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Content Details:

Abdusalam Faraj Ibrahim Yahia(Author) *Oman Chamber of Commerce and Industry*	**An empirical estimation of Laffer curve in Oman Economy. Does Oman hav an optimal total tax rate?**

Abstract:

This study aims to estimate the existence and shape of a Laffer curve and to examine the impact of Total Tax and Contribution Rate (TTCR) on the Total Tax Revenue (TTR) in Omani economy over the period 2007- 2024. Standard theoretical constructs used to characterize corporate tax revenues as a quadratic function of TTCR. The Empirical results of using non-linear approach of regression models indicate that quadratic term in tax rate is significant and correctly signed, thus confirming a bell-shaped Laffer curve in Omani economy. Empirical results also show that when the tax rate is less than 25.9%, tax rate and real tax income have a significant positive relationship, but when the tax rate is larger than 25.9%, tax rate and tax revenue have a significant negative relationship. This value indicate that Oman was taxing on the right side of its Laffer curve during the period of 2014-2018 and Oman could have experienced higher tax revenues with a lower tax rate. Therefore, policy maker should take in their consideration that reforming the tax system in Oman by adjusting the tax rates over time is necessary for increasing the tax incomes. In addition, in order to identify the competitiveness of the tax system in Oman within the GCC group, this paper suggests that the optimal tax rate maximizing the corporate tax revenue should not exceed 25.9%. In addition, it is very important to take into consideration reducing the number of tax payments so that the Sultanate's tax system is competitive. Finally, policy maker could use estimated Laffer curve as useful tool for budgetary planning in Oman.

JEL Classification: E62; H2; H21.

Keywords: Tax Rate; Tax Revenue, Laffer curve; Quadratic Function, Sultanate of Oman.

Introduction:

The current situation of the tax system in the Sultanate indicates its weak competitiveness within the system of the Gulf Cooperation Council countries as result of increase of total tax rates. Recently, the various tax rates and fees have witnessed a steady rise, multiplicity and diversification, which will have negative effects on the development and growth of the private sector. At a time when we are aware of the financial challenge, facing the government because of the conditions of the economic crisis resulting from the drop in oil prices, but the imposition of more fees will lead to higher tax rates. Hence, this will reduce the capability of private sector to grow, which results in a decrease in tax revenues in the Sultanate's general budget.

Problem statement:

Many debates have emerged recently to answer the following questions:

- Will the excessive in imposing more fees and taxes on private sector institutions in Oman will have a negative impact on the total tax revenue?
- More precisely, is there a turning point in the relationship between the total tax revenue and the total tax rate? or is it possible to estimate an optimal tax rate that leads to an increase in tax revenues and does not impede the development and growth of private sector institutions and of sustainable development in the Sultanate of Oman?
- Finally, is Laffer curve theory practically applicable in the Omani economy?

Objectives of the study:

Previous empirical studies do not have conclusion on a clear relationship between the total tax rate and total tax revenues in the Oman economy. Accordingly, this study aims to fill in this gap by achieving the following objectives:

- To estimate and analyzes the relationship between tax rate and tax revenue.
- Attempts to derive the Laffer's curve for Omani economy.
- Analyze and evaluate the impact of a higher total tax rate on total tax revenue

- ➢ Determining the optimal total tax rate that helps achieve the greatest return and does not negatively affect the growth and development of private sector institutions
- ➢ Using Laffer's estimated model to help economic policy makers to adjust the tax system of the Sultanate in line with the requirements of sustainable development.
- ➢ Analysis of the tax system in the Sultanate from the perspective of competitiveness within the group of Gulf Cooperation Council countries.

Research Methodology:

This study is based on three main hypotheses that

H1: The tax system in the Sultanate of Oman is an efficient system that stimulates investment and is competitive, at least within the group of Gulf Cooperation Council countries.

H2: there is no statistically significant relationship between total tax rate and total tax revenue.

H3: laffer`s curve theory is not applicable for Oman economy.

Therefore, in order to test these hypotheses and to reach the objectives of the study, comparative descriptive analytical method was used. in addition, the multiple nonlinear regression model was preformed to analyze the relationship between tax rate and tax revenue and a quadratic function was estimated in order to figure out the shape of Laffer`s curve for Oman economy. The relevant data in this study has been collected from National Omani Center for Statistics and Information Statistical Year Book, the PWC Year Report, the world bank data base and other secondary date were collected from relevant journal papers and textbooks. All Computations were performed using Excel sheet and software package called E-views version 5.1, 2010

Background on the tax structure in Omani Economy

The issue of taxation in Oman is not new. It dates back to the 1990s, when Oman imposed a corporate tax in 1994, which later exempted some sectors and projects. In order to replace the current scheme of taxation of rental agreements, authorities in Oman have been advised by the IMF to find additional sources of

Revenue as Oman diversify its economy (e.g., imposing VAT, excise taxes on luxury goods and services and a simple property tax in the short run), (IMF, 2017). Recently, some of GCC countries have enforced (VAT), but Oman remained wary of applying it for fear of upsetting international and local businesses and investors. Consequently, Value Added Taxes (VAT) in Oman just applied in the beginning of 2021.

