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Examining the asymmetric influence of tax revenue policy in an oil-dependent economy: evidence from Oman

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Abstract

Purpose – This study aims to examine the asymmetric effects of tax revenue policies on the economic activity of Oman.

Design/methodology/approach – This study applies the nonlinear autoregressive distributed lag model and uses data from 1980 to 2022.

Findings – The findings confirmed that economic activity has a cointegrating relation with the positive and negative shocks of the tax revenue policy and selected macroeconomic variables. In addition, the long-run results show that positive changes in tax revenues have a positive significant effect on the economy, while negative shocks in tax revenues have a negative effect on the economy at the 5% significance level. The study concludes that a significant long-term asymmetric relationship exists between taxation policy changes through the revenue channel for the economy of Oman.

Originality/value – No previous study has specifically investigated the asymmetric impact of tax revenue policies on the economy of Oman, which is an oil-dependent country. To the best of the authors' knowledge, this study is the first attempt to explore this relationship with respect to the Omani economy, and it uses extensive time series data and employs various contemporary econometric techniques. Given Oman's reliance on oil and gas revenues, which typically fund approximately 70% of the country's annual budget through taxation on oil and gas sold, fluctuations in global oil prices directly influence country's fiscal position. Thus, this study contributes to the literature by empirically confirming the asymmetries impact of fiscal (tax) policies on Oman's economy. The implication of the results suggests that the government cut back on tax incentives and tax exemptions for local and foreign businesses. This move can foster economic growth and reduce the negative competition effect among investors and taxpayers, which may ultimately improve the country's tax revenue.

Keywords Asymmetry effect, NARDL, Tax revenues policy, Oman

Paper type Research paper

1. Introduction

Economists assert that tax revenues play a fundamental role in shaping the economic landscape of any country; in particular, the significance of such earnings is pronounced in oil-dependent countries such as Oman, where the oil tax revenues consists of, on average, 70% of its public budget [Alshoaibi, 2018; Arezki *et al.*, 2018; Alqassab, 2020; Central Bank of Oman (CBO), 2022].

JEL classification – C22, C23, H2

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Situated at the heart of the Arabian Peninsula, Oman owns significant reserves of oil and gas which have historically been the backbone of its economy (Al-Mawali *et al.*, 2016). The heavy reliance on oil revenues by Oman has long been evident, with the energy sector contributing a substantial portion of the government's income (Ahmad and Masan, 2015). However, while the oil wealth has fueled economic growth and prosperity, it has also exposed the country to the inherent risks associated with a single-commodity economy (Kamrava, 2018). For example, fluctuations in oil prices during the COVID-19 crisis resulted in unpredictable revenue streams, thus, challenging the government to plan and allocate resources effectively (Al Awaidy *et al.*, 2021).

In this context, the claim of diversifying tax revenues in Oman became increasingly important (Alshoaibi, 2018). Hence, the government set the target of improved taxes as a high priority amidst the limited fiscal space and resources of the country (Almutairi, 2014). The fiscal policy framework was revised to bolster the stability in tax revenues and increasing the confidence and trust of taxpayers on the nation's tax administration. The policy sought to secure a sustainable source of the state's income, which would serve to alleviate the effect of oil price instability and reduce dependence on fluctuating oil revenues (Pauceanu, 2016).

The imbalance in the fiscal policy with respect to taxes led the government to conduct a fiscal reform strategy that encourages economic diversity to broaden its tax revenue base. By diversifying the tax revenue base far from oil sector revenues, the Omani government can strengthen its fiscal resilience, enhance economic stability and foster long-term growth and development (Ahmad and Masan, 2015). This strategy was implemented through an effective tax system and the imposition of a plausible tax burden on various economic activities including corporate profits and consumption. To this end, the government can promote fiscal discipline, encourage responsible governance and generate revenues which can be channeled toward the provisions of essential public services, infrastructure projects and social welfare programs (Scalia, 2017). The strategy does not only ensure an equitable distribution of wealth, but it also enhances the overall quality of life for Omani citizens (Zakharova and Medas, 2009). The planned strategy also sought to avoid the Dutch disease issue, which became problematic for the economy.

Although fiscal and monetary policies are crucial tools for a government to manage and enhance the performance of economy, the Omani government aims to make the fiscal policy of taxation more effective and flexible than the monetary policy in stabilizing the economy (Ahmad and Masan, 2015). However, the additional tax burden and complexity of tax collection could adversely impact local businesses, particularly during the difficult recovery from the COVID-19 pandemic. As such, this situation has impeded efforts to attract foreign investment to help move the economy beyond oil. Moreover, it potentially generates social and economic discontents which have dire consequences for the government including tax evasion and encouragement of individuals to resort to shadow economic activities (Gamal *et al.*, 2019; Al Shekaili and Karim, 2020; Ahamed *et al.*, 2022).

The current study focuses on filling the gap found regarding the impact of the taxation fiscal policy and its reforms on the economy of Oman compared with the monetary policy's influence. The research concentrates on this issue due to several reasons. First, the taxation fiscal policy was planned to be the main financial stability source of the economy of Oman, notably, the national currency (Riyal) was pegged to the US dollar, which may not be forever a rational option for the country (Basher, 2015). Consequently, the Omani economy sustains an ineffective monetary policy rather than a fiscal policy. Secondly, as with other oil-dependent countries, Oman's fiscal policy has changed recently because of high oil price shocks. Thirdly, the Omani economy possesses distinctive traits, particularly the absence of

personal income tax. Thus, expansionary fiscal policies that rely heavily on public expenditure funded by oil and gas tax revenues may be ineffective.

Fourth, from a country-level analysis, no study has examined the asymmetric effect of the tax revenue policy on the economy of Oman, an oil-dependent country. Thus, this study is the first to be undertaken in this regard. The study analyses the magnitude of the effect of tax revenue changes on the whole economy using recent econometric methodologies, such as the Zivot and Andrews unit root test with structural break and the nonlinear autoregressive distributed lag (NARDL) model. Fifth, given Oman's heavy reliance on oil and gas revenues, uncertainties and fluctuations in global oil prices tend to influence the country's fiscal stability. Finally, while government spending is indeed a critical factor for economic growth, this study focuses on tax revenue as it directly reflects the government's capacity to generate funds for various economic activities. Moreover, analyzing tax revenue allows us to assess the efficiency and sustainability of the government's income sources, whereas government spending is often influenced by political and external factors that may complicate a clear causal interpretation.

