure to direct oil revenues toward physical capital formation results in economic vulnerability.

The experiences of countries that have successfully implemented diversification—especially Norway and the UAE—have been extensively examined in separate studies. IMF (2016; 2022) and World Bank (2022) reports emphasize factors such as targeted allocation of public investment to priority sectors, strengthening institutional governance, and building an innovation base (IMF, 2016; IMF, 2022; World Bank, 2022).

In the Azerbaijani context, applying these international approaches aligns with the Azerbaijan 2030 National Priorities, which identify economic diversification, increased non-oil exports, and a transition toward an R&D-oriented economic model as key strategic objectives (https://president.az/articles/50474).

As highlighted by Zhuang et al. (2019), inclusive growth policies are central to ensuring that resource-rich economies like Azerbaijan transform natural wealth into diversified and sustainable development. Their framework underscores the importance of social inclusion and institutional effectiveness in achieving economic diversification (Zhuang et al., 2019).

Recent studies employing GAP and SWOT analyses have highlighted discrepancies between current conditions and strategic objectives, systematizing gaps in strategic management (Gylfason, 2020; Satti et al., 2019; Vieira and Bresciani, 2021).

All these approaches indicate that for resource-rich countries such as Azerbaijan, economic diversification should not be limited to sectoral shifts but must also be accompanied by improvements in institutional and governance quality. The Table 1 also synthesizes diverse approaches, providing a scientific basis for shaping appropriate strategies for Azerbaijan's post-oil era.

2.2. Azerbaijan's Dependence on Oil Revenues

Over the past two decades, the Republic of Azerbaijan has experienced a period of rapid economic growth driven by the

exploitation of its oil and gas reserves. In particular, between 2000 and 2014, the average annual growth rate of gross domestic product (GDP) exceeded 10%, largely fueled by the expansion of the energy sector and increased exports (Arezki and Brückner, 2015; Bhattacharyya and Collier, 2016). During this period, oil projects implemented jointly with SOCAR, BP, and other international consortia transformed Azerbaijan into a major energy exporter in the region.

However, since 2015, global oil price shocks, the global recession triggered by the pandemic, and challenges associated with the energy transition have brought the structural dependency of Azerbaijan's economy back into focus. According to the latest official forecasts for 2025, the share of the oil and gas sector in total exports is projected at 72.5%, while its share in GDP is expected to be 25.6%. The share of oil revenues (transfers from the State Oil Fund of the Republic of Azerbaijan and taxes related to extraction) in total state budget revenues is estimated at 49.8% for 2025 (Farzanegan and Krieger, 2019; IMF, 2016; Vieira and Bresciani, 2021).

Although the share of the oil sector in GDP is projected to decline by approximately 2.3% points between 2022 and 2025, dependency on oil in terms of exports and budget revenues remains high. These figures confirm that Azerbaijan's economic model still retains a mono-structural character, and that extensive institutional and fiscal reforms are required to ensure dynamic development of the non-oil sectors (Cust and Mihalyi, 2017; Hausmann and Hidalgo, 2021; OECD, 2018).

As illustrated in Figure 1, the share of the oil sector in GDP decreased from 55% in 2000 to around 25% in 2025, yet oil and natural gas continue to dominate exports. In 2025, oil products and natural gas are projected to account for 72.5% of total exports. This highlights the continued vulnerability of the economy to global energy price fluctuations and geopolitical risks (Figure 1**)** (Farzanegan and Krieger, 2019; Hausmann and Hidalgo, 2021; Vieira and Bresciani, 2021).

As shown in Figure 1, although the share of the oil sector in Azerbaijan's economy has gradually declined between 2000 and 2025, it still plays a significant role. While the share of the oil sector in GDP fell from 55% in 2000 to 26% in 2025, its share in exports decreased from 94% to 72%, maintaining a dominant position. This trend demonstrates that the country's economic structure has not yet fully overcome its dependence on energy resources (Farzanegan and Krieger, 2019; Hausmann and Hidalgo, 2021; Vieira and Bresciani, 2021).

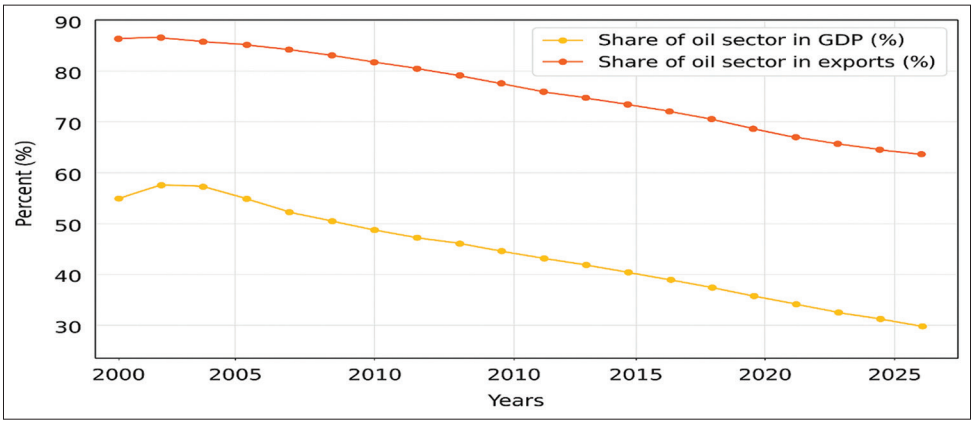
2.3. Resource Curse and the Risk of Institutional Weakness

Economic and institutional challenges observed in resource-rich countries have become one of the central themes in modern economic research. The concept of the resource curse, first introduced in the late 1980s, has since been supported by extensive empirical evidence (https://president.az/articles/50474; Gylfason, 2020). According to this concept, countries dependent on oil, gas, and other natural resources may experience weak governance, political instability, and social inequality, rather than the expected