Oman seeks to diversify its economy and attract foreign investment. Therefore, the stability of the tax system and the application of appropriate tax rates will have a significant impact on the growth of its tax revenues as well as will have a positive impact on the business environment and economic diversification programs.

The tax system in the Sultanate of Oman consists of direct taxes and indirect taxes. It can be illustrated as follows:

First: Taxes:

1) Corporate tax

2) Tax on property: It consists of municipality fees on rents of real estate and registration of real estate transactions

3. Local tax on goods and services, including:

4- Customs fees: such as customs declaration fees, customs clearance fees, and Gulf representative authorization fees.

Second: Fees: These include:

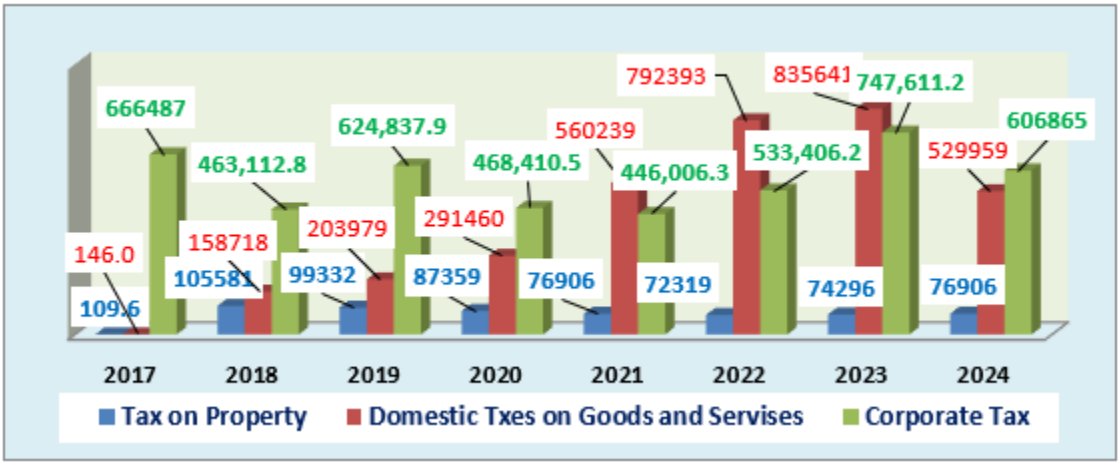
- Immigration and passport fees.
- Administrative fees: such as driver's licenses and transaction authentication.
- Other fees: These include labor recruitment license fees, in addition to fines, penalties, and

mining fees.

The relative importance of tax revenues

The actual data in Figure (1) indicate that the total revenues from tax revenues for the year 2023 amounted to 1873317.2 million Omani riyals. This value is obtained from corporate income tax - property taxes - local taxes for goods and services - customs duties. In 2024, the relative importance of the tax on property and goods and services is estimated at about 45% of the total tax revenues while the relative importance of corporate tax is 40%.

Figure 1 Break down of total tax (thousands of OMR)



Source: Prepared by the author based on the data of the National Center for Statistics, annual report.

Competitiveness of the tax system in the Sultanate of Oman within GCC Region

According to PWC and The World bank, the Total Tax and Contribution Rate (TTCR) is a measure of all the taxes born expressed as a percentage of commercial profit, which is the profit before all taxes borne. The TCCR includes only the taxes and mandatory social payments that are a cost to the company, such as corporate income tax (CIT), Social Security contributions (SSCs),

profit taxes and other taxes. It excludes the taxes that a business collects and pays on behalf of others, such as VAT, which is ultimately a cost to its customers, or employees` SSCs, which are the responsibility of its employees.

Resent data, also, shows that corporate tax increased in Oman from 12% to 15%, for tax years beginning on 1 January 2017, and the tax exemption on the first OMR 30,000 of taxable profit has moved. These changes are part of Oman's overall strategy to diversify its revenue away of oil revenue and to finance its budget deficit. As result of these changes, the total tax rate of Oman has increased from 23.9% in 2016 to 27.4% in 2021 and 2023. As consequence, TTCCR in the Sultanate considered as highest among (GCC) region and the challengeable task for Omani government is to set such tax rates, which would be acceptable for the business institutions at the same time maximizing its revenue from corporate tax and fees. However, the theory of the Laffer Curve explains the relationship between tax revenue and tax rate and the key question now is, "whether Laffer`s curve theory applicable in the Omani economy or not?