The subsequent sections of this paper are organized as follows. Section 2 provides an overview of the pertinent literature. Then, the methodology and data utilized are outlined in Section 3. Section 4 presents the empirical findings, while Section 5 offers concluding remarks on the study.

2. Literature review

The body of empirical research has demonstrated that, contingent upon the nature and rate of taxes, tax policy can have either positive or negative effects on the macroeconomy (Nguyen *et al*., 2021; Neog and Gaur, 2020; Kate and Milionis, 2019). According to Jaimovich and Rebelo (2017), an increase in the capital income tax rate might lead to a decrease in the incentives for entrepreneurship and leaving the innovation industry. The ultimate impact of taxes, whether positive or negative, is determined by how they affect the supply or demand sides of the economy. This study presents the empirical literature that has shown the negative impacts of taxes, followed by the ones that disclosed the positive effects.

For instance, Nguyen *et al*. (2021) used the structured VAR technique to examine the effects of consumer, corporate entities, and individual income taxes in the UK from 1973 to 2009. According to the study, taxation on income cutbacks has a favorable impact on investment, GDP and private consumption. A 1% reduction in the average income tax rate results in a 0.78% increase in GDP. The study also found that switching from an income tax to a consumption tax basis has a favorable impact on investment and growth, even though the impact of a reduction in consumption tax has not been particularly significant.

Halit and Taner (2020) found a similar result when examining the effects of tax structure modifications as well as overall tax rates on economic growth for more than 100 high, middle and low-income countries using GMM estimating techniques. According to findings, moving from income taxes to consumption and property taxes has a favorable and significant impact on growth rates, whereas moving from property and consumption taxes to income taxes positively affect low-income economies. The justification offered was that taxes on consumption have less of an impact on the incentives to work and invest, which ultimately affects economic growth.

Alinaghi and Reed (2021) used a meta-analysis of 1979 estimates compiled from 49 studies to examine the impact of taxes on growth in the Organization for Economic Co-operation and Development (OECD) countries. The influence of tax policies, whether they are tax ambiguous, tax positive, or tax negative fiscal policies, was evaluated by the authors. Tax rises that fund unproductive investments or increases in distortionary taxes along with a decline in non-distortionary taxes fall under the first category. The second group consists of tax increases that fund profitable ventures, tax reductions associated with increases in

non-distortionary taxes, or tax increases intended to reduce the deficit. The final group consists of levies that have unclear economic consequences. According to the findings, a 10% tax cut for a tax-negative fiscal package increases GDP growth by 0.2%, while a 10% tax cut for tax-positive fiscal policy reduces GDP growth by 0.2%.

Using NARDL, Abdulkarim and Saidatulakmal (2021) investigated the asymmetric effects of fiscal policy factors on economic development in Nigeria from 1980 to 2018. The authors found that, both in the short and long term, economic development reacts symmetrically to changes in customs, excise levies, and petroleum profit taxes.

Adopting a quantile regression technique, Alavi *et al.* (2020) examined the asymmetric effects of fiscal policy on economic development in Iran from 1988 to 2016. The empirical outcomes portray that foreign trade, investment, and taxes all significantly boosted economic growth. In addition, although other variables have an asymmetric influence on economic growth, taxes have a symmetric effect. On the other hand, Auerbach and Gorodnichenko (2012) demonstrated through regime switching models that the impacts of tax and spending policies on business cycle are asymmetric and fiscal policy works better during recessions than during expansions.

Maganya (2020) used Granger causality and the autoregressive distributed lag model (ARDL) to examine the impact of taxes on economic growth in Tanzania from 1996 to 2019. The study came to the conclusion that income taxes had a negative effect on GDP growth, whereas domestic goods and services (TGS) taxes had a positive impact. In addition, the findings demonstrated a two-way Granger causal relationship between Tanzania's GDP growth and TGS.

As demonstrated by Stone (2020), fiscal stimulus or temporary boosts in government expenditure and tax breaks are important as anti-recessionary measures. Some lessons on the effectiveness of fiscal policy have been learned from the global financial crises of the last two decades, including the COVID-19 era. First, depending on the nation and the circumstances, fiscal policy can be an effective tool in crisis period. Second, fiscal policy should be countercyclical, whether in good or bad times. Third, fiscal stimulus needs to be sufficient, temporary, and well-targeted. Fourth, fiscal policy can be used in tandem with monetary policy to address structural challenges.

Kate and Milionis (2019) conducted a study to assess the impact of capital taxation on economic growth in 77 countries including the OECD members, as well as several other Asian, African, and Latin American countries, over the 1965–2014 period. The study used econometric techniques, including fixed effects panel regressions as well as a panel error correction estimator developed by Pesaran *et al.* (2001). The main conclusion of the study is that capital taxation has a positive impact on economic growth for high-income countries that operate close to the technology frontier, while it has a negative association for low-income countries operating far away from the technology frontier.

Lawler and Al-Sayegh (2019) examined the relationship between changes in tax revenues, oil revenue, and GDP in addition to assessing the viability of tax reform in Kuwait, using annual data over the period 1998–2015. The study employed Augmented Dickey and Fuller (1979) unit root test and cointegration test, as well as the General Least Squares (GLS) to validate the long relationship between the variables. The authors concluded that changes in tax revenues have no impact on the GDP of Kuwait, which may be due to the country's heavy reliance on oil resources to fund its budget rather than tax sources.

Pokharel (2019) examined the impact of tax reforms on economic growth in South Asian Association for Regional Cooperation (SAARC) countries over the 1990–2012 period, using panel data regressions such as fixed effects (FE) and random effects (RE) estimators. The study revealed the existence of a significant negative relationship between taxation and economic growth in the group of countries. The scarcity of empirical studies on the taxation-growth nexus in an exporting oil country such as Oman is a justification to conduct this study.

3. Methodology and data

This section explains the estimation techniques applied to achieve the objective of this study, together with the description of the data sources.

3.1 Specification of the nonlinear autoregressive distributed lag model

This study employs the NARDL model developed by Shin *et al.* (2014) to assess the impact of fiscal policy changes, particularly shifts in tax revenues, on the Omani economy. The model is well-suited for analyzing the asymmetric effects of taxation in an oil-dependent economy, where tax revenues are significantly affected by fluctuations in global crude oil and gas prices. By applying the NARDL framework, this analysis explores how both increases and decreases in tax revenues influence economic activity in Oman.