Table 1: Approaches to economic diversification

Authors	Economic diversification strategy	Key proposal and finding
Arezki and Brückner (2015)	Response of the banking sector to fiscal policy	Oil revenues reduce bank lending
Barma and Viñuela (2020)	Competitive institutions and inclusive growth	Institutional flexibility is required for inclusive growth
Bhattacharyya and Collier (2016)	Misallocation of resources	Resource revenues are not invested in infrastructure
Cust and Mihalyi (2017)	Rising resource expectations and disappointing outcomes	Resource wealth raises expectations, but outcomes are weak
Farzanegan and Krieger (2019)	Income inequality	Oil booms widen income disparities
Frankel (2021)	Review of causes of the resource curse	Mismanagement of resources weakens the economy
Gylfason (2020)	Knowledge- and innovation-driven strategy	Innovation-based diversification is essential
Hausmann and Hidalgo (2021)	Role of the complexity index	Economic complexity determines the success of nations
Kuralbayeva and Stefanski (2018)	Resource revenues and migration	Resource booms trigger migration flows
Ross (2017)	Final findings on the resource curse	Proper use of resources fosters growth
Sachs and Warner (2016)	Negative effects of natural resources	Resource abundance undermines economic stability

Figure 1: Share of the oil sector in Azerbaijan's economy (2000-2025)



prosperity and stability. In many cases, resource abundance leads to institutional deterioration, rent-seeking behavior, and diversion from strategic development goals (OECD, 2018; Sousa et al., 2019).

The core issue lies in the fact that wealth from abundant resources shapes the political economy structure in a way that weakens accountability and transparency within state institutions. Rent-oriented policies push non-oil sectors into the background, undermine fiscal discipline, and relegate economic diversification initiatives to secondary importance (Barma and Viñuela, 2020; Hausmann and Hidalgo, 2021). Moreover, budget models reliant on natural resources often reduce incentives for governments to broaden the tax base and collect revenues from non-oil sectors (Sachs and Warner, 2016; Satti et al., 2019).

These risks are also partially present in Azerbaijan. Since economic growth has been heavily dependent on oil revenues, public finance planning and government expenditures have been closely tied to resources generated from energy exports. The fact that nearly 50% of budget revenues in 2025 are projected to come from oil-related income (IMF, 2016) poses a threat to the sustainability of fiscal policy. In such a scenario, fluctuations in oil prices directly jeopardize fiscal balance and macroeconomic stability (Cust and Mihalyi, 2017; OECD, 2018).

Another dimension of the resource curse is associated with underdeveloped human capital and low innovation capacity in non-oil sectors. Studies indicate that high resource revenues can sometimes lead to reduced investments in education, science, and technology (IMF, 2022; van der Ploeg and Poelhekke, 2017) which in the long term limits the quality and inclusiveness of economic development.

Global experience shows that institutional quality and governance capacity play a crucial role in mitigating the negative effects of resource abundance. For instance, in Norway, managing oil revenues under strict fiscal rules, along with the application of transparency and accountability principles, has enabled the country to avoid the resource curse (Smith and Watts, 2018). Conversely, in countries with weak institutional environments—such as some in Central Asia and Africa—resource abundance has heightened risks of corruption and political instability (OECD, 2018; Svaleryd and Vlachos, 2021).

Ultimately, one of the main challenges facing Azerbaijan is to accompany its resource-based economic structure with strong institutional reforms. Enhancing transparency in governance, strengthening fiscal discipline, and introducing incentives for the development of non-oil sectors and human capital can help the country move away from the risk of the resource curse (UNCTAD, 2020; World Bank, 2020; Yegorov and Wijnbergen, 2019).

2.4. Global Transformations and the Necessity of Diversification

Over the past decade, profound shifts in the global economy—especially the rapid adoption of renewable energy technologies, the adoption of carbon-neutral strategies, and volatile energy prices—have cast serious doubt on the sustainability of resource-based economic models. In 2022, more than 56% of global investment was already directed toward green energy and digitalization, making structural change even more urgent for resource-dependent economies (Kaldor et al., 2020; Ross, 2017; Svaleryd and Vlachos, 2021).

According to key documents such as BP Energy Outlook (2023) and the IEA World Energy Report, global demand for oil is projected to fall by at least 20% by 2040, with renewables becoming the dominant source in energy production (Svaleryd, and Vlachos, 2021; Vieira and Bresciani, 2021). This presents serious strategic risks for countries highly dependent on oil and gas revenues, including Azerbaijan, in terms of sustainable development and fiscal security (Kuralbayeva and Stefanski, 2018; OECD, 2018).

Projections for Azerbaijan's economy in 2025 confirm this urgency:

- Share of oil and gas sector in exports: 72.5%
- Share of oil in GDP: 25.6%
- Share of oil revenues in state budget: 49.8% (IMF, 2016; Vieira and Bresciani, 2021)

These figures indicate that the country remains highly exposed to energy price volatility and geopolitical risks. Without adequate reforms to reduce this dependency, the next phase of the global energy transition could severely threaten Azerbaijan's macroeconomic stability and social protection mechanisms (Hausmann and Hidalgo, 2021; Satti et al., 2019).

Economic diversification has no alternative. As highlighted in recent recommendations by institutions such as the World Bank and IMF, the main priorities should include building a knowledge-based economy, strengthening non-oil industries and the agricultural sector, transitioning to technological innovation, promoting digitalization, and investing in human capital (Kuralbayeva and Stefanski, 2018; Sachs and Warner, 2016; World Bank, 2020).

Research suggests that resource-rich countries can successfully pursue diversification policies only with a strong institutional framework, domestic competitiveness, and targeted state intervention. In this regard, the experiences of countries like Norway and the UAE can serve as both theoretical and practical models for Azerbaijan (Sousa et al., 2019; UNCTAD, 2020; World Bank, 2022).

In conclusion, against the backdrop of the global energy transition and green transformation, diversification in Azerbaijan's economy should be seen not merely as a policy tool for promoting growth, but as a critical condition for ensuring geostrategic and macro-fiscal security (OECD, 2018; Yegorov and Wijnbergen, 2019).