Figure2 total tax rate in the GCC Countries

Source: prepared by the author and based on PWC Reports.

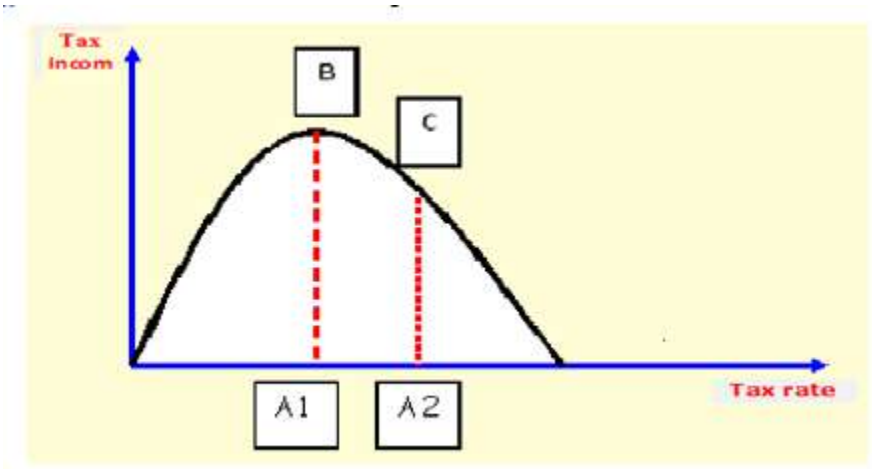
Brief review on the tax impact and Laffer curve concept

Tax is a compulsory contribution to government revenue, levied on workers' income and corporate profits, or added to the cost of some goods, services, and transactions. Taxes are not voluntary payments or donations, but rather contributions enforced by the law and in case of failure to comply, it leads to prosecution and punishment. (Sarunas et al.,2012).

According to Laff curve hypothesis, economic activities are a decreasing function of the taxation rate. Therefore, total tax revenue increases with the taxation rate at its lower levels and decreases against it at its higher levels (Heijman et al., 2005). Figure (3) represents hypostatical Laffer curve and as can be seen, Laffer curve is graphed as an inverted hyperbola whose peak occurs at the points B, which is maximize tax revenue at A1 of tax rate. As logic requires, both a tax income rate of 0 and 100% will create no revenues. This leads to a nation that relationship between tax rate and tax revenue must be parabolic. Any marginal tax cut starting from a point to the right of the peak will increase revenues. Any marginal tax cut starting from a point to the left of the peak will lower revenues. It is important to emphasize that, tax reduction would motivate investors and entrepreneurs to invest more and more for higher profits, especially as these profits would be less tax-deductible.

In the literature, many debates have arisen regarding estimating the laffer curve. (Jafari et al., 2010b) estimated the rate and effect of threshold tax on economic growth in Iran during 1980 -2008. Due to poor results of the estimated linear model they specified a nonlinear model on explain the role of tax on economic growth in Iran. Their results indicate that there exists a threshold tax rate of 22%. In other words, if tax rate is less than 22% then as a result, tax revenue rate will increase, which in turn increase the economic growth will increase and if tax rate is more than 22%, it will have a detrimental effect on economic growth of the country.

Figure 3 Typical Laffer curve: tax kills tax assumption



.**Source:** prepared by the author according to Laffe

(Sarunas et al., 2012), applied binomial regression model to test The relationship between tax rates and budgetary income in EUR region. The results of the analysis performed in this paper support the notion of the Laffer Curve representing a bell shaped arch. Both the function of VAT revenue and the function of labor tax revenue are parabolic and illustrate that efficiency of the tax system declines with an increase in tax rates. Labor tax revenue is positively dependent on tax base and tax rate itself It was found to be significant with the correct sign of the coefficient.

(Haniyeh et al., 2014) has estimated the Laffer curve for the Iranian economy by using threshold regression method. Their main finding confirm that since the tax rate is low (the threshold value is less than 0.0848) in two-regime model, tax rate and tax income have a significant positive relationship, but when the tax rate is high (the threshold value is larger than 0.0848), tax rate and tax income have a significant negative relationship

(Clausing et al.,2007) Has studied variation among OECD countries in the size of corporate income tax revenues relative to GDP over the period 1979–2002. His model included factors such as: a function of the statutory tax rate; the breadth of the tax base; corporate profitability, and the share of the corporate sector in GDP. The main finding show that a parabolic relationship between tax rates and revenues, suggesting a revenue-maximizing corporate income tax rate of 33% for all cases in the sample. This revenue-maximizing rate is found to decrease as economies are smaller and more integrated with the world economy.

