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Growth Effect of Sectoral Expenditure, Human Capital, and Labor Productivity in Oman: An Empirical Study using ARDL Framework

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Abstract: Oman has joined the ranks of resource-dependent economies in understanding the vital role strategic public spending and human capital development play in sustaining long-term economic growth. This research investigates how sectoral spending, labor productivity, domestic investment, and human capital development affect economic growth between 1990 and 2024 within the framework of Oman Vision 2040 and the country's economic diversification efforts beyond oil. The study began its analysis by testing the stationarity properties of the variables, which revealed a mixed order of integration. Based on these results, the study utilized the Autoregressive Distributed Lag (ARDL) method to analyze long-run relationships and assess short- and long-term effects. Using the bounds test, researchers established that the variables maintain a long-term cointegrated relationship. According to the estimation findings, labor productivity and military spending demonstrate a substantial negative influence on Oman's economic growth. Investments in education and human capital, demonstrated through secondary school enrollment, have a significant positive correlation with economic growth. The analysis revealed that domestic investment does not produce statistically significant results, which implies that its current distribution does not enhance economic performance effectively. Standard diagnostic tests validated the model, which demonstrated that the findings are both robust and reliable. The findings demonstrate that Oman needs to focus on educational advancement and skill training while reassessing how resources are allocated between investments and military expenditures to enable its shift towards a diversified knowledge-based economic structure.

Keywords: Economic Growth, Sectoral Expenditure, Labor Productivity, Domestic Investment, Oman.

1. Introduction

The economic strategy Vision 2040 has led Oman to implement various diversification initiatives to maintain sustainable growth despite its reliance on oil. The vulnerability of Oman's economic growth path remains exposed because substantial hydrocarbon revenues cannot shield the country from global oil price fluctuations (Hassan, 2025). Recent oil price declines have emphasized the importance of developing

diverse economic structures and building resilient systems (Ridwan, 2023). The government has begun prioritizing human development investments and key public sectors more strongly in response to economic challenges. The year 2024 saw education spending reach 5.1% of GDP, and health expenditures amount to 4.4%, indicating a policy movement toward human capital development (Mishra et al., 2024). The nation allocates 8.7% of its GDP to military spending, which stands as one of the region's largest percentages. Annual growth rates of labor force productivity demonstrate moderate progress, ranging between 1.3% and 2.1% throughout the last few years (Khaledi et al., 2024). The presented statistics prompt essential inquiries into the performance and financial outcomes derived from sectoral investments. Although previous research has examined Gulf countries' economic expansion, only a limited number of studies have implemented a country-focused econometric analysis to explore the prolonged and immediate impacts of sectoral spending, especially human capital and labor productivity, on GDP per capita. The motivation for this study stems from the absence of targeted empirical research analyzing how sector-specific spending on education, health, military, and investment influences Oman's economic growth. The government distributes major resources into these sectors, yet concrete proof of their contribution to GDP per capita remains scarce. The existing research on GCC nations fails to address Oman's special financial framework and neglects to utilize appropriate econometric techniques like ARDL, which would allow analysis of both long-term and immediate economic impacts. This study bridges the existing knowledge gap by offering data-driven insights to enhance policy decision-making in alignment with Oman's Vision 2040 objectives.

Governments utilize sectoral expenditures to invest in areas like education and health, as well as military spending and domestic infrastructure development, to achieve their economic growth targets. Omani government spending shows significant financial commitments to education and health, which demonstrates the nation's strategic objective to enhance human capital development (Bhandari & Mohite, 2024). The government uses education funding to increase workforce productivity and drive economic growth by enhancing the skills and job prospects of its population (Ridzuan et al., 2023). Health spending strives to enhance people's health and reduce illness so they become more productive at work. While Oman has allocated substantial funding to these areas, there remains insufficient data to demonstrate their impact on GDP per capita growth (Lai et al., 2024). An analysis of Oman's economic diversification strategies and oil revenue dependence enables a proper assessment of how government spending affects long-term economic outcomes. This research investigates Oman's economic growth through econometric analysis to measure both direct and indirect investment effects on budget allocations in multiple sectors.

Oman's economic future will depend on sectoral spending patterns, labor productivity levels, domestic investment flows, and military spending. For the past decade, Oman's labor productivity growth rate has maintained moderate performance with an annual increase between 1.3% and 2.1%. The reduced growth rate demonstrates the challenges Oman faces in maximizing its workforce potential (Ahmed et al., 2024). The sluggish progression in productivity levels generates doubts about the success of human capital investments and the wider economic impact of inadequate labor productivity levels. Oman requires home-grown investments that blend state and private sector funds to build its infrastructure and expand its economic variety. Oman has succeeded in drawing foreign direct investment, yet domestic capital continues to focus on oil, while non-oil sectors receive minimal investment (Rajan, 2024). The 16.2% GDP share from gross domestic fixed investment in 2024 incorporates significant funding for oil and gas projects, which brings up concerns about resource distribution to other sectors, including manufacturing and

technology. Oman allocates 8.7% of its GDP to military spending, which surpasses most Gulf countries, resulting in debates about prioritizing security over economic development (Sujee et al., 2024). The significant portion of GDP allocated to military expenses implies a potential opportunity cost by reducing funds available for education, health, and infrastructure development, which could generate greater economic benefits over time. Researching how these variables interact and their combined effect on GDP per capita growth helps create balanced economic policies that advance Vision 2040's goals.