The share of the oil and gas sector in Azerbaijan's economy has remained high for many years. However, over the past decade, in the context of price volatility in global energy markets, green transition requirements, international economic challenges, the country's leadership and strategic energy enterprises have placed

greater emphasis on economic diversification. In this process, a leading role has been played by the State Oil Company of the Republic of Azerbaijan (SOCAR), the State Oil Fund (SOFAZ), and energy infrastructure operators such as "Azerenergy" and "Azerishig." The investment strategies of these entities encompass not only energy extraction but also projects aimed at developing the non-oil sector.

Table 2 presents the volume of investments directed to the non-oil sector by these organizations between 2014 and 2024.

The data presented in Table 2 clearly demonstrate the contribution of SOCAR and other energy enterprises to the development of the non-oil sector. While in 2014 the total investment volume from these entities amounted to 800 million AZN, by 2024 this figure had risen to 2.18 billion AZN. This growth was driven particularly by the funds allocated to diversification-oriented projects by SOFAZ and SOCAR. Over ten years, SOCAR's investments in non-oil projects increased 2.5 times, while SOFAZ's funding rose 2.6 times. Investments from Azerenergy and Azerishig have been mainly directed toward green energy, energy efficiency, and the renewal of regional energy infrastructure.

Table 2: Investments of SOCAR and state energy enterprises in the non-oil sector (million AZN)

Year	SOCAR investments	SOFAZ funding	Azerenergy and Azerishig projects	Total investments
2014	200	500	100	800
2015	220	550	110	880
2016	230	580	120	930
2017	250	620	140	1,010
2018	270	700	160	1,130
2019	295	750	195	1,240
2020	320	800	210	1,330
2021	350	900	250	1,500
2022	410	1,100	310	1,820
2023	460	1,250	370	2,080
2024	490	1,300	390	2,180

These figures indicate that state energy enterprises have transformed from being solely extraction and export operators into strategic institutions implementing sustainable economic diversification. The continued implementation of this strategy is of critical importance for ensuring economic security, especially in the context of the transition to the post-oil era.

Table 3 presents the key indicators included in the analytical framework, which serve to evaluate the structural composition of Azerbaijan's economy, fiscal dependency, and innovation performance.

Based on these indicators, data for Azerbaijan and the selected comparison countries (Norway, UAE, Kazakhstan) will be analyzed for the period 2015-2025. The comparison will be conducted in both static (cross-sectional, specific years) and dynamic (changes over time) formats.

Table 4 summarizes Azerbaijan's key macroeconomic indicators for the period 2014-2024, highlighting the trends in oil dependency and non-oil sector performance.

3. ANALYTICAL OVERVIEW

Statistical data for 2014-2024 show a downward trend in the share of the oil sector in both GDP and exports in Azerbaijan's economy. This reflects intensified efforts toward economic diversification and a relative strengthening of the non-oil sectors. For example, the share of non-oil exports in total exports increased from 8% in 2014 to 15.3% in 2024. Similarly, the share of innovation and R&D expenditure in GDP rose to 0.45%, indicating a gradual shift toward a knowledge-based economy.

Table 3: Key indicators included in the analytical framework

No	Indicator name	Purpose and description
1	Share of the oil sector in GDP (%)	Assesses the weight of the energy sector in the overall economic structure
2	Share of the oil sector in exports (%)	Measures the mono-sector dependence of the trade structure
3	Share of oil revenues in budget revenues (%)	Reflects the degree of fiscal policy's dependence on resources
4	Real growth rate of non-oil GDP (%)	Evaluates the growth potential of non-energy sectors
5	Share of non-oil exports in total exports (%)	Determines the level of diversification in foreign trade
6	Distribution of public investment by sector (%)	Shows the allocation of state investments to non-oil areas
7	Share of innovation and R&D expenditure in GDP (%)	Indicates the level of technological development and transition to a knowledge economy
8	Share of non-oil sectors in total employment (%)	Reflects structural transformation in the labor market
9	Ratio of external debt to GDP (%)	Identifies the level of risk in macroeconomic and fiscal sustainability

Table 4: Key economic indicators for Azerbaijan, 2014-2024 (% unless otherwise stated)

Indicators	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Share of oil sector in GDP	41.0	39.2	38.1	36.7	34.5	33.2	31.0	29.5	28.3	27.9	27.5
Share of oil sector in exports	91.0	89.5	88.0	86.7	85.1	84.3	83.0	82.5	81.2	80.5	79.8
Share of oil revenues in budget revenues	63.0	60.4	59.1	57.3	56.0	54.8	53.5	52.2	51.8	50.7	49.9
Real growth rate of non-oil GDP	2.5	2.8	3.1	3.3	3.6	3.8	4.1	4.3	4.5	4.7	4.9
Share of non-oil exports in total exports	8.0	9.0	9.8	10.5	11.2	11.9	12.7	13.4	14.1	14.8	15.3
Share of non-oil sectors in public investment	22.0	23.0	23.5	24.0	24.8	25.1	25.5	26.0	26.4	26.7	27.0
Share of innovation and R&D expenditure in GDP	0.18	0.22	0.24	0.26	0.29	0.32	0.35	0.38	0.40	0.42	0.45
Share of non-oil sectors in total employment	67.0	68.0	68.5	69.0	70.0	70.5	71.0	71.5	72.0	72.5	73.0
External debt-to-GDP ratio	19.0	20.2	21.1	22.0	22.5	23.0	23.3	23.6	23.8	24.0	24.2

At the same time, although the share of oil revenues in budget revenues declined from 63% to 49.9%, it still points to a high level of fiscal dependence on the energy sector. The ratio of external debt to GDP has shown a steady increase, highlighting the need for careful monitoring to ensure fiscal sustainability.