Following Shin *et al.* (2014), the study decomposes the non-linear behavior of the explanatory variable, such as tax revenue (TR), into positive and negative partial sum series (Kisswani and Khan, 2023). This decomposition of TR can be mathematically expressed as follows:

$$TR_t = TR_0 + TR_t^+ + TR_t^- \tag{1}$$

where TR_0 represents the initial level of tax revenue, the positive partial sum series, TR^+ captures the cumulative effects of increases in the tax revenue variable, while the negative partial sum series, TR^-, reflects the cumulative effects of decreases in the tax revenue variable (Pal and Mitra, 2016). The partial sums for both positive and negative changes in the tax revenue are calculated using the following formulas:

$$TR_t^+ = \sum_{j=1}^{t} \Delta TR_i^+ = \sum_{j=1}^{t} \max\left(\Delta TR_j, 0\right) \tag{2}$$

$$TR_t^- = \sum_{j=1}^{t} \Delta TR_i^- = \sum_{j=1}^{t} \min\left(\Delta TR_j, 0\right) \tag{3}$$

Regarding the partial sum components of tax revenue changes, this study employs a NARDL model following the methodology of Shin *et al.* (2014), as outlined below:

$$\begin{aligned}\triangle ln\ SEA_t = {} & \varphi_0 + \sum_{i=1}^{q} b_i \triangle \ln SEA_{t-j} + \sum_{i=0}^{p2} c_i \triangle \ln TR_{t-i}^+ + \sum_{i=0}^{p3} d_i \triangle \ln TR_{t-i}^- \\ & + \sum_{i=0}^{p4} e_i \triangle \ln FDI_{t-i} + \sum_{i=0}^{p5} f_i \triangle \ln DSP_{t-i} + \sum_{i=0}^{p6} k_i \triangle SE_{t-i} \\ & + \sum_{i=0}^{p7} g_i \triangle CPI_{t-i} + \alpha_1 \ln SEA_{t-1} + \alpha_2 \ln TR_{t-1}^+ + \alpha_3 \ln TR_{t-i}^- \\ & + \alpha_4 \ln FDI_{t-1} + \alpha_5 \ln FDI_{t-1} + \alpha_6 SE_{t-1} + \alpha_7 CPI_{t-1} + \varepsilon_t \end{aligned} \tag{4}$$

where Δ denotes the first-difference operator while $\Delta lnSEA_{t-j}$ captures changes in the lagged dependent variable. *SEA* denotes the size of economic activity, measured by the constant prices of Oman's *GDP*. *FDI* represents foreign direct investment inflows, while *DSP* refers to the diversification support program initiated by the Omani government to enhance private sector growth. *SE* measures the shadow economy as a percentage of GDP, and *CPI* indicates the inflation rate, defined as the percentage change in the consumer price index. The former

two variables are expressed as ratios since they are already in percentage form, while the remaining variables are used in logarithmic form. The notations q, $p2$, $p3$, $p4$, $p5$, $p6$ and $p7$ denote the optimal lag-length for the lagged dependent and independent variables. The parameters b, c, d, e, f, k and g represent the short-run effects, while α_2-α_7 normalized by α_1 represent the long-run effects. φ_0 is the intercept term, and ε_t represents the error term.

The procedure for the NARDL technique involves several stages. The first is the estimation of the NARDL model in equation (4) using standard OLS. The second stage is to determine the presence or absence of an asymmetric (nonlinear) cointegrating relationship among the variables by testing the null hypothesis of no cointegration: H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = \alpha_7 = 0$ against the alternative hypothesis of cointegration: H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq \alpha_7 \neq 0$. The procedure for testing this hypothesis follows the bounds-testing approach of Pesaran *et al.* (2001), using a modified Wald (F-statistic) test. The null hypothesis is rejected if the computed F-statistic exceeds the upper critical bound, indicating cointegration. If the test statistic is below the lower bound, the null hypothesis cannot be rejected, suggesting no cointegration. However, if the test statistic falls between the two critical bounds, the inference is inconclusive. These critical bounds are based on the values provided by Narayan (2005). If cointegration is confirmed, the long-run estimates are derived by normalizing the coefficients of the lagged explanatory variables by the coefficient of the lagged dependent variable. A corresponding dynamic short-run error correction term (*ECT*) model can also be determined as follows:

$$\begin{aligned}\triangle ln\ SEA_t = \varphi_0 &+ \sum_{i=1}^{q} b_i \triangle \ln SEA_{t-j} + \sum_{i=0}^{p2} c_i \triangle \ln TR^{+}_{t-i} + \sum_{i=0}^{p3} d_i \triangle \ln TR^{-}_{t-i} \\ &+ \sum_{i=0}^{p4} e_i \triangle \ln FDI_{t-i} + \sum_{i=0}^{p5} f_i \triangle \ln DSP_{t-i} + \sum_{i=0}^{p6} k_i \triangle SE_{t-i} \\ &+ \sum_{i=0}^{p7} g_i \triangle CPI_{t-i} + \partial_i ECT_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

where ∂ is the coefficient of the error correction term (ECT_{t-1}), representing the speed of adjustment back to equilibrium in the long run after a deviation in the short run. In other words, it indicates how much of the disequilibrium from the previous period is corrected to achieve equilibrium in the current period. The ECT is expected to be negative, less than one, and statistically significant to appropriately reflect the adjustment process toward the system's long-run equilibrium after a short-term disturbance. A negative ECT indicates that deviations from equilibrium are being corrected in the right direction, while a value between −1 and 0 signifies a gradual return to stability. The magnitude of the coefficient represents the proportion of the disequilibrium corrected each period; for instance, an ECT of −0.5 would imply that half of the previous period's deviation is adjusted in the current period. Values outside the range of −1–0 suggest instability or oscillations in the system. Statistical significance confirms the reliability of this adjustment process (Engle and Granger, 1987).