Education, healthcare, defense, and domestic investment are the four areas whose effects on Oman's GDP growth are dissected in this study. The primary objective is to use the ARDL approach to assess the immediate and delayed effects of expenditure on GDP per capita, taking into account both the short and long term. The study investigates the combined effects of labor productivity, domestic investment, and military expenditure on sector-specific performance and their collective impact on economic growth. Through these research objectives, the study will bridge a major research void concerning Oman's distinct fiscal framework and economic behavior, which are not adequately explored when compared to other GCC nations. Most studies about sectoral spending in Gulf countries do not use complex econometric approaches such as ARDL to evaluate how different government expenditures affect economic performance from the perspective of individual nations. The research on how military spending affects economic growth in Oman remains scarce in terms of empirical data. Through this research, we will perform an extensive analysis that will reveal fresh perspectives about sectoral investment efficiency and provide evidence-based suggestions to guide policy-making within the framework of Oman's Vision 2040.

The structure of the remaining sections is as follows: The second section offers a thorough examination of existing research. The study's data sources and econometric methodology are detailed in Section 3. Section 4 with the heading “Results and Discussion” presents the main outcomes of the econometric analysis and explores their broader implications. The final section of the paper provides concluding statements and outlines policy recommendations based on the research results.

2. Literature Review

The empirical literature extensively examines how government spending affects economic growth and presents different results depending on the region and sector studied. Zulkifli et al. (2022) discovered through ARDL analysis of Malaysia's data from 1990 to 2022 that government spending variables impact growth differently over time because only trade openness and labor expenditure show positive long-term effects. The analysis reveals that housing and education serve as important drivers for long-term growth, which endorses Wagner's law rather than the Keynesian approach to expansionary fiscal policy. Similarly, Poku et al. (2022) utilized ARDL techniques to evaluate Ghanaian data from 1970 to 2016 and discovered that government expenditure positively influenced GDP growth in the short term. Gross Capital Formation and Foreign Direct Investment provided sustained growth support, while population growth showed a negative impact. In the Nigerian context, Jibir et al. (2023) identified that capital and recurrent expenditures both contributed positively to long-term growth, yet demonstrated that recurrent expenditures had a negative impact on short-term growth. The long-term benefits of capital expenditure on administrative services offset its negative short-term impact. Buthelezi's (2023) study used VEC and Markov-switching models to analyze South Africa's government spending patterns and found that increased government expenditure failed to drive growth and even harmed weaker economies, thus contradicting

Keynesian economic theories. Studies by Wahab et al. (2018) and Mallick et al. (2016) confirmed that sector-specific investments show that education and health expenditures create long-term growth benefits for OIC and Asian nations and demonstrate that public spending must be strategically directed.

Numerous investigations have looked at the link between worker productivity and economic growth, which has produced different results in different areas and economic settings. Using sophisticated panel cointegration and Granger causality methods from 1994 to 2018, M'baye (2022) investigated this nexus within the West African Economic and Monetary Union (WAEMU). The study utilized multiple Granger causality models, such as Dumitrescu and Hurlin's (2012) and Toda and Yamamoto's (1995) enhanced VAR approach, but found no causal relationship between labor productivity and economic growth. The labor-intensive nature of WAEMU countries becomes clear because their workforces consist largely of informal employment rather than improved productivity. In contrast, Alam et al. The study conducted by Alam et al. in 2013 discovered connections between labor productivity, economic development, and foreign direct investment (FDI) in both short- and long-term perspectives through panel data analysis from 19 OECD countries between 1980 and 2009 using the GMM estimator. The investigation demonstrates that while economic growth and labor productivity display bidirectional causation over an extended period, in the short term, economic growth benefits from positive influences from both FDI and labor productivity. Korkmaz and Korkmaz (2017) analyzed seven OECD countries from 2008 to 2014 through panel cointegration and Granger causality tests. Their research showed a long-run equilibrium connection between economic growth and labor productivity per hour worked, with unidirectional causation flowing from economic growth to labor productivity. Advanced nations experience higher productivity as a result of continuous economic growth. Cristea et al. Cristea and their team (2020) researched the socioeconomic effects within the European Union and found that aging populations negatively impact labor productivity, which demands policy reforms to sustain productivity and manage poverty risks. The research demonstrates how worker productivity and economic development interact through complex and context-specific relationships involving structural, demographic, and institutional components.

Research on the impact of domestic investment on economic growth has garnered significant academic interest, yet has produced diverse results dependent on regional and methodological factors. The research conducted by Bakari (2017) examined Malaysia's economic performance between 1960 and 2015 through the application of Johansen cointegration and Vector Error Correction Models (VECM) as well as Granger causality tests. The study demonstrated that for economic growth to expand over an extended period, domestic investment together with exports and labor make significant contributions, while immediate economic effects remain negligible. The Malaysian development strategy achieves greater success through consistent capital accumulation throughout extended periods. Bakari and Weriemmi (2024) examined Arab countries over the period from 1990 to 2020 using VECM analysis and found no lasting connection between domestic investment and economic growth. The analysis discovered short-term bidirectional causality between domestic investment and economic performance, which shows immediate economic benefits from domestic investment, yet these impacts are not sustained over time. Belloumi and Alshehry (2018) analyzed Saudi Arabia's economic data from 1970 to 2015 using ARDL bounds testing and multiple cointegration methods. The study demonstrated negative bidirectional causality between domestic capital investment and non-oil GDP growth due to structural inefficiencies in capital allocation within oil-dependent economies. Zaharuddin and Jalil (2022) analyzed Malaysia's journey to high-income status using

economic data from 1979 to 2019. Gross fixed capital formation (GFCF), which measures domestic investment levels, shows a positive effect on GDP, with a 1% rise in GFCF resulting in a 0.8136% increase in GDP. Finally, Younsi et al. (2021) investigated 41 African countries and found that domestic investment (DI), along with foreign aid (AID) and FDI, creates a nonlinear pattern that boosts economic growth. The effectiveness of domestic investment in driving economic growth in both short-term and long-term periods usually depends on the wider macroeconomic stability as well as the quality of institutions and their integration with external capital flows.