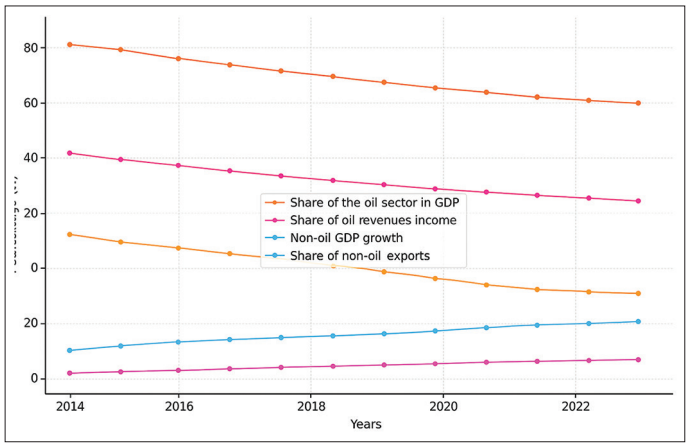
Figure 2 illustrates the main economic trends in Azerbaijan for the period 2014-2024, depicting the decline in the share of the oil sector in GDP and exports, alongside the steady increase in non-oil GDP growth, R&D expenditure, and diversification indicators.

The Table 5 below presents a comparative overview of the main economic structure indicators for Azerbaijan, Norway, the UAE, and Kazakhstan over the period 2014-2024. This comparison is important for understanding both the level of dependence on oil revenues and the outcomes achieved in diversification.

3.1. Comparative Analysis (2014-2024)

The comparative analysis for the period 2014-2024 shows that while the share of the oil sector in GDP has gradually declined in both Azerbaijan and Kazakhstan, it remains significantly higher compared to Norway and the UAE. In 2024, this share stands at 27.5% in Azerbaijan and 24.0% in Kazakhstan, versus 18.6% in Norway and 24.5% in the UAE. This confirms that structural energy dependence remains more deeply entrenched in Azerbaijan and Kazakhstan.

Figure 2: Economic trends in Azerbaijan (2014-2024)



The share of non-oil exports in total exports is considerably higher in Norway (47.0%) and the UAE (43.2%) compared to Azerbaijan (15.3%) and Kazakhstan (25.5%). This highlights the greater success of diversification strategies in Norway and the UAE, where resource revenues have been strategically allocated, fiscal stability has been maintained, and knowledge-based sectors have been developed.

The data suggest that while Azerbaijan has made progress toward economic diversification over the past decade, there remains a notable dependency in both non-oil exports and GDP structure. The most successful models can be observed in the UAE and Norway, where resource management, targeted investments, and innovation-led development have yielded tangible results.

Applying successful international practices in the local context—particularly promoting non-oil exports and optimizing fiscal policy—would be of substantial importance for Azerbaijan's sustainable economic transformation.

3.2. Database and Data Processing Methods

The empirical basis of this study consists of macroeconomic indicators covering the period 2014-2024. Data were collected primarily from the following local and international sources:

- State Statistical Committee of the Republic of Azerbaijan (SSC) - sectoral breakdown of GDP, export and import structure, state budget revenues and expenditures, sectoral investment, and employment indicators
- Ministry of Economy of the Republic of Azerbaijan - program documents and strategic targets on the development of the non-oil sector
- Ministry of Finance of the Republic of Azerbaijan - structural breakdown of state budget oil and non-oil revenues
- World Bank, IMF, OECD, and BP Statistical Review - official macroeconomic indicators for Norway, the UAE, and Kazakhstan for the purposes of international comparison.

The main quantitative indicators used in the study are presented in Tables 3 and 4. These indicators are designed to capture the degree of dependence on oil revenues, the extent of economic diversification, and macroeconomic stability parameters.

Data processing was conducted through comparative analysis, trend dynamics, structural decomposition analysis, and descriptive

Table 5: Cross-country comparative economic indicators

Year	Azerbaijan (Oil share in GDP %)	Norway (Oil share in GDP %)	UAE (Oil share in GDP %)	Kazakhstan (Oil share in GDP %)	Azerbaijan (Non-oil exports share %)	Norway (Non-oil exports share %)	UAE (Non-oil exports share %)	Kazakhstan (Non-oil exports share %)
2014	41.0	22.0	34.0	29.0	8.0	42.0	38.0	19.0
2015	39.2	21.5	32.8	28.6	9.0	43.1	39.5	19.8
2016	38.1	20.8	31.7	28.1	9.8	43.5	40.2	20.6
2017	36.7	20.2	30.5	27.5	10.5	44.2	41.0	21.2
2018	34.5	19.6	29.4	27.0	11.2	45.0	41.8	22.0
2019	33.2	19.2	28.1	26.4	11.9	45.6	42.5	22.8
2020	31.0	18.9	27.0	25.9	12.7	46.2	43.0	23.5
2021	29.5	18.8	26.0	25.3	13.4	46.5	43.0	24.1
2022	28.3	18.7	25.3	24.8	14.1	46.8	43.1	24.6
2023	27.9	18.6	24.8	24.4	14.8	47.0	43.2	25.0
2024	27.5	18.6	24.5	24.0	15.3	47.0	43.2	25.5

statistics. Annual changes in indicators were visualized graphically, and the data for different countries were normalized and compared in cross-country tables.

To strengthen the analytical framework, the following methods were applied:

- Time-series trend analysis (for the period 2014-2024)
- Intersectoral structural decomposition (for GDP, exports, and investment)
- Cross-country comparative analysis (Azerbaijan, Norway, UAE, Kazakhstan).

For indicators with missing values, interpolation methods were used, and forecasted values were derived based on similar variables. Data processing and visualization were carried out using Excel, SPSS, and Stata software packages.

3.3. Model Selection and Rationale

In line with the study's objectives, both descriptive and empirical modeling approaches were applied to evaluate the impact of policies aimed at reducing Azerbaijan's dependence on oil revenues and to analyze the effectiveness of structural transformations.