(Stinespring.,2009a) applied linear, log-log, and semi-log econometric models to estimate the impact of corporate income tax rates on corporate tax revenue at the state level during the period 1992-2011 and in order to determine whether a Laffer curve exists for state corporate income taxes. The main results of Stinespring work show that these values indicate that 8 states were taxing on the right side of their Laffer curve in 2002, and 22 states were taxing on the right side of their Laffer curve in 2007. The results also support the hypothesis of the existence of a Laffer curve for the corporate income tax.

(Alex et al., 2007), examined the relationship between changes in corporate tax receipts and tax rates in several developed countries including Ireland, Switzerland and Norway. Applied a second order a dynamic (lags included in the model) regression models. theire model consist of four variables such as Corporate Tax Revenue as percentage of /GD; Tax Rate, Corporate Profitability Corporate Share. They found evidence that a Laffer curve has existed in the corporate tax sphere throughout most of their sample period.

(Chris.,2007) tested the Dynamic Responses to Corporate Tax Cuts and he concluded that the main factor causing the surge in corporate tax revenues appears to be taxpayer responses to reduced tax rates. Lower rates generate real and financial responses from businesses, prompting them to report higher profits. In addition, taxation significantly effects the location of foreign direct investment, corporate borrowing, transfer pricing, dividend and royalty payments, and research and development performance. Countries that raise corporate tax rates will cause to fewer investment projects and capital will emigrate, which lead to reduction in government revenues.

As we have seen, previous studies focused on studying the relationship between taxation and economic growth in developing countries but there is a gab or a lack of the research on the impact of tax rates on total tax revenues for the Omani economy. Therefore, this paper aims to estimate the impact of corporate income tax rates on tax revenue at Omani Economy over the period 2009 -2018 and attempts to answer the question that is Laffer curve theory Adaptable in practice in Omani economy?

The relationship between tax revenue and tax rate

Available data on the tax revenue indicates that total revenue of tax and fees has been increased during the period of 2010-2023 due to different reasons. therefore, it might be good idea to assess the correlation between tax revenue, tax rate and companies' profits. as can be seen from table below, Multiple correlation coefficients indicates that there is a positive relationship between tax revenue and tax rate. In contrast, tax revenue has a negative relation with companies' profits. Therefore, this negative relationship indicates the fact that as tax rate increases leads to increase in tax revenue and to decrease in a company's profit.

Table 1 The relationship between tax revenue and tax rate

	Total revenue of tax and fees	TR	CPG
Total revenue of tax and fees	**1.00**	**0.85**	**-0.24**
TR	**0.85**	**1.00**	**-0.5**
CPG	**-0.24**	**-0.5**	**1.00**

Data and Specification of the Model

The goal of Omani government is to set such tax rates, which would be acceptable for the business institutions at the same time maximizing its revenue from corporate tax and fees. hence, drawing on the existing literature and following the work by (Clausing.,2007), (Alex.,2007),(Chris et al., 2007), and (Stinespring.,2009a,b), we specify the following multiple non-linear regression models that allowed us to estimate Laffer curve and to identify the impact of the total tax rates on the total tax revenue in Oman.

$$TTR/GDP_t = \alpha + \beta_1*(TTCR_t) + \beta_2*(TTCR^2_t) + \beta_3*(CP_t) + e_t \quad (1)$$

$$TTR/GDP_t = \alpha + \beta_1*(TTCR_t) + \beta_2*(TTCR^2_t) + e_t \quad (2)$$

$$TTR/GDP_t = \alpha + \beta_1*(TTCR_{t-1}) + \beta_2*(TTCR^2_{t-1}) + et_{-1} \quad (3)$$

Where:

TTR/GDP_t = Total Tax Revenue in period "t" as percentage of GDP (the total revenue from corporate and property taxes, fees and licenses, excluding service charges)

$TTCR_t$ = Total Tax and Contribution Rate

$TTCR_{t-1}$ = Total Tax and Contribution Rate in period (t_{-1}), as suggested by (Alex,2007, Chris Edwards, 2007).

CP_t = Growth rate of Corporate Profitability in period "t".

e_t = represents an error term that is approximately normally distributed with a variance of 6^2 – i.e., $et \sim N(0, 6^2)$ – and it is assumed that $B_1 > 0$, $B_2 < 0$.

The data in this paper covers the period from 2007-2023, and has been collected from WPC database, World Bank database and national center for statistics and information yearbook. Excel Sheet and E-views software, version 10 package were used to carry out all computations.