Human capital emerges from the combination of education levels with healthcare quality and workforce standards as they shape the economic growth paths of nations. The study by Wegari et al. Wegari et al. Wegari et al. (2023) conducted an analysis of Ethiopia's economic growth between 1980 and 2020 by applying ARDL modeling techniques and stationarity tests. The research demonstrates that Ethiopia's GDP growth maintains a consistent relationship with human capital factors such as educational attainment and health expenditures, showing that increasing secondary school attendance and expanding health funding are essential for Ethiopia's economic advancement. Widarni and Bawono (2021) found that education played a constructive role in building human capital and economic growth throughout their study of Indonesia between 1984 and 2019. Their research highlighted how technological development works synergistically alongside other factors. Through a panel data study with fixed effects on 32 developing nations from 2000 to 2014, Altiner and Toktas (2017) demonstrated that human capital development, especially secondary education, leads to moderate economic growth improvements. Primary education did not affect growth significantly, and rapid population growth, along with insufficient capital per worker, resulted in a negative labor force impact on growth. Using nonparametric and semiparametric approaches, Matousek and Tzeremes (2021) examined a dataset from 100 countries spanning 1970 to 2014 through a nonlinear perspective. Under perfect substitutability conditions between skilled and unskilled labor, their study demonstrated how human capital exerts a positive influence on economic outcomes. Finally, Uddin et al. (2021) investigated how institutions connect with human capital across 120 developing countries. The study showed that both factors increase growth individually, but weak institutions result in ineffective human capital deployment and decreased effectiveness. Research indicates human capital drives economic growth, yet its effectiveness relies on the quality of education and institutional strength alongside technological and governance synergies.

There is a noticeable gap in the literature regarding the specific impact of labor productivity, domestic investment, and human capital on economic growth in Oman. Existing studies largely overlook Oman's unique economic structure, high reliance on oil revenues, and ongoing diversification efforts under Vision 2040. Moreover, there is limited empirical research that applies appropriate econometric models to assess the short- and long-term effects of these variables within the Omani context. The interaction between human capital and institutional quality, as well as sector-specific contributions to productivity, remains unexplored. This gap highlights the need for a comprehensive, country-specific analysis to guide more effective economic policy and planning in Oman.

3. Methodology

3.1. Data and Variables

This paper studies the resource curse hypothesis in Oman between 1990 and 2024 to assess whether Oman suffers from resource curse symptoms or not. The period between selected times related to oil revenue experienced significant changes from 1990 through 2024, which included phases of economic expansion alongside periods of instability and transformation. Revenue trends remained stable in 1990 before transitioning into a phase of substantial growth. Oil revenues experienced a surge during the early 2000s, which reached its highest point between 2009 and 2012. The collapse of the global oil price caused revenue declines in 2014. The years after 2014 experienced economic fluctuations as revenues recovered in 2018 but fell again in 2020 because of the COVID-19 pandemic. The data sources include the National Center for Statistics and Information (NCSI) and the World Development Indicators (WDI), which are well-established institutions. Table 1 lists the variables along with their descriptions and logarithmic transformations, as well as the units of measurement and data sources. The study examines seven macroeconomic variables: Gross Domestic Product GDP and Labor Force (LAB) show that domestic investment (DO), human capital (HC), military expenditure (MILX), and health expenditure (LHLX) are the main factors that influence economic development. The nation's economic growth is evaluated using per capita real GDP within GDP measurements, while LLAB measures labor growth through self-employment statistics. An economy's growth trajectory depends heavily on domestic investment activities, which span infrastructure construction, land renovations, and plant machinery equipment purchases. The level of economic growth and technology transfer relies significantly on human capital, as educational attainment and graduation rates measure it. MILX measures the financial expenditure of sovereign nations on military capabilities, which influences both international stability and defense strategies. Health expenditure (LHLX) refers to the financial resources allocated for healthcare services across a country or region, including hospitals and medical services, as well as public health programs, preventive healthcare, pharmaceutical production, medical research activities, and health insurance systems. Better health outcomes follow increased health funding, but proper resource allocation and management continue to be essential.

Table 1: Data and Sources of the Variables

Variables	Description	Logarithmic Form	Unit of Measurement	Sources
GDP	GDP Per Capita	LGDP	Current (US$)	NCSI
LAB	Labor	LLAB	Productivity output	WDI
DI	Domestic Investment	LDI	gross domestic fixed investment (US$)	WDI
HC	Human Capital	LHC	secondary school enrollment rate %	WDI
MLX	Military Expenditure	LMLX	Military expenditure (current US$)	WDI
HEX	Health Expenditure	LHEX	Health Expenditure (Current US$)	WDI
EDU	Education Expenditure	LEDU	Education Expenditure (Current US$)	WDI