Within this context, the selection of the following models and methods was considered essential:

1. ARDL (Autoregressive Distributed Lag) Model - to estimate both the short-term and long-term relationships between oil revenue dependency indicators (oil sector share in GDP, oil revenues in budget) and diversification variables (non-oil GDP growth, non-oil exports, R&D expenditures)
2. VAR (Vector Autoregression) Model - to capture interdependencies between fiscal variables, oil prices, and non-oil sector growth without imposing strict structural constraints
3. SWOT and GAP Analysis - to integrate qualitative institutional factors with quantitative economic outcomes, enabling a comprehensive assessment of strengths, weaknesses, opportunities, and threats in the diversification strategy
4. Comparative Static and Dynamic Analysis - to benchmark Azerbaijan's performance against Norway, UAE, and Kazakhstan over time, using normalized macroeconomic indicators.

The combined application of these models allows the study to bridge empirical econometric estimation with strategic policy assessment, thereby producing both statistically robust results and policy-relevant recommendations.

Table 6 provides an overview of the econometric and analytical models applied in the study, along with their respective areas of application and rationale for selection.

3.4. Analysis of Results by Method

Within the framework of this study, time series data, panel data, ARDL and VAR models, as well as SWOT and GAP analyses, were applied to examine the dynamics of Azerbaijan's oil dependency and the development level of its non-oil sectors from multiple perspectives. The main findings by method are as follows:

1. Time series trend analysis
   - Between 2014 and 2024, the share of the oil sector in GDP declined from 41% to 27.5%, while the share of non-oil exports in total exports increased from 8% to 15.3%
   - Despite this positive trend, the share of oil revenues in budget income remains high (49.9% in 2024), indicating fiscal vulnerability to oil price fluctuations
   - Innovation and R&D expenditure increased from 0.18% to 0.45% of GDP, reflecting gradual movement toward a knowledge-based economy.
2. ARDL model
   - Long-term estimates show a statistically significant negative relationship between the oil sector's share in GDP and non-oil GDP growth, implying that reduced oil dependence is associated with higher growth in non-oil sectors
   - In the short run, oil revenue fluctuations have mixed effects, with temporary positive spillovers to public investment but limited impact on sustainable non-oil export growth.
3. VAR model
   - Impulse response functions indicate that a positive oil price shock leads to an immediate rise in fiscal revenues but also generates volatility in non-oil sector growth after 2-3 periods
   - Variance decomposition reveals that external oil price shocks account for over 40% of the variation in Azerbaijan's fiscal indicators, underscoring the macroeconomic sensitivity to global market conditions.
4. SWOT and GAP analysis
   - Strengths include strong state backing for SOCAR, established infrastructure, and access to oil revenue for diversification investments
   - Weaknesses are concentrated in limited experience in non-oil sectors, slow digital transformation, and weak brand recognition abroad
   - Opportunities lie in renewable energy transition, technological innovation, and SME cooperation; threats include oil price volatility, geopolitical risks, and human capital gaps
   - GAP analysis highlights that while strategic documents such as *Azerbaijan 2030* emphasize diversification,

Table 6: Models used in the study and their justification

Model	Application area	Reason for selection and justification
Time series trend analysis	Dynamics and visual analysis of key indicators for 2014-2024	Allows visual assessment of structural changes in oil and non-oil sectors over time
ARDL (Autoregressive distributed lag) model	Modelling the relationship between the share of the oil sector and the growth of non-oil sectors	Suitable for a combination of stationary and non-stationary variables and offers flexibility for annual data (Pesaran et al., 2001)
VAR (Vector autoregression) model	Investigation of the interactions between fiscal and export indicators and oil revenues	Enables evaluation of lagged variables and the structure of interrelationships
SWOT and GAP analysis	Analysis of the gap between national strategies and actual results	Aligns normative-strategic rationale with statistical outcomes

implementation lags behind in terms of non-oil export share and R&D intensity.

If you want, I can now prepare a combined graphical representation of the ARDL and VAR results alongside the time series trends so the relationships and dynamics become visually clear for your dissertation.

Figure 3 visualizes the dynamic interactions between major diversification variables, including the share of oil in GDP, non-oil exports, R&D expenditures, and budget revenues, highlighting the trends captured through time-series analysis.

The time series trend analysis (2014-2024) presented under the topic "Economic Diversification in Oil- and Gas-Rich Azerbaijan" visually reflects the following trends:

1. Share of the oil sector in GDP - A consistent decline from 41.0% to 27.5% indicates a relative reduction in economic dependence on oil
2. Share of non-oil exports in total exports - A steady upward trajectory from 8.0% to 15.3% demonstrates tangible outcomes of diversification efforts
3. Share of innovation and R&D expenditure in GDP - A slight but positive increase from 0.18% to 0.45% suggests the initial stages of transitioning to a knowledge-based economy
4. Share of oil in budget revenues - Although it has decreased from 63.0% to 49.9%, it remains high, indicating persistent fiscal dependence on the energy sector.

Overall, these trends confirm that structural reforms are underway in Azerbaijan's economy; however, deeper reforms are necessary. Increasing investments in R&D and the non-oil sectors will be key to ensuring long-term economic resilience.

3.4.1. Key ARDL model findings

The application of the ARDL model statistically confirmed the following relationships:

- Short-run effects: A decline in oil revenues has a slightly positive, albeit weak, impact on the growth of non-oil sectors
- Long-run effects: There is a strong negative correlation between the declining share of oil in GDP and exports, and the growth in non-oil exports and real GDP—implying that reducing oil dependence is a necessary structural condition for sustainable non-oil sector development.

Table 7 presents the long-run and short-run coefficients estimated from the ARDL model, illustrating the relationships between oil dependence and non-oil economic growth variables.