Following the determination of the cointegrating relationship between the variables and the estimation of the short-run and long-run models, the third stage involves testing the presence or absence of long-run and short-run symmetry using the standard Wald test. For long-run asymmetry, the relevant joint null hypothesis to be tested is: H_0: $-\alpha_2/b = -\alpha_3/b$ against the alternative hypothesis: H_0: $-\alpha_2/b \neq -\alpha_3/b$. For short-run asymmetry, the joint null hypothesis to be tested is: $H_0 : \sum_{i=0}^{p2} c_i = \sum_{i=0}^{p3} d_i$, against the alternative hypothesis: $H_1 : \sum_{i=0}^{p2} c_i \neq \sum_{i=0}^{p3} d_i$. Rejection of the null hypothesis for both long-run and short-run

symmetry suggests that tax revenue policy exerts an asymmetric influence on economic activity in Oman. The fourth stage is the computation of a battery of diagnostic and stability tests to ascertain the stability and reliability of the estimated models. Finally, the short-run asymmetric cumulative dynamic multiplier effects of a 1% change in the unit of the variables on the country's economic activity are derived as follows:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial lnSEA_{t+j}}{\partial TR_t^+},\ m_h^- = \sum_{j=0}^{h} \frac{\partial lnSEA_{t+j}}{\partial TR_t^-},\ h = 0,\ 1,\ 2\ldots \tag{6}$$

Such that as $h \to \infty$, then $m_h^+ \to \beta^+$ and $m_h^- \to \beta^-$, where β^+ and β^- are the asymmetric long-run coefficients calculated as $m_h^+\beta_1 = -\alpha_2/b$ and $\beta_2 = -\alpha_3/b$, respectively.

3.2 Data sources

This study utilizes annual data for the period of 1980–2022. The data on variables including size of economic activity (SEA), tax revenue (TR), foreign direct investment (FDI) inflows, and the diversification support programme (DSP) were sourced from the Omani National Center for Statistics and Information (NCSI) (2023). For the shadow economy, the data was extracted from Medina and Schneider (2019) and it spans from 1980 and 2017. The moving average method was employed to derive missing data by interpolation procedure from 2016 to 2022. For inflation rate, the data was obtained from the Central Bank of Oman (CBO).

4. Empirical results

This section presents the results obtained from the estimation of the NARDL model.

4.1 Unit root test results

The analysis which covers the 1980–2022 period begins by conducting the classical unit root test proposed by Dickey and Fuller (ADF) in 1979. This test aims at determining the integration order of the variables under examination. The results of this test are presented in Table 1.

The results indicate that all examined variables exhibit a unit root at their level, suggesting zero-order integration, or an I(0) process. This conclusion stems from the inability to reject the null hypothesis at a 5% significance level, except for the shadow economy and inflation rate

Table 1. ADF unit root test results

	Level		First difference	
Series	Test statistics	I(*d*)	Test statistics	I(*d*)
LTR	−2.887	*I*(1)	−7.524**	*I*(1)
LSEA	−2.486	*I*(1)	−4.406**	*I*(1)
SE	−4.239**	*I*(0)	−4.503**	*I*(1)
LFDI	−2.876	*I*(1)	−9.834**	*I*(1)
LDSP	−1.601	*I*(1)	−4.822**	*I*(1)
INF	−4.364**	*I*(0)	−7.893**	*I*(1)

Notes: The notation, I(*d*) represents the order of integration. Tests are conducted with an intercept and trend based on the characteristics of the empirical data. Mackinnon (1996) critical values for intercept with trend are given as: −4.192, −3.521 and −3.191 at 1%, 5% and 10% levels, respectively. The model is estimated by setting the maximum lag to 2, which was selected based on Schwarz (1978) information criteria (SIC). Asterisks, ***, ** and * indicate significance at 1, 5 and 10% levels, respectively

Source: Estimation's output

variables, which demonstrated stationarity at their initial level. However, after undergoing a first-order transformation, the non-stationary variables became stationary, indicating an I(1) process. Overall, the results reveal a combination of integration orders among the variables, encompassing both I(0) and I(1) processes.

However, the traditional ADF test has limitations in addressing structural breaks within time series data, leading to potential distortions in size and generating spurious inferences, as highlighted by Zivot and Andrews (1992) and Perron (1997). To address this issue and ensure accurate identification of unit root characteristics in the variables, this study employs the Zivot and Andrews (ZA) unit root test, specifically designed to account for structural breaks within the data-generating process.

Moreover, whereas applying the ARDL does not require a unit root test, conducting the test is important to ensure that none of the variables is/are integrated to the second order, i.e. I(2). The ZA unit root test has three forms with a structural break and it is built on the assumption that the true break point is endogenously estimated at an unknown point (Zivot and Andrews, 1992). However, this study utilizes the first form of intercept's change at an unknown break point. The results are reported in Table 2.

Setting the optimal lag length to 2, which was selected based on the SIC, the results in Table 2 show that the tested variables including logarithm tax revenue policy, logarithm FDI, and inflation rate are stationary in their level at the 5% significance level, integrated of order zero [I(0)] with a one-time break, respectively. While the variables of logarithm size of economic activity and logarithm of shadow economy are non-stationary at level at the 1% significance level, respectively. But they become stationary after taking their first difference, integrated to first order with one structural break point i.e. I(1) process.

Finally, results show that the variable of diversification support program is nonstationary with one time break point at the 5% significance level and is integrated to first order after taking its first difference with one break point at the 5% significance level. From the results, the variables enter the model with a mixture of integration orders at different significance levels.

The Zivot-Andrews unit root test results reveal a break date of 2004. Owing to the Sultanate's dependence on the oil and gas industry, changes in oil prices tend to have an impact on tax revenue. Accordingly, the break dates that have been found may be linked to the 33.37% annual shift in oil prices in 2004 as a result of the Iraq War, rising demand from Asian countries, and low inventories, including Oman. The break point of 2006 reflects the

Table 2. Zivot-Andrews unit root test results

	Level				First difference			
Series	T. Stat.	T_b	Model	I(*d*)	T. Stat.	T_b	Model	I(*d*)
LTR	−14.81**	2004	B	*I*(0)	−8.56**	2004	B	–
LSEA	−5.05***	2015	B	*I*(0)	−6.15**	2008	B	*I*(1)
SE	−5.49***	2009	B	*I*(0)	−5.93**	2007	B	*I*(1)
LFDI	−7.48**	2005	B	*I*(0)	−11.51**	2012	B	–
LDSP	−3.69**	2006	B	*I*(0)	−5.66**	2015	B	*I*(1)
INF	−6.91**	2007	B	*I*(0)	−8.98**	2006	B	–

Notes: The notation, I(*d*) represents the order of integration. Model B represents a change in the level shift or intercept and a change in the trend. Zivot and Andrews (1992) critical values for intercept break are −5.57 (1%), −5.08 (5%) and −4.82 (10%). The model is estimated by setting the maximum lag to 2, which was selected based on Schwarz (1978) information criteria (SIC). Asterisks, ***, ** and * indicate significance at 1, 5 and 10% levels, respectively
Source: Estimation's output

expansionary fiscal policy of huge expenditures for national security purposes. The break points of 2007, 2008, 2012 and 2015 mirror the influence of the global financial crisis and change in oil prices in the energy oil market, which resulted in a drop in GDP since the country heavily relies on oil revenues.