3.2. Theoretical Framework and Model Specification

The research analyzes Oman's GDP per capita responses to different economic factors using the Cobb-Douglas production function model. . The model positions GDP per capita as the dependent variable and uses labor productivity, domestic investment, human capital, health expenditure, education expenditure, and military expenditure as independent variables. Traditional Cobb-Douglas production functions associate output with labor and capital inputs, whereas modern modifications incorporate human capital and government spending to better represent present-day growth trends. Workforce efficiency measurement through labor productivity (LLAB) affects per capita output, while domestic investment (LDI) facilitates capital formation for production inputs and supports both infrastructure development and capacity expansion. Secondary education enrollment rates measure human capital, which leads to workforce improvements while driving long-term growth through innovation and efficiency gains. Investments in health (LHEX) and education (LEDU) through public funding result in better population health and more skilled workforce development, which boosts productivity and power. The Cobb-Douglas model excludes military spending (LMLX) as a variable, but this spending impacts economic growth through technology advancement or resource allocation away from productive sectors. Researchers apply a log-linear transformation to this framework, which allows them to evaluate input elasticity and understand how various inputs impact GDP per capita growth through the integration of theoretical concepts and empirical validation. Adopting a standard Cobb-Douglas production function assuming a constant rate of returns, the aggregate output function can be shown as follows:

$$Y_t = f(K_t, L_t) \tag{1}$$

Where Y_t is the GDP at time t, K_t is capital at time t, and Lt is effective labor at time t.

Now, by replacing study variables in a theoretical format, we can get the following functional form:

$$GDP_t = f(LAB_t, DI_t, HC_t, MLX_t, HEX_t, EDU_t) \tag{2}$$

The econometric version of Equation (2) can be written in Equation (3) as follows:

$$lnGDP_t = \beta_0 + \beta_1 LAB_t + \beta_2 DI_t + \beta_3 HC_t + \beta_4 MLX_t + \beta_5 HEX_t + \beta_6 EDU_t + \varepsilon_t \tag{3}$$

Where β_0 denotes the intercept term, β_1 to β_6 denote the coefficients of the explanatory variables, and ε_t shows the error term.

3.3. Empirical Framework

The study achieved its research goals by applying several econometric methods. The research employed Augmented Dickey-Fuller (ADF) as well as Phillips-Perron (P-P) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root tests to analyze the stationary properties of the data. The utilization of unit root testing boosts model precision and establishes stable statistical characteristics, and guides researchers towards suitable econometric methods like ARDL and VAR alongside cointegration models. Unit root testing is an essential preliminary procedure for macroeconomic and financial datasets because they frequently demonstrate trends and shocks. Unit root testing helps researchers identify stationary conditions and integration levels, which result in accurate model specification and reliable empirical outcomes.

The ARDL bounds testing approach served as our method for determining the cointegration between the series. This method, developed by Pesaran et al. Pesaran and colleagues developed the ARDL bounds testing procedure. The ARDL bounds testing procedure introduced by Pesaran et al. (2001) delivers various advantages that position it above traditional cointegration methods. The ARDL bounds test distinguishes itself from traditional methods because it permits usage on variables with varying integration orders, including I(0) and I(1), without needing all variables to share the same integration order. The ARDL bounds testing approach demonstrates superior reliability in research with limited sample sizes compared to other methods that lose statistical power under these conditions. The method delivers accurate and dependable long-term relationship estimates for the model. The structure of the ARDL bounds test is represented in Equation 4.

$$\Delta \ln GDP_t = \vartheta_0 + \pi_1 lnGDP_{t-1} + \pi_2 lnLAB_{t-1} + \pi_3 lnDI_{t-1} + \pi_4 lnHC_{t-1} + \pi_5 lnMLX_{t-1} + \pi_6 lnHEX_{t-1} + \pi_7 lnEDU_{t-1} + \sum_{i=1}^{w} \vartheta_1 \Delta lnGDP_{t-i} + \sum_{i=1}^{w} \vartheta_2 \Delta \ln LAB_{t-i} + \sum_{i=1}^{w} \vartheta_3 \Delta \ln DI_{t-i} + \sum_{i=1}^{w} \vartheta_4 \Delta lnHC_{t-i} + \sum_{i=1}^{w} \vartheta_5 \Delta \ln MLX_{t-i} + \sum_{i=1}^{w} \vartheta_6 \Delta \ln HEX_{t-i} \sum_{i=1}^{w} \vartheta_7 \Delta \ln EDU_{t-i} + €_t \quad (4)$$

No cointegration (the null hypothesis) is contrasted with evidence of cointegration (the alternative hypothesis). If the F-statistic exceeds the threshold values for the upper and lower limits, we cannot accept the null hypothesis. Null and alternative hypotheses are shown in Equations 5 and 6:

$$H_0 = \vartheta_1 = \vartheta_2 = \vartheta_3 = \vartheta_4 = \vartheta_5 = \vartheta_6 \quad (5)$$

$$H_1 = \vartheta_1 \neq \vartheta_2 \neq \vartheta_3 \neq \vartheta_4 \neq \vartheta_5 \neq \vartheta_6 \quad (6)$$

H_1 stands for the alternative hypothesis, and H0 for the null hypothesis.

