Palacký University Olomouc
University of Clermont Auvergne
University of Pavia

MASTER THESIS

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GLODEP 2024

Managing resource revenues in oil-rich countries

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May 2024

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Erasmus Mundus Joint Master's Degree in Global Development Policy (GLODEP)

Palacký University Olomouc

University of Clermont Auvergne

University of Pavia

Declaration

I, Alina Zhalturova, declare that the Master's Thesis titled *"Managing resource revenues in oil-rich countries"* submitted to GLODEP Consortium is the product of my independent research, conducted under the supervision of Professor Jean Francois Brun. I have properly acknowledged and attributed all the materials and sources utilized in its preparation.

Date: 29 May 2024

UNIVERZITA PALACKÉHO V OLOMOUCI

Přírodovědecká fakulta

Akademický rok: 2023/2024

ZADÁNÍ DIPLOMOVÉ PRÁCE

(projektu, uměleckého díla, uměleckého výkonu)

Jméno a příjmení:	**B.A. Alina ZHALTUROVA, M.A.**
Osobní číslo:	**R220698**
Studijní program:	**N0588A330004 Global Development Policy**
Téma práce:	**Managing resource revenues in oil-rich countries**
Zadávající katedra:	**Katedra rozvojových a environmentálních studií**

Zásady pro vypracování

While resource management in oil-rich nations has received considerable attention, a nuanced exploration of effective strategies remains crucial. This study aims to
investigate the dynamics of managing resource revenues in oil-rich countries, focusing on both economic and governmental implications. The primary focus of the
study will be on the comparative analysis of countries with different economic and geo-political landscapes in order to unveil distinctive approaches and to provide
a comprehensive understanding of the challenges and opportunities associated with resource revenue management. Utilizing a mixed-methods approach, the research
will delve into the governance structures, as well as economic diversification efforts within these nations, contributing valuable insights for policymakers and scholars
in the field.

Rozsah pracovní zprávy:	**10-15 000 words**
Rozsah grafických prací:	**as needed**
Forma zpracování diplomové práce:	**tištěná/elektronická**
Jazyk zpracování:	**Angličtina**

Seznam doporučené literatury:

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Datum zadání diplomové práce: **9. ledna 2024**
Termín odevzdání diplomové práce: **31. května 2024**

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V Olomouci dne 15. ledna 2023

GLODEP

Funded by the Erasmus+ Programme of the European Union

Declaration of honour on the use of AI

During the writing of the submitted thesis, I used ChatGPT and Grammarly to ensure grammatical accuracy and coherence of the text of my thesis. After using these AI tools, I declare that I have reviewed and edited the text and I take full responsibility for the content of the submitted thesis.

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Acknowledgements

I would like to express my sincere gratitude to all those who made this thesis possible.

First and foremost, I would like to thank my supervisor, Professor Jean Francois Brun, for their exceptional guidance, patience, and unwavering support throughout the course of this research. Their knowledge and expertise have been instrumental in shaping this thesis.

I owe a special thanks to my GLODEPmates, who became my second family and contributed immensely to both my personal and professional growth.

Above all, I would like to extend my heartfelt thanks to my family and friends from all over the globe for their boundless love, support, and encouragement. To my grandma, whose wisdom and love have been my guiding light. To my dad, your unwavering belief in me has given me the strength to overcome all challenges. To my two younger sisters, Tomiris and Laura, who are my greatest motivation and the reason behind all my achievements.

Lastly, I thank all others who contributed directly or indirectly to this work. Thank you.

Abstract:

This thesis investigates the management of natural resource revenues, particularly focusing on oil, in developing countries and its impact on government expenditures across various sectors. Given the complexities of the "resource curse" and economic development, this study employs a robust empirical analysis using a panel dataset from 47 countries over the period from 2009 to 2021. The study examines how resource revenues influence spending in health, education, and military sectors, contingent upon governance quality and economic conditions. The findings reveal that higher oil revenues correlate with increased public expenditure, particularly in countries with robust governance structures. Case studies of Mexico and Kazakhstan provide comparative insights into different approaches to managing oil wealth and their outcomes. The research underscores the importance of economic diversification, stabilisation mechanisms, and strategic investments in human capital for achieving sustainable development. Policy recommendations are provided to guide resource-rich countries in optimising their natural resource revenues to foster long-term economic growth.

Keywords: *resource revenue management, oil-rich countries, government expenditure, resource curse, oil boom.*

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List of Abbreviations

IV	Instrumental Variables
OECD	Organisation for Economic Cooperation and Development
PIH	Permanent Income Hypothesis
GNP	Gross National Product
GDP	Gross Domestic Product
USSR	Union of Soviet Socialist Republics
FDI	Foreign Direct Investment
VAT	Value Added Tax
OPEC	Organisation of the Petroleum Exporting Countries
EIA	Energy Information Administration
IRENA	International Renewable Energy Agency
BP	British Petroleum
VMD	Variational Mode Decomposition
WTI	West Texas Intermediate
EU	European Union
USA	United States of America
IMF	International Monetary Fund
WHO	World Health Organisation
WGI	Worldwide Governance Indicators
PCSE	Panel-Corrected Standard Errors
VIF	Variance Inflation Factor
GLS	Generalised Least Squares
PCA	Principal Component Analysis
GMM	Generalised Method of Moments
2SLS	Two-Stage Least Squares
STEM	Science, Technology, Engineering and Mathematics

Introduction

The management of natural resource revenues, especially from oil, plays a pivotal role in shaping the fiscal landscapes of developing countries. Mostly, this is because these countries use resource revenues to finance public spending and stimulate economic growth (Sachs and Warner, 1995). However, the relationship between natural resource wealth and economic development is complex and multifaceted, and it has been the subject of extensive academic and policy discussions, given the potential for both positive and negative outcomes (Karl, 1997). While some countries have successfully utilised their natural resource wealth to achieve sustainable development, others face economic instability and governance problems, often referred to as the "resource curse" (Auty, 1993; Collier and Hoeffler, 2005).

This study explores the impact of natural resource revenues on government expenditures in developing countries, with a particular focus on understanding how these revenues influence spending patterns across different sectors. The study hypothesises that higher oil revenues are correlated with higher public expenditure on health, education, and military, contingent upon the quality of governance and prevailing economic conditions. By examining a comprehensive panel dataset comprised of 47 countries over the period from 2009 to 2021, this research aims to provide robust empirical evidence to support or refute this hypothesis, as well as to contribute to the existing literature on resource revenue management and offer policy recommendations for optimising the use of natural resource revenues.

The findings of this study are intended to contribute to the broader discourse on the management of natural resource revenues in developing countries. They provide insights into the critical role of governance and economic conditions in shaping the effective utilisation of these revenues. Moreover, the policy implications derived from this research are particularly relevant for countries like Kazakhstan and Mexico, which have experienced challenges related to resource dependency. By highlighting the need for economic diversification, the establishment of stabilisation mechanisms, and strategic investments in human capital, this study offers valuable recommendations for policymakers aiming to transform natural resource wealth into sustainable economic growth.

The structure of this thesis is as follows: Chapter 1 provides a literature review and theoretical framework, including the "resource curse", Dutch Disease, and the Permanent Income Hypothesis. It also presents case studies of Mexico and Kazakhstan, illustrating the diverse experiences of resource-rich countries. Moreover, in this part, the impact of various shocks on resource income management

is discussed, namely the impact of thhe COVID-19 pandemic, climate change, and the geopolitical situation in the world. Chapter 2 describes the research design, data sources, and econometric specifications used to analyse the impact of natural resource revenues on public expenditure. It also includes a descriptive analysis of the dataset. Chapter 3 presents the results of the regression analyses and robustness checks, such as lagged effects analysis, instrumental variables (IV) analysis, and subgroup analyses, discussing the implications of the findings for understanding the relationship between resource revenues and public expenditure. Chapter 4 summarises the main findings, evaluates the hypotheses, and offers policy recommendations for managing natural resource revenues in developing countries.

By addressing these objectives and questions, this thesis aims to provide a nuanced understanding of the impact of natural resource revenues on public expenditure and contribute to the formulation of effective policies for resource-rich developing countries.

Chapter 1. Literature Review and Theoretical Framework of Resource Revenue Management

1.1 Resource Curse and Revenue Management: Theoretical Models and Global Perspectives

The “resource curse”, as described by Auty (1993), highlights a paradox where countries rich in natural resources, notably oil or gas, may exhibit poorer economic performance and governance compared to those less reliant on such exports. In contrast, nations such as Singapore, Japan, and South Korea have shown that high economic development is achievable without substantial natural resources. While resource-abundant economies typically experience lower growth rates (Sachs and Warner, 1995), exceptions such as Norway and Canada show that developed democracies can successfully manage commodity exports (Siegle, 2005).

The explanation for this paradox lies in the intrinsic characteristic of non-renewable natural resources, as outlined in the OECD's Policy Guidance for Resource-rich Countries (2019). These include their finite nature, high volatility, and the potential to trigger “Dutch disease” - a term denoting the adverse economic impacts of resource wealth, such as currency appreciation and reduced competitiveness of other economic sectors (Brahmbhatt et al., 2010). Addressing these challenges necessitates a balanced and effective strategy for resource revenue management that considers the many components and characteristics of the resource economy, in particular the role of taxation (Lemgruber, 2014) and institutional aspects such as corruption and the rule of law (Bhattacharyya and Hodler, 2010).

In the discourse on resource revenue management, The Permanent Income Hypothesis (PIH) and the Dutch Disease emerge as critical theoretical aspects. The Permanent Income Hypothesis introduced by Milton Friedman (1957) suggests that consumption should be based on expected lifetime income rather than current income. In the context of oil revenue management, PIH suggests that during the fluctuation of oil prices, countries should save the windfalls from high oil prices rather than increase public spending or reduce taxes temporarily, which generally can help stabilise economies and promote intergenerational equity (Hayashi, 1982). Djiofack et al. (2011) explored how the PIH could make public finances in oil-depleting countries less vulnerable during post-oil transitions, though they note it doesn't necessarily improve long-term growth or household welfare.

While the Permanent Income Hypothesis offers a strategy for the prudent financial management of resource windfalls, the Dutch Disease phenomenon highlights potential economic challenges that might arise from these windfalls due to currency appreciation and shifting labor markets (Brahmbhatt et al., 2010). Basically, it happens because the resources shift from tradable to non-tradable sectors

occurs due to increased consumption, the so-called “spending effect”. In turn, this leads to inefficient resource allocation since temporary shocks are often misjudged as permanent (Collier and Gunning, 1999). An example of this is Australia, which experienced mining booms from the second half of the 20th century to the early 21st century. These booms had a positive impact on the local currency, the Australian dollar, but a negative impact on manufacturing and other sectors of the economy, although there was overall GDP growth (Koitsiwe and Adachi, 2015). It showcases the importance of exchange rate containment policies and economic diversification in the context of Dutch Disease.

Collier and Gunning (1999) argue that sustainable development in resource-abundant nations necessitates a sophisticated approach to managing windfall profits, with options for both public and private sector involvement. Governments can act as custodians, directly utilising or redistributing windfall revenues, benefitting the private sector through various means, such as an increase in the supply of goods and services, as well as through subsidies, tax reductions, transfer payments, or wage increases. Alternatively, windfall gains may be partially or completely transferred to private entities, as seen in the case of Mexico with oil revenues.

Similarly, revenues initially accruing to private agents can be redirected to the public sector, including through export taxation mechanisms. Collier and Gunning (1999) note that non-neutral tax systems can shift revenues from the private to the public sector during external shocks, notably in trade tax-dependent developing countries. For instance, Kenya, without directly taxing coffee exports during the 1976-1979 boom, effectively generated about half of the export profits via significant import taxes, illustrating an unforeseen redistribution of revenues in favor of the state through a tax system that was not adapted to external economic shocks (Collier and Gunning, 1999).

To conclude, effective management of resource revenues in oil-rich countries is complex and multifaceted, demanding an approach that transcends traditional economic strategies. It is vital to recognise the temporal nature of resource booms, the economic distortions they can cause, and the importance of governmental transparency and adaptability. This section highlights the necessity for a balanced approach that draws from both theoretical insights and global case studies aiming to foster sustainable growth and mitigate the challenges of resource dependence.

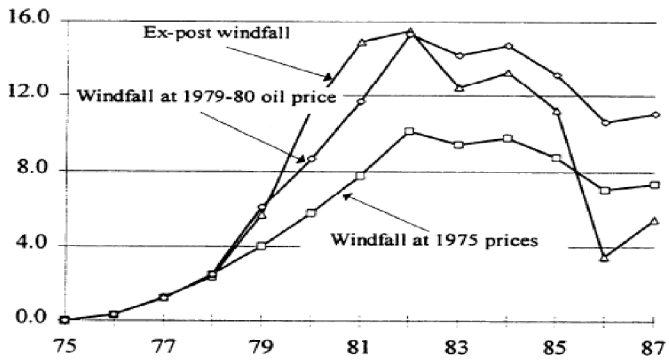
1.2 Case studies – Mexican and Kazakh Oil Booms

1.2.1 The Mexican Oil Boom

Latin American countries have long been prominent players in the international oil market (Yakovlev, 2019). In this context, Mexico's experience as one of the 15 largest oil exporters globally and the second-largest in Latin America after Brazil offers valuable insights into resource revenue management (CIA, 2021). Notably, oil has only been a central aspect of Mexican politics twice: first, during the nationalisation of the oil industry in the late 1930s, and second, during the oil boom of the 1970s and 1980s. This latter period, particularly between 1977 and 1985, not only witnessed a sharp increase in oil production and exports but also contributed to the country's economic crisis and the eventual decline of the Mexican regime (Gelman, 2010).