4.2 Results of asymmetric autoregressive distributed lag model estimation to cointegration

An estimation is basically made of the asymmetric influence of fiscal policy of tax revenues on the economy of Oman. To do this, the NARDL bounds test for cointegration was applied.

Table 3 summarizes the findings of the joint null hypothesis of no cointegration, i.e. $\rho = \theta+ = \theta- = 0$" against its alternative hypothesis. The result offers strong evidence for a cointegrating (long-run) relationship between the variables. Specifically, the computed F-statistic (7.12) exceeds the 3.86 critical value of the upper bound at the 5% significance level. The conclusion that there is cointegration between the size of economic activity and the positive and negative shocks to tax revenue policy changes (as well as foreign direct investment, diversification support programmes, the shadow economy, and inflation) was reached as a result of the null hypothesis of "no cointegration" being rejected. Having confirmed the existence of a cointegrating relationship, the long and short run estimations have to be conducted.

4.3 Estimation results of the nonlinear autoregressive distributed lag model

The estimation results portray that the optimal lag length of the NARDL model estimated is: 1,4,1,1,2,0,0, as recommended by the Akaike Information Criterion (AIC). In Panel A, Panel B and Panel C of Table 4, respectively, the long-run and short-run estimates of the NARDL model and the diagnostic tests' outcomes are reported.

4.3.1 Long-run and short-run results. The long-run estimation results (Panel A of Table 4) show that positive shocks in tax revenue have a significant positive effect on economic security, while negative shocks in tax revenue reduce economic activity. The results suggest that a 1% positive adjustment in tax revenue leads to a 0.28% increase in economic activity. With an average GDP of USD 49.16bn between 1980 and 2022, this corresponds to an increase of approximately USD 13.76bn in economic activity. Conversely, a 1% negative shock in tax revenue is associated with a 0.102% decline in economic activity, resulting in a reduction of approximately USD 5.01bn in economic output.

These findings suggest that positive changes in tax revenue are more strongly associated with economic activity (0.28%) compared to negative changes (0.102%) in Oman. In terms of the positive impact of tax revenue increases on economic growth, the results align with recent empirical studies that highlight a significant and positive relationship between revenue

Table 3. Estimation results of nonlinear ARDL bounds test to cointegration

Model		*Calculated F-Statistics*	*K*
LSEA = f (LTR$^+$*, LTR*$^-$*, LFDI, LDSP, SE, INF)*		7.122***	6
Critical values for Case II: restricted constant and no trend		*I*(0)	*I*(1)
	10%	2.218	3.314
	5%	2.618	3.863
	1%	3.505	5.121

Notes: Critical bounds values are provided by Narayan (2005) for finite sample typical of this study. Asterisk (***) denotes significance at 1% level. *K* denotes the number of explanatory variables
Source: Estimation's output

Table 4. Estimation results of the NARDL model

Panel A: NARDL (1, 4, 1, 1, 2, 0, 0) Long-run coefficient estimates – Dependent variable: LnSEA						
CONS	LTR^{+}	LTR^{-}	*LFDI*	*LDSP*	*SE*	*INF*
19.890*** (13.273)	0.284** (3.492)	−0.102** (1.740)	−0.050** (−2.957)	0.135** (2.588)	0.074** (3.329)	−1.023 (−0.960)

Panel B: NARDL (1, 4, 1, 1, 2, 0, 0) Short-run coefficient estimates – Dependent variable: ΔLnSEA				
Lag order	*0*	*1*	*2*	*3*
ΔLTR^{+}	−0.074 (−1.837)**	−0.196 (−3.945)**	−2.238 (−4.693)**	−0.181 (−4.234)**
ΔLTR^{-}	0.003 (0.216)	–	–	–
ΔLFDI	−0.005 (−1.153)	–	–	–
ΔLDSP	0.010 (4.828)**	0.062 (3.183)**	–	–
ΔSE	–	–	–	–
ΔINF	–	–	–	–
$\mathbf{W_L}$ = 19.141 (0.002)				
$\mathbf{W_S}$ = 5.472 (0.065)				

Panel C: diagnostic statistics tests						
$\boldsymbol{ECT_{t-1}}$	$\boldsymbol{\chi^2_{SC}}$	$\boldsymbol{\chi^2_{HET}}$	$\boldsymbol{\chi^2_{NORM.}}$	$\boldsymbol{\chi^2_{FF}}$	***Adj. R^2***	**CS (CS^2)**
–0.417 (−8.667)**	7.203 [0.126]	3.731 [0.444]	0.976 [0.614]	0.898 [0.354]	0.62	*S*(*S*)

Notes: The model is estimated by setting the maximum lag to 4, and the optimum lag length is suggested based on the Akaike Information Criterion (AIC). *Δ* is the first difference operator. An asterisk (**) denotes significance at the 5% level. $\mathbf{W_L}$ and $\mathbf{W_S}$ are the Wald tests of long-run and short-run symmetries. The values in parenthesis "(.)" in panels A and B are the *t*-ratios, and the values in bracket "[.]" are the *p*-values of the LM test statistics. χ^2_{SC}, χ^2_{HET}, χ^2_{N} and χ^2_{FF} denote LM tests for serial correlation, heteroscedasticity, normality and functional form, respectively. CS (CS^2) refers to the cumulative sum of recursive residuals and the cumulative sum of recursive residuals of square, respectively

Source: Estimation's output

and growth in Oman (see Javed and Husain, 2024; Al-Saadi and Khudari, 2024; Ahmad and Masan, 2015; Maalel and Mahmood, 2018; Javed and Husain, 2020). The asymmetric response, where positive changes in tax revenue exert a stronger effect than negative changes, reflects the resilience of Oman's economy and its adaptive strategies for promoting sustainable growth through an effective taxation system. This finding is particularly relevant given the volatility of oil revenues and the pressing need to diversify the economy. Compared to the 0.28% effect of positive changes in tax revenue observed in this study, previous studies report coefficient magnitudes ranging from 0.25% to 10.42%, reflecting varying effects on growth in Oman.