We used the ARDL method after establishing that the parameters are cointegrated. Engle and Granger's [54] error correction model (ECM) is applied to evaluate short-term correlations and the "Error Correction Term," after which the long-term associations have been established. Equation 7 is employed for the long-run ARDL estimation.

$$\Delta lnGDP_t = \vartheta_0 + \sum_{i=1}^{w} \vartheta_1 \Delta \ln GDP_{t-i} + \sum_{i=1}^{w} \vartheta_2 \Delta \ln LAB_{t-i} + \sum_{i=1}^{w} \vartheta_3 \Delta LDI_{t-i} + \sum_{i=1}^{w} \vartheta_4 \Delta lnHC_{t-i} + \sum_{i=1}^{w} \vartheta_5 \Delta \ln MLX_{t-i} + \sum_{i=1}^{w} \vartheta_6 \Delta \ln HEX_{t-i} + \sum_{i=1}^{w} \vartheta_6 \Delta \ln EDU_{t-i} + \ell ECT_{t-i} + €_t \quad (7)$$

Where the speed of adjustment is denoted by ℓ

The study utilizes multiple diagnostic tests to verify the regression model's reliability and strength. The Jarque-Bera test checks if residuals follow a normal distribution by analyzing their skewness and kurtosis, which is essential for standard hypothesis testing validity. The Lagrange Multiplier (LM) test examines whether error terms exhibit autocorrelation across different observations to verify compliance with classical linear regression assumptions. The Breusch-Pagan-Godfrey test serves to check whether the residuals maintain constant variance in all observations while addressing heteroscedasticity issues. Heteroscedasticity produces inefficient estimation and biased standard errors, which undermine the validity of statistical conclusions. The Ramsey RESET performs a Regression Equation Specification Error Test to detect model misspecification by examining if nonlinear combinations of fitted values add explanatory power to the dependent variable. If the test outcome is significant, it indicates that the model possibly misses key

variables or nonlinear relationships. These diagnostic tests together verify that the regression model specification is correct, all assumptions hold true, and estimated relationships have statistical validity, enhancing the study's credibility.

4. Results and Discussion

4.1. Results of the Unit Root

The unit root test constitutes a statistical methodology employed to ascertain the stationarity of a time series variable, an essential consideration within the realm of econometric modeling. Stationarity denotes the constancy of a variable's statistical properties, such as mean and variance, over temporal intervals. The presence of a unit root signifies non-stationarity, suggesting that perturbations to the variable exert enduring effects. In the context of this analysis, three distinct tests—the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and DF-GLS test—were utilized to evaluate the stationarity of various economic indicators, which encompass GDP, labor statistics, domestic investment, human capital, military expenditure, educational expenditure, and health expenditure. At the level form (I(0)), the majority of variables do not reject the null hypothesis associated with a unit root, thereby indicating non-stationarity. For instance, the ADF test outcomes for GDP (LNGDP) at the intercept level (-2.564) and the intercept with trend (-2.002) do not achieve significance at conventional thresholds, thereby implying the non-stationarity of GDP in its original formulation. Likewise, labor (LNLAB) and educational expenditure (LNEDU) display positive or near-zero values, further corroborating the assertion of non-stationarity. Conversely, upon applying first differencing to the variables (I(1)), the results exhibit a marked transformation, with the majority of variables attaining stationarity. For example, the first-differenced LNGDP yields an ADF statistic of -3.011, with a significance level of 1%, thereby affirming its stationarity. Domestic investment (LNDI) likewise demonstrates considerable stationarity at the first difference, with ADF and PP test values surpassing the critical thresholds at the 1% significance level. This indicates that, following the removal of trends, these variables stabilize, rendering them amenable to subsequent econometric analysis. A notable relationship at the present lag is discernible for specific variables, particularly in their first-differenced state. For instance, health expenditure (INHEX) achieves high significance at the 1% level in both the ADF and PP tests subsequent to first differencing, signifying a robust correction towards equilibrium. Similarly, human capital (LNHC) and military expenditure (LNMLX) also manifest high significance at first difference, implying that their short-term fluctuations are stationary and responsive to prior alterations. This suggests that shocks to these variables exert only temporary effects and exhibit tendencies to revert to equilibrium over time. The findings derived from the unit root test substantiate that the majority of economic variables examined in this study are non-stationary at the level but attain stationarity subsequent to first differencing. This validates the implementation of different transformations in econometric models to ensure the accuracy of inferences, thereby underscoring the critical importance of addressing non-stationarity within the framework of time series analysis.

Table 2. Results of the unit root test

LEVEL I (0)	ADF Unite Root		PP Unite Root		DF GLS test	
	Intercept	Intercept and	Intercept	Intercept and	Intercept	Intercept and

		Trend		Trend		Trend
LNGDP	-2.564 (1)	-2.002 (4)	-2.209 (2)	-1.940 (1)		-2.0776
LNLAB	0.060915 (6)	-2.1688 (6)	-0.6218 (4)	-1.6770 (4)	-2.2165 (1)	-2.1807 (1)
LNDI	-2.253 (0)	-4.1397(0)	-2.134162 (16)	-4.0058 (16)	-1.393 (0)	-4.061(0)
LNHC	-1.04271(0)	-1.43399 (0)	-1.0626 (1)	-1.34272 (2)	-0.2785(0)	-1.659(0)
LNMLX	0.0542 (0)	-2.7690(0)	-0.1184 (2)	-2.3417(3)	-0.2341	-1.762
LNEDU	1.5680(0)	0.8925(0)	1.5724(1)	0.892(0)	-1.282 (0)	1.079 (0)
INHEX	- 1.019 (0)	-1.410 (0)	-1.0175 (2)	-1.651(3)	-0.2956	-1.574
First differ I(1)	ADF Unite Root		PP Unite Root		DF GLS test	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend	Intercept	Intercept and Trend
LNGDP	2.918203(3*	-3.011570(3)***	-3.634(1)***	-3.565(0)	-3.591	-3.089
LNLAB	-3.2628 (5)	-3.201(5)***	-2.2165(1)	-2.1807(1)	-3.3019	-3.1622
LNDI	-5.697(2)***	-11.694 (2)***	-11.6948(15)	12.341(15)***	-5.9287	-6.357
LNHC	6.4117(0)***	-6.4757(0)	-6.4117(0)	-6.5458 (2)	-6.3809	-6.605
LNMLX	-4.50652(0)	-4.5754(0)***	4.42997(5)***	-4.4469(6)***	4.5610(0)	-4.561 (0)
LNEDU	-1.5226 (0)	-1.83744(0)	-1.4786 (1)	-1.7820(1)	-1.5765	-2.374
INHEX	-5.1789(0)***	-5.1668(0)***	-5.1620 (2)***	-5.1492 (2)***	-5.2623	-5.3334