The discovery of significant oil fields in the early 1970s, especially the Cantarell field in the Bay of Campeche, propelled Mexico into the ranks of the leading oil powers. This boom coincided with rising global oil prices during the administration of President José López Portillo (1976-1982), who capitalised on this oil windfall to accelerate economic development and mitigate external debt (Grayson, 1981). The government accrued all oil revenues, significantly impacting the nation's economic trajectory. The economic impact of the boom was substantial, with oil windfalls reaching approximately 8% of GNP at its peak (Collier and Gunning, 1999). Figure 1 illustrates the petroleum windfall in Mexico from 1975 to 1987, showing actual windfalls at 1975 prices, hypothetical recalculations at 1979-1980 prices, and ex post figures. This graph highlights the volatile nature of oil revenues, particularly the unexpected sharp decline in the mid-1980s, underscoring the challenges in forecasting the boom's magnitude and duration from early expectations.

Figure 1. The petroleum windfall in Mexico, 1975-1987 (Billion 1988 $)



Source: Collier and Gunning, 1999

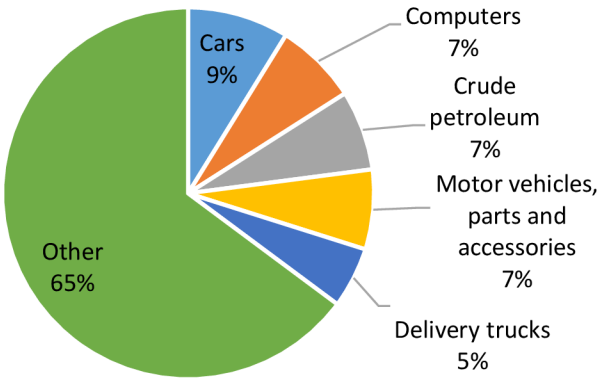
Although the boom was considered temporary, the government did not fully anticipate its short-term nature. It embarked on ambitious infrastructure projects, expanded social programs, and pursued aggressive industrialisation strategies, leading to booms in production and investment. However, the administration failed to manage the growing demands of distribution coalitions and the increasing external debt, resulting in capital outflow and peso devaluation in 1981 as oil prices fell (Collier and Gunning, 1999).

Subsequently, President Miguel de la Madrid's tenure (1982-1988) was marked by the nationalisation of the banking system and currency devaluation, leading Mexico to declare its inability to service its external debt. Debt restructuring negotiations were prolonged, only concluding in 1985 following further devaluations and economic reforms. Yet, a late 1987 oil price slump triggered inflation rates exceeding 159%, marking the 1980s as Mexico's "Lost Decade" (also referred to as "Decada perdida") (Gelman, 2010; Stroganov, 2008).

Pemex, Mexico's state-owned petroleum company, played a pivotal role during the oil boom. Pemex has been instrumental in directing oil revenues to the national treasury, holding a monopoly over the exploration, extraction, and export of the nation's oil resources. Despite the sector's liberalisation, Pemex continued to dominate, accounting for 96% of petroleum production in 2019, with private firms contributing a mere 4% (EIA, 2023). The taxation framework imposed on Pemex, comprising a profit-sharing fee that was reduced from 65% to 40% in 2021, a hydrocarbon extraction fee, and corporate income tax which accounts for 30%, has historically placed a significant tax burden on the company (Shah, 2021). This taxation regime not only limits Pemex's ability to invest in its growth but also highlights a broader economic challenge: Mexico's heavy reliance on oil revenues to fund government expenditures.

Recognising this, recent reforms aimed at reducing the tax burden on Pemex represent steps towards revitalising the company and easing Mexico's fiscal reliance on oil. As shown in Figure 2, the top components of Mexico's export portfolio now include cars ($41.5B), motor vehicles ($30.7B), computers ($30.3B), delivery Trucks ($27.1B), and crude petroleum ($20.3B) (OEC, 2023). The tourism sector, generating approximately $19.5 billion annually, has become a critical component of the national economy, evidencing successful diversification efforts beyond oil. This shift shows Mexico's resilience and adaptability in transitioning towards a more balanced economic model (CIA, 2021).

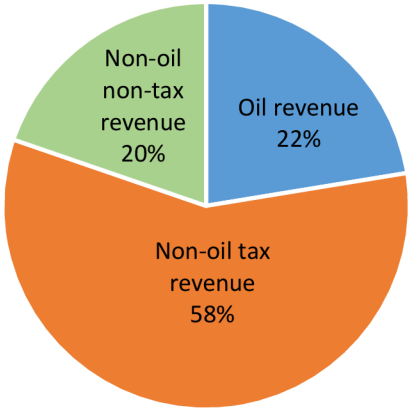
Figure 2. Structure of Mexico's exports in 2022



Source: compiled by the author based on the OEC data

The Mexican oil boom of 1977-1985, while a period of economic euphoria driven by substantial oil revenues, eventually underscored the vulnerabilities of an oil-dependent economy. The subsequent economic crises and the challenges faced by later administrations in managing the boom's aftermath revealed the complexities of resource revenue management. Today, Mexico's diversified economy, with a robust manufacturing sector and a thriving tourism industry, suggests successful mitigation of the "resource curse". This economic transformation is reflected in the composition of Mexico's budgetary revenues. As shown in Figure 3, while oil revenue still comprises 22% of the total budget in 2022, the majority is now drawn from non-oil tax and non-tax revenues, illustrating a broadened economic base. While oil revenues make up a significant portion of the budgetary revenue, the larger picture is that these revenues are no longer the sole pillar of the economy since this type of revenue comprises only 2.5% of GDP in 2020 and 5% in 2022 (IMF, 2023).

Figure 3. Structure of Mexico's total budgetary revenue, 2022



Source: compiled by the author based on the IMF data

This backdrop provides a stark contrast to Kazakhstan, where the economy remains less diversified and more heavily reliant on oil and gas. The Kazakh oil boom, though pivotal for its economic growth, has not yet led to the economic restructuring that Mexico has successfully implemented over the decades.

1.2.2 The Kazakh Oil Boom

Following the collapse of the USSR, Kazakhstan, alongside other post-socialist countries such as Russia, Azerbaijan, and Central Asian countries, encountered significant challenges in revitalising an underdeveloped national economy and strengthening weak state institutions. Inheriting vast mineral reserves, including crucial oil and gas resources, Kazakhstan was on the brink of an economic transformation (Bayanova, 2017). The discovery of massive oil fields like Tengiz in 1979 and Kashagan in 2000 marked the onset of Kazakhstan's prominence in the global oil sector (Campaner and Yenikeyeeff, 2008), ranking 12th in the world for proven oil reserves (OPEC, 2022).

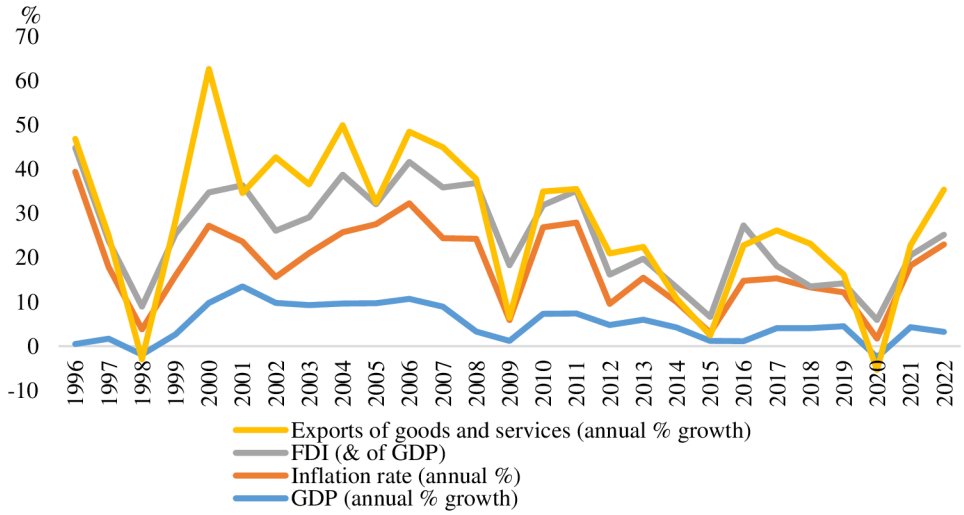
Thus, in the period following Kazakhstan's independence in 1991, particularly from the early 2000s onwards, Kazakhstan experienced what is commonly referred to as the Kazakh oil boom. This phase significantly altered the nation's economic landscape, utilising its abundant natural resources to foster development, reduce poverty, and elevate its GDP per capita (Aliev, 2015), entering the upper-middle-income group of countries by 2006[1] (Hamadeh et al., 2023).

As Kazakhstan navigated through the prosperity brought by the oil boom, it also faced the challenges inherent in such windfalls. Figure 4 showcases the GDP growth rate, inflation rate, foreign direct investment (FDI) as a percentage of GDP, and export growth rate, providing a multifaceted view of the economic impact of the oil boom. Throughout the oil boom era, lasting to the present day, Kazakhstan experienced significant fluctuations in economic performance influenced by the global economic environment and the inherent volatility of oil export dependency, which was particularly evident during the 2008-09 global crisis. In response, the Kazakh government embarked on initiatives

[1] The World Bank classifies countries by income level based on gross national income (GNI) per capita and assigns them to four groups: low, lower-middle, upper-middle and high income. The classifications re updated annually on July1. As of July, 1 2023 (i.e. FY2024), the classification is as follows:
- Low-income countries: $1,135 or less. Low-income countries: $1,135 or less;
- Lower-middle income countries: $1,136 to $4,465;
- Upper middle-income countries: $4,466 - $13,845;
- High-income countries: US$13,845 or more.

aimed at economic diversification, inspired by successful global models such as Norway's sovereign wealth fund (Zhelev, 2019). The National Fund of the Republic of Kazakhstan was established in 2000, one of the main objectives of which is to reduce the dependence of the republican and local budgets on the world price situation through the accumulation and reinvestment of oil revenues (Government of the Republic of Kazakhstan, 2001).

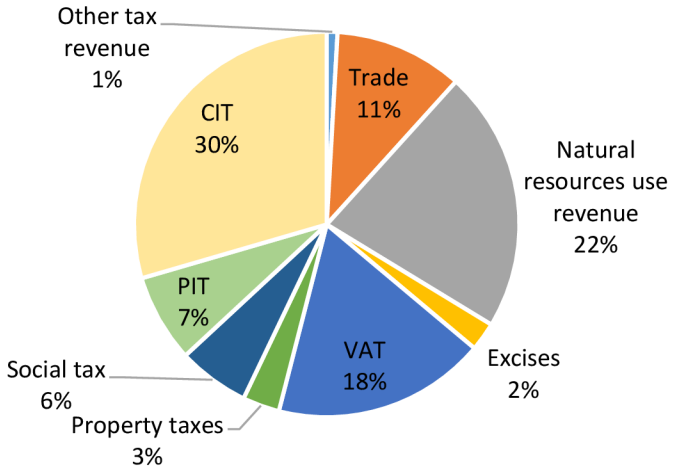
Figure 4. Macroeconomic data of Kazakhstan, 1996-2022



Source: Compiled by the author based on the World Bank data

Adding to the complexity of Kazakhstan's oil boom narrative, the taxation regime for oil and gas companies underscores the sector's significant impact on the country's revenue stream. Figure 5 is a graphical representation of Kazkahstan's tax revenue structure from 2005 to 2021, which underscores the significant contribution of oil and gas to the national budget. The composition of tax revenues, as illustrated, emphasises the heavy reliance on corporate income tax, value-added tax, and notably, natural resources use revenue, providing a clear picture of the fiscal impacts of the oil sector. Remarkably, 8 out of the ten largest taxpayers in Kazakhstan are involved in the extraction of oil and associated gas, showing the industry's substantial contribution to the national budget (Ranking.kz, 2023). Companies engaged in oil and gas extraction are subject to a special rent tax on exports, which is contingent on global crude prices. This tax structure ensures that higher oil prices result in increased budget contributions. For instance, the tax rate for oil prices between $40 to $50 per barrel is 7%, and for prices between $50 to $60 per barrel, it's 11%. The corporate income tax rate stands at 20%, and VAT at 12%, adding layers to the taxation landscape (Orazbaeva, 2024).