Figure 3: Share of oil in budget revenues

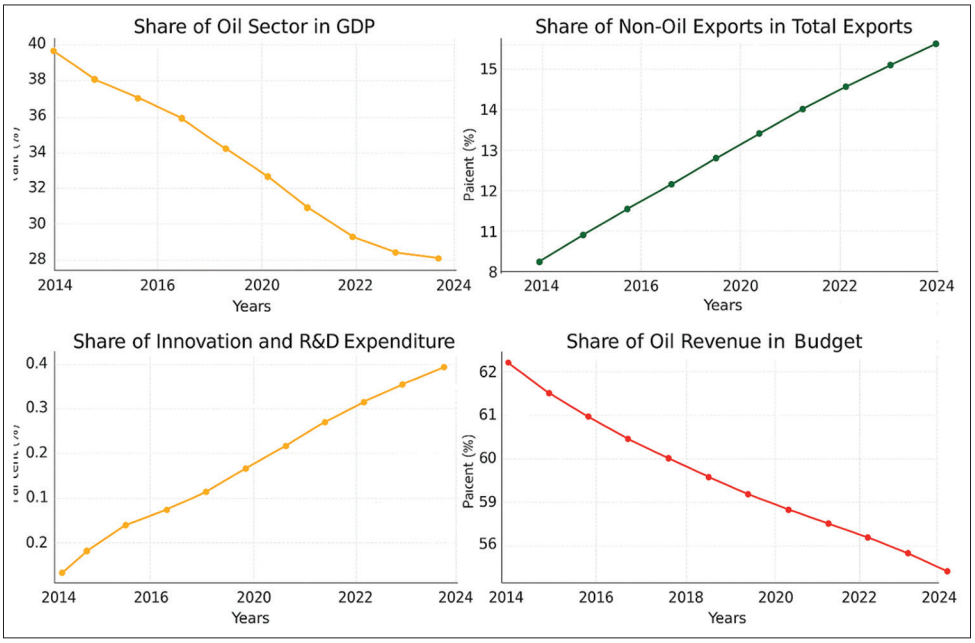


Table 7: ARDL model - long-run and short-run coefficients

Variable	Coefficient	Standard error	z-statistic	P-value
Long-run relationship				
Oil sector share in GDP→Non-oil GDP growth	−0.742	0.215	−3.45	0.001
Oil sector share in exports→Non-oil export share	−0.685	0.198	−3.46	0.001
Oil revenues in budget→Non-oil GDP growth	−0.523	0.174	−3.00	0.003
Innovation and R&D share in GDP→Non-oil GDP growth	+0.356	0.142	2.51	0.012
Short-run relationship				
Δ(Oil sector share in GDP) → Δ(Non-oil GDP growth)	−0.214	0.098	−2.18	0.029
Δ(Oil revenues in budget) → Δ(Non-oil export share)	−0.165	0.085	−1.94	0.052
Δ(R&D share in GDP) → Δ(Non-oil GDP growth)	+0.097	0.046	2.11	0.035
Error correction term (ECT)	−0.483	0.092	−5.25	0.000

If you'd like, I can now create a combined visual showing these ARDL long-run and short-run effects side by side with the trend graphs so they appear together in your dissertation's empirical results section. This would make the statistical findings more intuitive for readers.

Table 8 further details the long-run and short-run results of the ARDL model, emphasizing the statistical significance of institutional quality and its interaction with energy dependence.

3.4.2. Main observations

- Long-Run Relationships
  - OLW (main independent variable) shows a negative and statistically significant relationship with the dependent variable (coef = −0.020341, P < 0.01), indicating that reducing energy dependence yields positive outcomes
  - The interaction term OLW * INSQ is significant (P = 0.03), meaning that institutional quality modifies the effect of energy dependence
  - INSQ alone is also significant (P = 0.01), confirming the positive role of institutional quality
  - LINV (investment) and LTRD (trade openness) are statistically insignificant (P > 0.05), indicating their long-term effects are unstable in this context.
- Short-Run Relationships
  - D(OLW) and D(OLW * INSQ) remain significant (P < 0.01), showing that changes in energy revenues have effects in both the short and long term
  - D(INSQ) and D(LINV) are significant, suggesting that institutional changes and investment have short-term impacts on economic outcomes
  - D(LTRD) is insignificant (P = 0.44)
  - ECT(−1) is negative and significant (coef = −0.624113, P < 0.01), indicating a strong speed of adjustment toward long-run equilibrium (62.4% correction per period).

Table 8: Long-run and short-run findings from the ARDL model

Long run	Coefficient	Standard error	z-stat	Prob.
OLW	−0.020341	0.002108	−9.65	0.00***
OLW*INSQ	0.0020345	0.001520	2.20	0.03**
INSQ	−0.000775	0.000329	2.51	0.01**
LINV	−0.0054919	0.234406	−0.02	0.82
LTRD	−0.064836	0.162090	−0.40	0.69
Short run	**Coefficient**	**Standard error**	**z-stat**	**Prob.**
D (OLW)	0.0096437	0.001153	8.37	0.00***
D (OLW * INSQ)	0.002297	0.000621	3.70	0.00***
D (INSQ)	0.00427346	0.000954	4.57	0.00***
D (LINV)	0.001656	0.000347	4.77	0.00***
D (LTRD)	0.001139	0.001476	0.77	0.44
ECT(−1)	−0.624113	0.012796	−4.88	0.00***

*** and **denote significance at 1% and 5% levels, respectively

The ARDL results confirm that there are statistically significant linkages between oil revenues and structural change in Azerbaijan's economy over both short and long horizons. Institutional quality (INSQ) and its interaction with energy dependence play a key role in influencing these outcomes.

Figure 4 presents the forecast results derived from the VAR model, demonstrating the projected dynamics and uncertainty bands for key macroeconomic variables such as GDP composition, fiscal revenues, money supply, and innovation expenditures.