Note: 1. ***, **, and * are 1%, 5%, and 10% significance levels, respectively. 2. The optimal lag length is selected automatically using the Schwarz information criteria for the ADF test, and the bandwidth has been selected by using the Newey–West method for the PP test.

4.2. ARDL Bound Test

The ARDL bounds test results for the model examine the long-term connections between GDP as the dependent variable and the independent variables labor force, domestic investment, human capital, military expenditure, education expenditure, and health expenditure. The F-statistic value of 8.474588 indicates robust evidence against the null hypothesis, which presumes no level relationship. To determine cointegration, we must compare the calculated F-statistic against asymptotic critical values across multiple

significance thresholds of 10%, 5%, 2.5%, and 1%. At all conventional significance levels and specifically at 1% (4.66), the F-statistic surpasses the upper bound (I1), which leads to the rejection of the null hypothesis. The results show that GDP maintains a stable long-term equilibrium relationship with its explanatory variables. The use of three independent variables in the model contributes to robust estimation results. The F-statistic surpassing the upper threshold demonstrates that military, education, and health expenditures exert sustained impacts on GDP, which underscores the importance of these sectors economically. Cointegration indicates that deviations from equilibrium triggered by short-term shocks will self-correct over time. The ARDL method stands out as suitable for further analysis through its capability to estimate the Error Correction Model (ECM), which measures short-term dynamics alongside maintaining established long-term relationships. The findings indicate that sustained investment in defense education and healthcare sectors generates long-term economic growth, which becomes essential for macroeconomic stability and sustainable development.

Table 3: Result of ARDL bound test

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	8.800***	10%	1.990	2.940
k	6	5%	2.270	3.280
		2.50%	2.550	3.610
		1%	2.880	3.990

4.3. Short-Run Estimation

The ARDL estimation results provide critical understanding about the influence of different government spending types on Oman's economic development and thoroughly document their impact over both short-term and long-term periods. Table 3 data shows the separate economic growth effects produced by military and health spending, along with education expenditure. Research demonstrates that military expenditures (LMLX) show a strong inverse relationship with economic growth (LGDP). The economic growth suffers negative effects from military expenditure during both immediate and extended periods, which show impact coefficients of -0.148 for short-term and -0.168 for long-term effects. The analysis demonstrates that increasing military spending by 1% leads to a 0.168% long-term economic growth reduction and a 0.148% short-term growth reduction with statistically significant results. When governments allocate more resources to military spending, it restricts investment opportunities in essential growth sectors, including infrastructure and education, which are vital for long-term economic development. The opportunity cost theory demonstrates how excessive military spending diverts money away from sectors that could generate higher financial returns. The immediate effect of military spending on Oman's GDP demonstrates negative consequences, which are less severe due to its minimal contribution to productive economic output.

The relationship between health expenditure (LHEX) and education expenditure (LEDU) demonstrates a strong positive correlation when linked to economic growth. Long-term evidence shows that a 1% increase in health spending produces a 0.166% GDP growth with a highly significant statistical correlation at the 1% level. Increased public healthcare funding results in improved labor productivity and lower disease

burdens, which improves workforce performance and stimulates economic growth. Allocating funds to health spending is crucial because it supports human capital development, which then becomes key to achieving sustainable economic growth. Funding investments in education (LEDU) generates substantial economic growth while demonstrating the benefits of developing human capital. A 1% increase in education spending produces 0.130% long-term GDP growth and 0.272% short-term GDP growth. Immediate investment in education produces fast economic benefits by generating jobs and boosting worker skills and productivity. Education investment generates ongoing financial benefits, which makes education an essential part of long-term development strategies. Endogenous growth theories have been validated by research, which shows education as the primary catalyst for economic innovation and lasting growth through productivity advancements. The Error Correction Term (ECT) provides crucial stability information by measuring the speed with which economies return to equilibrium following temporary disturbances. The Error Correction Term (ECT) value of -1.259 proves highly significant at the 1% level, indicating prompt correction of short-term economic growth disparities. The large negative figure illustrates that any deviations from long-term equilibrium are corrected at a rate of 125.9% per time period. The economic system in Oman features strong internal mechanisms that quickly bring government spending and GDP relationships back to their balanced state after disruptions occur.