Figure 5. Kazakhstan's composition of tax revenues (average 2005-2021)



Source: compiled by the author based on the World Bank data

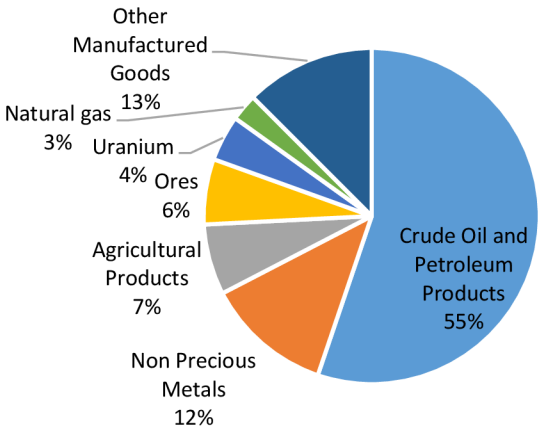
Yet, challenges in diversification persist, as illustrated in Figure 6, which represents Kazakhstan's export structure in 2023, showing a continued heavy skew towards oil. The challenge of diversifying the Kazakh economy can also be partly explained by the country's small population and limited domestic market despite its large territory (9th in the world) (Aliev, 2015). Additionally, Kazakhstan is a landlocked country, which restricts its potential for international trade and transportation routes.

Furthermore, recognising the need for sustainable management of oil wealth, Kazakhstan instituted measures to ensure intergenerational equity of oil revenues. In 2024, the Ministry of Finance launched the "National Fund for Children" project. It distributes half of the investment income of the National Fund annually among children up to 18 years old. The projected savings for a child up to 18 years of age may amount to about USD 3.5 thousand (Ministry of Finance of the Republic of Kazakhstan, 2023).

However, the journey towards economic stability and growth is plagued by governance issues, notably low institutional quality and prevalent corruption, which hinder effective reform and democratisation efforts (Kolstad and Søreide, 2009). According to Freedom in the World 2021 Country Report, the level of political rights and civil liberties in Kazakhstan remains low, partly due to the country's insufficient legal framework to ensure free and fair elections (Freedom House, 2021). In 2023,

Kazakhstan scored 39 points out of 100 on the Corruption Perceptions Index[2] (Transparency International, 2023). In response, the Government established the Anti-Corruption Agency of the Republic of Kazakhstan in 2019.

Figure 6. Kazakhstan's export structure, 2023



Source: Compiled by the author based on QazTrade data

In conclusion, the case of Kazakhstan's oil boom reflects the fundamental obstacles and advantages brought by extensive natural resource wealth. While the boom has triggered substantial economic changes and brought a period of prosperity, it has also underscored the vital importance of diversification and effective governance to counteract the negative effects of the "resource curse", as voiced by many experts.

The trajectories of Mexico and Kazakhstan provide insightful contrasts in managing oil wealth. While both nations experienced significant economic gains from their oil booms, their long-term outcomes diverge markedly due to differences in economic policies, governance structures, and diversification efforts. Mexico's shift towards a diversified economy highlights a proactive approach to mitigating the risks associated with resource dependency. In contrast, Kazakhstan's continued reliance on oil underscores the challenges that lie in transitioning from an oil-dependent economy to a more diversified one. This comparative analysis not only reflects the unique contexts of each country but also illustrates broader lessons for resource-rich developing nations.

[2] The Corruption Perception Index (CPI) is an index developed by the non-governmental organization Transparency International to assess the perceived levels of public sector corruption, as determined by expert assessments and opinion surveys. The index is published annually and ranks 180 countries on a scale from 100 (very clean) to 0 (highly corrupt).

1.3 Current Challenges in Resource Revenue Management

In recent years, the global oil market has been exposed to a series of unforeseen events that have highlighted its fragility, as well as the vulnerability of resource-abundant economies. These challenges have arisen from various sources, such as global pandemics, geopolitical conflicts, and climate change. To ensure economic sustainability and resilience to future shocks, resource-rich countries must adapt their resource revenue management strategies. This requires a clear and logical approach that takes into account the challenges posed by such events (EITI, 2022).

1.3.1 New Shocks and Their Impacts

The COVID-19 pandemic is a prime example of how external shocks can have a detrimental impact on the economies of oil-exporting countries. The decline in oil demand and the drop in prices to $20 per barrel of Brent crude oil by the end of Q1 2020 compelled oil-exporting countries to reassess their financial strategies and explore options for economic diversification. The OPEC+[3] agreement on production cuts was a short-term measure to stabilise prices. However, it highlights the need to develop more flexible and sustainable approaches to managing natural resource revenues (Mitrova et al., 2020). Thus, the U.S. Energy Information Administration's monthly data show that OPEC's total crude oil production declined by 6.0 million b/d between April and May of 2020. Therefore, it is the largest monthly production decline since 1993 (EIA, 2020).

Against this backdrop, analysing the relationships between major oil producers during the pandemic deserves special attention. For instance, the 2020 oil war between Russia and Saudi Arabia highlights the complexity of geopolitical and economic interactions in the global oil market. Disagreements that arose amid attempts to stabilise oil prices led to a brief but acute conflict, which combined with the pandemic, resulted in additional pressure on prices (Ma et al., 2021).

Therefore, it is important to note that in the context of resource management, new realities are forcing countries to rethink their financial strategies. One such reality is global climate change. In this regard, the intensification of global efforts to combat climate change and the transition to renewable energy

[3] The Organisation of the Petroleum Exporting Countries (OPEC) is an international intergovernmental organisation established by leading oil-producing countries in order to collectively influence the global oil market and maximise profit. OPEC+ is a community of non-OPEC states, but cooperating with the organisation and among themselves on some oil production and export issues. As of January 2024, OPEC+ includes 11 countries: Azerbaijan, Bahrain, Brunei, Brazil, Kazakhstan, Malaysia, Mexico, Oman, Russia, South Sudan and Sudan.

sources emphasise the need for countries dependent on hydrocarbon production to review their economic models. As per the 2015 Paris Agreement[4], countries globally pledged to reduce their carbon footprint and limit global warming (UNFCC, 2015). This has significantly spurred investment in green energy and research in this area. For instance, according to the IRENA 2020 report, renewable energy accounted for 72% of the total capacity additions in 2019, surpassing fossil fuels (IRENA, 2020). In turn, the BP Statistical Review of World Energy 2020 indicates that global demand for coal decreased in 2019, marking the first decline since 2001. This trend is part of a broader effort to reduce the use of fossil fuels. These changes require countries with a high share of income from natural resources to adapt their economies and seek alternative sources of income (British Petroleum, 2020).

In conclusion, the global energy transition and new shocks emphasise the necessity of an integrated approach to managing natural resource revenues. Strategies should aim to diversify the economy, develop green technologies, and improve energy efficiency. This will enable exporting countries to adapt to current economic challenges and seize opportunities for sustainable development in the future.

1.3.2 Influence of Superpowers and Global Politics

Geopolitics in the oil market has played a central role in international relations over the past 120 years, and rivalry over access to oil supplies and control of oil sources has been the cause of much of the conflict seen in the 20th century (Dudin, 2020). In the current geopolitical environment, superpowers and major political powers exert significant influence over the global distribution and management of natural resources, particularly oil. This influence manifests itself through several channels, including international sanctions, direct military interventions and political alliances, which not only affect global oil prices but also the economic stability of oil-rich countries.

Sanctions imposed by superpowers, particularly the United States and the European Union, on oil-exporting countries such as Iran and Venezuela have caused significant disruptions to global oil supply chains. For example, U.S. sanctions against Iran, reimposed in 2018, have severely restricted country's oil exports, contributing to volatility in global oil prices (OFAC, 2024). Similarly, sanctions against

[4] The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris, France, on 12 December 2015. It entered into force on 4 November 2016.

Venezuela have paralysed its oil industry, leading to lower production and exports. These actions affect not only the targeted countries, but also the dynamics of the global oil market, influencing prices and supply routes (OFAC, 2024).

The ongoing conflict between Russia and Ukraine, which began in 2014 and escalated to a full-scale military clash in February 2022, has far-reaching implications for global energy markets. Russia, being one of the world's largest producers of oil and natural gas, plays a key role in global energy supply. The conflict has raised concerns in terms of energy security and supply disruptions, leading to fluctuations in global oil prices. Furthermore, EU sanctions imposed on Russia's energy sector have complicated global energy trade, affecting oil-rich countries and creating a more volatile and unpredictable market (IEA, 2022). Zhang et al. (2024) examined the relationship between war and oil prices in detail, using a multiresolution causality testing technique based on Variational Mode Decomposition (VMD). The results of the study showed that the war and related events caused a 52.33% increase, or $37.14, in West Texas Intermediate (WTI) crude oil prices and a 56.33% increase, or $41.49 per barrel in Brent crude oil prices. According to the analysis, the war can account for between 70.72% and 73.62% of the fluctuations in oil prices during the respective periods. Additionally, the conflict had an impact on a number of other oil-exporting countries. For instance, since Kazakhstan's exported oil is transported through the territory of Russia, the country’s government had to negotiate with the EU and the USA to ensure the non-sanctioned status of Kazakh oil in transit (Ministry of Energy of the Republic of Kazakhstan, 2024).

In addition to the Russia-Ukraine war, other regional conflicts and political instability are also affecting the global oil market. According to a World Bank report, the recent escalation of conflict in the Middle East, which occurred amid supply chain disruptions caused by Russia's invasion of Ukraine, could significantly affect global oil prices. It is expected that in moderate supply disruptions similar to the 2011 Libya situation, oil prices could increase by 3-13%. In more severe scenarios, such as the 2003 Iraq war, increases could reach 21-75%. These fluctuations in oil prices will have broad implications for countries dependent on natural resource revenues, increasing economic instability and making it more difficult to manage government revenues. Understanding these dynamics and their potential impact on the global economy is key to developing effective strategies for managing resource revenues and minimising the impact of geopolitical risks (World Bank, 2023).

Chapter 2. Data and Methodology

2.1 Research Design and Data

This study analyses the impact of natural resource revenues on public expenditure in developing countries, taking into account specific economic and institutional contexts. The panel includes annual data from 2009 to 2021 for 47 countries[5], covering a period marked by significant global economic changes and fluctuations in natural resource prices, particularly oil.

The choice to employ a panel data approach was guided by several key considerations. Panel data analysis allows for the observation of the same entities over time, providing a detailed picture of dynamics and relationships not observable in pure cross-sectional or time-series data. This method is particularly suited to examining the impacts of resource revenues, which can vary significantly across contexts and over time. Additionally, panel data controls for individual heterogeneity, addressing potentially confounding factors that could bias results if unobserved heterogeneity were ignored (Greene, 2012).

The panel dataset comprises 611 observations across 19 variables. Data was collected from several international databases, including the World Bank's World Development Indicators, the International Monetary Fund (IMF), and the World Health Organisation (WHO), as well as several other international non-governmental organisations and research centers. The variables selected for this analysis are grouped into categories reflecting different aspects of government, economic and institutional dynamics (Table 1). This approach to data collection ensured comprehensive data integration and a robust platform for analysis.

Each variable's relevance is directly tied to the research questions and hypotheses. For instance, government expenditure variables like total government expenditure as a percentage of GDP and per capita expenditures in the health, military, and education sectors are analysed to assess the impact of resource revenues. These expenditures are hypothesised to increase with higher oil revenues, contingent on the quality of governance and economic conditions within the country. Economic indicators such as GDP growth rate, inflation rate, and oil prices are included to control for economic stability and changes in the economic environment that might influence public spending. Institutional

[5] The complete list of countries included in the panel dataset is presented in Appendix A.

quality indicators like the Voice and Accountability and Rule of Law are incorporated to explore how governance quality affects the relationship between resource revenues and government spending.