In contrast, Al-Abri *et al.* (2019) reported a negative effect of approximately −0.47%. The variation in results may stem from differences in the focus of these studies, as prior research either examined both oil and non-oil revenues or solely the impact of oil revenues on growth, whereas the current study focuses exclusively on the asymmetric impact of tax revenue on growth.

Despite oil and gas revenues accounting for 70% to 80% of Oman's total public revenue, the observed positive effect of tax revenue increases on growth highlights the potential of taxation to sustain and foster economic growth. This supports the nation's economic diversification efforts (Mansour and Zolt, 2022). Oman's economy has historically been heavily dependent on oil receipts, making it vulnerable to fluctuations in global oil prices, which directly affect government revenue and expenditure (Javed and Husain, 2024). However, as Oman pursues economic diversification policies to reduce its reliance on oil, fiscal policy adjustments, including tax revenue reforms, have become essential for stabilizing and stimulating non-oil sectors (Abdelkawy and Al-Shammre, 2024). Upward adjustments in tax revenue provide the government with fiscal flexibility to fund expenditures, mitigating the effects of volatile oil and gas revenues. This creates a more pragmatic and stable foundation for economic growth. Conversely, downward adjustments in tax revenue, whether due to a shrinking tax base or increased tax evasion, exacerbate reliance on oil revenues, exposing the government and economy to the adverse consequences of oil price volatility. However, the effect of such downward adjustments may be mitigated by Oman's substantial sovereign wealth fund, which has historically shielded the economy and public spending from short-term fluctuations in oil prices (Abdelkawy and Al-Shammre, 2024).

Furthermore, the results reveal that foreign direct investment inflows significantly reduce economic activity at 5% level of significance. The coefficient of −0.05 indicates that a 1% increase in FDI inflows leads to a 0.05% decline in economic activity. Based on an average GDP of USD 49.16bn between 1980 and 2022, this corresponds to a reduction of approximately USD 2.458bn in economic output for every 1% increase in FDI inflows. This result contrasts with existing empirical studies, which generally report a positive influence of FDI inflows on economic growth in Oman, with magnitudes ranging from 0.06% to 2.03% (see Abdouli and Hammami, 2017a, 2017b; Hussein and Ahmed, 2019; Mowlaei and Intezar, 2021; Omri, 2014). Although Abdouli and Hammami (2017a, 2017b) reported a −0.002% effect of FDI inflows on growth in Oman, this relationship was not statistically significant. The observed discrepancy may arise from differences in the scope of analysis, study periods, estimation techniques, and the inclusion or exclusion of certain variables.

The significant negative impact of foreign direct investment inflows on growth in Oman may be explained by several interconnected factors. A primary reason is the concentration of FDI inflows in the oil and gas sector, which accounts for 65.5% of total FDI in the country. Due to this heavy concentration and the nature of investments in the oil and gas industry, increased FDI inflows may not necessarily drive growth in other areas of economic activity. Over the study period, Oman's reliance on oil exports for growth and its limited capacity to attract diversified FDI have created an economic structure in which FDI inflows often fails to

align with the broader needs of the local economy. This misalignment can result in a crowding-out effect, where foreign investment overshadows domestic production and investment, thereby reducing local economic activity (Hussein and Ahmed, 2019; Hamid *et al.*, 2022). Additionally, foreign direct investment inflows in Oman is frequently directed toward capital-intensive projects that neither generate substantial employment nor stimulate local firms, thereby limiting broader economic benefits (Mishrif, 2018). This situation may also reflect the effects of "Dutch disease," where significant FDI inflows into the oil and gas sector are associated with an appreciation of the Omani rial, making non-oil exports less competitive (Hassan, 2024; Onyeiwu, 2000).These challenges underline the difficulties of integrating FDI inflows into an economy heavily reliant on a single resource, such as oil. Addressing these issues requires a more diversified economic strategy to attract FDI inflows that supports sustainable growth. Effective policies, including leveraging technology to diversify and channel FDI inflows into nonoil sectors, can help achieve this goal (Kari and Saddam, 2012; Sulaiman *et al.*, 2020).

The shadow economy has a significant positive effect on economic activity in Oman at 1% level of significance. The coefficient of 0.074 indicates that a 1% increase in shadow economic activities is associated with a 0.074% rise in overall economic activity. Given the average GDP of USD 49.16bn between 1980 and 2022, this amount to a reduction of about USD 3.64bn in economic output for every 1% increase in shadow economic activities. This finding is consistent with prior studies in emerging economies, including Oman, which have found a significant positive relationship between the shadow economy and economic growth, with impacts ranging from 0.24% to 5.1% (see Gamal, 2024; Saafi *et al.*, 2023; Saunoris, 2018; Mawusi, 2019; Mughal and Schneider, 2020; Nguyen and Duong, 2021; Zaman and Goschin, 2015). However, this result contrasts with other studies that suggest a negative relationship between the shadow economy and growth (Baklouti and Boujelbene, 2019; Friedman *et al.*, 2000; Johnson *et al.*, 1998; Loayza, 1997).

The positive effect of the shadow economy on economic growth in Oman can largely be attributed to the country's substantial informal sector and its vast unregulated labor market (Al-Mataani *et al.*, 2017). In a predominantly cash-based economy like Oman, a considerable share of economic transactions takes place outside the formal banking system. These unreported activities contribute to aggregate demand and consumption, thus driving overall economic activity (Malit *et al.*, 2017). The informal sector complements the formal economy by offering employment opportunities, generating income, and supplying essential goods and services that may not be adequately provided through official channels. Furthermore, Oman, like other Gulf Cooperation Council (GCC) nations, has a significant expatriate population, with 43.4% of its residents being non-Omani (NCSI, 2024). Many expatriates engage in informal economic activities, further amplifying the shadow economy's positive consequence on overall growth (Gamal *et al.*, 2019). While certain aspects of the shadow economy, such as tax evasion and corruption, are often viewed negatively, they can sometimes produce unintended positive outcomes (Ozili, 2020). For instance, widespread tax evasion may prompt the government to lower tax rates to encourage compliance, which could, in turn, stimulate business activity and investment in the country (Li *et al.*, 2020).