Empirical Results

The primary results of the regression of model (1) are shown in Table N. 2. It suggests that Initial estimation indicates that the model explains more than 76% of the dependent variable. In addition, Durbin-Watson test, which is 1.8, indicates that there is no problem of serial correlation. Durbin-Watson statistic measures the linear association between adjacent residuals from a regression model. If the statistic is below about 1.5, it is a strong indication of positive first order serial correlation (Vebbek, 2004, pp. 102-104). Contrary, the estimates are virtually identical, with a positive and significant coefficient on the tax rate, and a negative and significant coefficient on the tax rate squared. Also, a small value of the corporate profit coefficient (0.0004) may indicate that many companies have left the market due to the negative impact of the economic slowdown in recent years or perhaps due to unfavorable economic environment variables such as legislation or taxes. These results provide strong support for the existence of tax revenue Laffer curve.

Table 2 Results of Model (1):

$$\mathbf{TTR/GDP_t = \alpha + \beta_1 *(TTCR_t) + \beta_2 *(TTCR^2_t) + \beta_3 * (Corporate\ Profitability)_t + e_t}$$

Variables	Coefficient	t-Statistic
Constant	-61.60325	-2.61
Tax rate	5.110695	2.67*
(Tax rate)^2	-0.098213	-2.55*
CPG	0.00035	1.52
R-squared : 0.76		D.W Stat: 1.8

* Significant at 5% level of significance

The results of model 2 in Table N. 3 suggest that despite the fact that the coefficient b_1 and b_2, which represent tax rate and tax rate squared, carry the expected signs that confirm the result obtained by the first model and both coefficients are significant at the ten per cent level of significance. However, since corporate tax rate changes can happen mid-year, and may affect revenues with a lag. Hence, we re-estimate same sets of specifications but with one-year lag for the corporate tax rate. The results of the re-estimation suggest that all variables carry the correct signs and the equation seems to be sufficient as evident from the values of adjusted R^2 and the "t" statistics. The regression results also, show that the coefficient B_1 and B_2 that represent tax rate and tax rate squared are statistically significant at the five per cent level of significance.

Table 3 Results of non-linear regression models

(Tax Rate - one Year Lagged)

Results of model (2): $TTR/GDP_t = \alpha + \beta_1*(TTCR_t) + \beta_2*(TTCR^2_t)$			**Results of model (3): Tax Rate - 1 Year Lagged** $TTR/GDP_t = \alpha + \beta_1*(TTCR_{t-1}) + \beta_2*(TTCR^2_{t-1}) + e_{t-1}$		
variables	**Coefficient**	**t-Statistic**	**variables**	**Coefficient**	**t-Statistic**
Constant	-35.11216	-1.56	**Constant**	-54.63884	-2.6*
Tax rate	3.003207	1.66	**Tax rate_(t-1)**	4.615827	2.7*
(Tax rate)^2	-0.056577	-1.54	**Tax rate_(t-1)^2**	-0.089411	-2.6*
R-squared	0.63		**R-squared**	0.68	
Durbin-Watson stat: 1.7			**Durbin-Watson stat:** 1.8		

* Significant at 5% level of significance.

Accordingly, two points raised from our investigation: first the lag form is somewhat stronger, as evidenced by higher quality of the fit; second lag form is appropriate for estimation a laffur