Table 1. Variables description

Category	Name and Description	Source
Government Spending	Total government expenditure as a share of GDP (%) (*GovExp_pctGDP)*	International Monetary Fund (IMF) database
	Share of military expenditures divided by the number of inhabitants (current US$) (*MilExp_perCapita)*	Stockholm International Peace Research Institute (SIPRI) Military Expenditure database
	Share of health expenditures divided by the number of inhabitants (Current US$) (*HealthExp_perCapita)*	World Health Organisation (WHO). Global Health Observatory data repository
	Share of education expenditures divided by the number of inhabitants (Current US$) (*Educexp_perCapita)*	Calculated by the author using World Bank database
Resource Revenues	Resource revenues as a share of GDP (%) (*ResRev_pctGDP)*	United Nations University World Institute for Development Economics Research (UNU-WIDER) database
	Oil rents as a share of GDP (%) (*OilRent_pctGDP)*	World Bank (WB) database
Economic Indicators	GDP annual growth rate (%) (*GDP_GrowthRate)*	World Bank (WB) database
	Annual inflation rate, average consumer prices (%) *(InflationRate)*	International Monetary Fund (IMF) dataset
	Foreign Direct Investment net inflows as a share of GDP (%) (*FDI_pctGDP)*	World Bank database
	Europe Brent Spot Price FOB, annual average (US$ per Barrel) (*OilPrice)*	U.S. Energy Information Administration database
	Total debt service on external debt (Current US$) (*DebtService)*	World Bank database
	Fuel Exports as a share of merchandise exports (%) (*FuelExport)*	World Bank database
	Ores and metals exports as a share of merchandise exports (%) (*OreMetalExport)*	World Bank database
Institutional Indicators	Voice and Accountability (*VoiceAccount_GovInd)*	World Bank database. Worldwide Governance Indicators (WGI)
	Political stability and absence of violence/terrorism (*PolitStab_GovInd)*	
	Government Effectiveness (*GovEffect_GovInd)*	
	Regulatory quality (*RegQuality_GovInd)*	
	Rule of law (*RuleOfLaw_GovInd)*	
	Control of corruption *(CorruptControl_GovInd)*	

The principal objective of this study is to empirically assess the impact of resource revenues on public expenditure across different governmental budget categories, moderated by institutional quality and economic stability. The study hypothesises that higher oil revenues are correlated with higher public expenditure on health, education, and the military, which depends on the quality of governance and economic conditions. To test this hypothesis, the database used in the study includes both resource-rich countries and those without a significant stock of natural resources. This comparison enables an analysis of the institutional and economic performance of both groups of countries.

2.2 Descriptive analysis

This section provides a detailed overview of the dataset used in the study, focusing on public expenditure categories, economic indicators, and institutional context variables crucial for understanding resource revenue management in resource-rich countries.

Descriptive statistics reveal notable variations across the data, as illustrated in Table 2. For instance, government expenditure as a percentage of GDP averages around 26.85%, but with significant variation among countries, ranging from 11.52% to 66.44%. Military spending per capita averages $80.21, with a standard deviation of $91.32, indicating substantial differences in defence budgets possibly influenced by geopolitical stability, regional threats, or military commitments. Health expenditure per capita averages $223.38, ranging widely from $14.84 to $1040.02, reflecting diverse healthcare investments likely influenced by healthcare policies and economic capacity.

Table 2. Descriptive statistics of key variables[6]

Variable	Mean	Std. Dev.	Min	Max
Government expenditure, % of GDP *(GovExp_pctGDP)*	26.85	8.71	11.52	66.44
Military expenditure per capita, Current US$ *(MilExp_perCapita)*	80.21	91.32	2.10	612.20
Health expenditure per capita, Current US$ *(HealthExp_perCapita)*	223.38	187.46	14.84	1040.02
Education expenditure per capita, Current US$ *(EducExp_perCapita)*	172.50	140.88	9.36	636.61
Resource revenues, % of GDP *(ResRev_pctGDP)*	3.53	6.80	0.00	36.35
Oil rents, % of GDP *(OilRent_pctGDP)*	4.05	8.13	0.00	48.67
Number of observations		611		

[6] The descriptive statistics table for the complete set of variables is presented in Appendix B.

Similarly, education expenditure per capita averages $172.50, with considerable variation, underlining the varied emphasis placed on education in national budgets. An intriguing aspect of the dataset is the average natural resource revenue as a percentage of GDP, which is 3.53%, with countries showing a wide range of resource dependence. The standard deviation of 6.80 indicates a wide range of resource dependence among the countries, reflecting broader strategies of economic diversification.

Time series plots for selected countries such as Kazakhstan, Russia, China, and Mexico show how economic and political contexts influence public expenditure and resource management. For example, fluctuations in government spending and resource revenues in Kazakhstan and Russia correlate with changes in global oil prices and domestic political shifts. In contrast, China exhibits minimal resource revenues despite relatively stable government spending, suggesting a more diversified economy with minimal dependence on natural resources.

Furthermore, a comparative analysis was conducted by categorising countries into "high" and "low" resource groups based on their resource revenues, with 5% as the threshold for high resource revenues. The results of this analysis are presented in Table 3. Countries with high resource revenues tend to have higher government and military expenditures, which is consistent with the "resource curse" theory, which suggests that resource-rich countries tend to allocate more of their budget to governance and security (Auty, 1993).

Table 3. Comparative analysis of government spending by resource dependency

Variable	**Resource group**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**	**t-stat**	**p-value**
Government expenditure, % of GDP *(GovExp_pctGDP)*	High	130	30.25	9.49	12.21	52.12	5.11	0.000
	Low	481	25.93	8.26	11.52	66.44		
Military expenditure per capita, Current US$ *(MilExp_perCapita)*	High	130	172.49	128.93	11.50	612.20	15.25	0.000
	Low	481	55.27	56.58	2.10	308.40		
Health expenditure per capita, Current US$ *(HealthExp_perCapita)*	High	130	272.82	184.01	43.39	935.73	3.42	0.001
	Low	481	210.02	186.33	14.84	1040.02		
Education expenditure per capita, Current US$ *(EducExp_perCapita)*	High	130	245.67	155.30	21.84	636.61	6.93	0.000
	Low	481	152.73	129.99	9.36	582.11		

The integration of these results with global economic events provides additional insights. For instance, fluctuations in GDP growth rates and government spending spikes during significant global crises, such as the recession that followed the 2008 financial crisis and the COVID-19 pandemic in 2020, suggest that fiscal policies were reactive in nature and were aimed at stabilising economies during downturns. This comprehensive analysis provides the basis for a deeper econometric investigation of the causal relationships between these factors, establishing a robust foundation for understanding the dynamics of resource management and public finance strategies in diverse geopolitical and economic landscapes.

2.3 Econometric Model Specification

This section outlines the econometric methodology used to analyse the impact of resource revenues on public expenditure in resource-rich countries. The analysis focuses on key expenditure categories, including government expenditure, military spending, health spending, and education spending, as described in the previous sections. The primary objective is to identify and quantify the relationships between resource revenues and these public expenditure categories while controlling for various economic and institutional factors.

To investigate the impact of resource revenues on public expenditure, we employ a panel data regression specification. Panel data allows for the observation of multiple entities over time, providing a richer dataset to control for unobserved heterogeneity (Greene, 2012) and capturing the dynamics of the relationship between resource revenues and public expenditure. The general form of the specification is as follows:

$$GovExp_{pctGDP_{it}} = \gamma + \beta_1 \times ResRev_{pctGDP_{it}} + \beta_2 \times OilRent_{pctGDP_{it}} + \beta_3 \times GDP_{GrowthRate_{it}}$$
$$+\beta_4 \times InflationRate_{it} + \beta_5 \times FDI_{pctGDP_{it}} + \beta_6 \times OilPrice_{it} + \beta_7 \times DebtService_{it}$$
$$+\beta_8 \times FuelExport_{it} + \beta_9 \times OreMetalExport_{it} + \beta_{10} \times VoiceAccount_{GovInd_{it}}$$
$$+\beta_{11} \times PolitStab_{GovInd_{it}} + \beta_{12} \times GovEffect_{GovInd_{it}} + \beta_{13} \times RegQuality_{GovInd_{it}}$$
$$+\beta_{14} \times RuleOfLaw_{GovInd_{it}} + \beta_{15} \times CorruptControl_{GovInd_{it}} + u_i + \epsilon_{it}$$

Where GovExp_pctGDP$_{it}$ represents the government expenditure as a percentage of GDP for country i in year t, γ is the intercept, $\beta_1, \beta_2, \ldots, \beta_{14}$ are the coefficients of the independent variables, u_i denotes the unobserved country-specific effect, and ϵ_{it} is the error term, assumed to be independently and identically distributed. This specification is adapted similarly for models analysing military, health,

and education expenditures, with the respective spending type as the dependent variable, ensuring a consistent approach across different analyses.

Initial analyses included examining summary statistics and checking for multicollinearity among the independent variables. This was followed by a check for stationarity using the Levin-Lin-Chu test (Levin et al., 2002), which confirmed that all dependent variables do not exhibit unit roots. Model estimation employed both fixed effects and random effects models. The choice between these models was informed by the Hausman test (Hausman, 1978), which suggested the use of random effects model due to the absence of systematic differences between the fixed and random effects estimators. Additionally, robustness checks were conducted to ensure the reliability of the regression results. The Modified Wald test (Greene, 2000) indicated the presence of heteroscedasticity, and Woolridge's test (Wooldridge, 2002) confirmed serial correlation. Furthermore, Pesaran's test (Pesaran, 2004) revealed significant cross-sectional dependence.

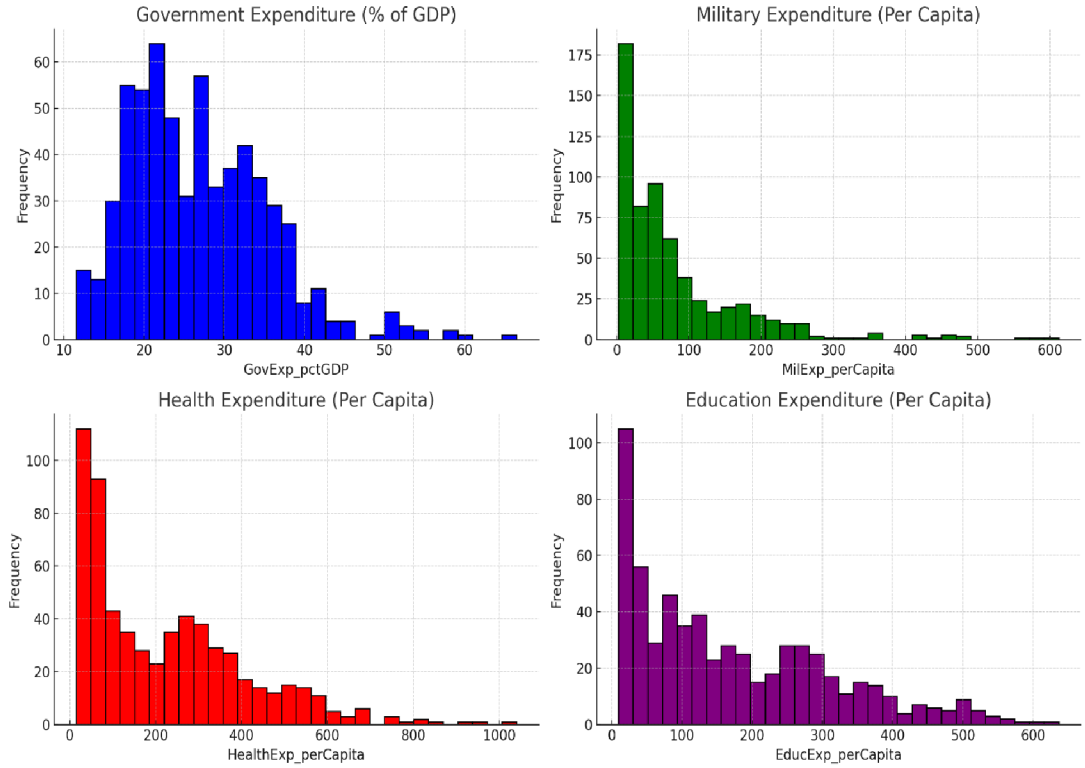
Given the presence of autocorrelation and cross-sectional dependence, the standard errors were adjusted using the methodology proposed by Driscoll and Kraay (1998), which corrects for such issues, providing more robust inference. These econometric techniques underscore the rigorous approach adopted in this study to effectively investigate the dynamic impacts of resource revenues on government spending patterns. Consequently, this methodology not only enhances the robustness of the findings but also meets to rigorous statistical standards, thereby providing a solid basis for subsequent policy recommendations.

Chapter 3. Empirical Analysis and Results

3.1 Regression Analysis and Results

This section examines the impact of natural resource revenues on public expenditure in developing countries, with a focus on health, military and education. By employing a variety of econometric methods, this study analyses the nuances of how these revenues affect governmental budget allocations under different institutional and economic frameworks. To gain a deeper understanding of the distribution patterns of the total government budget, as well as government spending on the health, military and education across countries, it is necessary to examine the histograms presented in Figure 7.