The results also show that the long-term effect of the diversification support program on economic growth in Oman is both positive and statistically significant. A 1% increase in the diversification support program is associated with a 0.14% increase in economic activity, amounting to about USD 6.8824 billion in economic output. This 0.14% growth reflects Oman's strategic efforts to reduce its dependence on oil revenues, particularly in the face of global oil price volatility and the need for sustainable, long-term economic development. These findings are consistent with previous empirical studies that identified a significant

positive relationship between economic diversification and growth (Alshomaly and Shawaqfeh, 2020; Al Yahyai, 2023; Siddiqui and Abhishek, 2020), with reported impacts ranging between 0.3% and 2.07%. However, the results contradict those of Matallah (2022), which found a negative relationship between diversification and growth in 11 oil-exporting countries in the Middle East and North Africa (MENA) region, including Oman. The positive findings in this study are unsurprising, given the Omani government's bold and sustained efforts to diversify both its economy and public revenue sources away from oil.

Oman's economic diversification initiatives date back to the 1980s, driven by the vulnerabilities associated with heavy reliance on oil and gas revenues, which made the economy susceptible to external fluctuations (Mishrif, 2018). To address these challenges, the government introduced Oman Economic Vision 2020, a strategic plan implemented between 1996 and 2000 that marked the initial phase of the diversification process (Al Saqri, 2018). This strategy focused on promoting investments in sectors such as tourism and nonoil industries, expanding private sector activity, and strengthening human capital development (Valeri, 2020). These sectors were intended to create jobs, boost productivity, and attract foreign investment (Mishrif, 2018). By reducing dependence on oil revenues, the diversification strategy aimed to mitigate the risks associated with oil price volatility and establish a more resilient and dynamic economic structure, thereby fostering increased economic activity (Mubeen *et al.*, 2017; Nasir *et al.*, 2019). However, the success of the diversification strategy in driving economic growth hinges on advancements in technological infrastructure and the development of other key industries within the economy (Siddiqui and Abhishek, 2020).

The long-run estimation results indicate that inflation does not have a statistically significant effect on economic activity in Oman. This finding may be attributed to the country's consistently low and stable inflation rate, which is partly maintained by the peg of the Omani Rial to the US Dollar (Aloui *et al.*, 2018; Hakro and Omezzine, 2016). Additionally, in an economy heavily dependent on oil revenues, fluctuations in oil income and government expenditure may offset the typical effects of inflation on consumer behavior and investment decisions, thereby reducing the overall influence of inflationary pressures (Al-Abri *et al.*, 2019; Pattanaik, 2008).

The dynamic short run results (Panel B of Table 4) show that the current, first, second, and third lagged variables of a positive tax revenue shock have different negative effects on economic activity in Oman. Specifically, at a 5% significance level, a positive shock to tax revenue in periods one, two, and three reduces economic activity by 0.19%, 0.22% and 0.18%, respectively. Contrariwise, a negative tax revenue shock and FDI inflows are insignificant, consequently, they don't exert such an effect on the economy of Oman in the short run. Furthermore, the current and first lagged variables of diversification support program have a positive significant consequence on economic activity at the 5% significance level. The remaining variables including shadow economy and the inflation rate do not have significant influence on economic activity of Oman.

To put it briefly, there is a difference between the results of the short- and long-term estimations. For example, a positive shock to tax revenue increases economic activity over the long run at the 5% significance level, but it decreases economic activity during the short run. For instance, a 1% rise in the positive shock of tax revenue motivate the economy to contract by 0.74% in the short term, but it expands economic activity by 0.28% over the long term. The results of the short run suggest that most of the parameters accompanying the short-run asymmetric effects of tax revenues are statistically insignificant and do not exert any meaningful effect on economic activity in the country.

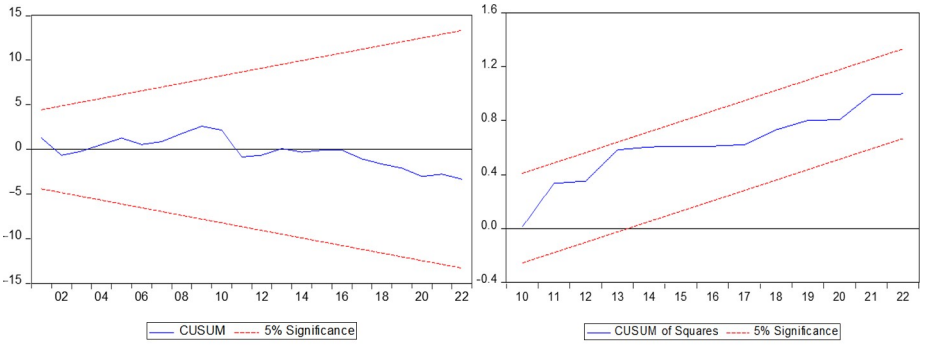
The one-year lagged parameter of the error correction term ECT_{t-1}, which represents "the speed of adjustment toward long-run equilibrium," is negative, below one, and statistically significant at the 5% level, supporting a cointegrating long-run relation between the variables. This suggests that around 42% of the disequilibrium in economic activity and its explanatory variables in the past period will be adjusted toward long-run equilibrium within the current year. The adjusted R^2 implies that 62% of the variation in economic activity in Oman is attributed to the tax revenue changes (i.e. positive or negative shocks of the tax revenues), along with the control variables.

4.3.2 Long-run and short-run asymmetry tests results. Panel B of Table 4 presents the results of long-term (WLR) and short-term (WSR) asymmetry tests. The evidence indicates the rejection of the null hypothesis of "long-run symmetry" between the positive and negative shocks in the tax revenues. The Wald test statistic value for the long-run symmetry (WLR) of 19.14, which is associated with its *P*-value of 0.002 (i.e. less than 5%), confirms the existence of asymmetry during the long run. This suggests the existing long-run asymmetric effect of the positive shocks in tax revenues on economic activity in Oman.