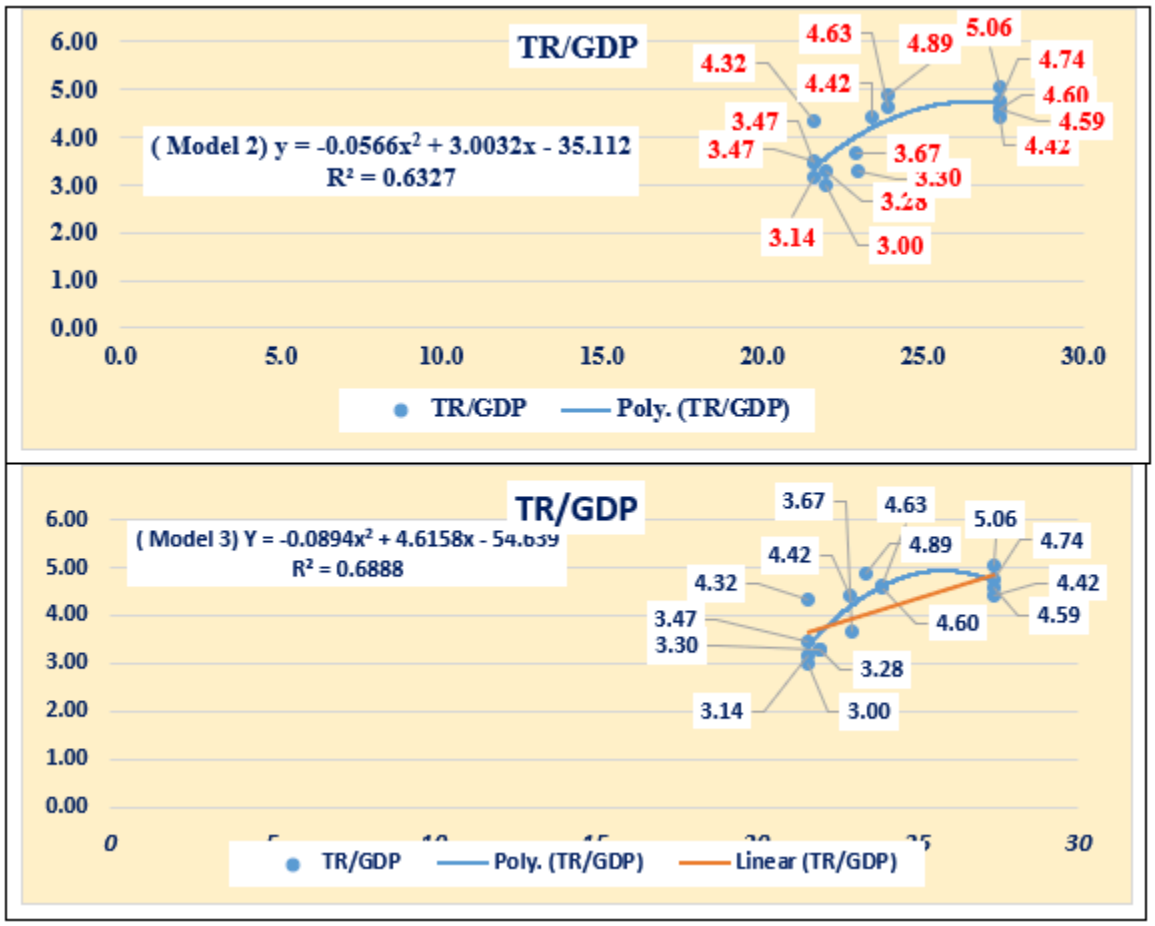
curve; third, Important point of the results is that quadratic term in tax rate is significant and correctly signed, thus confirming a bell-shaped Laffer curve in Omani economy. Accordingly, we can calculate tax rates which maximizing corroborate tax revenue. This is done by finding derivate of equation 3 and setting the derivate to zero. We found that revenues maximizing tax rate is approximately 25.9 in one year –lag model.

$$\text{Maximize } (TTR/GDP_{t)} = -54.638 + 4.615\ TTCR_{t-1} - 0.089 TTCR^{2}_{t-1}$$

$$0 = 4.615 - 0.089(2)\ TTCR_{t-1} \longrightarrow -4.615 = -0.178\ TTCR_{t-1} \longrightarrow TTCR_{t-1} = 25.9$$

To sum up, the estimates of the dynamic model are virtually identical, with a positive and significant coefficient on the tax rate, and a negative and significant coefficient on the tax rate squared, a pattern consistent with the Laffer curve shape, which illustrated in figures 4 and 5.

Figures 4 & 5 Comparison of the estimated static and Dynamic Laffur curves



Source: prepared by the author

Conclusion:

The main goals of this study were to determine the impact of Total Tax and Contribution Rate (TTCR) on the total tax revenue (TTR), to find out the optimal tax rate, and to estimate the existence and shape of a Laffer curve, in Oman economy. A linear regression models with one year – lag was used in this study and the empirical results indicate that quadratic term in tax rate is significant and correctly signed, thus confirming a bell-shaped Laffer curve in Oman economy. Empirical results also show that when the tax rate is less than 25.9, tax rate and real tax income have a significant positive relationship, but when the tax rate is larger than 25.9%, tax rate and tax

revenue have a significant negative relationship. This result confirms the fact that the optimal tax rate should not exceed 25.9 in Oman economy.

Recommendations and policy implication:

First, policy maker should take in their consideration that the Sultanate of Oman could have experienced higher tax revenues with a lower tax rate. Therefore, reforming the tax system in Oman by adjusting the tax rates over time is necessary for increasing the tax incomes. Second, in order to identify the competitiveness of the tax system in Oman within the GCC group, this study suggests that the optimal tax rate maximizing the corporate tax revenue should not exceed 25.9. Third, it is very important to take into consideration reducing the number of tax payments so that the Sultanate's tax system is competitive. Finally, estimated Laffer curve might be used as useful tool for budgetary planning in Sultanate of Oman.

Acknowledgment

It is important to confirm that this research has been supported by Oman chamber of commerce and industry (OCCI). Therefore, the author would like to thank the chairman of (OCCI) HE, Faisal Abdullah Al Rowas and Chief Executive Officer of OCCI, Zakaria bin Abdullah Al-Saadi, for their support and encouragement. Finally, this research does not reflect the opinion of OCCI in any manner and any errors in this study are the responsibility of the author.