Figure 7. Dependent variables histograms



Source: Compiled by the author based on data from the World Bank, International Monetary Fund (IMF), World Health Organisation (WHO), and United Nations University World Institute for Development Economics Research (UNU-WIDER)

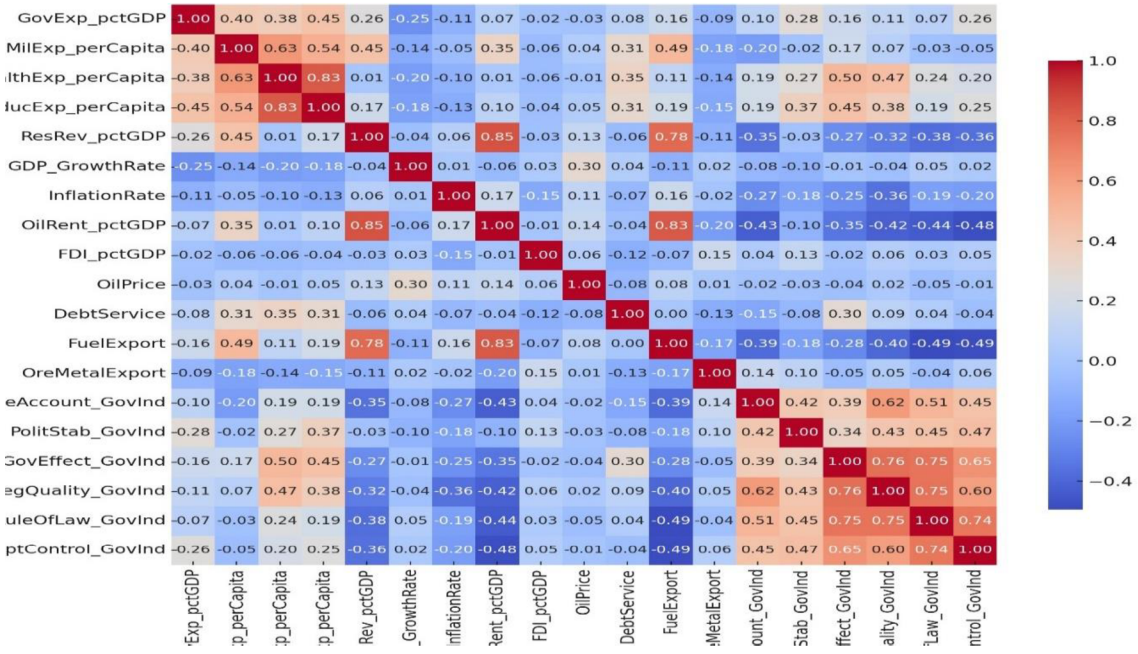
The histogram of total governmental expenditure displays a skewed pattern. While the majority of countries allocate a moderate share of their gross domestic product (GDP) to public spending, a

significant number of countries exhibit substantially higher levels of public expenditure. This indicates significant discrepancies in fiscal policies and priorities across countries. The histogram of health expenditure per capita shows a right-skewed distribution, indicating that while most countries invest at a moderate proportion of their budget on health, a subset of countries invest significantly more. This reflects disparities in healthcare investment and priorities. A similar phenomenon is observed in the distribution of military spending per capita, with most countries maintaining low levels of spending while a few spend significantly more due to regional security needs or national defence strategies.

Moving to a more detailed analysis, the initial econometric specifications included a broad set of variables in order to capture the multifaceted effects on government spending as described in Chapter 2. Firstly, the correlation analysis (Figure 8) played a pivotal role in refining the model specifications by identifying and eliminating multicollinearity. A significant overlap was found between the variables representing resource revenues ("ResRev_pctGDP") and oil rents ("OilRent_pctGDP"). Consequently, the variable that stands for oil rents as a percentage of GDP ("OilRent_pctGDP") was excluded from the analysis to ensure a more accurate econometric model specification. Additonally, correlation analysis reveals several other significant relationships. Notably, there is a positive correlation between military and health expenditures and resource revenues, suggesting that higher resource revenues may lead to higher expenditures in these sectors. Furthermore, a negative correlation between GDP growth rate and government spending suggests that higher spending may occur during periods of economic downturn, potentially as a fiscal stimulus.

Following the variable selection, diagnostic checks were conducted across all four models – total government expenditure, health, military, and education expenditure – to ensure the robustness of the econometric models. These checks identified three critical statistical issues that can reduce the accuracy of the analyses: first-order autocorrelation, cross-sectional dependence, and heteroskedasticity. First-order autocorrelation occurs when a variable is correlated with its own previous values, which can lead to biased results (Baltagi, 2015). Cross-sectional dependence refers to a scenario in which observations in different groups (e.g., countries) are not independent of each other, which can distort the standard errors and statistical inferences (De Hoyos and Sarafidis, 2006). Heteroscedasticity is defined as the unequal variation in the error terms of a regression model, which affects the efficiency of the estimates (Kiefer and Vogelsang, 2005).

Figure 8. Correlation matrix of full variable set



Source: Compiled by the author based on data from the World Bank, International Monetary Fund (IMF), World Health Organisation (WHO), and United Nations University World Institute for Development Economics Research (UNU-WIDER)

To mitigate these issues, four distinct methodologies have been considered, namely Panel-Corrected Standard Errors (PCSE) (Beck and Katz, 1995), robust standard errors, clustered standard errors, and Driscoll-Kraay standard errors (Driscoll and Kray, 1998). The PCSE method is particularly effective for random effects models and adjusts for heteroskedasticity and autocorrelation in panel data models with a large number of cross-sections (Beck and Katz, 1995). Meanwhile, the method incorporating robust standard errors permits the consideration of heteroskedasticity, but not autocorrelation. Clustered standard errors extend the range of applicability by accounting for both heteroskedasticity and autocorrelation within clusters of observations, for instance, within the same country (Cameron and Miller, 2015). The last two mentioned approaches apply to both random effects and fixed effects models. Finally, Driscoll-Kraay standard errors provide an extended correction for heteroskedasticity, autocorrelation, and cross-sectional dependence, which is particularly useful in fixed effects models of panel data with a limited time dimension but a large number of cross-sections (Driscoll and Kray, 1998). Following a comprehensive evaluation, Driscoll-Kraay standard errors were selected for the health, military, and education per capita expenditure model specifications, as they effectively address all of the identified issues, ensuring that the analysis results are robust and accurately reflect the

underlying economic patterns. Additionally, the Hausman test (Hausman, 1978) conducted for these models advised the use of a fixed effects model. However, the appropriate approach for the governmental expenditure model was more complex due to the earlier diagnostics indicating the suitability of the random effects model.

3.1.1 Government Expenditure as a Percentage of GDP

This subsection presents the regression results of an econometric model specification that examines the influence of natural resource revenues on total government expenditure as a percentage of GDP. To ensure the robustness and accuracy of the results, a rigorous econometric approach was applied, taking into account the complexities inherent in multi-country financial data.

In order to ascertain the robustness of the government expenditure model analysis, extensive diagnostics were conducted, the results of which are presented in Table 4. These included a Variance Inflation Factor (VIF) test (Myers, 1990), which confirmed that the exclusion of the variable that represented oil rents ("OilRent_pctGDP") effectively reduced multicollinearity, a common issue where independent variables are too highly correlated, potentially inflating the variance of the estimated regression coefficients (Farrar and Glauber, 1967). The Wooldridge Test for Autocorrelation (Wooldridge, 2002) revealed significant first-order autocorrelation, indicating that past values of the dependent variable influenced current values. This necessitated an adjustment to the modelling approach.

Table 4. Diagnostics checks

Diagnostic Test	**Statistic**	**Result**
Variance Inflation Factor (VIF)	Mean VIF = 2.34	VIF<10 (No significant multicollinearity)
Wooldridge Test for Autocorrelation	F(1, 46) = 32.247	Prob > F = 0.0000 (Significant)
Breusch and Pagan Test for Random Effects	Chi-square = 2080.52	Prob > chi-square = 0.0000 (Significant)
Levin-Lin-Chu (LLC) Test for Unit Roots	t = -2.7913	p = 0.0026 (Stationary)
Pesaran's Test of Cross-Sectional Independence	CD statistic = 3.551	Pr = 0.0004 (Significant)
Modified Wald Test for Groupwise Heteroskedasticity	Chi-square = 5865.19	Prob > chi-square = 0.0000 (Significant)

Additionally, the Breusch-Pagan Lagrange Multiplier Test for Random Effects (Breusch and Pagan, 1980) supported the suitability of the random effects model, in accordance with the results of the Hausman test (Hausman, 1978), which assesses the consistency of an estimator when compared to an alternative, less efficient estimator that is also consistent under the null hypothesis of no systematic difference. The Levin-Lin-Chu (LLC) Test for Unit Roots (Levin et al., 2002) confirmed the stationarity of the variables, which is essential for the reliability of any conclusions drawn from time series data. Furthermore, significant cross-sectional dependence and heteroskedasticity across groups were identified through Pesaran's test of cross-sectional independence (Pesaran, 2004) and the Modified Wald Test for Groupwise Heteroskedasticity (Greene, 2000), necessitating robust error adjustments.

These diagnostics highlighted the data's complexity and the necessity for robust estimation techniques. Although the Hausman test (Hausman, 1978) initially advised the use of a random effects model, the robustness provided by Driscoll-Kraay standard errors (Driscoll and Kray, 1998) when considering autocorrelation and heteroskedasticity made it a compelling alternative. Consequently, Table 5 presents a comparison of the regression results using both PCSE (Beck and Katz, 1995) and Driscoll-Kraay standard errors (Driscoll and Kray, 1998) in order to provide a comprehensive view of the effects of resource revenues on government spending.

Thus, the comparison of two distinct approaches enables an understanding of the impact of various factors on government expenditure. For instance, the results indicate that resource revenues exert a positive and significant effect in both models, suggesting that higher natural resource revenues lead to an increase in public spending. The effect is more pronounced in the Driscoll-Kraay model (coef.=0.474, p = 0.006) than in the PCSE model (coef. = 0.208, p = 0.041). With regard to the GDP growth rate, both models show a negative correlation, indicating that higher economic growth is correlated with a lower share of government spending (PCSE: coef.= -0.203, p<0.001; Driscoll-Kraay: coef. = -0.221, p = 0.009). Furthermore, the inflation rate is negative under PCSE (coef. = -0.062, p=0.035), suggesting that higher inflation may result in a reduction in government spending as a percentage of GDP. However, this effect is not statistically significant according to the Driscoll-Kraay model. Both foreign direct investment (FDI) and oil prices have a small and statistically insignificant effect on government expenditure, indicating that there is limited direct effect in the conditions studied. The results indicate that debt service has a small but significant positive effect in both models, suggesting that higher debt service payments are associated with higher government spending.

Table 5. Main regression results using Panel-Corrected Standard Errors (PCSE) and Driscoll-Kraay standard errors

Variable	**PCSE Coefficient**	**PCSE t-stat**	**Driscoll-Kraay Coefficient**	**Driscoll-Kraay t-stat**
Resource revenues, % of GDP	0.208 (0.102)*	2.05	0.474 (0.143)**	3.33
GDP annual growth rate, %	-0.203 (0.036)***	-5.63	-0.221 (0.071)**	-3.11
Inflation rate, annual, %	-0.062 (0.029)*	-2.11	-0.037 (0.034)	-1.09
Foreign Direct Investment, % of GDP	-0.011 (0.059)	-0.19	0.118 (0.081)	1.45
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	-0.012 (0.008)	-1.42	-0.006 (0.010)	-0.59
Debt service on external debt, current US$	1.91e-11 (6.64e-12)**	2.88	1.65e-11 (3.48e-12)***	4.74
Fuel exports, % of merchandise exports	0.008 (0.018)	0.48	-0.050 (0.039)	-1.28
Ores and metals exports, % of merchandise exports	-0.026 (0.020)	-1.27	-0.022 (0.021)	-1.03
Voice and accountability, governance indicator	0.989 (0.543)	1.82	1.084 (0.827)	1.31
Political stability and absence of violence/terrorism, governance indicator	2.059 (0.576)***	3.57	0.724 (0.423)	1.71
Government effectiveness, governance indicator	0596 (0.994)	0.60	2.947 (1.011)*	2.91
Regulatory quality, governance indicator	-0.224 (0.960)	-0.23	-2.722 (1.298)	-2.10
Rule of law, governance indicator	-1.887 (1.104)	-1.71	-2.098 (0.954)*	-2.20
Control of corruption, governance indicator	3.413 (1.437)*	2.38	-1.182 (1.002)	-1.18
Constant	*30.353 (0.931)****	*32.59*	*26.768 (1.052)****	*25.45*
Number of observations	*611*		*611*	
R-squared	*0.5639*		*0.1956*	

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, **p<0.001.*

Furthermore, the results of the governance indicators are also inconclusive. While some indicators, such as political stability, show a significant positive relationship under PCSE (coef. = 2.059, p<0.001), this is not the case under Driscoll-Kraay (coef. = 0.724, p = 0.113). Such findings underscore the significance of stable and effective governance in potentially increasing government spending through enhanced budgetary allocations or expanded public services. Consequently, these

results underline the pivotal role of natural resource revenues and economic growth in shaping public expenditure, with governance indicators and external economic conditions providing supplementary context but less direct influence.

3.1.2 Health Expenditure per Capita

In this part of the study, we examine the impact of natural resource revenues and other significant economic and institutional factors on per capita health expenditure. The advanced diagnostic tests discussed earlier, including Variance Inflation Factor (VIF) (Myers, 1990), Wooldridge test for autocorrelation (Wooldridge, 2002) ($F(1, 46) = 182.219$, Prob > F = 0.0000), Modified Wald test for heteroscedasticity (Greene, 2000) ($chi2(47) = 80811.82$, Prob > chi2 = 0.0000), Levin-Lin-Chu test for stationarity (Levin et al., 2002) (Adjusted $t^* = -0.6401$, $p = 0.2611$), and Pesaran's test for cross-sectional dependence (Pesaran, 2008) (Pesaran CD = 19.253, Prob = 0.0000) confirmed the robustness of the model against multicollinearity, autocorrelation, heteroscedasticity, and non-stationarity issues. The Driscoll-Kraay standard errors method was employed to address these statistical challenges effectively (Driscoll & Kraay, 1998). This method, results of which are presented in Table 6, was found the most appropriate after comparing results with other robust techniques such as PCSE and Fixed Effects with Clustered Standard Errors, ensuring that the model provides a robust representation of the determinants of health expenditure.