Furthermore, the results demonstrate that the null hypothesis of "short-run symmetry" cannot be rejected since the Wald test statistic's *P*-value for short-run symmetry (W_{SR}) of 0.065 is higher than 5%. This indicates a statistically insignificant effect of negative tax revenue shocks on economic activity. This result suggests an absence of nonlinearity between negative tax revenue shocks and economic activity in Oman in the short term.

4.3.3 Diagnostic tests and dynamic multiplier effect results. The results of the statistical diagnostic tests are reported in Panel C of Table 4. The results prove that the estimated NARDL model is statistically not affected by the issues of heteroscedasticity, serial correlation, misspecification bias or error functional form, and nonnormality. It also suggests that the estimated model is well-fitted and correctly formulated.

To check the model stability, the tests of the cumulative sum of recursive residuals and the cumulative sum of recursive residuals of square introduced by Brown *et al.* (1975), which are referred to as *CS* and CS^2 were utilized, and their results are reported in Panel C of Table 4 and plotted in Figure 1. Notably, the *CS* and CS^2 plots did not cross the five percent critical lines. This demonstrates the parameters of the NARDL model are stable, where "*S*" denotes stability.



Source: Authors' estimation

Figure 1. Plots of CUSUM and CUSUMSQ for the Omani economic activity model

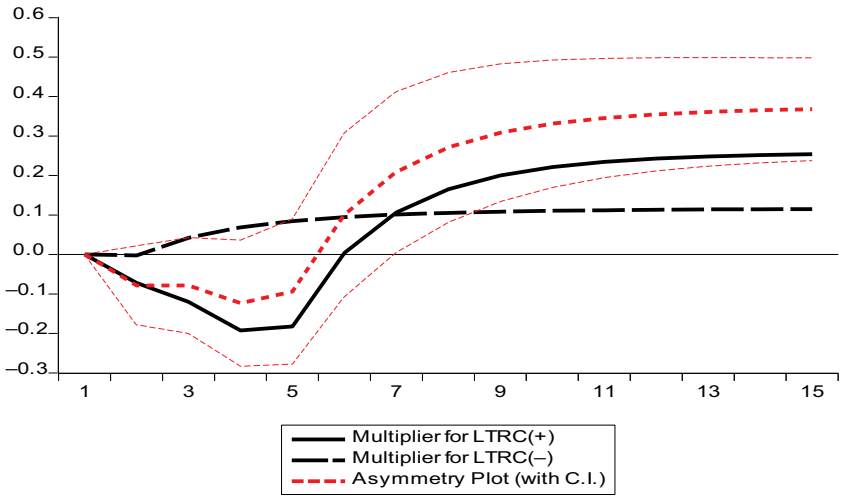
This study progresses to the analysis of the cumulative asymmetry dynamic multiplier effect of a 1% change in tax revenue shocks, respectively, on economic activity, computed from the NARDL model and shown in Figure 2.

The effects of the dynamic multiplier show the variations of economic activity to a 1% shock to tax revenues and its related fluctuations from an initial level to the new symmetry levels. The linear grouping of multipliers indicating the positive (black line) and negative (dashed black line) changes are explained through asymmetry curves.

The black line below shows how economic activity adjusts to a positive shock in tax revenues, while the black dashed line shows how it adjusts to a negative shock in tax revenues. The asymmetry, or the total difference between positive and negative changes in revenues from taxes, is shown by the thick red dashed line in the middle of the graph. The corresponding 95% confidence interval line lies between the upper and lower bounds of the thin red dashed lines. In comparison to the negative tax revenue shock, Figure 2 supports the evidence that the reaction of economic activity in Oman to the positive tax revenue shocks is more significant.

5. Conclusion remarks

Despite the numerous studies on tax revenue and economic growth relations, little has been done on the connection between these two phenomena in Oman, an oil-exporting country. To fill this gap, this study examines the asymmetric effects of changes in the fiscal taxation policy (captured by tax revenues) on the economic activity of Oman. The study employs the NARDL model using yearly data spanning from 1980 to 2022. The cointegration test result reveals the existence of a cointegrating (long-run) relationship between economic activity and positive and negative shocks to tax revenues, including the control variables. The estimation results show that positive changes in tax revenues have a significant positive influence on economic activity in both the long-run and short-run at the 5% significance level, while negative shocks in tax revenues have a significant negative impact on economic



Source: Authors' estimation

Figure 2. Plots of asymmetric cumulative dynamic multiplier for the Omani economic activity model

activity only in the long-run at the 5% level. The findings suggest that positive shocks to tax revenues in Oman exert a significant effect on economic activity. In general, tax revenue contributes to economic growth by providing the government with the financial resources to invest in public goods and services, such as infrastructure, education, and healthcare, which in turn enhance productivity and stimulate economic activity. Additionally, tax revenue can be used to fund policies that foster business development, innovation, and social stability, all of which are crucial for long-term growth. On the other hand, a decline in tax revenues may cause financial deficits and force the government to reduce expenditures on public services, which negatively affects the overall economy.

Despite the challenges posed by issues such as tax evasion, the size of the shadow economy, appreciation of the national currency, and potential strain on public services, there are several positive economic implications of the significant effect of tax revenues on the official economy in Oman. First, is the opportunity to implement effective measures to combat tax evasion and reduce the size of the shadow economy. By addressing these issues, Oman can enhance its revenue collection efforts, leading to a more robust and sustainable fiscal framework. This, in turn, fosters economic stability and investor confidence, promoting long-term growth and development.

Furthermore, increased tax revenues can contribute to the appreciation of the national currency. A stable currency reflects confidence in Oman's economic prospects, attracting foreign investment, and fostering international trade. This can result in increased purchasing power for consumers, lower import costs, and improved the country's competitiveness in global markets.

Moreover, rising tax revenues provides the government with the necessary resources to invest in public services and infrastructure. By prioritizing sectors such as agriculture, healthcare, education, and transportation, the Omani government can enhance the quality of life for its citizens, promote social inclusion, and stimulate economic activity. Improved public services also contribute to a more conducive business environment, attracting investment and driving economic growth.

To conclude, while challenges such as tax evasion and the size of the shadow economy problem may present obstacles, the significant effect of tax revenues on the Omani economy offers numerous positive implications. By effectively addressing these challenges and leveraging increased tax revenues from both the oil sector and non-oil sectors, the Omani government can bolster its fiscal resilience, strengthen its national currency far from the negative effects of the US dollar pigging, and enhance public services, ultimately fostering sustainable economic development and prosperity for its citizens.

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