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Inan Ince(Author) *International University (IU) Stuttgart*	**Trust repair strategies in video content creation: A qualitative analysis of three case studies from YouTube**

Abstract and preliminary results

Social media platforms have become pivotal arenas for public discourse, with YouTube standing out as a prominent medium for content creation and consumption (Pérez-Torres et al., 2018). However, the very nature of this platform exposes creators to the potential for controversies that can significantly impact their reputation and relationship with their audience. As YouTubers navigate the complexities of public perception, understanding the mechanisms of trust repair becomes essential. However, to date, the existing literature on trust repair has primarily focused on the traditional approaches, leaving a gap in the exploration of social media content creation following controversies (Wang & Zhao, 2023; Su, 2023). This study aims to bridge that gap by examining how YouTubers utilize problem-solving techniques to rebuild trust and foster engagement with their audiences, particularly in response to controversies (Healy, 2019). By using an abductive approach, frameworks such as Benoit's (1995) image restoration theory, or Coombs' (2007) crisis communication theory will serve as conceptual backdrop for analysis.

With the inception of broadband internet connection and availability in many households worldwide (Chauhan & Maniar, 2018), video content creation has become not only a hobby, but often a source of income for many (Ernayani et al., 2023; Törhönen et al., 2019). This shift has led to a competitive environment where trust acts as a vital currency, influencing creators' ability to sustain their audiences and monetize their content effectively (Dekavalla, 2020). However, following controversies connected to these content creators, subsequent actions to mitigate the negative effects appear to not always deliver the desired results. The analysis of reactions of one successful (Mark Fischbach aka Markiplier, MF), one mixed (James Charles, JC), and one failed (Logan Paul, LP) attempt already offers some general, albeit broad, insight into trust repair techniques (see table 1). Reflecting preliminary findings on theoretical frameworks such as Image Restoration Theory (Benoit, 1995) already hints at possible explanations for (missing) success, when studying audience reactions: While all three cases express, for instance, some level of mortification, results vary when combined with timely corrective action (successful, MF), defeasibility (mixed, JC), and untimely corrective action (failed, LP). The final study elaborates on specific details, deeper analyses and offers propositions for future research avenues.

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Table 1

Prominent first-order categories in YouTuber apology videos

YouTuber	Selected, prominent first-order categories
MF	Reflection Addressing community Acceptance of responsibility Admission of mistakes
JC	Emotional language Admission of mistakes Justification Appeals to family and fans
LP	Professional language Emotional distance Deflection Justification

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An Investigation of Road Construction Project Delays in Somalia

Abstract

Somalia has faced many road construction problems since the central government collapsed. Road construction in Somalia suffers from chronic delays that exacerbate infrastructure gaps and stall economic recovery. The government of Somalia lacked the financial capacity to build or maintain roads during the civil war and therefore requested international organizations and governments to finance the construction of main roads, providing access to the people and enabling them to reach their destinations. This study aims to find and rank the primary causes of road construction delays in Somalia, involving stakeholders through a survey of 80 stakeholders. The data was collected from the client/government, consultants, contractors, and external sources. We analyzed the data using SPSS, descriptive statistics, frequency, and percentages, and ranked them using the relative importance index (RII). The key findings are inadequate data collection before the design, lack of funding, weather-related issues such as flooding, poor communication and coordination among all partners, political interference, delayed payments, corruption, and security challenges. Based on those results, we highly recommend capacity building for the workers and improving the coordination among stakeholders, adopting a transparent tendering process, and prioritizing the project timeline for seasonal rain to speed project delivery.

Keywords: Road construction, Somalia, delay, stakeholder, relative importance index RII.

Abhitesh Sachdeva(Author) *IIT Roorkee* **G.D. Ransinchung R.N.(Co-Author)** **Praveen Kumar(Co-Author)**	**Sustainable Alternatives in Full-Depth Reclamation: Geopolymer Binders from Fly Ash and GGBS Instead of Portland Cement**