The findings from this rigorous econometric analysis highlight the subtle influence of natural resource income, governance, and economic conditions on per capita health expenditure. Thus, the coefficient for resource revenues as a percentage of GDP has a positive but statistically non-significant coefficient of 0.847 (p=0.486), suggesting that while higher resource revenues could potentially increase health spending, the effect may be mitigated by how these revenues are managed within specific governance structures. Conversely, the significant negative impact of the inflation rate on health expenditure (coefficient = -0.942, p=0.007) indicates that higher inflation may reduce the real value of health budget allocations. Furthermore, governance indicators, particularly political stability and the rule of law, show positive and significant impacts on health expenditure, with coefficients of 15.743 (p=0.026) and 52.779 (p=0.042), respectively. This implies that stable and effective governance may facilitate the allocation of resource revenues to enhance health sectors. The correlation between debt service payments and health expenditure is positive (coefficient = 1.15e-09, p=0.000), indicating a commitment to maintain or even increase health financing despite financial constraints.

Table 6. Health expenditure per capita - regression results using Driscoll-Kraay Standard Errors

Variable	Coefficient	t-stat
Dependent variable: Health Expenditure per Capita		
Resource revenues, % of GDP	0.847 (1.178)	0.72
GDP annual growth rate, %	1.308 (1.657)	0.79
Inflation rate, annual, %	-0.942 (0.287)**	-3.28
Foreign Direct Investment, % of GDP	-1.240 (0.740)	-1.68
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	0.145 (0.198)	0.73
Debt service on external debt, current US$	1.15e-09 (1.79e-10)***	6.43
Fuel exports, % of merchandise exports	-0.560 (0.453)	-1.24
Ores and metals exports, % of merchandise exports	-0.035 (0.217)	-0.16
Voice and accountability, governance indicator	-1.833 (17.139)	-0.11
Political stability and absence of violence/terrorism, governance indicator	15.743 (6.210)*	2.54
Government effectiveness, governance indicator	23.989 (23.939)	1.00
Regulatory quality, governance indicator	-57.601 (31.761)	-1.81
Rule of law, governance indicator	52.779 (23.20)*	2.27
Control of corruption, governance indicator	-1.691 (34.927)	-0.05
Constant	*231.658 (28.032)**	*8.26*
Number of observations	*611*	
R-squared (within)	*0.1739*	

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, **p<0.001.*

Therefore, these insights align with the broader themes of governance and resource management discussed in earlier chapters. The significance of governance quality suggests that effective management and transparent allocation of resource revenues are crucial for improving health outcomes. Policymakers should consider this evidence to optimise health budget allocations in resource-rich developing countries, seeking sustainable improvements in health outcomes consistent with broader economic and governance conditions.

3.1.3 Military Expenditure per Capita

The following subsection explores the factors influencing military expenditure per capita across developing countries. The analysis commenced with a series of rigorous diagnostic tests to ensure the integrity and reliability of the data, paralleling methodologies used in prior sections to maintain consistency across the study's analyses.

The Wooldridge test for serial correlation (Wooldridge, 2002) confirmed the presence of first-order autocorrelation (F(1, 46) = 24.463, Prob > F = 0.0000), indicating that consecutive observations are not independent. This finding was of critical importance in the process of adjusting the econometric model specification for accuracy. Similarly, the Modified Wald test for groupwise heteroscedasticity (Greene, 2000) showed significant heteroscedasticity across all groups of data (chi-squared = 110,000, Prob > chi-squared = 0.0000). The Levin-Lin-Chu panel unit root test (Levin et al., 2002) verified that the variable for military expenditure per capita is stationary (Adjusted t* = -2.5892, p-value = 0.0048), thereby ensuring that non-stationarity did not affect the results. Furthermore, Pesaran's test for cross-sectional independence revealed interconnectedness among panels (Pesaran's CD = 5.285, Prob = 0.0000) (Pesaran, 2008). Given the issues identified, the data was subjected to further analysis. The results showed that the Driscoll-Kraay standard errors method produced the most robust results, which are presented in Table 7. Moreover, this particular method is applicable to the fixed effects model, which is crucial for our analysis since the Hausman test (Hausman, 1978) advised the use of this model over the random effects model.

Table 7. Military expenditure per capita - regression results using Driscoll-Kraay Standard Errors

Variable	**Coefficient**	**t-stat**
Dependent variable: Military Expenditure per Capita		
Resource revenues, % of GDP	1.232 (0.867)	1.42
GDP annual growth rate, %	0.147 (0.345)	0.43
Inflation rate, annual, %	-1.278 (0.293)***	-4.37
Foreign Direct Investment, % of GDP	0.412 (0.466)	0.88
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	0.180 (0.061)**	2.96
Debt service on external debt, current US$	2.62e-10 (5.42e-11)***	4.83
Fuel exports, % of merchandise exports	0.213 (0.178)	1.20
Ores and metals exports, % of merchandise exports	-0.32 (0.095)**	-3.35
Voice and accountability, governance indicator	-2.412 (8.14)	-0.30
Political stability and absence of violence/terrorism, governance indicator	9.018 (4.765)	1.89
Government effectiveness, governance indicator	13.793 (13.418)	1.03
Regulatory quality, governance indicator	-39.713 (15.566)*	-2.55
Rule of law, governance indicator	5.080 (7.482)	0.68
Control of corruption, governance indicator	-8.579 (7.928)	-1.08
Constant	*57.145 (4.893)**	*11.68*
Number of observations	*611*	
R-squared (within)	*0.152*	

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, **p<0.001.*

The regression outcomes thus confirm several notable economic relationships. The coefficient for resource revenue as a percentage of GDP is positive at 1.232, although not statistically significant, suggesting a weak potential link between higher resource revenues and increased military spending. The inflation rate has a significant negative impact, indicating that higher inflation, which diminishes purchasing power, correlates with lower military spending. Conversely, the variable that stands for oil price reveals that higher oil prices, which increase oil export revenues, are likely to enhance military spending. This reflects the economic benefit of higher commodity prices to the military budgets of oil-exporting countries

Furthermore, debt service payments show a highly significant positive relationship (coef. = 2.62e-10, p=0.000), suggesting that higher debt service obligations are often associated with sustained or increased military spending, possibly due to strategic imperatives. Additionally, the governance indicator that stands for regulatory quality significantly impacts military spending (coef. = -39.713, p=0.025), suggesting that better governance leads to more efficient budget utilisation. Political stability also potentially increases military spending (coef. = 9.018, p=0.083), although this effect was not statistically significant. This suggests that in stable environments, there is a tendency towards more strategic defence planning.

Therefore, this analysis indicates that the relationship between military spending and economic and institutional factors in developing countries is complex. The findings show that while natural resource revenues do not exert a significant direct influence on military budgets, other economic indicators, such as inflation and oil prices, in conjunction with governance factors, play a pivotal role. This insight is of great value to policymakers attempting to achieve a balance between military spending and economic stability and the quality of governance.

3.1.4 Education Expenditure per Capita

This part of the study aims to investigate the relationship between natural resource revenues and education expenditure per capita in developing countries. A meticulous examination began with the application of several diagnostic tests to determine the robustness of our dataset, following the same strategy as in previous sections of the study. To address the presence of first-order autocorrelation, indicated by the Wooldridge test for autocorrelation in panel data (Wooldridge, 2002) ($F(1,46)=26.983$, $p < 0.0001$), we adjusted our model accordingly. Heteroscedasticity was identified

via the Modified Wald test (Greene, 2008) (chi-squared = 50386.88, $p < 0.0001$). Cross-sectional dependencies were confirmed using Pesaran's test (Pesaran CD = 5.882, $p < 0.0001$). Additionally, the Levin-Lin-Chu (LLC) (Levin et al., 2002) test verified the stationarity of the series (LLC adjusted $t^* = -6.2783$, $p < 0.0001$). Table 8 summarises the regression results employing Driscoll-Kraay Standard Errors that accounted for the identified issues.

Table 8. Education expenditure per capita - regression results using Driscoll-Kraay Standard Errors

Variable	Coefficient	t-stat
Dependent variable: Education Expenditure per Capita		
Resource revenues, % of GDP	4.017 (0.792)***	5.07
GDP annual growth rate, %	0.504 (0.624)	0.81
Inflation rate, annual, %	-0.976 (0.361)*	-2.7
Foreign Direct Investment, % of GDP	-0.229 (0.488)	-0.47
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	0.254 (0.110)*	2.31
Debt service on external debt, current US$	6.33e-10 (1.6e-10)**	3.96
Fuel exports, % of merchandise exports	-0.102 (0.214)	-0.48
Ores and metals exports, % of merchandise exports	0.112 (0.195)	0.57
Voice and accountability, governance indicator	29.058 (12.827)*	2.27
Political stability and absence of violence/terrorism, governance indicator	11.748 (5.921)	1.98
Government effectiveness, governance indicator	1.832 (14.037)	0.13
Regulatory quality, governance indicator	-22.486 (14.738)	-1.53
Rule of law, governance indicator	18.225 (11.895)	1.53
Control of corruption, governance indicator	18.058(19.905)	0.91
Constant	*164.617*	*17.46*
Number of observations	*611*	
R-squared (within)	*0.199*	

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, **p<0.001.*

The analysis revealed that resource revenues as a percentage of GDP has a significantly positive coefficient at 4.017 ($p < 0.0001$), a strong association between higher resource revenues and increased education spending. This finding suggests that resource-rich economies tend to invest more in education, reflecting the potential of well-managed fiscal capacity to enhance public service delivery. Conversely, a negative coefficient for the inflation rate at -0.976 ($p = 0.019$) emphasises the adverse effect of high inflation on education spending. Higher global oil prices, indicated by a positive coefficient of 0.254 ($p = 0.039$), are likely to boost education spending in oil-exporting nations. It is

noteworthy that governance indicators, such as the voice and accountability index, also showed a significant positive effect on education expenditure with a coefficient of 29.058 ($p = 0.043$). This reinforces the role of good governance in the efficient allocation of resources to education.

In conclusion, the following findings highlight the significant influence of economic resources and governance quality on the allocation of education spending in developing countries. Effective management of natural resource revenues can substantially enhance public sector investments in education. These insights emphasise the importance of robust governance structures and economic stability in leveraging natural resource wealth for educational development.

3.2 Robustness Analysis and Results

This section aims to evaluate the robustness of the regression results presented in the previous section regarding the relationship between natural resource revenues and different types of government expenditure. The analysis examines the influence of governance quality on this relationship, the temporal dynamics of resource revenue effects using lagged variables, and addresses potential endogeneity through the implementation of instrumental variables. Additionally, a subgroup analysis was conducted based on the level of resource revenue dependency.

3.2.1 Impact of Resource Revenues on Government Expenditure by Governance Quality

Governance quality has a profound influence on the manner in which natural resource revenues impact government expenditure. This subsection explores the differential impacts of governance, with a particular focus on government effectiveness and corruption control. By categorising countries into groups based on governance quality, the study assesses the extent to which these factors moderate the relationship between resource revenues and government spending.

The analysis begins by classifying countries based on median levels of two critical Worldwide Governance Indicators (WGI): government effectiveness and control of corruption. This categorisation allowed for separate analyses of impacts for each governance level, providing a clearer picture of how governance quality can either mitigate or exacerbate the effects of resource revenues on public expenditure. The regression outputs for both governance aspects are presented in Table 9, capturing the vital statistics for each subgroup.

Table 9. Impact of resource revenues on government expenditure by governance quality

Governance indicator	Group	Coefficient of ResRev_pctGDP	P-value	R-squared	Obs	Confidence interval
Government effectiveness	High (above median)	-0.0567 (0.1233)	0.654	0.0006	304	[-0.3254, 0.2120]
	Low (below median)	0.3743 (0.1492)*	0.028	0.1049	307	[0.0491, 0.6994]
Control of corruption	High (above median)	-0.0245 (0.2448)	0.922	0.0000	297	[-0.5579, 0.5090]
	Low (below median)	0.3381(0.1508)*	0.045	0.1058	314	[0.0095, 0.6667]

**Standard errors are in parentheses. Significance levels:* p<0.05.*

The analysis reveals that in countries with low government effectiveness, an increase in resource revenues is associated with a significant increase in government spending, as indicated by a coefficient of 0.374 (p-value = 0.028). This suggests potential inefficiencies or misappropriations of funds, consistent with the findings of Arezki and Brueckner (2011) regarding increased rent-seeking practices under weak governance. Conversely, in countries with high government effectiveness, the impact of resource revenues on government spending is insignificant (coef. = -0.0567, p-value=0.654), supporting the notion that strong governance frameworks can effectively manage and utilise resource wealth to avoid the resource curse as proposed by Robinson, Torvik, and Verdier (2006). Similarly, the analysis of the governance indicator that stands for corruption control shows that countries with weaker control exhibit a statistically significant positive relationship between resource revenues and government spending, supporting theories that poor governance leads to misallocation of revenues (Mehlum et al., 2006). Contrarily, robust corruption control mechanisms appear to nullify this relationship, emphasising the importance of strong institutions for channelling resource wealth towards sustainable development (Caselli and Cunningham, 2009).