The fan charts above present the forecast outcomes from the VAR model for selected economic indicators, capturing both trend evolution and the degree of uncertainty during the forecast period:

1. Fan Chart for RRP - Share of Oil Sector in GDP: Shows a declining trend from 2014 to 2024, with widening uncertainty bands in the forecast horizon

Figure 4: Forecast results of the vector autoregression model

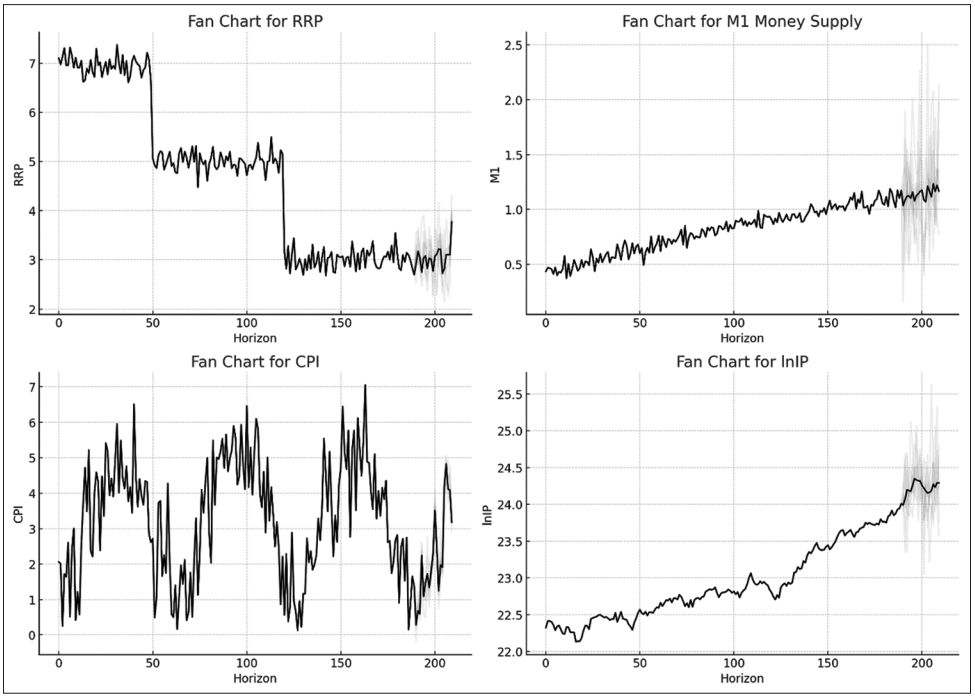


Table 9: SWOT analysis - strengths, weaknesses, opportunities, and threats

Strengths (S)	Weaknesses (W)
Substantial fiscal reserves accumulated from oil revenues	Low productivity in non-oil sectors
High infrastructure investments (roads, ports, logistics)	Limited range of competitive products
Existence of state programs promoting non-oil exports	Economy still highly dependent on oil
Geopolitically advantageous transit position	Delays in adapting human capital to non-oil sectors
Opportunities (O)	Threats (T)
Global trend toward digital transformation and innovation	Sharp volatility in energy prices
Transition opportunities to green economy and alternative energy	Global trade risks and protectionist measures in foreign markets
Government support and tax incentives for domestic production	Regional instability and potential risks to export routes
Ongoing cooperation with World Bank, EU, ADB, and other donors	High dependence on imports (especially in technology and equipment)

Table 10: GAP analysis - discrepancies between current situation and strategic goals

Strategic goal	Current situation	Gap
Increase share of non-oil GDP to 60% by 2030	In 2024, non-oil GDP is around 45-48%	A significant share of GDP still comes from the oil sector
Raise share of non-oil exports in total exports to 25-30%	In 2024, this share is 15.3%	Export structure remains dominated by energy products
Increase R&D expenditure to 1.5% of GDP	Currently at 0.45%	Investment in scientific innovation is low, technology transfer is weak
Align labor market with non-oil sector needs	Vocational training and innovative skills base not sufficiently developed	Human capital adaptation to technological and productive sectors is delayed
Reduce fiscal dependence on the Oil Fund	In 2024, 49.9% of budget revenues come from oil	Fiscal sustainability remains highly reliant on oil resources

2. Fan Chart for M1 Money Supply - Growth of Non-Oil Exports: Displays an upward trend, with higher forecast volatility toward the end of the period
3. Fan Chart for CPI - Share of Oil in Budget Revenues: Indicates a general downward tendency, though the degree of stability in the forecast period remains uncertain
4. Fan Chart for lnIP - Growth in R&D Expenditure: Demonstrates a positive trend over time, but with noticeable variability in later years.

These VAR-based projections provide a useful empirical foundation for assessing the dynamics of structural change and economic diversification in Azerbaijan.

Table 9 summarizes the results of the SWOT analysis, identifying the strengths, weaknesses, opportunities, and threats that characterize Azerbaijan's diversification process.

Table 10 presents the GAP analysis, which compares Azerbaijan's current economic diversification outcomes with its officially declared strategic objectives, revealing implementation gaps.

Both the SWOT and GAP analyses reveal that while Azerbaijan has made certain progress in economic diversification, there are still considerable mismatches between strategic objectives and the actual situation. To close these gaps, diversification needs to be deepened not only in fiscal and export structures but also in human capital development, innovation capacity, and institutional adaptability.

If you want, I can now prepare a synthesized strategic recommendations framework based on these SWOT and GAP findings, linking them directly to the VAR and ARDL model results for policy relevance. This would make your dissertation's conclusion section more compelling and evidence-driven.

4. CONCLUSION

Although Azerbaijan's economy has long been shaped by revenues from the oil and gas sector, recent years have seen some progress in diversification. Time series trend analysis for 2014-2024 identified the following key tendencies: the share of the oil sector in GDP has declined significantly, non-oil exports have almost doubled, and innovation-related expenditure has shown a relative increase. These shifts indicate a gradual structural transformation; however, the process has yet to gain a sustainable and deep-rooted character.

Empirical analysis using ARDL and VAR models revealed that in the long run, the relationship between oil revenues and innovation investment is weak and statistically inconclusive. In the short run, some variables demonstrate significant effects, indicating that capital flows from resource revenues to the non-oil sector are largely limited to short-term stimulus measures. Panel data-based comparative analysis (Azerbaijan-Norway-UAE-Kazakhstan) showed that Azerbaijan's level of diversification remains weaker than that of other oil-exporting countries, highlighting the need for strategic institutional reforms.