ABSTRACT

Each pavement, regardless of its material composition, is designed with a specific lifespan and inevitably deteriorates over time. Construction flaws or the use of low-quality materials can result in premature failure [1]. Traditional repair methods, such as overlaying or mill-and-fill, are commonly used but are only effective when the defects are confined to the wearing course of the pavement [2]. When the deterioration extends to the granular layers (base or sub-base), the pavement is classified as structurally failed and requires reconstruction or recycling through the Full-Depth Reclamation (FDR) technique [3]. Cement is a widely used stabilizer in FDR projects because of its compatibility with various soil types. However, to promote sustainability, researchers advocate using alternative binders to minimize cement usage in construction activities [4]. FDR using geopolymer contributes to sustainable practices by utilizing construction demolition and industrial waste materials. Limited research has been conducted on geopolymer-treated base stabilized through the FDR approach, particularly regarding comparative durability analyses under Wetting-Drying (W-D) and Freezing-Thawing (F-T) conditions [5]– [7]. This study explored the potential of geopolymer binders made from Fly Ash (FA) and Ground Granulated Blast Furnace Slag (GGBS) as substitutes for Portland cement in FDR projects of flexible pavements. FA and GGBS blends were alkali-activated with Sodium Hydroxide (NaOH) to achieve a 7-day Unconfined Compressive Strength (UCS) target of 4.95 MPa and Flexural Strength (FS) of approximately 20% of UCS. Chemical stabilization with cement and geopolymer reduced the plasticity index of in-situ base soil by 20% and 25%, respectively, due to the flocculation of soil grains. Both cement and geopolymer binders enhanced the mechanical properties of the reclaimed materials. The target 7-day UCS of 4.95 MPa was achieved using either 7% cement or a geopolymer binder (GP2), having FA: GGBS proportion of 80:20 and 2M NaOH solution. Strength continued to develop over time; curing from 7 to 28 days resulted in an average strength increase of 57.76% for UCS and 55.15% for FS in geopolymer-treated samples. At 56 days, the strength parameters further improved, with UCS and FS increasing by 50.50% and 30.61%, respectively, indicating a prolonged strength development period compared to conventional cement-stabilized bases.

Durability tests under W-D and F-T cycles revealed the resilience of geopolymer-treated materials. Weight loss under these conditions decreased intermittently, with W-D cycles causing more abrupt mass loss than F-T cycles. For instance, the GP2 mix experienced a maximum mass loss of 19.87% after the fifth W-D cycle, compared to only 2.58% under the F-T test. Despite this, the

total mass loss across all specimens remained below 12%, validating the durability of all the compositions in both tropical and snow-prone regions. These findings highlight the potential of geopolymer to replace cement from FDR projects, which not only limits the carbon footprint but also provides an efficient disposal of industrial by-products.

Keywords: Geopolymer, Full Depth Reclamation, Durability, Stabilization.

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Juliet Etifit(Author) *University of Uyo*	**Enhancing Cyber Resilience in Small Loan Companies: A Strategic Framework For Data Backup And Recovery**

Abstract

In the financial service sector, particularly within small scale loan companies also known as digital lenders,have been linked to various data protection breaches. These breaches occur when lenders access and share borrowers personal data for the purpose of debt recovery. Data plays a pivotal role in every aspect of business operations from loan origination and risk assessment to customer relationship management and regulatory compliance. The integrity, availability, and confidentiality of this data are not just operational necessities but also regulatory imperatives. As cyber threats continue to escalate in complexity and frequency, loan companies face increasing pressure to protect sensitive financial and personal data against loss, corruption, and unauthorized access. Within this context, data recovery and backup strategies have become indispensable pillars of a robust cybersecurity framework. This paper investigates the critical importance of implementing comprehensive data backup and recovery mechanisms specifically tailored to the unique needs and risk profile of a loan company. Given the volume of sensitive customer data including credit histories, personal identification, income verification, and loan repayment records even a brief loss of data can have severe legal, reputational, and financial consequences.

This work explores various backup methodologies, including full, incremental, differential, and real time replication strategies, evaluating their effectiveness in ensuring continuous data availability and integrity in a high risk financial environment. Additionally, this abstract highlights the risk small loan companies face from modern cyber threats such as ransomware, phishing attacks, insider threats, and system level failures. Particular emphasis is placed on ransomware, which can paralyze operations by encrypting critical databases and demanding payment for decryption keys. In such scenarios, a secure and regularly tested backup system often serves as the only viable method for rapid recovery bypassing ransom demands and minimizing business downtime.

This study also explores the deployment of cloud based backup solutions, immutable storage, and end to end encryption as essential technologies for safeguarding financial data. Furthermore, the implementation of automated backup schedules, access controls, and compliance focused data

retention policies is analyzed to ensure alignment with financial regulations such as PCI DSS, GDPR, and local financial data protection laws.

Case studies and hypothetical breach simulations are used to illustrate the impact of poor backup practices, including data breaches that resulted in customer distrust and regulatory penalties. Conversely, examples of well executed disaster recovery plans demonstrate how proactive investment in cybersecurity infrastructure can mitigate risks and preserve business continuity.

In conclusion, this abstract asserts that in a small loan company where data is both a strategic asset and a liability, data recovery and backup systems are not optional safeguards but mission critical components of cybersecurity. By integrating layered security strategies with intelligent backup and recovery protocols, loan institutions can ensure resilience in the face of cyber adversity, protect customer trust, and maintain uninterrupted financial services.

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