In depth country analyses further underscore the nuanced impact of governance on resource revenue utilisation. For instance, countries such as Colombia, with moderate resource revenues, show an increase in government expenditure in contexts of lower government effectiveness. On the contrary, countries like Indonesia, which have higher resource revenues but also stronger governance indicators, do not show a significant increase in expenditure. Similarly, countries with weak corruption control frameworks, such as Russia and Kazakhstan, show a marked increase in government spending when resource revenues are rising. This observation aligns with the theoretical framework proposed by

Mehlum et al. (2006), which posits that the absence of effective oversight systems can lead to waste or diversion of resources.

3.2.2 Temporal Dynamics and Lagged Effects

This subsection examines the temporal dynamics of natural resource revenues and their delayed effects on government expenditure, highlighting the importance of temporal considerations in policy formulations. To address potential econometric issues such as multicollinearity, heteroskedasticity, and autocorrelation, one and two-year lagged values of resource revenues variable were incorporated into the regression models (Table 10).

Table 10. Comparison of regression results with and without lagged variables

Variable	**Model without Lags**	**Model with Lags**
Resource revenues, % of GDP	0.471*** (0.142)	0.028 (0.109)
GDP annual growth rate, %	-0.228*** (0.045)	-0.146*** (0.028)
Inflation rate, annual, %	-0.036 (0.038)	-0.000 (0.039)
Foreign Direct Investment, % of GDP	0.114 (0.060)	0.035 (0.057)
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	-0.006 (0.008)	-0.010 (0.008)
Debt service on external debt, current US$	0.000* (0.000)	0.000* (0.000)
Fuel exports, % of merchandise exports	-0.049 (0.056)	-0.050 (0.040)
Ores and metals exports, % of merchandise exports	-0.025 (0.031)	-0.016 (0.025)
Voice and accountability, governance indicator	1.342 (0.950)	0.958 (0.861)
Political stability and absence of violence/terrorism, governance indicator	1.007 (1.054)	1.650 (0.960)
Government effectiveness, governance indicator	2.587 (1.464)	1.517 (0.919)
Regulatory quality, governance indicator	-2.203 (1.553)	-0.922 (1.406)
Rule of law, governance indicator	-2.249 (1.544)	-2.670 (1.453)
Control of corruption, governance indicator	-0.267 (1.486)	1.479 (1.388)
Lagged Resource Revenues (Year -1) (ResRev_pctGDP_lag1)	-	*0.200* (0.101)*
Lagged Resource Revenues (Year -2) (ResRev_pctGDP_lag2)	-	*0.450** (0.156)*
Constant	*27.415*** (1.642)*	*27.376*** (1.407)*
Number of observations	*611*	*517*

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, ***p<0.001.*

Initial regressions employed a random-effects GLS approach, adjusted for robust standard errors (Dieleman and Templin, 2016). Consequently, the coefficient for current year resource revenues

("ResRev_pctGDP") was not statistically significant (coef. = 0.028, p = 0.796), indicating that immediate effects cannot be detected within the same fiscal year. This suggests that alterations in resource revenues do not instantly affect government spending. In contrast, the one-year lagged effect ("ResRev_pctGDP_lag1") showed a positive correlation with government expenditure, and was statistically significant (coef. = 0.200, p = 0.049). This indicates that the impact of resource revenues becomes apparent after one year, reflecting the time lag in fiscal responses or budget adjustments. Finally, the two-year lagged effect ("ResRev_pctGDP_lag2") was more pronounced and statistically significant (coef. = 0.450, p = 0.004), highlighting a substantial delayed impact on government expenditure. This suggests that resource revenue fluctuations are likely factored into government spending plans with a notable delay, affecting budget allocations and fiscal policy decisions two years after the revenue is generated.

To address severe multicollinearity among lagged variables, particularly where VIF for "ResRev_pctGDP_lag1" was exceedingly high at 33.62, a Principal Component Analysis (PCA) was conducted (Hotelling, 1933). The first principal component, which explained 97.17% of the variance, effectively summarised the information obtained from the correlated lagged variables. This reduction in dimensionality permitted the elimination of multicollinearity concerns without the loss of crucial information, thereby enhancing the robustness of the regression analysis. The application of robust standard errors addressed potential heteroskedasticity, ensuring reliable inference despite the possibility of unequal error variances across panels. Furthermore, a System GMM estimator was employed to address autocorrelation and the dynamic nature of the dataset, thereby ensuring robust estimates of the lagged variables (Arellano and Bover, 1995; Blundell and Bond, 1998). The significant coefficient for the two-year lag ("ResRev_pctGDP_lag2") (coef. = 0.5266, p = 0.007) obtained using System GMM provides further evidence of the lagged impact of resource revenues. Additionally, the Hansen test of overidentification (Hansen, 1982) confirmed the validity of the instruments (Prob > chi2 = 0.998), supporting the appropriateness of the model specifications.

Therefore, the findings from this robustness analysis affirm that the impact of resource revenues on government expenditure is significant and characteristically delayed, with the most substantial effects materialising two years after the revenues are recorded. This delayed response underscores the necessity for governments in resource-rich countries to plan and adapt their fiscal policies to accommodate this temporal dynamic.

3.2.3 Instrumental Variables (IV) Analysis

This part of the study aims to explore the use of an instrumental variable (IV) approach (Angrist and Pischke, 2009) to address potential endogeneity between resource revenues and total government expenditure as a percentage of GDP. Therefore, The IV approach employed oil prices ("OilPrice") and their interactions with GDP growth rates ("GDP_GrowthRate") and inflation rates ("InflationRate") as instruments. These instruments are likely to affect government revenues but tend to be external to spending decisions, making them appropriate for determining the true effect of resource revenues.

Initially, a first-stage regression was conducted where resource revenues were regressed on the chosen instruments along with other economic indicators and governance metrics. This step was critical for predicting the values of the potentially endogenous variable, resource revenues ("ResRev_pctGDP"). In the second-stage regression, these predicted values were employed in a Two-Stage Least Squares (2SLS) regression model (Theil, 1953; Basmann, 1957) to assess their impact on government expenditure, while controlling for additional economic and governance factors.

A series of diagnostic tests were performed to ascertain the reliability of the instruments. The first-stage F-statistic, which is widely used to test whether instruments have sufficient explanatory power in the instrumental variable regression context, yielded a value of 5.73. This is below the critical value of 10 suggested by Staiger and Stock (1997), indicating potential weakness in instrument strength, which may affect the reliability of the 2SLS estimates. Furthermore, overidentification tests using the Sargan statistic confirmed the validity of the instruments (p-value > 0.10), suggesting that the model is not subject to overidentification problems (Sargan, 1958).

Further analysis, summarised in Table 11, included interaction terms between oil prices ("OilPrice") and key economic indicators to explore their combined effects on fiscal dynamics. The interaction term between oil prices and GDP growth rate had a significant negative coefficient of -4.59 (std.err.=1.33, $p<0.001$), suggesting that higher oil prices during periods of economic growth are associated with specific fiscal adjustments, possibly indicating a tendency towards saving or reduced expenditure. Conversely, an interaction term between oil prices and the inflation rate displayed a significant positive coefficient of 9.49 (std.err.=1.09, $p<0.001$). This indicates that during periods of high inflation, higher oil prices result in increased government spending, which may be a component of compensatory fiscal policy aimed at mitigating the effects of inflation.

Table 11. Impact of interactions on government spending

Variable	Coefficient	t-stat
Dependent variable: Government expenditure as a percentage of GDP		
Endogenous variable: Resource revenues as a percentage of GDP		
Oil Price * GDP Growth Rate Interaction	-4.59 (1.33) ***	-3.46
Oil Price * Inflation Rate Interaction	9.49 (1.09) ***	8.69
Resource revenues, % of GDP	0.298 (0.517)	0.58
GDP annual growth rate, %	-0.454 (0.091)***	-4.99
Inflation rate, annual, %	-0.060 (0.072)	-0.83
Foreign Direct Investment, % of GDP	-0.039 (0.102)	-0.38
Debt service on external debt, current US$	4.51e-11 (9.49e-12) ***	4.75
Fuel exports, % of merchandise exports	0.041 (0.099)	0.41
Ores and metals exports, % of merchandise exports	-0.041 (0.017)*	-2.44
Voice and accountability, governance indicator	1.148 (0.983)	1.17
Political stability and absence of violence/terrorism, governance indicator	1.895 (0.915)*	2.07
Government effectiveness, governance indicator	-1.189 (1.735)	-0.69
Regulatory quality, governance indicator	0.060 (1.136)	0.05
Rule of law, governance indicator	-4.593 (1.329)**	-3.46
Control of corruption, governance indicator	9.492 (1.093)***	8.69
Constant	*30.120 (0.804)****	*37.48*
Number of observations	*611*	
R-squared	*0.3271*	

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, ***p<0.001.*

Consequently, the instrumental variables (IV) approach offers substantial insights into the causal relationships between resource revenues and government spending. The results highlight the critical role of external economic factors like oil prices in shaping fiscal policies, emphasising the need for adaptive fiscal strategies that respond effectively to external economic shocks. The analysis supports the necessity of accumulating fiscal reserves during economic expansions and implementing proactive adjustments to expenditure in response to inflationary pressures. This underscores the intricacy of fiscal policy management in resource-rich environments.

3.2.4 Subgroup Analysis Based on Resource Revenue Dependence Levels

This subsection delves into the impacts of resource revenues on government expenditure across different levels of resource dependence. By conducting a detailed subgroup analysis, we aim to reveal how varying degrees of reliance on resource revenues affect governmental fiscal behaviors. The

analysis started by categorising countries into three groups – "low", "moderate", and "high" resource revenue dependency – based on quantiles of resource revenues as a percentage of GDP ("ResRev_pctGDP"). Each group underwent regression analysis using Driscoll-Kraay standard errors to account for autocorrelation and heteroscedasticity, ensuring the robustness of the findings (Driscoll and Kraay, 1998).

In the "low" dependency group, the resource revenues variable ("ResRev_pctGDP") was omitted due to collinearity, indicating minimal variation in resource dependence. Countries from the panel dataset analysed, such as Albania, India, and Thailand, are examples where other economic factors predominantly influence government expenditure. In contrast, the analysis for countries with "moderate" dependence, such as Ghana, Colombia, and Vietnam, showed a significant positive relationship between resource revenues and government expenditure. The model showed a coefficient of 2.2407 with a p-value of 0.009, underscoring a responsive fiscal behavior to changes in resource revenues. Similarly, countries from the"high" dependence group displayed a statistically significant impact of resource revenues on government spending (coef. = 0.3027, p-value = 0.026), reflecting the critical role of these revenues in fiscal management. The key results from the subgroup analysis are summarised in Table 12.

Table 12. Impact of resource revenues on government expenditure by dependence level

Resource Dependence Category	**Coefficient**	**t-statistic**	**95% Confidence Interval**
Low Dependence	Omitted	-	-
Moderate Dependence	2.2407 (0.7225)**	3.10	[0.6664, 3.8150]
High Dependence	0.3027 (0.1189)*	2.55	[0.0436, 0.5617]
Full Model (all categories)	0.4743 (0.1332)**	3.56	[0.1840, 0.7647]

*Standard errors are in parentheses. Significance levels: *p<0.05, **p<0.01, ***p<0.001.*

The comprehensive model that included all categories of dependence, along with additional control variables such as GDP growth rate, inflation rate, foreign direct investment, and governance indicators further confirmed the significant impact of resource revenues. The overall model showed that resource revenues positively affect government expenditure with a coefficient of 0.4743 and a p-value of 0.004, substantiating the influence across different models and specifications.

Therefore, the subgroup analysis further enriches our understanding of how different levels of resource revenue dependence impact governmental fiscal policies. It highlights that while countries with moderate and high dependence show significant fiscal responses to changes in resource revenues,

those with low dependence are influenced more by other economic factors. In general, the robustness analysis, spanning various econometric techniques and subgroup analyses, conclusively supports the study's initial findings and reinforces the reliability of its conclusions. By addressing potential data issues and exploring various facets of resource revenue impacts, we have solidified the foundation for policy recommendations aimed at optimising resource revenue management in developing countries.

3.3 Limitations of the study

This study embarked on an ambitious effort to explore the impacts of natural resource revenues on government expenditures across a broad spectrum of countries. However, several constraints limited the scope and depth of the analysis, leading to important considerations for the interpretation of the findings.