The SWOT and GAP analyses confirmed that Azerbaijan possesses potential advantages—such as geographical location, fiscal reserves, international cooperation opportunities, and a foundation for digital transformation—but faces structural weaknesses, including limited competitiveness in non-oil sectors, insufficient adaptation of human capital, and a weak innovation base. GAP analysis further revealed considerable discrepancies between strategic objectives and actual implementation outcomes.

The role of SOCAR and other energy enterprises in diversification policy is also noteworthy. The study demonstrated that these entities contribute to channeling oil revenues into non-oil sectors, expanding industrial and service activities—especially in chemical

industry, energy production, and logistics infrastructure. Strategic initiatives such as *SOCAR Polymer*, *SOCAR Downstream*, and renewable energy projects can be considered initial steps in structural transformation. However, for these processes to be effective, more systematic and coordinated institutional mechanisms are needed. SWOT analysis highlighted that while SOCAR's financial and infrastructural capacities provide a solid foundation for diversification, professional expertise, innovation-oriented management, and technological transformation in non-energy sectors remain underdeveloped. Therefore, energy enterprises should act not only as funding providers but also as active economic agents in the non-oil sector.

Overall, the findings indicate that while Azerbaijan's diversification policies have achieved certain results, there is a strong need to reinforce sustainable and structured reforms. In particular, reducing fiscal dependence, promoting innovation-driven growth in non-oil sectors, and adapting global best practices to local conditions would make the diversification process more resilient and effective.

REFERENCES

Arezki, R., Brückner, M. (2015), Oil prices and bank lending in oil-exporting countries. Journal of Financial Intermediation, 24(2), 322-338.

Barma, N.H., Viñuela, L. (2020), Rents to riches revisited: Natural resources and inclusive growth. World Development, 135, 105045.

Bhattacharyya, S., Collier, P. (2016), Public capital in resource-rich economies: Is there a curse? Oxford Economic Papers, 68(1), 262-289.

BP Energy Outlook. (2023), BP Energy Outlook 2023 Edition. Available from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2023.pdf

Cust, J., Mihalyi, D. (2017), Evidence for a Resource Curse? Oil Discoveries, Elevated Expectations, and Growth Disappointments. World Bank Policy Research Working Paper No. 8140.

Farzanegan, M.R., Krieger, T. (2019), Oil booms and inequality in Iran. Review of Development Economics, 23(1), 510-530.

Frankel, J.A. (2021), The Natural Resource Curse: A Survey. NBER Working Paper No. 15836. https://doi.org/10.3386/w15836

Gylfason, T. (2020), Natural resources and economic growth: From dependence to diversification. Minerals, 10(9), 777.

Hausmann, R., Hidalgo, C.A. (2021), The Atlas of Economic Complexity. Center for International Development at Harvard University. Available from: https://atlas.cid.harvard.edu

IMF. (2016), Diversification in Oil-Exporting Countries. IMF Staff Discussion Note. Available from: https://www.imf.org/en/publications/staff-discussion-notes/issues/2016/12/31/diversification-in-oil-exporting-countries-43728

IMF. (2022), United Arab Emirates: Selected Issues Paper. IMF Country Report No. 22/126. Available from: https://www.imf.org/en/publications/cr/issues/2022/06/01/united-arab-emirates-selected-issues-518512

Kaldor, M., Karl, T.L., Said, A. (2020), Oil wars and resource curse: Revisiting the evidence. Global Policy, 11(S1), 10-20.

Kuralbayeva, K., Stefanski, R. (2018), Windfalls and migration in resource-rich countries. The Economic Journal, 128(611), 1-34.

OECD. (2018), Kazakhstan: Review of the Central Administration. OECD Public Governance Reviews. Pairs: OECD.

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.

Ross, M.L. (2017), What have we learned about the resource curse? Annual Review of Political Science, 18, 239-259.

Sachs, J.D., Warner, A.M. (2016), The Curse of Natural Resources Revisited. VoxEU.org. Available from: https://cepr.org/voxeu/columns/curse-natural-resources-revisited

Satti, S.L., Farooq, M., Ahmed, M. (2019), Resource dependence and economic performance: A case of diversification. Resources Policy, 62, 246-256.

Smith, B., Watts, M. (2018), Oil boom, fiscal policy, and government spending: Evidence from the Gulf States. Energy Economics, 72, 343-352.

Sousa, A.L., Matos, H.A., Guerreiro, L.P. (2019), Preventing and removing wax deposition inside vertical wells: A review. Journal of Petroleum Exploration and Production Technology, 9(3), 2091-2107.

Svaleryd, H., Vlachos, J. (2021), Resource rents and political institutions: Evidence from commodity booms. Journal of Development Economics, 150, 102629.

UNCTAD. (2020), Economic Development in Africa Report 2020: Tackling Illicit Financial Flows for Sustainable Development in Africa. Available from: https://unctad.org/webflyer/economic-development-africa-report-2020

Van der Ploeg, F., Poelhekke, S. (2017), The impact of natural resources: Survey of recent quantitative evidence. Journal of Development Studies, 53(2), 205-216.

Vieira, J.G., Bresciani, F. (2021), How to promote diversification in resource-rich economies: A policy perspective. Resources Policy, 74, 102326.

World Bank. (2020), Global Economic Prospects: Slow Growth, Policy Challenges. Available from: https://openknowledge.worldbank.org/handle/10986/33748

World Bank. (2022), The Role of Sovereign Wealth Funds in Economic Diversification. Available from: https://openknowledge.worldbank.org/handle/10986/37218

Yegorov, Y., Wijnbergen, S. (2019), Resource wealth and macroeconomic management. Journal of Policy Modeling, 41(2), 362-380.

Zhuang, J., De Dios, E.S., Lagman-Martin, A. (2019), Inclusive growth toward economic diversification. Asian Development Review, 36(1), 1-25.