The ARDL model reveals critical insights into how various economic factors affect economic growth (LNGDP) in the short term. The short-term coefficient for human capital (D(LNHC)) registers at -0.049347 with a probability value of 0.0873. The negative relationship observed between human capital and economic growth does not reach statistical significance according to conventional standards. Investments in human capital through short-term training expenditures and skill enhancement initiatives fail to generate immediate economic growth effects. The productivity gains from human capital improvements require time to surface because educational and training benefits develop gradually, not immediately. At the 1% significance level ($p = 0.0097$), education expenditure (D(LNEDU)) shows a coefficient value of -0.022676. Although the negative sign seems counterintuitive, it actually reflects the time lag between educational spending and its economic returns. An increase in education spending may shift resources away from other productive areas, which could cause a temporary decrease in economic output. The economic benefits provided by education require time to build, as students and trainees have not yet entered the workforce.

Based on the extremely high p-value of 0.9956 and its insignificant coefficient of -0.000516, the labor variable (D(LLAB)) fails to show a statistically significant impact on short-term economic growth. Research shows that economic growth remains unaffected by short-term labor supply shifts such as temporary job modifications and participation rate changes over the analyzed period. The influence of structural determinants on labor's contribution to economic growth depends on extended trends instead of brief variations. Overall, these findings elucidate a pivotal consideration: Sustainable economic development benefits substantially from educational and human capital investments, yet these investments yield negligible short-term results. Analysis of growth measures reveals a lack of immediate positive outcomes or displays negative impacts during transitional stages and periods of resource reallocation. The implementation of sustainable policy frameworks is crucial for unlocking growth potential through educational system enhancements and labor market reforms.

Table 4: Short-run Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP(-1)*	-0.352930	0.079599	-4.433823	0.0003
LNLAB(-1)	-0.235743	0.054996	-4.286524	0.0004
LNDI**	0.029584	0.022943	1.289458	0.2120
LNHC(-1)	0.055959	0.018357	3.048429	0.0063
LNMLX**	-0.029023	0.017324	-1.675281	0.1094
LNEDU(-1)	0.071224	0.031751	2.243231	0.0364
INHEX**	0.008312	0.040074	0.207422	0.8378
D(LNLAB)	-0.000516	0.091666	-0.005632	0.9956
D(LNHC)	-0.049347	0.027445	-1.797989	0.0873
D(LNHC(-1))	-0.123067	0.028272	-4.352986	0.0003
D(LNEDU)	-0.022676	0.007933	-2.858424	0.0097
D(LNEDU(-1))	-0.081408	0.029675	-2.743360	0.0125
CointEq(-1)*	-0.352930	0.036201	-9.749132	0.0000

4.4. Long-Run Estimation

The long-run elasticity results from the ARDL model provide complete insights into economic growth (LNGDP) dynamics by illustrating the temporal impact of various economic factors. The labor coefficient LNLAB reached -0.667 and showed statistical significance with a p-value of 0.001 at the 1% level, which indicates strong negative effects on long-term economic growth from labor. A rising labor supply that is not matched by productivity improvements or capital investments creates economic inefficiencies, which hinder overall economic growth. Rahman and Alam's (2021) research shows that major economies face growth problems when they expand labor inputs without productivity improvements. The domestic investment (LNDI) coefficient shows a positive value of 0.083, which fails to reach statistical significance because its p-value exceeds the threshold at 0.232. While investment is essential for capital formation and business growth, it only yields long-term growth when combined with technological progress and strong institutional systems. Ahmed and Shaikh (2024) demonstrate that physical capital stimulates economic growth through effective investment management, which results in growth benefits. Long-term economic growth depends heavily on education and skill development, which is shown by the highly significant positive coefficient of 0.158 ($p = 0.002$) for human capital (LNHC). The findings align with Rahman and Alam's (2021) research, which demonstrates how human capital development results in more innovation and productivity that propels economic growth.

The coefficient for military spending (LNMLX) stands at -0.082 with statistical significance at the 10% threshold ($p = 0.098$). The data indicates that higher military spending takes resources away from productive sectors, which leads to slower economic growth. Military investment strengthens national

security, but excessive spending reduces funds needed for essential activities that drive growth. The positive coefficient of 0.201 for education expenditure (LNEDU) demonstrates its statistically important role in economic growth (p = 0.027). This finding aligns with Bytyqi et al. Research by Bytyqi et al. (2024) showed that education spending drives economic growth in EU states by demonstrating that educational investments improve workforce abilities and productivity. Long-term economic growth remains unaffected by health spending, according to the non-significant coefficient of 0.023 paired with a p-value of 0.839 for LNHEX. This statement does not suggest that healthcare lacks importance because its influence on economic growth operates through indirect channels that take time to become apparent. The highly significant coefficient of 15.672 for the constant term (p = 0.0000) demonstrates that structural factors beyond the measured variables are impacting economic growth. Other essential factors, including governance quality, technological advancement, and macroeconomic stability, significantly determine long-term economic outcomes. These results demonstrate the necessity for strategic policy choices that will boost labor productivity while properly directing investment and focusing on human capital development to maintain economic growth. Labor expansion may harm economic growth by itself, but strategic enhancements in education and skill development can counteract these negative effects and build a stronger and more productive economy.

Table 5: Long-run estimation (Model 02)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNLAB	-0.667***	0.180	-3.701	0.001
LNDI	0.083	0.068	1.230	0.232
LNHC	0.158***	0.046	3.391	0.002
LNMLX	-0.082*	0.047	-1.735	0.098
LNEDU	0.201**	0.085	2.371	0.027
LNHEX	0.023	0.0114	0.205	0.839
C	15.672	1.265	12.383	0.0000

4.5. Diagnostic Test

The diagnostic evaluation outcomes for the model provide significant insights pertaining to its statistical integrity and dependability. The Jarque-Bera test, which assesses the adherence of residuals to a normal distribution, yielded an F-statistic of 1.707, accompanied by a p-value of 0.425. Given that the p-value exceeds common significance thresholds (e.g., 0.05 or 0.01), we do not reject the null hypothesis, thereby indicating that the residuals conform to a normal distribution. The Lagrange Multiplier (LM) test, utilized to investigate autocorrelation within the residuals, produced an F-statistic of 2.220 and a p-value of 0.137. The relatively elevated p-value implies a lack of substantial evidence for serial correlation, suggesting that the model is free from autocorrelation concerns.