One significant limitation was the restricted availability of essential data. The original aim of the study was to cover a wide range of countries from around the world, excluding only high-income countries, in order to assess the impact of natural resource revenues on different types of public expenditure in developing countries. However, the sample size had to be reduced to 47 countries due to significant data availability issues. For instance, one of the major challenges was the lack of available data for specific countries, particularly in the Arab world. Despite these countries being significant oil exporters, there is a notable absence of official data on resource revenues, which are crucial for this analysis. Additionally, data on debt service was also missing for these regions, further complicating the inclusion of such countries in the study. Furthermore, for some countries included in the initial dataset, there were many breaks in data reporting, especially for the years 2009 and 2012, which resulted in incomplete data series and thus, their exclusion from the final analysis.

The analysis also grappled with issues of multicollinearity, especially concerning oil rents. Oil rents, defined as the difference between the value of crude oil production at world prices and total costs of production, provide a specific insight into the economic impact of oil extraction. However, to better meet the broader objective of the study, which is to examine the impact of all natural resource revenues, we chose a more comprehensive measure that would minimise multicollinearity and increase the robustness of the model. In addition, the large number of variables relative to the sample size created additional difficulties in model specification, making the reliability of the regression results more challenging.

Furthermore, robust estimation techniques were also used to check for the presence of first-order autocorrelation, cross-sectional dependence and heteroskedasticity, but these issues could still affect the validity of the results obtained. Ensuring the correctness of the model in the face of complex economic interdependencies and conditions proved to be a challenge that affected the reliability of the study. Another challenge is the generalisability of the results, which are limited to a specific subset of countries analysed and may not reflect global patterns. The use of secondary data sources also casts doubt on the accuracy of the findings, given potential data quality issues. In addition, the assumption that variables such as the quality of governance are exogenous may introduce bias, as these factors may be influenced by other unmodelled dynamics in the contexts studied.

The period under study, 2009 to 2021, was marked by significant global events, including the financial crisis and the COVID-19 pandemic, which may have disproportionately affected the fiscal policies related to government spending and resource dependence in the analysed countries. This external influence could skew the results, suggesting a need for careful interpretation.

In summary, while this study provides valuable insights into the relationship between natural resource revenues and government spending, these limitations must be acknowledged. They not only affect the study's conclusions but also highlight areas for further research. Future studies could expand the data set, refine the model specifications, and explore the nuanced effects of external economic shocks to build on the foundations laid by this study.

Chapter 4. Conclusion and Policy Implications

The main objective of this study was to examine the impact of of natural resource revenues on public expenditure in developing countries. The empirical investigation took into account a wide range of economic and institutional indicators and was structured around four main models of total government expenditure, as well as health, military, and education expenditures per capita, each revealing distinct insights into the financial behaviors influenced by resource wealth. The study aimed to include a comprehensive panel dataset encompassing all developing countries of the world in the period spanning from 2009 to 2021. However, the sample size was reduced to 47 countries due to incomplete data for certain countries across particular variables.

The analysis yielded several significant findings. The total government expenditure model indicated that increases in resource revenues tend to lead to higher government spending, particularly when governance quality is robust. However, this relationship varies across countries and, over time, influenced by external economic conditions, such as global oil prices, and internal factors, such as fiscal policies and institutional stability. The next model, with health expenditure per capita as the dependent variable, found a complex relationship between resource revenues and health spending, with governance playing a crucial role. Countries with better governance mechanisms tend to be more efficient in channelling increased resource revenues towards healthcare. As for the military expenditure model, the analysis indicated that in resource-rich countries, military spending is not directly correlated with resource revenues, but is significantly influenced by geopolitical factors and the economic cycle, including fluctuations in oil prices. Finally, the per capita education expenditure model showed that higher resource revenues are associated with increased education spending, especially in countries with strong governance and accountability mechanisms that ensure these funds are allocated to public services.

The robustness checks also helped to identify new patterns in the data or to reaffirm the main regression analysis results. Using lagged variables of resource revenues, significant delayed effects on government spending were observed, highlighting the temporal dynamics of resource revenue allocation. Principal component analysis (PCA) was employed to address multicollinearity concerns, effectively reducing dimensions and confirming the robustness of our results. System GMM estimation addressed autocorrelation and dynamic data issues, reaffirming the significant impact of resource revenues on government expenditure. Additionally, the instrumental variables (IV) approach addressed potential endogeneity, confirming the causal relationship between resource revenues and

public spending. Our subgroup analysis further illustrated the varying impact of resource revenues based on the level of resource dependence. Countries with low resource dependence showed no significant variability in resource revenues, indicating that other economic factors play a more pivotal role in determining government spending. In contrast, countries with moderate and high resource dependence showed a significant positive relationship between resource revenues and government expenditure, reflecting the sensitivity of public spending to fluctuations in resource revenues.

The study hypothesised that higher oil revenues are correlated with higher public expenditure on health, education, and military, which depends on the quality of governance and economic conditions. The empirical analysis supports this hypothesis, demonstrating that increased oil revenues do indeed correlate with higher public expenditure in these areas. However, the extent and efficiency of this expenditure are significantly influenced by governance quality and economic conditions. Robust governance mechanisms ensure that resource revenues are efficiently allocated to critical public sectors, while poor governance can lead to mismanagement and inefficiencies.

These insights form the basis of the conclusions and policy recommendations regarding the studied topic. Given the focus on Kazakhstan and Mexico in the theoretical part of this thesis, both nations have experienced the so-called resource curse at certain points in their history, when abundant resources have not necessarily translated into broad economic growth or stability. For instance, Mexico experienced a resource curse in the 20th century due to economic instability and mismanagement during its oil boom (Tyburski, 2012). Nevertheless, the country has successfully diversified its economy and, in recent decades, has significantly reduced its resource dependence. Consequently, the experience of Mexico can serve as a useful guide for Kazakhstan in developing effective strategies for managing resource revenues, since contemporary research suggests that Kazakhstan is currently experiencing a resource curse, characterised by dependence on oil and gas revenues, corruption, and poor governance (Aliev, 2015).

In light of the high correlation between natural resource revenues and public expenditure identified in the analysis, it is crucial for Kazakhstan to intensify its economic diversification efforts. The reduction of reliance on hydrocarbon exports, which accounted for about 60% of the country's total exports in 2022 (Figure 6), necessitates the advancement of the economy's non-resource sectors. The primary objective should be the advancement of industrialisation through the establishment of a technologically advanced industry, and the transformation and digitalisation of fixed assets of existing enterprises, with a focus on the creation of high-tech products with subsequent access to global

markets. An important step is the establishment of favourable conditions for innovation and technological advancement, including the implementation of tax incentives[7] (tax credits rather than exemptions) for start-ups and substantial investments in research and development. Furthermore, it is necessary to enhance the country's integration into global value chains. This can be achieved by expanding collaboration with international companies, and by intensifying production processes. An illustrative example of successful integration into global value chains is the Kazakhstani company POSUK Titanium, which produces titanium slabs for Boeing (Government of the Republic of Kazakhstan, 2019). This indicates that the country has the capacity to cultivate productive international partnerships that facilitate diversification and economic growth.

Furthermore, it is imperative to foster entrepreneurship and the growth of small and medium-sized enterprises in the manufacturing and service sectors. This will facilitate the creation of new jobs and the strengthening of the domestic market. Additionally, the development of the tourism industry should be a priority, given Kazakhstan's distinctive natural and cultural resources. These measures will assist in reducing the country's reliance on fluctuations in global oil prices and in establishing a sustainable economy with diverse sources of income.

Moreover, in order to mitigate the impact of oil revenue fluctuations, Kazakhstan could enhance the functionality of its existing sovereign wealth fund to ensure that surplus revenues are saved during periods of high oil prices to support the economy during downturns. According to the Halyk Finance report, the National Fund of the Republic of Kazakhstan faces challenges in transparency and management efficiency (Halyk Finance, 2023). One potential avenue for enhancing transparency would be to publish all reports, including audited IFRS financial statements. In addition, it is necessary to establish rigorous regulations governing the utilisation of the fund, to minimise its use for recurrent expenditures, and to establish an independent supervisory body to monitor the fund's activities. The implementation of these measures would serve to reinforce the stabilisation and accumulation functions of the fund, rendering it more resilient to external shocks and thereby contributing to the country's long-term economic growth.

Finally, with significant government expenditure linked to oil revenues, it's crucial to channel part of this capital into long-term investments in human capital. It is recommended that continued investment be made in the fields of education and healthcare, with a particular focus on the quality and

[7] Tax credits are appropriate because they depend on the amount of investment actually made.

accessibility of services, as well as the training of personnel capable of working in new and emerging sectors of the economy. The development of STEM programmes and teacher professional development will be a pivotal factor in equipping young people with the requisite skills to secure employment in high-tech and innovative industries.

Consequently, the recommendations for resource-rich developing countries revolve around improving governance quality, diversifying economies, working on stabilisation mechanisms, and investing in human capital. Countries should develop strong economic frameworks to reduce the direct impact of natural resource revenue volatility on government spending. One way to do this is by diversifying government revenue sources by mobilising non-resource taxes and through the introduction of stabilisation mechanisms. Investment in infrastructure and human capital is important to promote long-term economic growth, reduce dependence on natural resources revenues, and contribute to more stable government revenue streams. Strengthening institutions and governance practices can help ensure that resource revenues are managed effectively and transparently, which is critical for maintaining public trust and achieving sustainable development.

In sum, the findings from the comprehensive analysis underscore the need for robust policy frameworks that can effectively manage natural resource revenues to foster sustainable economic growth. By focusing on institutional quality, economic diversification, and strategic investments, resource-rich developing countries can transform their natural wealth into a cornerstone for long-term prosperity.

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Appendices

Appendix A: Panel of countries

Africa	1. Algeria
	2. Angola
	3. Botswana
	4. Burkina Faso
	5. Cameroon
	6. Congo, Republic of
	7. Egypt
	8. Ethiopia
	9. Gabon
	10. Ghana
	11. Lesotho
	12. Madagascar
	13. Malawi
	14. Mauritania
	15. Mauritius
	16. Niger
	17. Rwanda
	18. Senegal
	19. Tanzania
	20. Uganda
	21. Zambia
Asia	22. Azerbaijan
	23. China, People's Republic of
	24. India
	25. Indonesia
	26. Iran
	27. Jordan
	28. Kazakhstan
	29. Pakistan
	30. Sri Lanka
	31. Thailand
	32. Vietnam
Americas	33. Belize
	34. Bolivia
	35. Colombia
	36. El Salvador
	37. Jamaica
	38. Mexico
	39. Peru
Europe	40. Albania
	41. Belarus
	42. Bulgaria
	43. Georgia
	44. Moldova
	45. Romania
	46. Russian Federation
Oceania	47. Fiji

Appendix B: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Government expenditure, % of GDP *(GovExp_pctGDP)*	26.85	8.71	11.52	66.44
Military expenditure per capita, Current US$ *(MilExp_perCapita)*	80.21	91.32	2.10	612.20
Health expenditure per capita, Current US$ *(HealthExp_perCapita)*	223.38	187.46	14.84	1040.02
Education expenditure per capita, Current US$ *(EducExp_perCapita)*	172.50	140.88	9.36	636.61
Resource revenues, % of GDP *(ResRev_pctGDP)*	3.53	6.80	0.00	36.35
Oil rents, % of GDP *(OilRent_pctGDP)*	4.05	8.13	0.00	48.67
GDP annual growth rate, % *(GDP_GrowthRate)*	3.41	4.07	-17.04	17.86
Inflation rate, annual, % *(InflationRate)*	5.80	6.55	-3.20	59.20
Foreign Direct Investment, % of GDP *(FDI_pctGDP)*	3.48	3.91	-17.29	37.32
Oil Price (Europe Brent Spot Price FOB), annual average, US$ per barrel	74.64	24.39	41.96	111.63
Debt service on external debt, current US$ *(DebtService)*	1.20e+10	3.14e+10	2.09e+07	3.37e+11
Fuel exports, % of merchandise exports *(FuelExport)*	21.33	28.53	0.00	98.40
Ores and metals exports, % of merchandise exports *(OreMetalExport)*	10.46	16.65	0.00	82.40
Voice and accountability, governance indicator *(VoiceAccount_GovInd)*	-0.42	0.69	-1.70	0.94
Political stability and absence of violence/terrorism, governance indicator *(PolitStab_GovInd)*	-0.45	0.67	-2.81	1.10
Government effectiveness, governance indicator *(GovEffect_GovInd)*	-0.33	0.48	-1.33	1.15
Regulatory quality, governance indicator *(RegQuality_GovInd)*	-0.30	0.57	-1.71	1.20
Rule of law, governance indicator *(RuleOfLaw_GovInd)*	-0.43	0.44	-1.30	1.02
Control of corruption, governance indicator *(CorruptControl_GovInd)*	-0.46	0.48	-1.48	1.00
Number of observations	*611*			