The Breusch-Pagan-Godfrey test, employed to identify heteroscedasticity (variance inconsistency within residuals), recorded an F-statistic of 0.768 alongside a p-value of 0.674. Since the p-value is significantly above conventional significance levels, we do not reject the null hypothesis of homoscedasticity, thereby

affirming that the variance of the residuals remains stable. The Ramsey RESET test, specifically designed to detect specification inaccuracies within the model, resulted in an F-statistic of 1.990 with a p-value of 0.1744. As the p-value does not indicate statistical significance, there is no compelling evidence of model misspecification, suggesting that the functional form of the model is indeed suitable. Furthermore, Figure 01, which encompasses the CUSUM and CUSUMSQ plots, offers a visual representation of the model's stability. Should these plots remain within the critical boundaries, the model may be regarded as stable over time. In summary, the diagnostic evaluations indicate that Model 02 fulfills essential statistical assumptions, including normality, homoscedasticity, and the absence of significant autocorrelation or specification errors, rendering it a robust model for subsequent analysis.

Table 6: Results of Diagnostic Test

Test	F-Statistics	P-Value
Jarque Bera test	1.707	0.425
Lagrance Multiplier Test	2.220	0.137
Breusch-Pagan Godfrey test	0.768	0/674
Ramsey Reset Test	1.990	0.1744

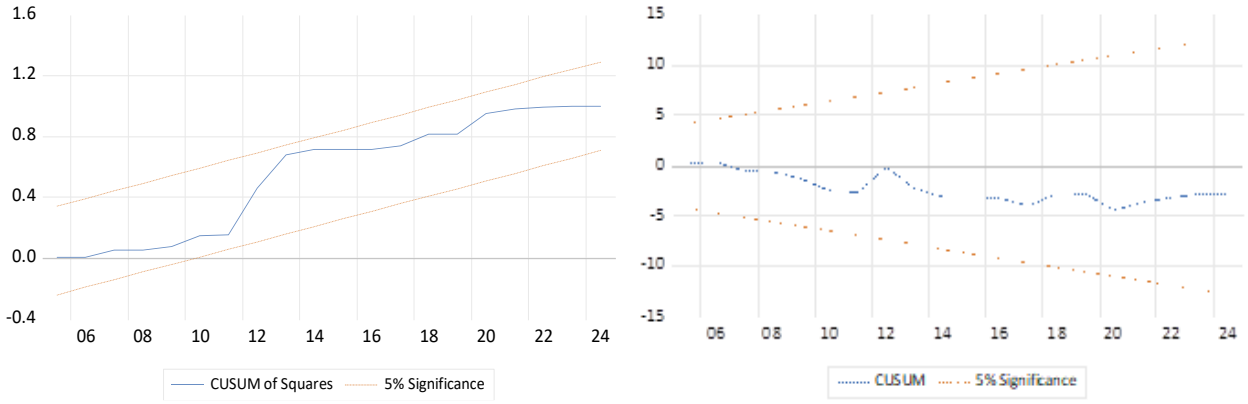

Figure 1: CUSUM & CUSUMSQ

5. Conclusion and Policy Implications

This study examines how government spending affects Oman's economic progress through three main sectors: military, education, and healthcare, by employing the Autoregressive Distributed Lag (ARDL) methodology. The study demonstrates that government spending drives economic growth, yet different sectors experience distinct effects at varying levels. Investing too much in military expenses reduces economic growth because it limits financial resources for essential sectors like education and healthcare. Investments in education and healthcare for human capital development produce sustained economic growth through strong positive impacts. According to recent research, we now understand that the resource curse theory holds true because economies dependent on natural resources need to establish sustainable investments to reduce their dependency risks.

Resource-reliant nations, including Oman, must pay great attention to these results. Policymakers must prioritize directing government funds into the education and healthcare sectors to achieve essential outcomes. Investing more resources in education generates long-term productivity growth through innovation and economic diversification, which helps to decrease dependency on hydrocarbon resources. Investing more in healthcare leads to workforce efficiency by boosting labor productivity and reducing employee sick days. The combination of various elements results in ongoing economic development while enhancing social conditions. Defense budget allocations require a comprehensive examination. Military security must be at the forefront of policymakers' considerations because defense budgets must align with national economic goals while promoting superior investment sectors. Countries need to maintain a strategic balance between security policies and economic development programs to achieve enduring fiscal stability. Research indicates that economic diversification functions as a vital approach to overcoming the negative impacts of resource dependency. Policy makers must support the expansion of manufacturing, technology, and service industries to shield the economy from risks associated with global oil price fluctuations. Economic diversification implementation enables sustainable growth that exceeds the potential of economies dependent on a single resource. The study confirms that ongoing institutional reforms remain vital for enhancing fiscal efficiency. Resources reach their intended destinations more efficiently when transparent budgeting systems work alongside robust financial management strategies, while government spending achieves greater impact. Better governance systems and reduced public spending waste will lead to enhanced economic resilience and growth.

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